CABANGA concepts
We plant the seed!

6 Beyers Office Park, Bosbok Road
Randpark Ridge
South Africa

Postnet Suite 470
Private Bag X3
Northriding 2162

Tel: + 27 11 794 7534
Fax: + 27 11 794 6946
ken@cabangaconcepts.co.za

Strategic Environmental Evaluation & Development • Strategic Environmental Evaluation & Development • Strategic Environmental Evaluation & Development • Strategic Environmental Evaluation & Develop

COAL OF AFRICA (PTY) LTD

COAL of AFRICA LIMITED

ENVIRONMENTAL MANAGEMENT PLAN

FOR MOOIPLAATS NORTH COLLIERY

(Mooiplaats 290 IT Portion 1 of 9)

MP 30/5/1/2/2/68 MR

F2005/03/18/003

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Prepared by:
Cabanga Concepts CC
Unit 6 Beyers Office Park
Bosbok Road
RandparkRidge
Tel/Fax: (011)794-7534

Executive Summary

Coal of Africa (Pty) Ltd (hereon referred to as CoAL) wishes to amend its Environmental Management Programme Report (EMPR), as per the EMPR directive issued to them on 27 October 2010 which instructed CoAL “to revise the approved EMP and submit within 180 days from the date of receipt of the directive ... compiled in accordance with the guideline marked as Annexure A.”.

Coal of Africa Limited (Pty) Ltd (CoAL) contracted Cabanga Concepts cc (Cabanga) as independent environmental consultants to undertake the amendment to the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP).

Project Description:

Mooiplaats North Colliery is an operating underground operation, and has a mining right in terms of the Mineral and Petroleum Resources Development Act (2002) for the Mooiplaats Colliery (EMPR, 2005). This mining right (MP 30/5/1/2/2/68 MR) was granted to Langcarel (Pty) Ltd in 2007 and CoAL has since purchased and taken over Langcarel. This mining right allowed for the underground mining of coal and on-site processing and associated infrastructure as discussed in the original EMPR.

This report has altered significantly from the original EMPR in order to attain compliance to the Minerals and Petroleum Resources Development Act, Act No. 28 of 2002 (MPRDA) and Annexure A referred to in the directive. EMP regulations were the focus of this document as per the DMR request, although impacts were also summarised in order to ensure compliance with Annexure A of the Directive and ensure adequate management plans are included for and cross-referenced to these risks/impacts.

The activities on site have varied slightly from the layout as indicated in the original EMPR, although the footprint area is largely the same (other than the co-disposal dump and associated infrastructure and the new access road) and an amendment is required to address these variations. In addition, a new pollution control dam is proposed and the existing surface water management on site will be upgraded.

No changes or additions to the coal mining method or processing at Mooiplaats North Colliery are proposed.

Description of Current Environmental Conditions:

Climate: The project area experiences a sub-tropical climate with hot summers and mild to cool winters, with summer rainfall.

Topography: The topography of the area is typical of the upper plateau edge with gentle rolling hills.

Geology: The site is situated in the Ermelo Coalfield. The Karoo Sequence rocks in this area are represented by the Ecca group, which consist of the Dwyka, fluvio-glacial tillites overlying felsites in an unconformable manner and schists and quartzites of the pre-Karoo basement.

Soils, Land Capability & Land Use: The actual mining area, comprising approximately 74 ha, could not be assessed due to impacts that destroyed the original soil and land capability or structures such as stockpiles and dumps that cover the area to such an extent that an assessment is not possible. The study area therefore comprises the remaining 126 ha and excludes the actual mining area.

Approximately 20.22% (25.51 ha) of the study area consists of moderately deep, moderately well-drained, yellow brown soils with **arable** land capability and moderate agricultural potential dominated by soil type **Av.**

Approximately 24.9% (31.42 ha) of the study area consist of shallow, moderately well-drained, yellow brown soils with **grazing** potential land capability and moderate to low agricultural potential. These soils consist of soil type **Gc.**

The remainder 53.2% (67.15 ha) consists of **wetlands** (imperfectly to poorly drained soils) and a small portion (1.68%) of **wilderness** land. Temporary wetland zones comprises 19.04% (24.04 ha), seasonal zones 26.55% (33.51 ha) and permanent zones 7.61% (9.6 ha) of the study area.

The pre-mining land use of the total lease area appears to be grazing (commercial cattle farming).

Currently, approximately 74 ha of the lease area is used for the actual mining operation and the broad mining components. The remainder 126 ha is vacant and no agricultural or other land uses was observed.

Surface Water: The area falls within the Water Management Area 8, Upper Vaal (WMA 8) and in Quaternary Catchment C11B.The Vaal River flows along the eastern side of the site boundary in a southerly direction.

A non-perennial stream flows through the site in a north easterly direction to form a confluence with the Witpunspruit downstream, which later joins the Vaal River to the east. The stream flows to the east of the main buildings and plant area. It is well defined in some area but comprises wetland areas in other section thus, the flood plain varies.

Groundwater: The Karoo sedimentary aquifer in the study area can be separated into three zones that are classified as aquifers in their own right; the perched aquifer; the shallow weathered Karoo aquifer and the deep fractured Karoo aquifer. The groundwater elevation correlates roughly with the topography.

Groundwater use in the area is predominantly agricultural and domestic purposes. The Karoo Formation aquifer of the Mooiplaats area can in general be classified as a low yielding aquifer. It does have a viable exploitation potential for domestic and stock-watering application and as such is the main water resource for these applications to the farming communities in the area. The aquifers will however not support formal irrigation application over any extensive area (> 10 ha). The shallow weathered aquifer can therefore be classified as a minor aquifer system in terms of aquifer management.

Air Quality: The local air quality is affected by agricultural activities, mining activities as well as nearby power generation activities. Most recorded dust levels at the Mooiplaats North Colliery fall within the 1200mg/m^2/day limits for industrial areas and even within the 600 mg/m^2/day for residential areas.

Noise: The current activities which contribute to elevated noise levels in the area include: traffic on tarred roads, farm roads and mine haul and access roads; agricultural activities including ploughing, reaping and seeding activities; mining activities including underground mining activities in the area; coal processing at wash plants and activities at Camden Power Station. The processing activities are currently contributing to elevated noise levels and therefore will not alter the current noise profile of the area.

No noise monitoring is currently undertaken on site.

Fauna & Flora: The study area falls within the Grassland Biome that is further divided into vegetation types. One dominant vegetation type occurs within the study site namely the Eastern Highveld Grassland. Although not present on the study site, another vegetation type, Eastern Temperate Freshwater Wetlands, occurs in the region in flat landscapes or shallow depressions filled with water. Both vegetation types are classified as Endangered. In addition, these vegetation types are listed as Vulnerable ecosystems in terms of Section 52 of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (Government Gazette, 2009).

Two plant species that are of conservation concern (Declining) were identified on the study site at the time of the field survey. In addition, ten plant species that are provincially protected by Schedule 11 of the Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998) were identified within the grassland and moist grassland on the study site.

From a faunal perspective, the study site provide suitable habitat to numerous species. Even though the only species of conservation concern recorded during the survey was *Sagittarius serpentarius* Secretary Bird), the habitat present on the study site suggested that a number of other species of conservation concern may also be encountered here.

Sensitive Sites: Four different types of wetland areas were classified within the study area and were categorised into HGM units. These include valley bottom wetlands without a channel, hillslope seepage wetlands feeding a watercourse, floodplain and hillslope seepage wetlands not feeding a watercourse. A total of nine HGM units were delineated and classified within the study area. In addition, the likely original pre-mining extent of wetlands was also delineated in order to assess the total mining impact more accurately.

The Witpuntspruit may also act as a movement corridor for a number of species.

Visual: The mine has already impacted on the visual aesthetics, although this has been limited to the area of disturbance due to the mine being an underground mining development. The wash plant and co-disposal dump currently exists at the operation, and these contrast with the surrounding areas.

<u>Archaeology:</u> No studies have been undertaken to date, however this is an operational mine with an active footprint of activity. This footprint will not be extended from its current position and thus no new areas will be disturbed.

<u>Socio-Economic:</u> The mine falls within the Gert Sibande District Municipality, one of three district municipalities in the Mpumalanga Province and more specifically within the Msukaligwa Municipality.

<u>Public Participation:</u> Issues raised by the Interested and Affected Parties (I&APs) include those concerned with legal compliance, request for information/documentation, surface water management and public participation. These need to be duly considered in the decision-making process.

<u>Environmental Impact Assessment:</u>

The following significant positive and negative impacts were identified during the EIA:

<u>Topography:</u>

- Alteration of topography through potential subsidence of surface layers
- Development of the co-disposal dump will alter the topography of the area

<u>Geology:</u>

- Permanent disturbance of geological strata

<u>Soils, Land Capability & Land Use:</u>

- Potential compaction of soils
- Loss and erosion of soil
- Potential for contamination of soils by hydrocarbons / chemicals and coal dust

<u>Surface Water:</u>

- Potential contaminated runoff from dirty areas may reach downstream water bodies and users
- Construction of the Pollution Control Dam (PCD) will reduce the risk of contamination to nearby surface water bodies and users
- Downstream water quantity of catchment reduced
- Potential silt-loading of drainage lines and downstream water bodies
- Potential hydrocarbon/chemical contamination from spills/leaks
- Irresponsible use of water during mining activities will impact on surface water quantity
- Potential harm through sewage leaks

<u>Groundwater:</u>

- Potential hydrocarbon/chemical contamination from spills/leaks
- Potential damage to groundwater aquifers and alteration of groundwater flow
  - No significant impact expected towards the adjacent mining as MPN is significantly compartmentalised by sills.
- Potential contamination plume of groundwater

    - MPN will also have a negligible impact on external users' boreholes and base flow to streams and fountains due to compartmentalisation. This may change if deeper boreholes are drilled in the vicinity and in such case these must be monitored.
    - The most significant impact relates to the potential plume development down-gradient of the co-disposal facility after closure, which will eventually reach the Witpunt Spruit tributary. The following comments relate to the seepage water quality:
        - The co-disposal will show an increase in the total dissolved solids with SO_4 as the dominant anion and will most likely acidify after closure; and
        - Significant elevation of Al, Fe and Mn will occur. Other metals such as Cd, Sb and Se may also be present in seepage but most probably not at non-compliant concentrations.
        - The model indicated that the contamination plume will not develop further than about 100 - 200 m horizontally from the mine boundary within 100 years after closure.
- The underground mine water will show an increase in the total dissolved solids with SO_4 as the dominant anion but will most likely not acidify. No significant elevation of metals will occur in the near-neutral mine water.
- Ingression of poor quality, low pH leachate into water table should leaks occur from above ground sources
- Reduction of local groundwater
- Irresponsible use of water during mining activities will impact on groundwater quantity
- Potential harm through sewage leaks
- Pumping of Usutu East by MPN will have no adverse effect for Usutu both in terms of the mine water quality and quantity. With respect to both, the pumping may actually have a beneficial effect as decanting of Usutu is prolonged and the mine water quality will probably improve over time.

<u>Air Quality:</u>

- Dust fallout, windblown dust generated from operational activities can impact on neighbouring residents
- Nuisance emissions from machinery

<u>Noise:</u>

- Increased noise levels from machinery during construction and operation.

<u>Fauna & Flora:</u>

- Alienation of animals from area
- Destruction and removal of natural vegetation
- Power lines are a potential risk to avifauna
- Potential harm to fauna through littering or hazardous substance poisoning
- Wetland species may be affected if poor quality water runoff reaches nearby wetland systems, affecting overall biodiversity

- Alien invasive encroachment

Sensitive Sites:

- Potential contaminated water runoff through spills or leaks can cause deterioration of ecological functioning of these systems, affecting overall biodiversity

Visual:

- Deterioration in visual aesthetics of the area
- Use of floodlights at night will increase the visibility of the site

Socio-Economic:

- Road degradation and increased potential for road incidences
- Positive impact due to continued employment opportunities
- Influx of unsuccessful job seekers which may informally settle in area
- Safety of persons in and around site

Environmental Management Plan:

An environmental management plan has been prepared to detail the mitigation measures necessary to manage the impacts associated with the Mooiplaats North Colliery.

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1 INTRODUCTION

Coal of Africa (Pty) Ltd (hereon referred to as CoAL) wishes to amend its Environmental Management Programme Report (EMPR), as per the EMPR directive issued to them on 27 October 2010 which stated "to revise the approved EMP and submit within 180 days from the date of receipt of the directive ... compiled in accordance with the guideline marked as Annexure A.". The activities on site have varied slightly from the original layout, although the footprint area is largely the same (other than the co-disposal dump and associated infrastructure and the new access road) and an amendment is required to address these variations.

CoAL has an existing mining right in terms of the Mineral and Petroleum Resources Development Act (2002) for the Mooiplaats Colliery (EMPR, 2005). This mining right (MP 30/5/1/2/2/68 MR) was granted to Langcarel (Pty) Ltd in 2007 and CoAL has since purchased and taken over Langcarel. This mining right allowed for the underground mining of coal and on-site processing and associated infrastructure as discussed in the original EMPR.

CoAL is therefore operating an underground operation on site, accessed via a boxcut, and the coal is processed on site. Associated infrastructure includes the wash plant with coal stockpiles, co-disposal discard/slurry facility, workshops and laboratories, admin block, bathroom facilities and various clean and dirty water storage areas.

The water use licence application for Mooiplaats was only recently submitted and included existing and future water uses at the existing Mooiplaats North Colliery and also included future water uses for the proposed Mooiplaats South development, which is part of Mooiplaats expansion project and documentation regarding this, has been submitted to Department of Mineral Resources (DMR) and the Mpumalanga Department of Economic Development, Environment and Tourism (MDEDET) for mining and environmental authorisation.

2 METHODOLOGY

This report has altered significantly from the original EMPR in order to attain compliance to the Minerals and Petroleum Resources Development Act, Act No. 28 of 2002 (MPRDA) and Annexure A referred to in the directive. EMP regulations were the focus of this document as per the DMR request, although impacts were also summarised in order to ensure compliance with Annexure A of the Directive and ensure adequate management plans are included for and cross-referenced to these risks/impacts.

2.1 Legislation

The environmental component of the project will strive to comply with the following legal requirements:

- The constitution of South Africa, 1996 (Act 108 of 1996)
- The Minerals and Petroleum Resources Development Act (Act 28 of 2002)
- The National Environmental Management Act, 1998 (Act 107 of 1998)
- The Environmental Conservation Act, 1989 (Act 73 of 1989)
- The National Environmental Management Act: Biodiversity Act, 2004 (Act No. 10 of 2004)
- The Atmospheric Pollution Prevention Act, 1965 (Act 45 of 1965) and the National Environmental Management: Air Quality Act (Act, 39 of 2004)
- The National Environmental Management Act: Waste Management Act (Act No. 59 of 2008)
- The National Heritage Resources Act, 1999 (Act 25 of 1999)
- The National Water Act, 1998 (Act 36 of 1998)
- The Hazardous Substances Act, 1973 (Act 15 of 1973)
- The National Nuclear Reactor Act, 1999 (Act 47 of 1999)

2.2 Environmental and Social Impact Assessment

Environmental impact assessment (EIA) methods were developed to: (1) identify the potential impacts of the development on the environment; (2) predict the probability of these impacts and (3) evaluate the significance of the potential impacts.

The methodology used by Cabanga Concepts is as follows:

2.2.1 The status of the impact

Positive: a benefit to the holistic environment

Negative: a cost to the holistic environment

Neutral: no cost or benefit

2.2.2 The duration of the impact

Score	Duration	Description
1	Short term	Less than 2 years
2	Short to medium term	2 – 5 years
3	Medium term	6 – 25 years
4	Long term	26 – 45 years
5	Permanent	46 years or more

2.2.3 The extent of the impact

Score	Extent	Description
1	Site specific	Within the site boundary
2	Local	Affects immediate surrounding areas
3	Regional	Extends substantially beyond the site boundary
4	Provincial	Extends to almost entire province or larger region
5	National	Affects country or possibly world

2.2.4 The reversibility of the impact

Score	Reversibility	Description
1	Completely reversible	Reverses with minimal rehabilitation & negligible residual affects
3	Reversible	Requires mitigation and rehabilitation to ensure reversibility
5	Irreversible	Cannot be rehabilitated completely/rehabilitation not viable

2.2.5 The affect (severe or beneficial) of the impact

Score	Severe/beneficial effect	Description
1	Slight	Little effect - negligible disturbance/benefit
2	Slight to moderate	Effects observable - environmental impacts reversible with time
3	Moderate	Effects observable - impacts reversible with rehabilitation
4	Moderate to high	Extensive effects - irreversible alteration to the environment
5	High	Extensive permanent effects with irreversible alteration

2.2.6 The probability of the impact

Score	Rating	Description
1	Unlikely	Less than 15% sure of an impact occurring

2	Possible	Between 15% and 40% sure of an impact occurring
3	Probable	Between 40% and 60% sure that the impact will occur
4	Highly Probable	Between 60% and 85% sure that the impact will occur
5	Definite	Over 85% sure that the impact will occur

2.2.7 The Consequence of the impact

Consequence = Severity + Spatial Scale + Duration + Reversibility

2.2.8 The significance of the impact

Significance = Consequence x Probability

Score out of 100	Significance
1 to 20	Low
21 to 40	Moderate to Low
41 t0 60	Moderate
61 to 80	Moderate to high
81 to 100	High

2.2.9 Is Mitigation possible?

Will mitigation be possible (yes or no).

2.3 Environmental Management Programme

This EMP was compiled to ensure that the significance of negative impacts are reduced through mitigation and management, and that the positive impacts are maximised. This EMP has been written in accordance with Section 39 (1) of the MPRDA and Annexure A of the directive as issued by the DMR.

2.3.1 Legal Requirements for the EMP

The legal requirements of the EMP, in terms of the MPRDA, are listed in the table below, with cross references to report sections where these are addressed.

Legal and Regulatory Requirement:	Section:
Regulation 51 of the MPRDA – Environmental Management Programme	
a. Description of environmental objectives and specific goals for:	Chapter 9
i. Mine closure.	Chapter 9.4
ii. Management of identified impacts.	Chapter 9.1
iii. Socio-economic conditions as set out in the Social	Chapter 9.2

Legal and Regulatory Requirement:	Section:
and Labour Plan (SLP).	
iv. Historical and cultural aspects if applicable.	Chapter 9.3
b. An outline of the implementation programme which must include:	
i. Description of appropriate technical and management options chosen for each environmental impact, socio-economic condition and historical and cultural aspects for each phase of mining.	Chapter 10 and Table 70, Table 71, Table 72, Table 73
ii. Action plans to achieve objectives and specific goals (51(a)) which must include a time schedule of actions to be undertaken to implement mitigation measures for each phase of mining.	Chapter 10 and Table 70, Table 71, Table 72, Table 73
iii. Procedure for environmental related emergencies and remediation.	Chapter 13
iv. Planned monitoring and environmental management programme performance assessment.	Chapter 11.14 & 11.12.1
v. Financial provision in relation to the execution of the environmental management programme which must include: aa. The determination of the quantum of the financial provision contemplated in regulation 54. bb. Details of the method providing for financial provision.	Chapter 14
i. An environmental awareness plan	Chapter 12
ii. Inclusion of supporting information and specialist reports.	Various appendices
iii. Undertaking by applicant.	Chapter 17

3 PROJECT DESCRIPTION

3.1 Details of Applicant

3.1.1 Contact Details

Name of Company: Langcarel (Pty) Ltd a wholly owned subsidiary of CoAL

Name of Mine: Mooiplaats Colliery (North)

Postal Address: The Campus

Gabba Building - 2nd floor

57 Sloane Street

Bryanston

2021

Telephone: 087 941 2631

Fax Number: 086 690 6605

Responsible Persons: Pieter Boshoff

3.1.2 Mineral Rights Holder

Name of Company: Langcarel (Pty) Ltd a wholly owned subsidiary of CoAL

Name of Mine: Mooiplaats Colliery (North)

Postal Address: The Campus

Gabba Building - 2nd floor

57 Sloane Street

Bryanston

2021

Telephone: 087 941 2631

Fax Number: 086 690 6605

Responsible Persons: Pieter Boshoff

3.1.3 Owner of the Land

Table 1 shows the surface right ownership and the relevant contact details for the surface owner. CoAL has a lease agreement in place with the Land owner.

Table 1: Surface Right Ownership

Farm	Portion	Area (ha)	Title deed number	Surface owner	Contact Details:
Mooiplaats 290 IT	Ptn 1	487.5458	T13234/79	Eglin Investments No. 44 (Pty) Ltd	PO Box 30502 Kyalami

Farm	Portion	Area (ha)	Title deed number	Surface owner	Contact Details:
					1684 011 388 5401
Mooiplaats 290 IT	Ptn 9	423.3176	T13234/79	Eglin Investments No. 44 (Pty) Ltd	PO Box 30502 Kyalami 1684 011 388 5401

3.2 Location of site

3.2.1 Regional setting

The site is situated approximately 2 km south of Camden Power Station and about 17 km south east of Ermelo, Mpumalanga Province alongside the N2 national road to Piet Retief.

3.2.2 Magisterial district and Municipalities

The site is situated within the Gert Sibande District Municipality of the Mpumalanga Province of South Africa. Specifically, the site is located in the Msukaligwa Local Municipality,

3.2.3 Direction and distance to neighbouring towns

Table 2 shows the nearest towns and distances and direction to these towns.

Table 2: Distances and directions to neighbouring towns

Town	Distance	Direction
Middelburg	100 km	NW
Hendrina	50 km	NW
Piet Retief	100 km	SE
Morgenzon	50 km	SW
Carolina	70 km	NNE
Bethal	50 km	W
Amersfoort	50 km	S
Breyten	30 km	NNE

3.2.4 Local setting (Plan1 and Plan 2)

The site is located in the Witpuntspruit and Vaal River catchments, which discharges into the Grootdraai Dam at Standerton. More specifically, Mooiplaats Colliery lies within the quaternary catchment C11B, which occupies an area of 537 km^2. The majority of the active mine site drains via tributaries into the Witpuntspruit and then into the Vaal River.

3.2.5 Land Tenure and use of immediately adjacent land

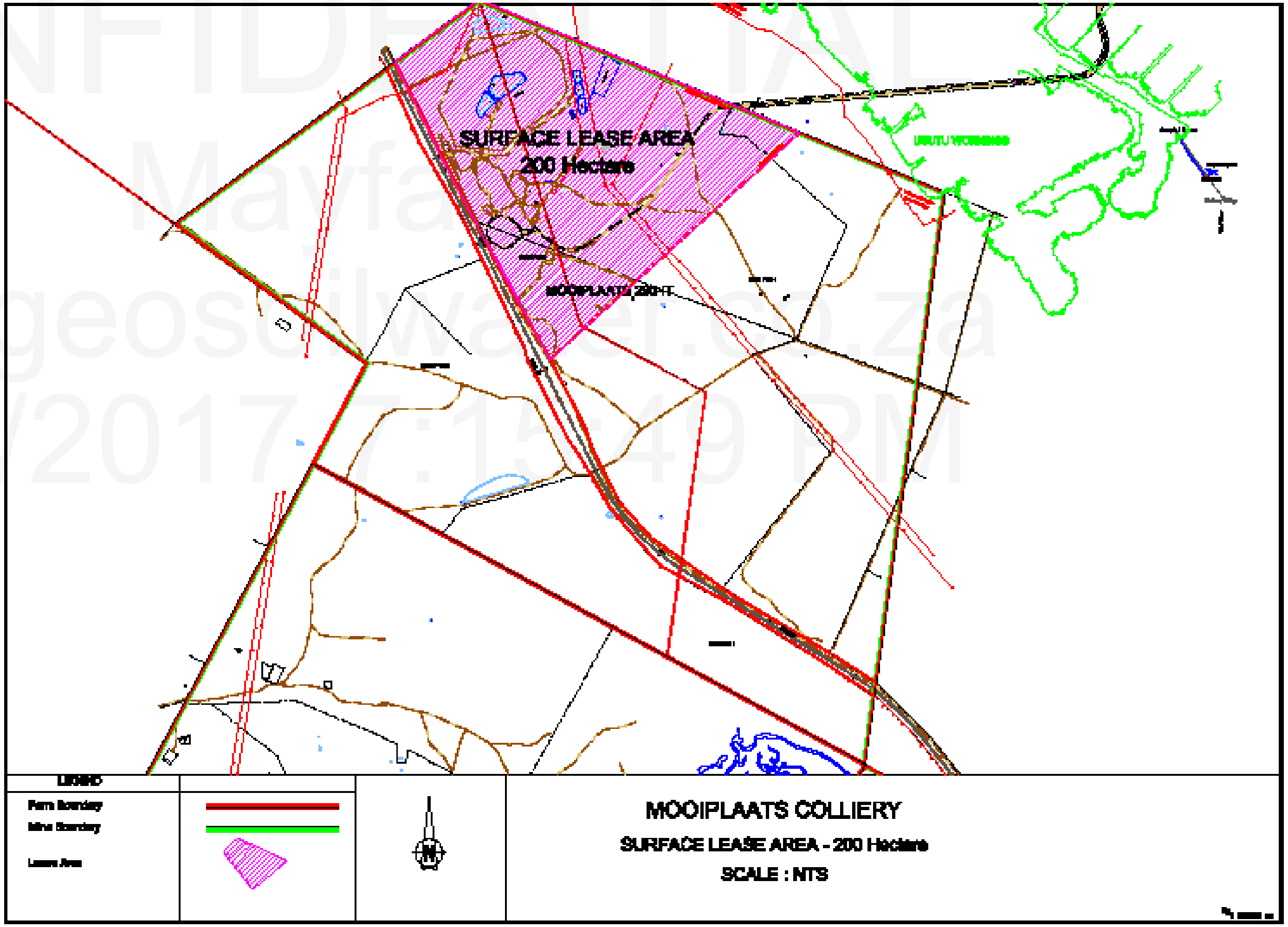
Land use of the area is mostly agriculture (crop farming and stock grazing) with power generation at Camden Power Station and associated servitudes, some coal mining activities and some residential development associated with the industrial activities in the area.

3.3 Description of the project

3.3.1 Surface infrastructure and servitudes

The site is adjacent to the N2, between Ermelo and Piet Retief. Railway lines traverse the south western part of the property and run southwest of the main boxcut and infrastructure area of the mine. Camden Power Station is adjacent to the colliery and several power lines traverse the property. There are also several railway lines feeding Camden Power Station to supply the station with coal. The railway lines and power lines have associated servitudes and several farm access roads occur on site.

Plan 1: Regional Setting



Plan 2: Lease area

Plan 3: Surface plan of Mooiplaats Colliery

Plan 4: Mine plan for Mooiplaats Colliery

Plan 5: Detailed surface infrastructure of plant area

Plan 6: Detailed surface infrastructure of admin area

Plan 7: Detailed surface infrastructure of the proposed PCD and related infrastructure

Plan 8: Surface layout of proposed intermittent dirty water storage areas and canals to divert dirty water to the main PCD

Plan 9: Cross section of the various canals as indicated in plan 7

Plan 10: Detailed plan of the PCD and associated silt trap

Plan 11: Detailed plan of the silt trap design

Surface infrastructure which occurs on site includes the following:

- Upslope diversion berms
- Mining area
    - T-shaped boxcut for underground access for equipment and staff access
    - Diversion berms and channels
    - Overburden and soil stockpiles
    - Conveyors for coal transport
    - Three settling dams
    - Erikson dams/tanks
- Office and Admin area
    - Potable water tank
    - Change house
    - Sewage treatment plant
    - Sump to collect runoff from office area fitted with pump
    - Office and administrative buildings
    - Workshop
    - Wash bay
    - Scrapyard
    - Substation
    - Generators
    - Diesel storage
    - Power lines
    - Parkade
    - Stores
    - First aid room
    - Lamp room
- Plant area
    - Workshop
    - Laboratory
    - Processing plant and control room

  - Coal stockpiling area
  - Conveyors
  - Substation
  - Power lines
  - Erikson dams/tanks
- Mine residue
  - Co-disposal facility
  - Return water dams
- General
  - Clean water storage tanks
  - Pollution control dam
  - Access road and secured access control
  - Weighbridges and haul roads
  - Boreholes

3.3.2 Mineral Deposit

The mining area lies within the Ermelo Coalfield and 3 coal seams occur on the target with the upper A and C seams being poorly developed and not economically viable to mine. The B Upper seam is developed sufficiently and is the target seam for underground mining methods (>100m below ground level). The B Lower seam is also not economically viable.

3.3.3 Mine products

The design allows for the processing of 220 000 tonnes per month nominal feed through the DMS plant and with a yield of 65% will result in 14 300 tonnes per month of washed product.

The bituminous or lean coal primary crusher is capable of crushing 220 000 tonnes per month which provides flexibility to Mooiplaats Colliery to ensure there is sufficient stockpile capacity of the bituminous / lean coal.

The ROM production will be approximately 190 000 tonnes per month, with infrastructure design allowing for extraction at any given time of either anthracite or bituminous coal.

3.3.4 Access to the workings

Access to the underground workings is via a T-shaped box cut. The box-cut has 1 roadway from the surface into the coal at a depth of approximately 44m. The first level is separate haul way of 167m each and 6.8m wide at a slope of 15^0 and carries a single conveyor system. The second level is the central paved access roadway, approximately 220m long and 6.8 m wide at a slope angle of 12^0, used for the transport of staff and mining materials in and out of the mine. As the coal was intercepted, mining eventually developed into four sections. Eventually the underground mine at Mooiplaats will have five active sections as the mining progresses.

3.3.5 Mineral Processing Plant

3.3.5.1 Method to wash coal through the plant

Feed material is deposited on the Run of Mine (ROM) stockpile. The material is fed with a front end loader into the feeders. The shift foreman communicates with the front end loader driver as to where and what type of material should be fed to the plant.

Feed material is extracted from the stockpile with 5 feed gates and vibrating feeders situated inside the ROM tunnel discharging material onto the reclaim conveyer. Three of the vibrating feeders are connected direct on line, which means that the throughput cannot be adjusted. Two of these feeders are fitted with variable speed drives (vsd) which is connected to the weightometer and control the feed at the desired rate. The feed rate is controlled at an average of 400tph to ensure the surge bin is kept full at all times.

A belt magnet is situated just outside the ROM tunnel running over the reclaim conveyer. The purpose of this magnet is to remove the scrap material from the material. The plant attendants make sure that the magnet is kept clear of tramp iron by running the magnet belt

The reclaim conveyer transfers the feed material onto a static grizzly, which is situated above the primary roll crusher. The static grizzly bars are set 90mm apart. The undersize material (-85mm) falls directly onto the scalping screen feed conveyer, while the oversize. (-300mm +85mm) passes through the primary roll crusher, set at 80mm. The discharge of the primary crusher also falls onto the scalping screen feed conveyer.

The scalping screen is fitted with 55mm panels. The oversize (-100mm + 50mm) of the scalping screen falls onto the secondary crusher feed conveyer, while the undersize (-50mm) discharges onto the surge bin feed conveyer, which feeds into the surge bin.

The secondary roll crusher feed conveyer feeds the secondary roll crusher, which is set at 45mm. The secondary crusher discharge falls on the scalping screen feed conveyer, where the material is again sized as oversized and correct sized material.

The crushing section concrete slabs and the ROM tunnel is kept clean by the crushing section attendants. Drums are placed outside to throw away all the papers and plastic from underground.

The plant feeder is a vibrating feeder, fitted with a variable speed drive, discharging material onto the primary plant feed conveyer. This conveyer is fitted with a weightometer, which is linked to the feeder's variable speed drive, controlling the feed to the plant per module at 200 ton per hour (tph). The plant is designed for 200tph per module as a maximum and this value is never exceeded.

The primary plant feed conveyer discharges onto a sieve bend (0.8mm slots across flow) onto the primary de-sliming screen. The primary de-sliming screen is fitted with 1x13 mm slotted panels. The slimes are pumped to the spiral dewatering cyclones in the spiral plant.

The primary de-sliming screen discharges in the mixing box feeding the 800mm cyclone fitted with a 280mm spigot. The pressure of the cyclone is between 110 -150kPa, which gives a head of 9-12D. The density at the mixing box is checked by hand every hour and recorded in the book. This will ensure that the automatic density is correct and problems can be identified as soon as possible.

The primary cyclone discharges over the sieve bends onto the primary drain and rinse screen. The primary drain and rinse screen is fitted with 0.5mm slotted panels to recycle the correct medium and wash the material to remove the rest of the magnetite adhering to the particles on the washing section. The float discharge section of screen is fitted with 20mm square panels. Material larger than 20mm is discharged onto the product conveyer, while material smaller than 20mm discharges onto the centrifuge feed conveyer. The sinks/discard section discharges onto the rewash feed conveyer.

The cement area and sumps around the primary and secondary cyclone plant are kept clean at all times.

The primary fines pump feeds the dewatering cyclones above the 4 x 3 start spirals. The spiral discard is pumped to the discard dewatering cyclone, from where the underflow discharges onto the spiral discard screen and is then discharged onto the discard conveyer. The spiral product pump feeds the product dewatering cyclone from where the underflow discharges onto the product dewatering screen and discharges then onto the product conveyer. The dewatering cyclones are fitted with 55mm HDPE spigots. The overflow from the dewatering cyclones feeds to the thickener. If there are any large pieces of material found in the spirals, a sievebend is holed.

The centrifuge feed conveyer discharges into the centrifuge where water is removed and pumped back to the spiral discard sump. The centrifuge product discharges onto the Export stockpile conveyer. The product conveyer also discharges onto the Export stockpile.

The rewash feed conveyer discharges into the mixing box of the rewash cyclone feed pump feeding the 800mm rewash cyclone fitted with a 265mm spigot. The pressure of the cyclone should be between 90 -130kPa, which will give a head of 9-12D. The density at the mixing box will be checked every hour by hand and recorded in the book. This will ensure that the automatic density is correct and problems can be identified as soon as possible.

The rewash cyclone discharges over the sieve bends onto the rewash drain and rinse screen. The rewash drain and rinse screen is fitted with 0.5mm slotted panels to recycle the correct medium and wash the material to remove the rest of the magnetite adhering to the particles on the washing section. The floats discharge onto the Eskom stockpile conveyer while the sinks/discard section discharge onto the discard conveyer.

The discard feed conveyer discharge into the discard bin, from where the discard is trucked to the co-disposal dump.

All the slurry (-0.5mm) from the plant are pumped to the thickener. Flocculant is added continuously to the thickener feed launder through the automatic flocculant plant of MC Process. The flocculant is made up of clean water and the auto dilution takes place with process water. Flocculant is pumped on a continuous tempo into the thickener to ensure that the overflow is clean.

The overflow from the thickener is recycled back to the plant while the underflow is pumped to the settling dam on the co-disposal dump. The density of the thickener underflow is measured every hour and the density measured should not be more than 1.1 S.G to prevent blockages in the line.

The beaching of the slurry dam is checked on a regular basis and the discharge pipes are changed when it is necessary.

The primary and middlings product is dispatched through the load out section. Only one product at a time can be extracted from the two stockpiles and loaded onto the load out conveyer. The product is extracted with 6 vibrating feeders in every tunnel. The operator should utilize all 6 feeders ensuring that product is extracted evenly throughout the stockpile. The product conveyers discharge onto the load out conveyer from where the product is discharged into the load out bin. The trucks are loaded by opening the gate below the load out bin.

The load out bin attendants ensure that product tunnels as well as the load out section are kept clean.

3.3.5.2 Quality Assurance

Samples are taken every two hours and the quick ash analysis is available two hours after the sample are taken.

1. The continuous samplers take samples at 4 places in the plant:
    a. Plant feed conveyer sampler
    b. Primary product conveyer sampler
    c. Eskom product conveyer sampler
    d. Final discard conveyer sampler
2. Samples are also taken at the following places:
    a. Primary cyclone discard
    b. Spiral product
    c. Spiral discard

Every two hours the lab personnel make the quick ash results of the primary product and the Eskom product available. The target for the primary product is 14% ash and for the rewash product is 24% ash. If the ash value is too low the specific density is increased and if it is too high the specific density is reduced

3. The weightometers are calibrated and tested once a month by Process automation. This is done to ensure accuracy on the scales, which will help with running an effective plant. An accurate scale will also ensure that the plant is not overfed and cause unnecessary blockages.
4. The densities in the primary washing plants and the rewash section are controlled by Process Automation density controllers. These controllers are checked and calibrated once a month by Process Automation. The hourly manual check ensures that the accuracy of the automatic

density can be tracked. If the automatic density is not working adequately it will be noted by manual checking of densities.

3.3.5.3 Maintenance

Maintenance is scheduled for Monday mornings and the foreman ensures that the checklist is completed after the maintenance. Before any work is done on any piece of equipment, the equipment is locked out according to the lock out procedure and the job card is completed. All personnel are equipped with adequate and appropriate PPE gear.

3.3.6 Estimated reserves

The reserve situation at Mooiplaats has been indicated in Table 3 below.

Table 3: Resources at the Mooiplaats North Colliery at 31 January 2011 Polygon 9386986

SECTION	AREA	SEAM NAME	SAMREC	SEAM THICKNESS	COAL AREA	COAL VOLUME	GROSS INSITU TONNES
Mooiplaats 290IT	9386986	SB	MEASURED (Anthracitic) VM<10%	1.47	562,548	828,368	1,296,422
Mooiplaats 290IT	9386986	SB	MEASURED (Lean) VM 10-20%	1.46	4,556,892	6,639,214	10,296,157
Mooiplaats 290IT	9386986	SB	MEASURED (Bituminous) VM>20%	1.99	3,647,703	7,265,555	10,708,527
Mined out (Lean)		SB					701,433
Mined out (Bituminous)		SB					942,185
Remaining (Lean)		SB					9,594,724
Remaining (Bituminous)		SB					9,766,342

3.3.7 Estimated labour force at full production

Although contractors are utilised to perform most of the tasks at the colliery, CoAL do endeavour to ensure that most of the labour force is drawn from the area. The expected breakdown of employees per sending area is as follows:

- City (Johannesburg): 6
- Town (Ermelo): 150
- Village (Wesselton): 300

Therefore the estimated total labour force at full production is in the region of 450 people for the entire colliery.

3.3.8 Planned Life of Mine

Mining commenced in 2009 with a life of around 10 years and will therefore continue for another 7 years. Application has been made to mine adjacent reserves which will add a further 8 years of mining, but increase the life of mine by a further 5 years due to overlap of mining the two areas.

3.3.9 Water Requirements

Potable water is obtained from 3 boreholes on site, each supplying an average of around 4 000 m^3/annum.

Process water is obtained from 4 boreholes drilled to access water from the old Usutu underground workings, with an average abstraction rate of 84 375 m3/annum per borehole. Make-up water is obtained from the various pollution control facilities on site and dewatering of the active underground sections of the Mooiplaats Colliery.

Water for dust suppression is obtained from dirty runoff water collecting in various pollution control facilities on site.

3.4 Estimates on type of solid waste, liquid effluent and gaseous emissions expected

3.4.1 Solid waste

All domestic waste is collected in bins on site and trucked for disposal at a licensed waste disposal site.

Small amounts of hazardous waste is generated at Mooiplaats colliery. It is collected in a specialised skip, located at the waste collection area at Mooiplaats North. It is then disposed of by a registered contractor at a registered H-H waste disposal facility. Safe disposal certificates are available at the mine.

Fluorescent tubes are crushed in a specialised 210 *l* crushing drum, which will be disposed of along with the other hazardous waste. A waste inventory is kept of all waste types and volumes generated and disposed of or recycled.

3.4.2 Liquid effluent

The mine currently has an on-site sewage treatment facility which handles sewage from the change house and office. The solid waste is degraded and the clean effluent is collected as part of the dirty water management system on site, flowing into a sump. Water from the sump will then be pumped to a pollution control dam on site which still needs to be erected (this has been properly designed, currently awaiting approval from the Department of Water Affairs prior to construction).

Used oil is collected in used oil containers, located at the waste collection area. This used oil is collected by a registered recycling contractor. Safe disposal certificates are available at the mine.

All storm water falling within the dirty footprint area is directed and captured within the dirty water system for recycling as process water or for dust suppression. Currently some minimal discharge occurs on site but adequate pollution control dam (PCD) and drainage trenches have been designed to contain dirty water runoff from all areas of activity (See figure 1 for the proposed Surface Water Management Plan).

Clean water is diverted around the property by means of soil berms and trenches and directed to the nearest natural drainage areas.

All the dirty water is contained on the surface: The following dirty water dams occur on site:

- Three settling dams collecting and settling water pumped from the underground workings and from the Usutu boreholes. Water collected in the sump constructed at the office area is also pumped into the settling dams.
- Water from the settling dams is pumped to the Erickson dams at the boxcut and at the wash plant for use as process water.
- The co-disposal facility has a one return water dam to collect runoff from the facility. This water is also pumped to the settling dams for re-use in the wash plant and underground.

3.4.3 Gaseous emissions

There are no scheduled processes taking place on the site regarding the National Air Quality Act (NEM:AQA).

3.5 Housing, recreation and other employee facilities

No employees are housed on site.

3.6 Transport

The coal is transported from the underground mining area to the surface near the wash plant via conveyor system. Coal is trucked from the mine to Umlabu Siding for railway transportation to various local and international markets and to Camden Power Station.

Figure 1: Conceptual Surface Water Management Plan

3.7 Project Phases

The project can be divided into four phases, namely, the construction phase, operational phase, decommissioning phase and the post closure phase. The activities associated with these phases are listed in the table below:

3.7.1.1 Construction Phase

- Construction of PCD and related water management features (See Appendix H for designs):
  - Upgrade of diversion trenches and canals for dirty water diversion to sumps and PCD.
  - Construction of Pollution Control Dam (PCD) and sump.
  - Construction of spill basin
  - Truck and heavy machinery operation.

3.7.1.2 Operational Phase

- Boxcut area and underground mining
  - Bord-and-pillar underground mining of the B-seam.
  - Operation of underground equipment and machinery.
  - Blasting.
  - Maintenance of the boxcut.
  - Dewatering of the underground workings.
  - Utilisation of settling dams and Erikson dams.
  - Conveyance of coal to surface.
- Coal Processing, stockpiling and discard handling.
  - Conveyance of coal to the crusher/wash plant.
  - The crushing and beneficiation of coal.
  - Discard trucked to co-disposal facility.
  - Slurry pumped to co-disposal facility.
  - Use and maintenance of the co-disposal dump.
  - Operation of the return water dam.
  - Maintenance of stockpiles (ROM & product).
- Plant infrastructure area and associated activities
  - The continuous loading and transport of coal along access and haul roads.
  - Maintenance of the access and haul roads.

- Use and Maintenance of the weighbridges.
- Diesel storage.
- Electricity generation through substations or generators during power failures.
- Use and maintenance of the laboratory, plant office and administration block.
- Domestic and industrial waste generation and removal.
- Servicing of machinery and vehicles at the workshop area & washing of equipment and vehicles at wash bay.
- Operation of floodlights at night.
- Management of the stockpiles (overburden, topsoil and subsoil).
- Utilisation of ablutions and sewage treatment.
- Access and security control.

- <u>Water management activities</u>
  - Abstraction, storage and transfer of potable water from boreholes.
  - Abstraction, storage and transfer of water from the old Usutu underground workings.
  - Separation of clean and dirty water management.
  - Operation and maintenance of pollution control dam.
  - Maintenance of pipelines and pumps.
- <u>Environmental Monitoring (dust, surface water and groundwater)</u>

3.7.1.3 Decommissioning Phase

- <u>Dismantling of infrastructure:</u>
  - Increased vehicle activity.
  - Removal of all surface / mining infrastructure not being use.
  - Final removal of coal product.
  - Final rehabilitation of roads no longer required.
  - Disposal of contaminated surface material onto the co-disposal facility.
  - Ripping/discing of all levelled areas.
  - Cladding of the co-disposal dump
- <u>Sealing of mine access and filling/profiling of boxcut</u>
  - Truck activity and operation of machinery.
  - Sealing of underground workings.
  - Mobilisation of overburden and subsoils.

- Filling of voids.

- Rehabilitation of all surface areas
  - Removal of all waste.
  - Re-profiling of all disturbed areas.
  - Application of subsoils and topsoils.
  - Amelioration of topsoil.
  - Erection of contour berms.
  - Establishment of artificial wetlands if deemed necessary for water flowing into the natural drainage lines.
  - Seeding all rehabilitated areas.
- Continued operation of water management facilities
  - Operation of berms and trenches
  - Operation of PCD
- Continued monitoring

3.7.1.4 Post-closure Phase

- Managing and monitoring for all post mining impacts to prevent any further pollution.
  - Continue Monitoring until a closure certificate is awarded.
  - Attendance to problem areas and general maintenance
- Application for a closure certificate.

4 DESCRIPTION OF AFFECTED ENVIRONMENT

Data for the various environmental aspects discussed below was obtained from various environmental reports compiled by various consulting companies. These have been cited where relevant. Where information was deemed to be outdated, updated data has been included and referenced as such.

4.1 Climate (CT Environmetal, 2009)

The climate data below was extracted from the EMP compiled for Mooiplaats South (CT Environmental, 2009).

Mpumalanga experiences a sub-tropical climate with hot summers and mild to cool winters. The average midday temperatures for Ermelo range from 24 to 27°C in January and 15 to 17°C in June. The region is the coldest during June when the mercury drops to 0.2°C on average at night. Ermelo normally receives about 625 mm of rain per year, with most rainfall falling during summer. It receives the lowest rainfall (1 mm) in June and the highest (112 mm) in January. The average sunshine duration is 60% in summer and 80% in winter and winds tend to be very light (CT Environmental, 2009).

Climate statistics were obtained from the South African Weather Service. The data was taken from Nooitgedacht weather station (Number 04428116), which is 1 694 m above sea level, for the period 1961 to 1990 (CT Environmental, 2009).

4.1.1 Temperature (CT Environmental, 2009)

Ermelo is an inland town where large variations occur between minimum and maximum temperatures as can be seen in Figure 2 The minimum temperatures in the winter months are low, especially over June and July, although average maximum temperatures remain mild (CT Environmental, 2009).

4.1.2 Rainfall (CT Environmental, 2009)

The rainfall pattern is typical of a Highveld summer rainfall area, but limited rain can also be experienced in the winter months (Figure 3) (CT Environmental, 2009).

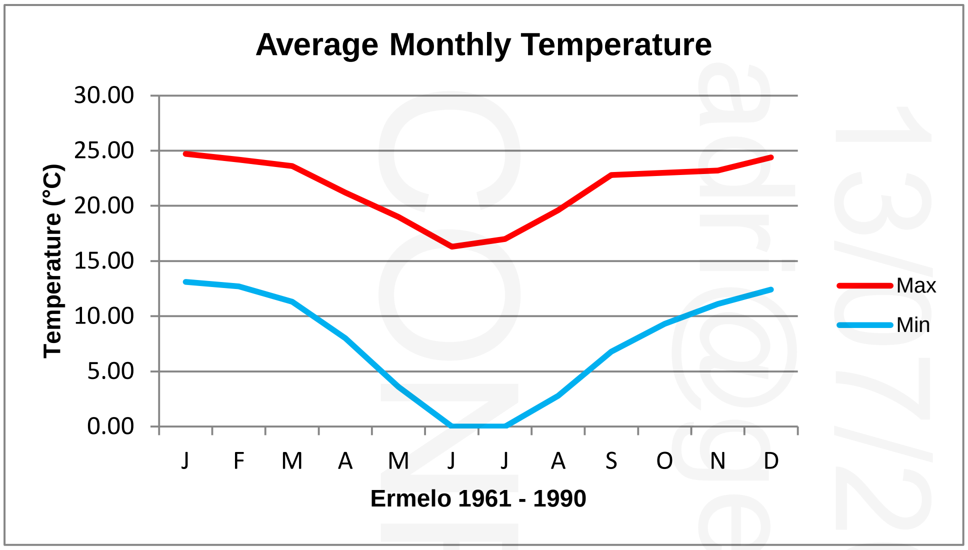


Figure 2: Average monthly temperatures for Ermelo (1961-1990) (CT Environmental, 2009)

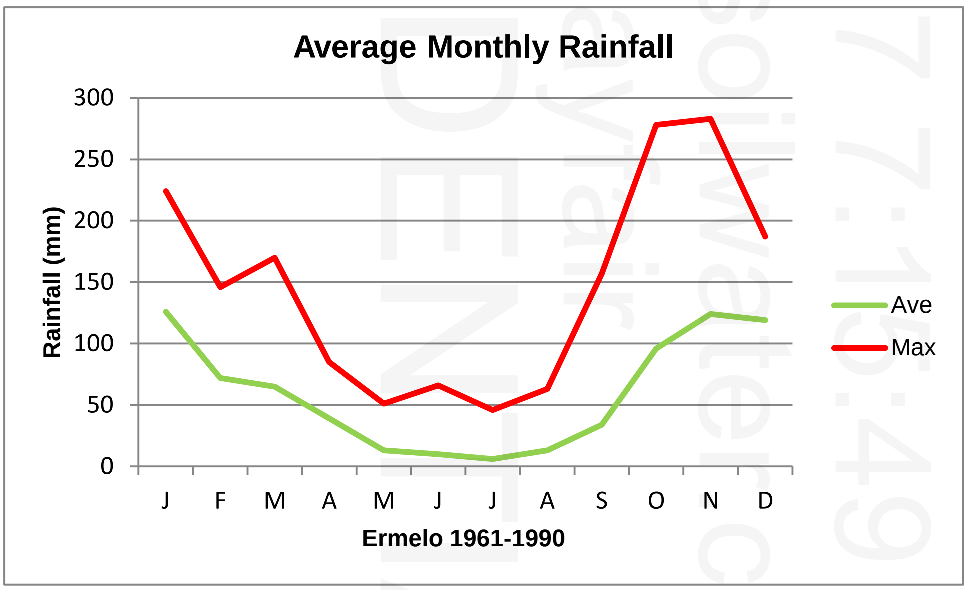


Figure 3: Average monthly rainfall for Ermelo (1961-1990) (CT Environmental, 2009)

4.1.3 Surface Wind (CT Environmental, 2009)

Wind roses were generated by Annegarn Environmental Research (AER) based on statistics obtained from the South African Weather Service. Figure 4 below shows the seasonal wind roses for the area of Ermelo. The following was observed:

- **Spring:** Wind from N and E was most prevalent. The strongest winds predominated from NW and NNW, and slightly milder winds blew from N, E, NE and W. Little wind from S.

- **Summer:** Wind came predominantly from E and NE, with a few milder winds coming from N and NE. The strongest winds were from E, ESE and NNW. Little wind from S and SW.
- **Autumn:** The autumn months were very windy, with wind coming from all directions. Wind was prevalent from W and E and the strongest winds were seen to come from NNW. Slightly milder winds ranged from the NW anti-clockwise to the ESE.
- **Winter:** The winter months had the most wind. These blew mainly from W, WNW, NW, NNW and N. The strongest winds came from the NNW with strong winds clockwise from SW to NW. There were a few strong winds from E. Little wind from S.

4.1.4 Evaporation (CT Environmental, 2009)

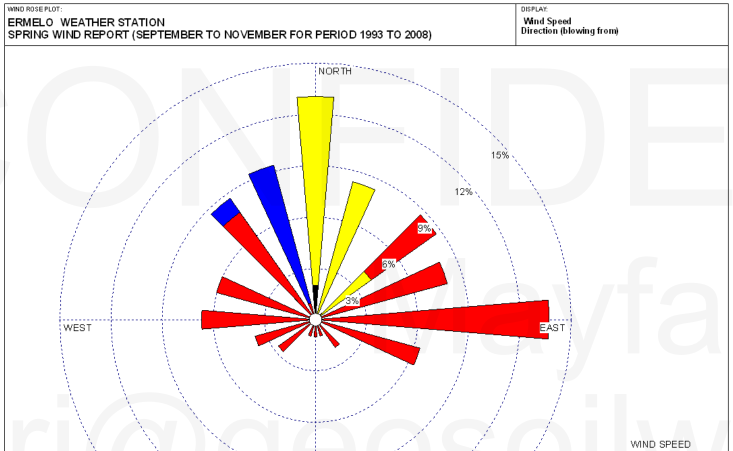
The mean annual evaporation at Ermelo, and for the study area, is 1 518 mm. Evaporation is much less variable, both in terms of seasonal and annual values, than rainfall.

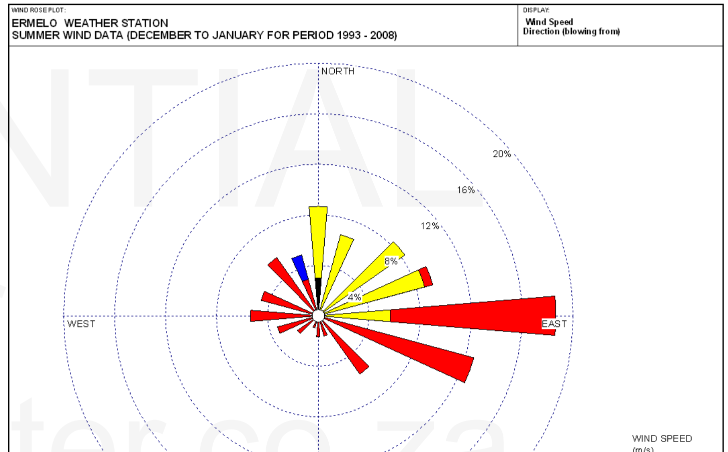
4.1.5 Extreme Weather Conditions (CT Environmental, 2009)

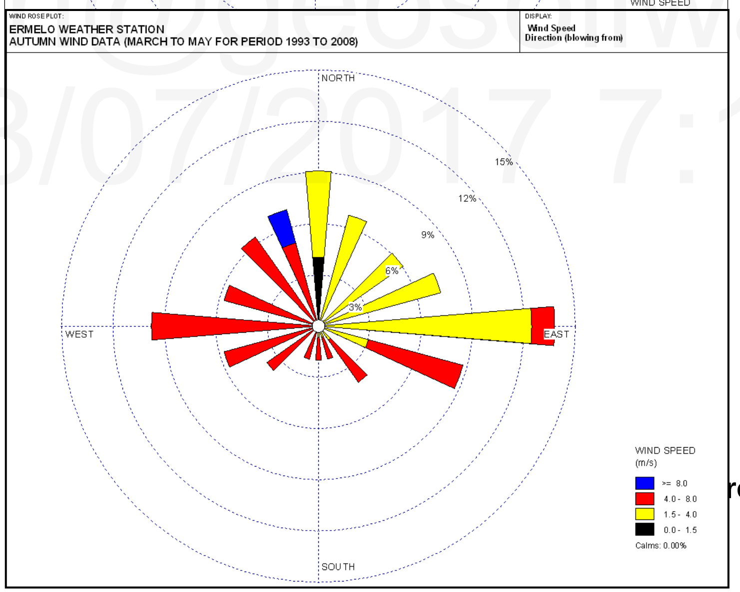
In terms of extreme weather conditions, Ermelo hardly ever experiences snow, and incidences of hail are limited. However, the trend of hail follows the trend of thunderstorms, which occur in the summer months between October and March. There is a very high incidence of fog in the area, especially during autumn and winter, and fog is even experienced during the summer months.

4.2 Topography (CT Environmetal, 2009)

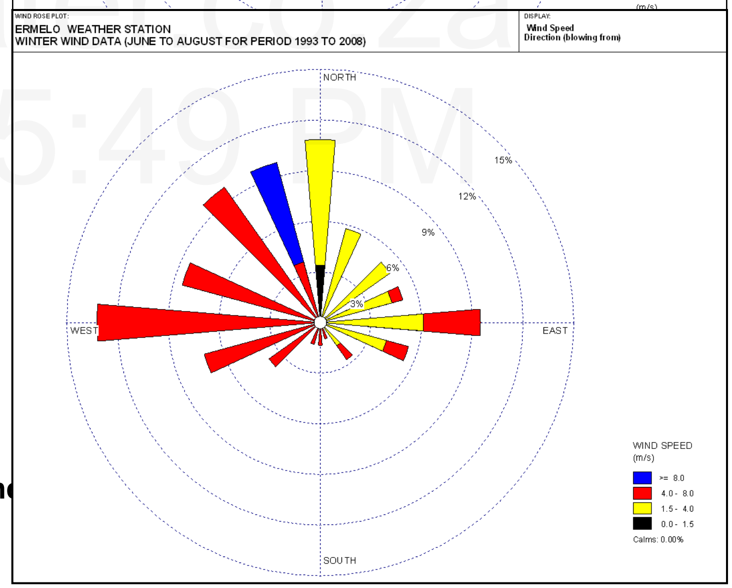
The topography of the area is typical of the upper plateau edge with gentle rolling hills. The moderately flat to rolling hilltop plains are the main cultivated areas, whereas the areas adjacent to the Vaal River and selected tributaries are dominated by steep relief and exposed rock faces. Cultivation in these areas is limited by limited soil depth. The elevation ranges between 1 720 meters above mean sea level (mamsl) on the hilltop plains and 1 586 mamsl in the river valleys.


WIND ROSE PLOT:
ERMELO WEATHER STATION
SPRING WIND REPORT (SEPTEMBER TO NOVEMBER FOR PERIOD 1993 TO 2008)
DISPLAY:
Wind Speed
Direction (blowing from)
NORTH
WEST
EAST
15%
12%
9%
6%
3%
WIND SPEED


WIND ROSE PLOT:
ERMELO WEATHER STATION
SUMMER WIND DATA (DECEMBER TO JANUARY FOR PERIOD 1993 - 2008)
DISPLAY:
Wind Speed
Direction (blowing from)
NORTH
WEST
EAST
20%
16%
12%
8%
4%
WIND SPEED


WIND ROSE PLOT:
ERMELO WEATHER STATION
AUTUMN WIND DATA (MARCH TO MAY FOR PERIOD 1993 TO 2008)
DISPLAY:
Wind Speed
Direction (blowing from)
NORTH
WEST
EAST
SOUTH
15%
12%
9%
6%
3%
WIND SPEED
(m/s)
>= 8.0
4.0 - 8.0
1.5 - 4.0
0.0 - 1.5
Calms: 0.00%

ronm


WIND ROSE PLOT:
ERMELO WEATHER STATION
WINTER WIND DATA (JUNE TO AUGUST FOR PERIOD 1993 TO 2008)
DISPLAY:
Wind Speed
Direction (blowing from)
NORTH
WEST
EAST
SOUTH
15%
12%
9%
6%
3%
WIND SPEED
(m/s)
>= 8.0
4.0 - 8.0
1.5 - 4.0
0.0 - 1.5
Calms: 0.00%

4.3 Geology

4.3.1 General geology (CT Environmental, 2009)

The site is situated in the Ermelo Coalfield. The Karoo Sequence rocks in this area are represented by the Ecca group, which consist of the Dwyka, fluvio-glacial tillites overlying felsites in an unconformable manner and schists and quartzites of the pre-Karoo basement. The remainder of the sequence, starting with the Pietermaritzburg Formation, consists of a series of essentially upward coarsening sequences each capped with a coal seam. The coal seams are named sequentially from the surface to the pre-Karoo basement in alphabetical order, A – F. Depending on the locality within the Ermelo Basin the coal seams can vary from a simple single coal ply through to complex multiple coal plies with inorganic partings.

4.3.2 Local Geology (CT Environmental, 2009)

In the area the A, D, E and F seams are generally thin and sporadically developed. The two major economic horizons occur within the B seam group and the C seam group. Both of these horizons are complex coal seams in close proximity to each other and both have a significant inorganic parting resulting in the split into a lower and upper coal ply.

Three coal seams occur on the property, identified from top to bottom as A, B and C and correlated with the Eland, Alfred and Gus seams of the Natal Coalfield. The seams are intercalated with sandstone of varying grain size with only minor occurrence of shale bands. The coal seams are more or less horizontal and variations in the overburden thickness are due mainly to topographic change in the landscape.

The A Seam is poorly developed in this area and has not been considered economically viable. Where this seam is present it was included in the determination of the overburden.

The C Seam is poorly developed with an average width of less than 40 cm where it was intersected. This seam is generally situated just below the B Lower Seam and has an average width of less than 1 m.

Only the B Upper Seam is developed sufficiently to form a viable economic entity and because of the depth of this reserve only underground mining methods are proposed. It stretches from the north-western part (1 600 – 1 620 mamsl) of Mooiplaats 290 IT in a south-eastern direction towards the intersection between the three farms (1 580 – 1 590 mamsl); along the boundary between Klipbank 295 IT and Adrianople 296 IT (1 525 – 1 630 mamsl); and towards the south-western portion of Klipbank 295 IT (>1 600 mamsl).

The B Lower Seam is present but is too thin to be considered as economically viable. The coal varies in appearance from dull lustrous to bright-banded with minor occurrences of shaly, carbonaceous, broken or weathered areas. The latter being very sub-ordinate, should have a negligible effect on the overall quality of the coal.

The B Seam varies in thickness from less than 1.2 m in the south-eastern corner of the reserve and increases to 2.4 m to the north. A depression in the seam to a width of approximately 1.5 m runs through the reserve from north to south. This was probably caused by the close proximity of a Dolerite Sill above the coal.

The overburden consists mainly of varying grained sandstone with occasional layers of shale/siltstone. Along the Vaal River (lowest local topographical feature) the depth to the coal seam ranges between 60 mbs 90 mbs. At the major sill breakthrough the coal seam is at its shallowest (20 mbs 60 mbs) because of:

- Upliftment of the coal.
- The lower topography (the Vaal River forms a small valley here).

4.3.3 Presence of dykes, sills and faults (CT Environmental, 2009)

Dolerite intrusions and sills related to the Lesotho Basalts can be found in the area. The B4 dolerite sill is by far the most prevalent sill and occurs in general over the target area below the floor of the major seam horizons. Its thickness is on average 30 m – 50 m, but where it has broken through it has been eroded by the current erosion surface in the major river valleys.

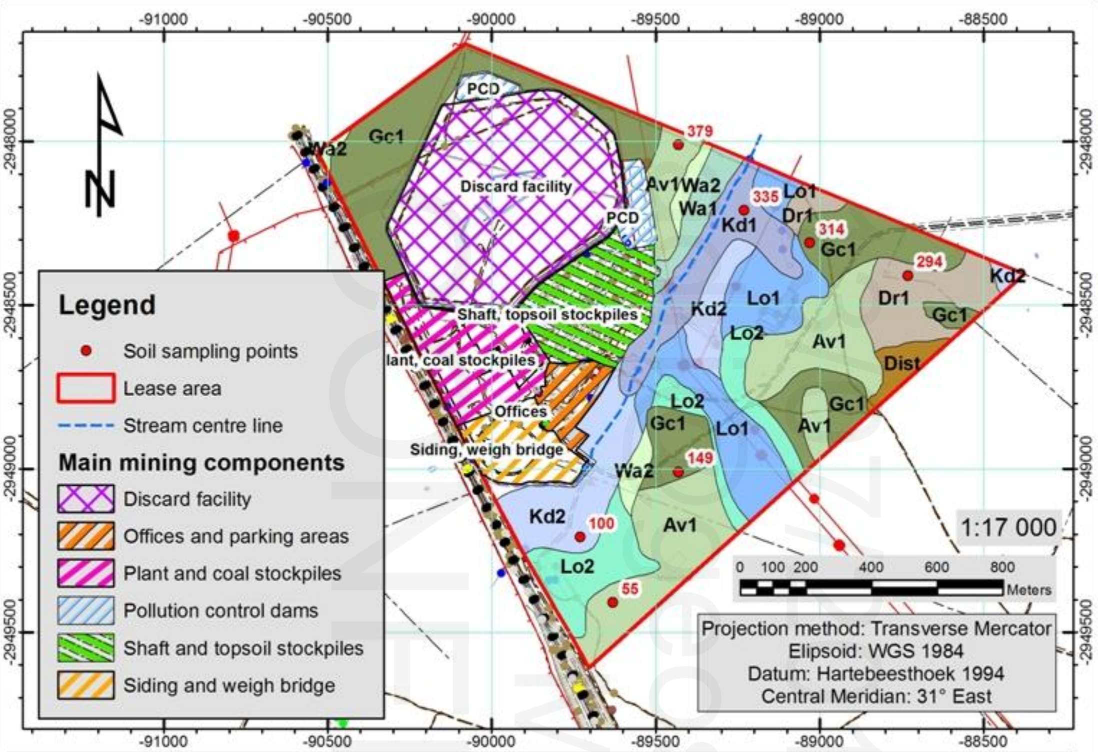
Few dolerite dykes have been identified in the area. The only known dolerite dyke outcrop has been observed in the southern part of Mooiplaats 290 IT. This sub-vertical dyke is 4 m wide with a strike in a NE – SW direction.

4.4 Soils

A soil study was conducted by Rehab Green (2011). Their findings are presented below with the full report included in **appendix A**.

4.4.1 Description of dominant soil types

A total of 10 soil types, based on dominant soil form, effective soil depth, internal drainage, terrain unit and slope percentage were identified during field observations and were symbolised as: Gc1, Av1, Dr1, Wa2, Wa1, Lo2, Lo1, Kd2, Kd1 and Dist. The extent of these soil types are shown on the soil map (Figure 5). The soil types are summarised in the soils legend (Table 4) in terms of the dominant and subdominant soil forms and families, average effective soil depth, the estimated clay content of the A and B or E or G-horizons, the derived texture class, a broad description of the dominant soil form, the soil's derived erodibility, agricultural potential, land capability as well as the number of units, the area and percentage comprised by each soil type.



ABBREVIATED SOIL LEGEND (For full legend see soil report)

Soil Type Code	Dominant Soil Form and Family	Summarized Description of Dominant Soil Form	Wetland zone	Unit Count	Area (ha)	Area (%)
Gc1	Glencoe 2100	Shallow, moderately well-drained, yellow brown, loamy sand soils: A brownish yellow loamy sand A-horizon overlying a yellow brown, sandy loam B1-horizon, overlying a hard plinthic B2-horizon.	Terrestrial land	5	31.42	24.90
Av1	Avalon 2100	Moderately deep, moderately well-drained, yellow brown, loamy sand to sandy loam soils: A brownish yellow loamy sand A-horizon overlying a yellow brown, sandy loam B1-horizon, overlying a yellowish grey, mottled soft plinthic B2-horizon.	Terrestrial land	4	25.51	20.22
Dr1	Dresden 2000	Very shallow, imperfectly drained, grey sandy soils: A grey to dark grey, sandy A-horizon, overlying a hard plinthic B-horizon.	Temporary wetland	2	9.25	7.33
Wa2	Wasbank 2000	Moderately deep, imperfectly drained, yellowish grey, sandy soils: A dark grey, sandy A-horizon, overlying a yellowish grey, leached, pure sand E-horizon overlying a hard plinthic B-horizon.	Temporary wetland	3	2.81	2.23
Wa1	Wasbank 1000	Moderately deep, somewhat poorly drained, grey, sandy soils: A dark grey, sandy A-horizon, overlying a grey to greyish white, leached, pure sand E-horizon overlying a hard plinthic B-horizon.	Seasonal wetland	1	3.22	2.55
Lo2	Longlands 2000	Moderately deep, imperfectly drained, yellowish grey, sandy soils: A dark grey, sandy A-horizon, overlying a yellowish grey, leached, pure sand E-horizon overlying a grey, mottled soft plinthic B-horizon.	Temporary wetland	3	11.98	9.49
Lo1	Longlands 1000	Moderately deep, somewhat poorly drained, grey, sandy soils: A dark grey, sandy A-horizon, overlying a grey to greyish white, leached, pure sand E-horizon overlying a grey, mottled soft plinthic B-horizon.	Seasonal wetland	3	15.57	12.34
Kd2	Kroonstad 2000	Moderately deep, somewhat poorly drained, yellowish grey, sandy soils: A dark grey, sandy A-horizon, overlying a yellowish grey, leached, pure sand E-horizon overlying a grey, mottled clay G-horizon.	Seasonal wetland	3	14.72	11.66
Kd1	Kroonstad 1000	Moderately deep, poorly drained, grey, sandy soils: A dark grey, sandy A-horizon, overlying a grey to greyish white, leached, pure sand E-horizon overlying a grey, clay G-horizon. Surface water and water tables often occur.	Permanent wetland	1	9.60	7.61
Dist	Witbank 1000	Disturbed land: Partly excavated, partly backfilled with rock material partly rehabilitated.	Terrestrial land	1	2.12	1.68
			TOTAL	26	126.2	100.0

Figure 3: Soil map of Mooiplaats Colliery lease area

Figure 5: Soil map for the Mooiplaats Colliery

Arable and grazing potential soils are both described in categories of well-drained and moderately well-drained soils. Wetland soils are described in categories of imperfectly drained and poorly drained soils. Wilderness land is described in categories based on the type of disturbances if more than 1 type occurs.

Table 4: Soil legend based on soil types, effective soil depth, terrain unit and slope percentage

Soil Type Code	Dominant Soil Form and Family	Subdominant Soil Form and Family	Effective Soil Depth (mm)	Clay content per horizon A, E, G, B	Texture Class	Summarized Description of Dominant Soil Form	Agricultural Potential	Land Capability	Wetland zone	Number of Units	Area (ha)	Area (%)
Gc1	Glencoe 2100	Avalon 2100, Dresden 1000	300-600	A: 10-12 B: 11-14	Loamy sand	Shallow, moderately well-drained, yellow brown, loamy sand soils: A brownish yellow loamy sand A-horizon overlying a yellow brown, sandy loam B1-horizon, overlying a hard plinthic B2-horizon.	Moderate-low	Grazing	Terrestrial land	5	31.42	24.90
Av1	Avalon 2100	Glencoe 2100, Clovelly 2100, Dresden 1000	600-1200	A: 10-13 B: 12-15	Loamy sand-sandy loam	Moderately deep, moderately well-drained, yellow brown, loamy sand to sandy loam soils: A brownish yellow loamy sand A-horizon overlying a yellow brown, sandy loam B1-horizon, overlying a yellowish grey, mottled soft plinthic B2-horizon.	Moderate	Arable	Terrestrial land	4	25.51	20.22
Dr1	Dresden 2000	Wasbank 1000, Longlands 1000	50-300	A: 6-10	Sandy-loamy sand	Very shallow, imperfectly drained, grey sandy soils: A grey to dark grey, sandy A-horizon, overlying a hard plinthic B-horizon.	Low	Wetland	Temporary wetland	2	9.25	7.33
Wa2	Wasbank 2000	Longlands 1000, Wasbank 1000, Dresden 2000	600-800	A: 6-10 E: 2-6	Sandy	Moderately deep, imperfectly drained, yellowish grey, sandy soils: A dark grey, sandy A-horizon, overlying a yellowish grey, leached, pure sand E-horizon overlying a hard plinthic B-horizon.	Low	Wetland	Temporary wetland	3	2.81	2.23
Wa1	Wasbank 1000	Longlands 1000, Kroonstad 1000	600-800	A: 6-10 E: 2-6	Sandy	Moderately deep, somewhat poorly drained, grey, sandy soils: A dark grey, sandy A-horizon, overlying a grey to greyish white, leached, pure sand E-horizon overlying a hard plinthic B-horizon.	Low	Wetland	Seasonal wetland	1	3.22	2.55
Lo2	Longlands 2000	Wasbank 1000, Longlands 1000, Dresden 2000	600-800	A: 6-10 E: 2-6 B: 15-25	Sandy	Moderately deep, imperfectly drained, yellowish grey, sandy soils: A dark grey, sandy A-horizon, overlying a yellowish grey, leached, pure sand E-horizon overlying a grey, mottled soft plinthic B-horizon.	Low	Wetland	Temporary wetland	3	11.98	9.49
Lo1	Longlands 1000	Wasbank 1000, Kroonstad 1000	600-800	A: 6-10 E: 2-6 B: 15-25	Sandy	Moderately deep, somewhat poorly drained, grey, sandy soils: A dark grey, sandy A-horizon, overlying a grey to greyish white, leached, pure sand E-horizon overlying a grey, mottled soft plinthic B-horizon.	Low	Wetland	Seasonal wetland	3	15.57	12.34
Kd2	Kroonstad 2000	Longlands 1000, Wasbank 2000	600-800	A: 6-10 E: 2-6 G: 40-50	Sandy-clay	Moderately deep, somewhat poorly drained, yellowish grey, sandy soils: A dark grey, sandy A-horizon, overlying a yellowish grey, leached, pure sand E-horizon overlying a grey, mottled clay G-horizon.	Low	Wetland	Seasonal wetland	3	14.72	11.66

Soil Type Code	Dominant Soil Form and Family	Subdominant Soil Form and Family	Effective Soil Depth (mm)	Clay content per horizon A, E, G, B	Texture Class	Summarized Description of Dominant Soil Form	Agricultural Potential	Land Capability	Wetland zone	Number of Units	Area (ha)	Area (%)
Kd1	Kroonstad 1000	Fernwood 2110, Longlands 1000	600-800	A: 5-8 E: 2-6 G: 40-50	Sandy-clay	Moderately deep, poorly drained, grey, sandy soils: A dark grey, sandy A-horizon, overlying a grey to greyish white, leached, pure sand E-horizon overlying a grey, clay G-horizon. Surface water and water tables often occur.	Low	Wetland	Permanent wetland	1	9.60	7.61
Dist	Witbank 1000	-	100-500	A: 10-20	Loamy sand-sandy loam	Disturbed land: Partly excavated, partly backfilled with rock material partly rehabilitated.	Low	Wilderness	Terrestrial land	1	2.12	1.68
TOTAL										**26**	**126.2**	**100.0**

4.4.1.1 Arable potential - Well-drained soils

No soils in this category.

4.4.1.2 Arable potential – Moderately well-drained soils

Soil type Av, dominated by the Avalon soil Form, covering 25.51 ha (20.22% of the study area), occurs on gentle to moderate midslopes (3-8% slopes) and consists of moderately deep, moderately well-drained, yellow brown, loamy sand to sandy loam soils. The soil profile sequence consists of a brownish yellow, loamy sand, Orthic A-horizon overlying a yellow brown, apedal, sandy loam B1-horizon, overlying a yellowish grey, mottled soft plinthic B2-horizon. The land capability was classified as arable potential with moderate agricultural potential. The erodibility was rated low due to stable physical and chemical properties and gentle to moderate slopes.

Four units of soil type Av were mapped of which 3 are situated to the east of the stream and 1 to the west.

4.4.1.3 Grazing potential – Well-drained soils

No soils in this category.

4.4.1.4 Grazing potential – Moderately well-drained soils

Soil type Gc1, dominated by the Glencoe soil Form, covering 31.42 ha (24.90% of the study area), occurs on gentle midslopes (2-5% slopes) and consists of shallow, moderately well-drained, yellow brown, loamy sand soils. The soil profile sequence consists of a brownish yellow, loamy sand, Orthic A-horizon overlying a yellow brown, sandy loam B1-horizon, overlying a hard plinthic B2-horizon. The land capability was classified as grazing potential with moderate to low agricultural potential due to insufficient effective soil depth. The erodibility was rated low due to stable physical and chemical properties and gentle slopes.

Five units of soil type Gc1 were mapped of which 4 are situated to the east of the stream and 1 to the west.

4.4.1.5 Wetland – Imperfectly drained soils

Soil type Dr1, dominated by the Dresden soil Form, covering 9.25 ha (7.33% of the study area), occurs on gentle midslopes (2-4% slopes) and consists of very shallow, imperfectly drained, grey sandy soils. The soil profile sequence consists of grey to dark grey, sandy, Orthic A-horizon, overlying a hard plinthic B-horizon. The land capability was classified as a temporary wetland zone with low agricultural potential due to insufficient effective soil depth and impeded internal drainage. The erodibility was rated moderate to high due to its shallowness and subsequent inability to accommodate annual precipitation.

Two units of soil type Dr1 were mapped, situated in the eastern portion of the study area.

Soil type Wa2, dominated by the Wasbank soil Form, covering 2.81 ha (2.23% of the study area), occurs on gentle foot slopes (3-5% slopes) and consists of moderately deep, imperfectly drained, yellowish grey, sandy soils. The soil profile sequence consists of dark grey, sandy, Orthic A-horizon, overlying a yellowish grey, leached, pure sand E-horizon overlying a hard plinthic B-horizon. The land capability was classified as a temporary wetland zone with low agricultural potential due to impeded internal drainage. The erodibility was rated low due to stable physical and chemical properties and gentle slopes.

Three units of soil type Wa2 were mapped situated adjacent to the central part of the stream.

Soil type Lo2, dominated by the Longlands soil Form, covering 11.98 ha (9.49% of the study area), occurs on gentle foot slopes (4-6% slopes) and consists of moderately deep, imperfectly drained, yellowish grey, sandy soils. The soil profile sequence consists of a dark grey, sandy, Orthic A-horizon, overlying a yellowish grey, leached, pure sand E-horizon overlying a grey, mottled soft plinthic B-horizon. The land capability was classified as a temporary wetland zone with low agricultural potential due to impeded internal drainage. The erodibility was rated low due to stable physical and chemical properties and gentle slopes.

Three units of soil type Lo2 were mapped situated in the southern part of the study area.

4.4.1.6 Wetland – Somewhat poorly to poorly drained soils

Soil type Wa1, dominated by the Wasbank soil Form, covering 3.22 ha (2.55% of the study area), occurs on gentle foot slopes (2-4% slopes) and consists of moderately deep, somewhat poorly drained, grey, sandy soils. The soil profile sequence consists of a dark grey, sandy, Orthic A-horizon, overlying a grey to greyish white, leached, pure sand E-horizon overlying a hard plinthic B-horizon. The land capability was classified as a seasonal wetland zone with low agricultural potential due to impeded internal drainage. The erodibility was rated low due to stable physical and chemical properties and gentle slopes.

One units of soil type Wa1 was mapped situated in the northern portion of the study area adjacent to the central part of the stream.

Soil type Lo1, dominated by the Longlands soil Form, covering 15.57 ha (12.34% of the study area), occurs on gentle foot slopes and valley bottoms (2-4% slopes) and consists of moderately deep, somewhat poorly drained, grey, sandy soils. The soil profile sequence consists of a dark grey, sandy, Orthic A-horizon, overlying a grey to greyish white, leached, pure sand E-horizon overlying a grey, mottled soft plinthic B-horizon. The land capability was classified as a seasonal wetland zone with low agricultural potential due to impeded internal drainage. The erodibility was rated low due to stable physical and chemical properties and gentle slopes.

Three units of soil type Lo1 were mapped situated in the eastern part of the study area.

Soil type Kd2, dominated by the Kroonstad soil Form, covering 14.72 ha (11.66% of the study area), occurs in gently sloped valley bottoms (2-3% slopes) and consists of moderately deep, somewhat poorly drained, yellowish grey, sandy soils. The soil profile sequence consists of a dark grey, sandy, Orthic A-horizon, overlying a yellowish grey, leached, pure sand E-horizon overlying a grey, mottled clay G-horizon. The land capability was classified as a seasonal wetland zone with low agricultural potential due to impeded internal drainage. The erodibility was rated low due to stable physical and chemical properties and gentle slopes.

Soil type Kd1, dominated by the Kroonstad soil Form, covering 9.6 ha (7.61% of the study area), occurs in a gently sloped valley bottom (1-2% slopes) and consists of moderately deep, poorly drained, grey, sandy soils. The soil profile sequence consists of a dark grey, sandy A-horizon, overlying a grey to greyish white, leached, pure sand E-horizon overlying a grey, clay G-horizon. Shallow surface water and water tables occurred frequently. The land capability was classified as a permanent wetland zone with low agricultural potential due to the degree of wetness in the soil profile. The erodibility was rated low due to stable physical and chemical properties and gentle slopes.

One unit of soil type Kd1 was mapped comprising the valley bottom along the northern section of the stream.

4.4.1.7 Wilderness – Disturbed soils

A section on the south-eastern boundary was excavated and partly backfilled with rock material, surrounded by a section that appeared to be rehabilitated at some stage. This section was symbolized as Dist and comprises 2.12 ha 1.68% of the study area and the land capability was classified as wilderness land due to its disturbed nature.

4.4.2 Other derived soil properties

Derived soil properties of each soil type, e.g. natural fertility, dry land production potential and irrigation potential are given in Table 5.

4.4.3 Soil chemical analyses

A sample of the A and/or B and G-horizon of the dominant soil types were taken at 7 localities and the soil chemical results are shown in

Table 6.

The average cation, phosphorus and ph values (values in red text) were calculated and compared to general fertility guidelines in Table 7. Values of the G-horizons were excluded.

The average K value of 37.9 mg/kg is low while the average Ca (298.5) and Mg (88.0) are low-moderate and moderate respectively. The low average Na concentration of 6.7 mg/kg is positive and indicates no accumulation of sodium and implies an absence of sodic soils. However, the higher Na concentration in the G-horizons of 89.6 and 104.9 mg/kg indicates a moderate build up of sodium due to the low permeability of the G-horizons.

The very low average P concentration of 0.5 mg/kg is common in natural soils. The average pH value of 5.58 with a minimum of 4.71 indicates acid soil conditions.

Table 5: Other Derived soil properties

Soil Type Code	Natural Fertility	Dry land crop production potential	Soil potential for Irrigation
Gc1	Low	Moderate-low	Moderate-low
Av1	Low	Moderate	Moderate
Dr1	Low	Low	Very low

Soil Type Code	Natural Fertility	Dry land crop production potential	Soil potential for Irrigation
Wa2	Low	Low	Very low
Wa1	Low	Low	Very low
Lo2	Low	Low	Very low
Lo1	Low	Low	Very low
Kd2	Low	Low	Very low
Kd1	Low	Low	Very low
Dist	Low	Low	Very low

Table 6: Soil chemical analysis

Samp Point	Soil Form	Hor	Depth	K mg/kg	Ca mg/kg	Mg mg/kg	Na mg/kg	T.Acid / T.Suur cmol(+)/kg	Acid saturat %	Resistance ohm	P (Bray 1) mg/kg	pH (H_2O)
55	Av2100	A1	0-250	64	117	37	0.7	0.19	15.29	4810	0.57	5.38
		B1	350-700	31	87	22	1.1			7210	0.51	4.84
100	Kd1000	A1	0-250	32	312	78	5.2	0.26	10.23	2870	0.19	5.31
		E	250-700	14	122	37	5.5			4530	0.17	5.67
		G	700-1000	70	661	327	89.6			1370	0.1	6.79
149	Gc2100	A1	0-250	75	334	100	4.6	0		2550	1.58	5.8

Samp Point	Soil Form	Hor	Depth	K mg/kg	Ca mg/kg	Mg mg/kg	Na mg/kg	T.Acid / T.Suur cmol(+)/kg	Acid saturat %	Resistance ohm	P (Bray 1) mg/kg	pH (H_2O)
		B1	250-600	35	25	13	0.79			5110	0.39	4.71
294	Wa1000	A1	0-250	51	894	284	11.2	0		1510	0.28	6.11
		E	350-700	15	391	139	4.1			3910	0.22	6.6
314	Gc2100	A1	0-200	42	86	21	0.05	0.62	46.63	5510	0.51	4.95
		B1	200-400	23	111	31	0.89			6520	0.3	5.12
335	Kd1000	A1	0-200	23	789	202	29.7	0		1790	0.36	6.35
		E	200-300	15	582	163	29.6			1620	0.21	6.76
		G	300-700	81	1447	614	104.9			850	0.15	7.97
379	Av2100	A1	0-250	75	235	65	1.4	0.1	5.00	3930	1.24	5.44
		B1	350-700	36	95	40	0.04			6220	0.49	5.18

Table 7: Soil fertility compared to broad fertility guidelines

<table>
<tr><th colspan="6">Guidelines (mg/kg)</th><th>Actual analysis</th></tr>
<tr><th colspan="2"></th><th colspan="2">Low</th><th colspan="2">High</th><th>Average calculated form Table 4 (mg/kg)</th></tr>
<tr><td colspan="2">Potassium (K)</td><td colspan="2"><40</td><td colspan="2">>250</td><td>37.9 (Low)</td></tr>
<tr><td colspan="2">Calcium (Ca)</td><td colspan="2"><200</td><td colspan="2">>3000</td><td>298.5 (Low-moderate)</td></tr>
<tr><td colspan="2">Magnesium (Mg)</td><td colspan="2"><50</td><td colspan="2">>300</td><td>88.0 (Moderate)</td></tr>
<tr><td colspan="2">Sodium (Na)</td><td colspan="2"><50</td><td colspan="2">>200</td><td>6.7 (Very low)</td></tr>
<tr><td colspan="2">Phosphorus (P)</td><td colspan="2"><5</td><td colspan="2">>35</td><td>0. 5 (Very low)</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td></td></tr>
<tr><th colspan="6">pH(H_2O)</th><th></th></tr>
<tr><th>Very acid</th><th>Acid</th><th>Slightly acid</th><th>neutral</th><th>Slightly alkaline</th><th>Alkaline</th><th></th></tr>
<tr><td><4</td><td>5-5.9</td><td>6-6.7</td><td>6.8-7.2</td><td>7.3-8</td><td>>8</td><td>5.58 (Acid)</td></tr>
</table>

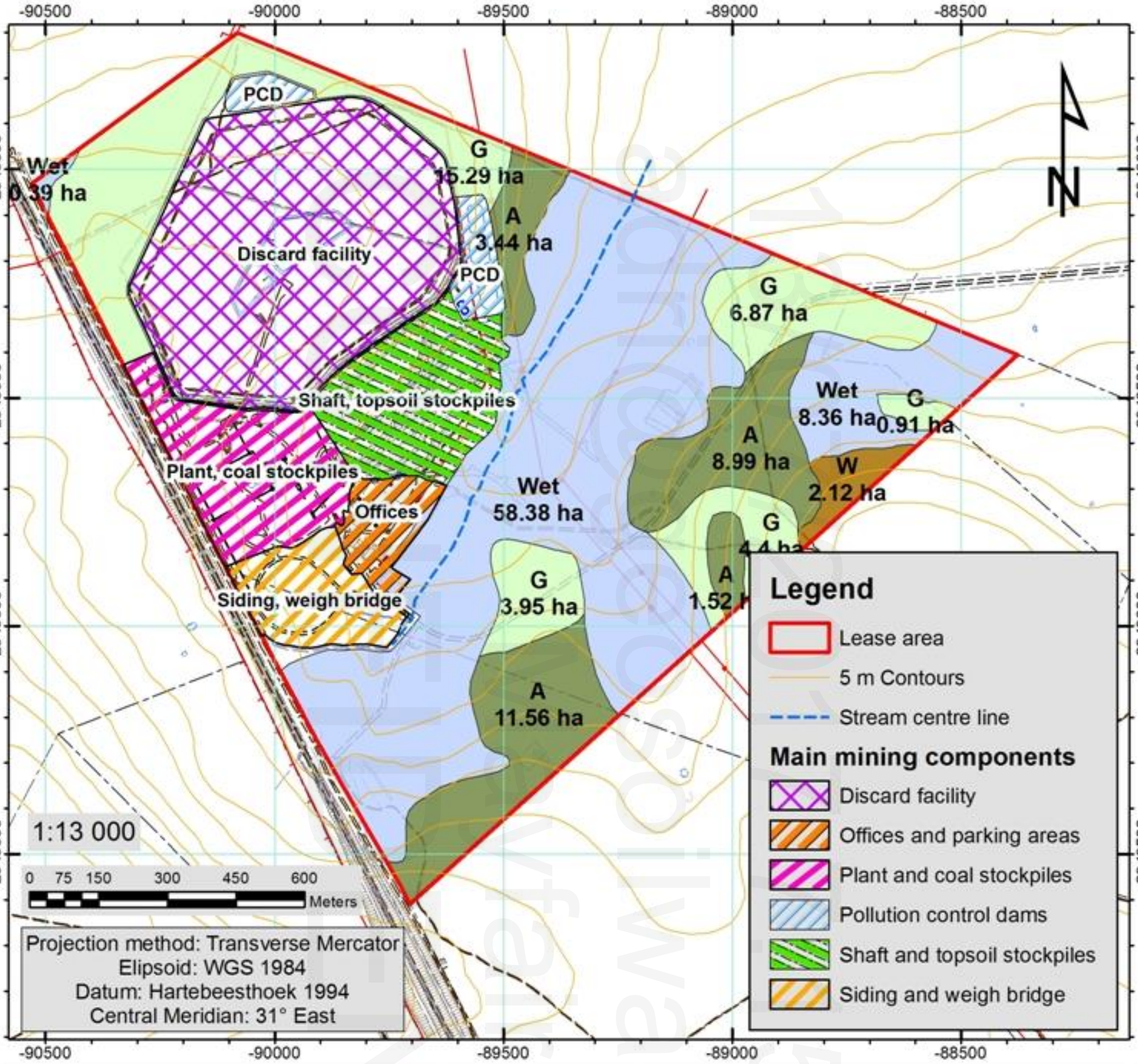
4.5 Land Capability

Table 8 shows the soil types grouped into each land capability class, a broad description of the soil group, the number of units per land capability class, and the area and percentage comprised by each land capability class. The extent of land capability classes is shown on the land capability map Figure 6. Wetland soils have been further discussed in the Sensitive landscapes section below.

Table 8: Land capability classes

LEGEND: LAND CAPABILITY						
Land Capability Code	**Land Capability Class**	***Soil Types**	**Broad Soil Description**	**Unit Count**	**Area (ha)**	**Area (%)**
A	Arable	Av1	Gentle midslopes; Moderately deep, moderately well-drained, yellow brown, loamy sand to sandy loam soils underlain by soft plinthite.	4	25.51	20.22

LEGEND: LAND CAPABILITY						
Land Capability Code	**Land Capability Class**	***Soil Types**	**Broad Soil Description**	**Unit Count**	**Area (ha)**	**Area (%)**
G	Grazing	Gc1	Gentle midslopes; Shallow, moderately well-drained, yellow brown, loamy sand soils underlain by hard plinthite.	5	31.42	24.897
Wet	Wetland	Dr1, Wa2, Wa1, Lo2, Lo1, Kd2, Kd1	Gentle foot slope and valley bottoms; Grey, imperfectly to poorly drained, sandy soils underlain by hard plinthite, soft plinthite and gleyed clay.	3	67.13	53.199
W	Wilderness	Dist	Disturbed, excavated and partly backfilled areas.	1	2.12	1.684
***See soil map**			**Total**	**13**	**126.18**	**100.0**



LEGEND: LAND CAPABILITY

Land Capability Code	Land Capability Class	*Soil Types	Broad Soil Description	Unit Count	Area (ha)	Area (%)
A	Arable	Av1	Gentle midslopes; Moderately deep, moderately well-drained, yellow brown, loamy sand to sandy loam soils underlain by soft plinthite.	4	25.51	20.22
G	Grazing	Gc1	Gentle midslopes; Shallow, moderately well-drained, yellow brown, loamy sand soils underlain by hard plinthite.	5	31.42	24.897
Wet	Wetland	Dr1, Wa2, Wa1, Lo2, Lo1, Kd2, Kd1	Gentle footslope and valley bottoms; Grey, imperfectly to poorly drained, sandy soils underlain by hard plinthite, soft plinthite and gleyed clay.	3	67.13	53.199
W	Wilderness	Dist	Disturbed, excavated and partly backfilled areas.	1	2.12	1.684
*See soil map, Figure 3			Total	13	126.18	100.0

Figure 4a: Land capability map of Mooiplaats Colliery lease area

Figure 6: Land capability map for Mooiplaats Colliery

4.6 Land Use

4.6.1 Pre-mining land use

According to electronic 1:50 000 scale topographic maps of the Chief Director of Surveys and Mapping as well as Google Imagery, the total lease area (200 ha) was used for grazing purposes (commercial cattle farming) prior to mining. No evidence of crop farming could be obtained.

4.6.2 Historical agricultural production

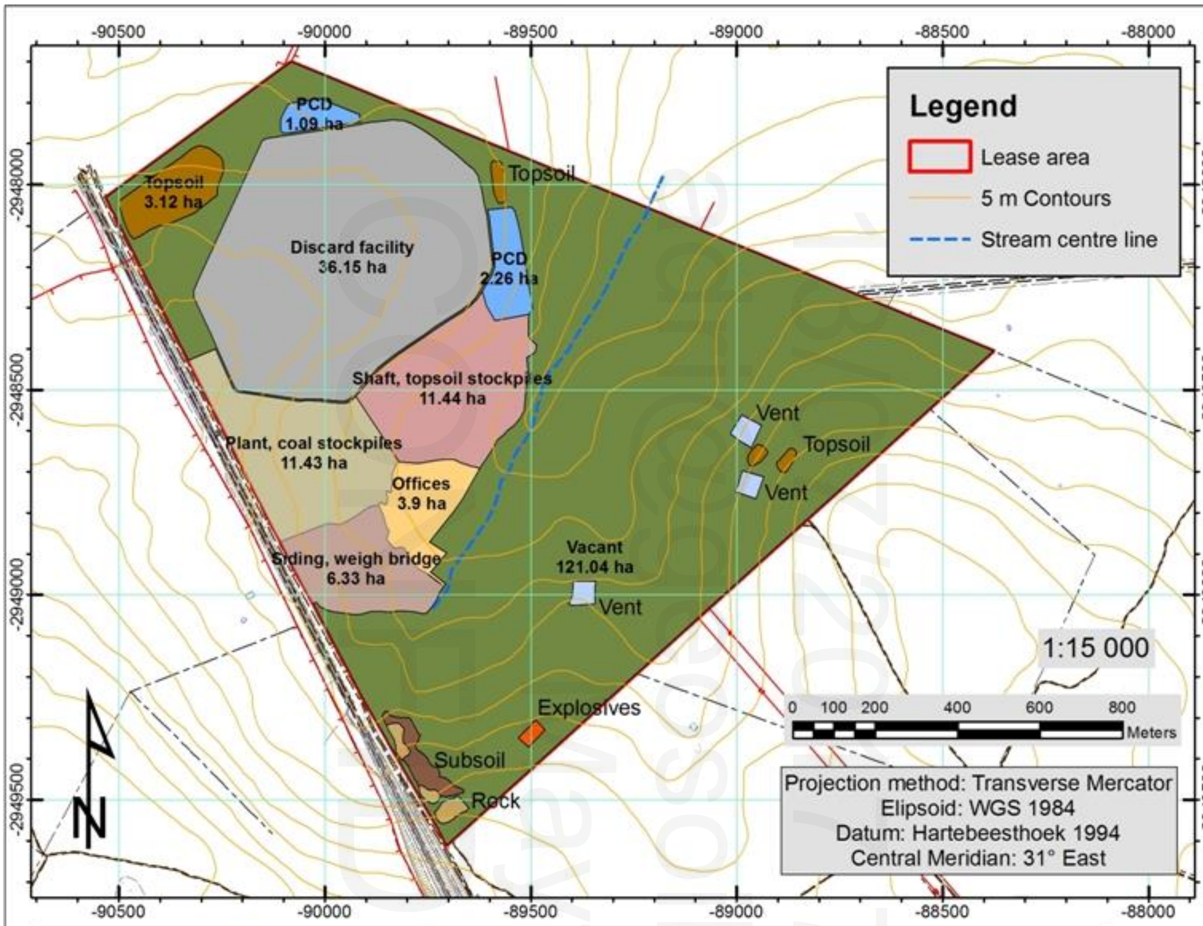
No evidence of previous cultivation in the lease area could be obtained. Grazing potential is estimated at 5-7 ha per livestock unit.

4.6.3 Evidence of misuse

Now evidence of misuse was observed.

4.6.4 Existing structures

Existing structures include those predominantly associated with Mooiplaats Colliery although old shafts, borrow pits, pipelines and power lines occur scattered throughout the area. These are indicated in Figure 7.



LEGEND – CURRENT LAND USE

Land Use	Pre-mining Land Use	Unit Count	Area (ha)	Area (%)
	Vacant - no specific land use	1	121.04	60.45
	Discard facility	1	36.15	18.06
	Shaft and topsoil stockpiles	1	11.44	5.72
	Plant and coal stockpiles	1	11.43	5.71
	Siding and weigh bridge	1	6.33	3.16
	Offices and parking areas	1	3.90	1.95
	Pollution control dams	2	3.35	1.67
	Ventilation shaft	3	0.94	0.47
	Explosives magazine	1	0.20	0.10
	Topsoil stockpile	4	3.72	1.86
	Subsoil dump	1	1.03	0.52
	Rock dump	3	0.70	0.35
	TOTAL	20	200.23	100.0

Figure 5: Current land use map of Mooiplaats Colliery lease area

Figure 7: Land use map for Mooiplaats Colliery

4.7 Surface Water

Surface water studies were conducted by Groundwater Consulting Services (GCS). Their findings are discussed below.

4.7.1 Surface water quantity

The area falls within the Water Management Area 8, Upper Vaal (WMA 8) and in Quaternary Catchment C11B.The Vaal River flows along the eastern side of the site boundary in a southerly direction.

A non-perennial stream flows through the site in a north easterly direction to form a confluence with the Witpunspruit downstream, which later joins the Vaal River to the east. The stream flows to the east of the main buildings and plant area. It is well defined in some area but comprises wetland areas in other section thus, the flood plain varies.

4.7.1.1 Catchment boundaries

The catchments were assessed from WMA8 to the Quaternary Catchment Area C11B to a site specific catchment area. Smaller sub-catchments were delineated over the site according to natural characteristics i.e.: topography and manmade elevation differences i.e. infrastructure on site.

The table below is a description of the delineated sub-catchments and their respective sizes.

Table 9: Summary of catchment area sizes

Catchment:	Area (km2)
WMA 8 Upper Vaal	55,022
Quaternary Catchment C11B	536
Main Catchment	5.74
Total potential impacting catchment	0.70
Sub-catchment 1	0.38
Sub-catchment 2	0.16
Sub-catchment 3	0.02
Sub-catchment 4	0.04
Sub-catchment 5	5
Sub-catchment 6	0.02
Sub-catchment 7	0.6

Figure 7 and 8 show the boundary of the main catchment and the extent of the sub-catchment boundaries respectively.

4.7.1.2 Mean annual run-off

Mean annual runoff (MAR) refers to the amount of water that essentially runs off on a catchment area after rainfall, evaporation, infiltration and friction have been take into consideration. A MAR of 41.97 million cubic meters (mcm) (obtained from the WR2005 database) was used to describe the general flow of surface water for the quaternary catchment C11B. Area and volume calculations were undertaken to reduce the quaternary catchment MAR to obtain site specific MAR for the various sub-catchments.

Table 10: Summary of MAR

Catchment:	MAR (mcm)
WMA 8 Upper Vaal	55,022.000
Quaternary Catchment C11B	41.9700
Main Catchment	0.449
Total potential impacting catchment	0.055
Sub-catchment 1	0.030
Sub-catchment 2	0.013
Sub-catchment 3	0.002
Sub-catchment 4	0.003
Sub-catchment 5	0.392
Sub-catchment 6	0.002
Sub-catchment 7	0.047

Figure 8: Main Catchment boundary

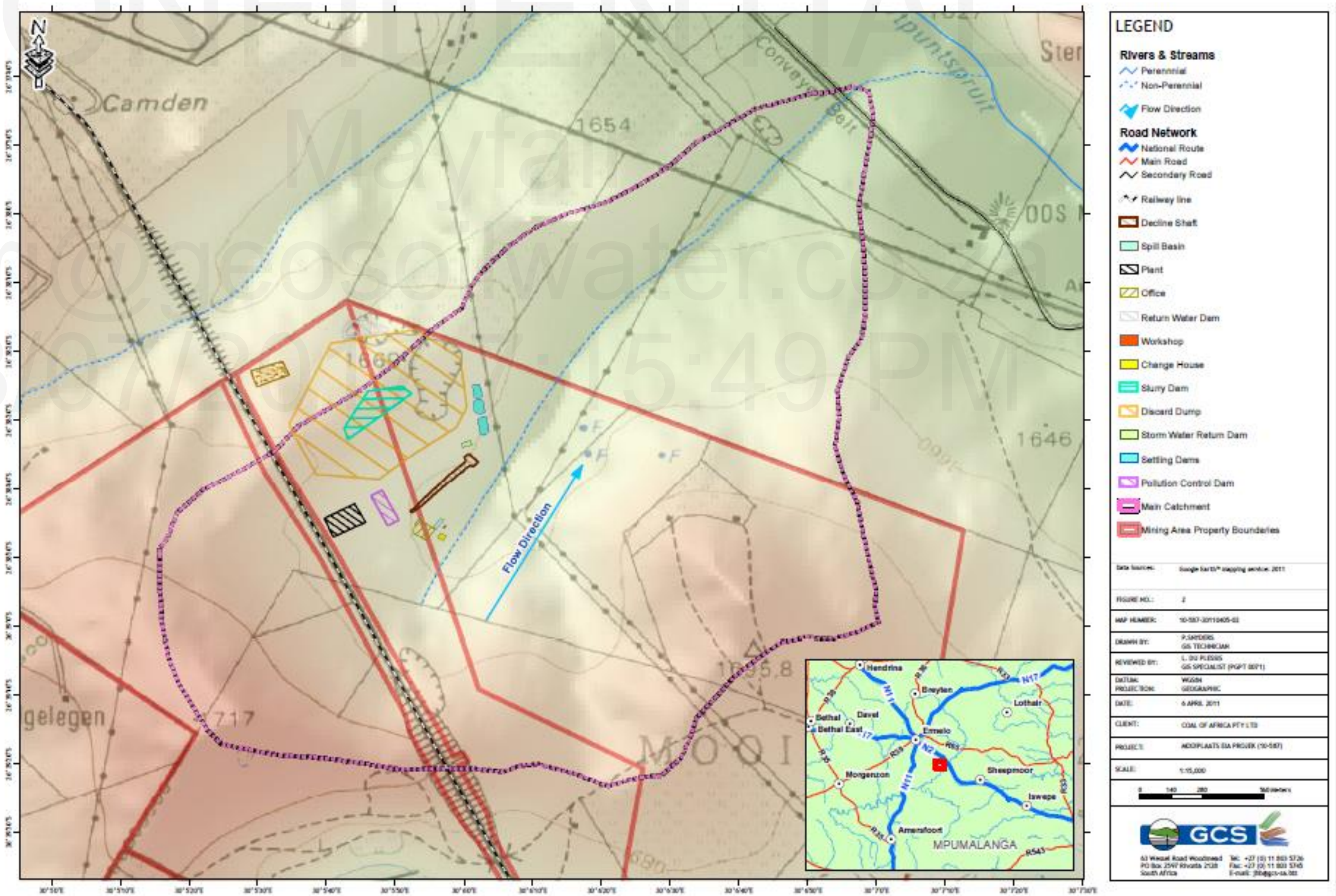
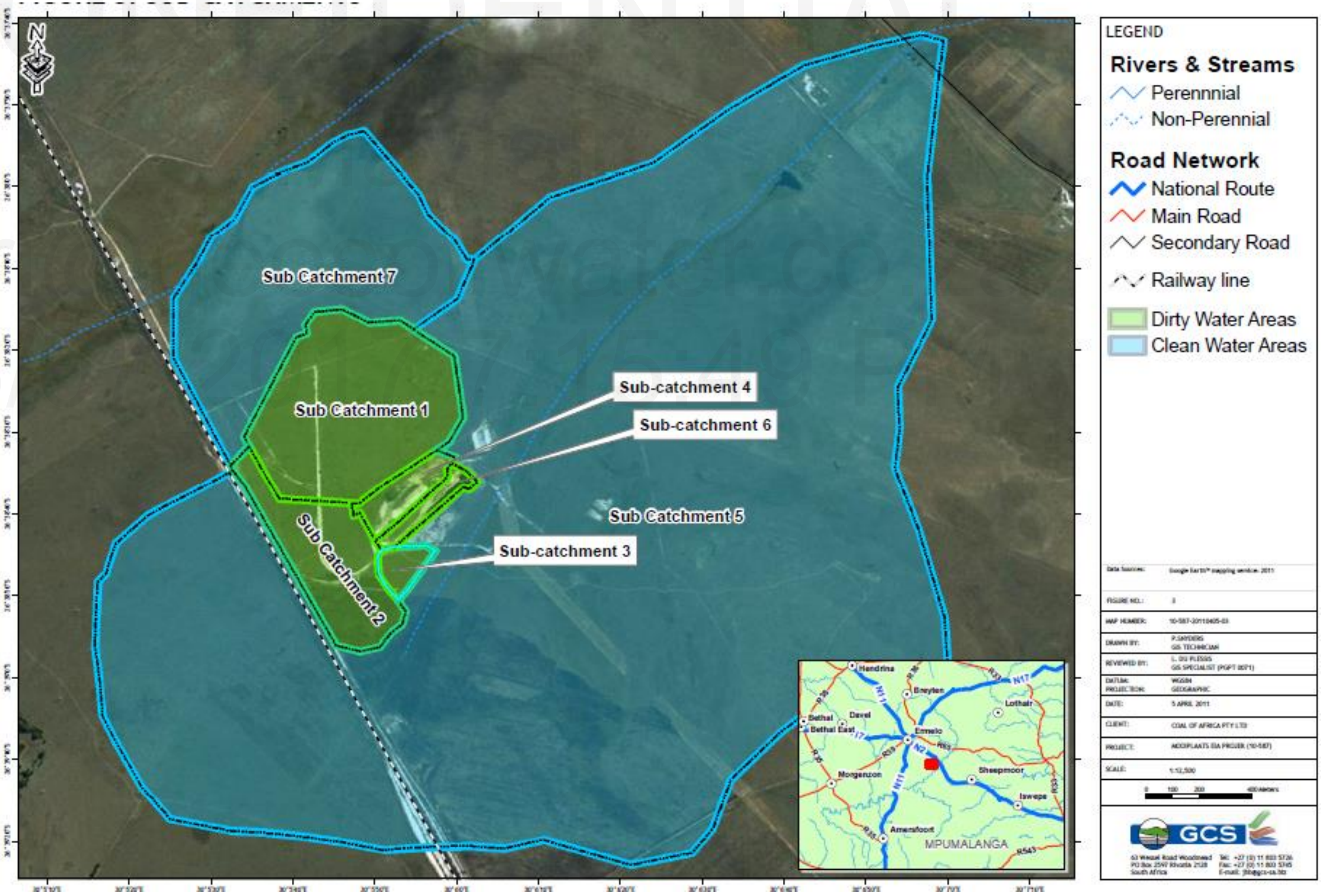


Figure 9:Sub-catchment boundaries



4.7.1.3 Normal dry weather flow

The Groundwater-Surface Water Interactions National Data Base supplied by DWA was referenced to obtain the normal dry weather flow (NWDF). A NWDF of 19.94 mcm was used to describe the dry period flow of surface water over the C11B quaternary catchment, this was then used to calculate the site specific NWDF and of all the sub-catchments.

Table 11: Summary of Normal Dry Weather Flow

Sub-catchment:	**NDWF (mcm)**
Quaternary Catchment C11B	10.45
Main Catchment	0.112
Total potential impacting catchment	0.014
Sub-catchment 1	0.007
Sub-catchment 2	0.003
Sub-catchment 3	0.000
Sub-catchment 4	0.001
Sub-catchment 5	0.097
Sub-catchment 6	0.000
Sub-catchment 7	0.012

4.7.1.4 Flood peaks and volumes

The flood flows from the 1:50 and 1:100 year rainfall storm events were calculated using Utility Program for Drainage (UPD), and were assessed utilising a combination of the Rational Method, the Alternative Rational Method and the Standard Design Flood Method.

The table below summarises the peak flow rates calculated over the main catchment. These flows were then used to calculate the corresponding flood flows over each of the sub-catchments. X shows a summary of these flood flows.

Table 12: Flood flow summary (m^3/s)

Catchment	**Rational Method**		**Alternative Rational Method**		**Standard Design Flood Method**	
	1:50	1:100	1:50	1:100	1:50	1:100
Main	78.13	99.99	82.75	99.52	90	113.97

Catchment	Rational Method		Alternative Rational Method		Standard Design Flood Method	
	1:50	1:100	1:50	1:100	1:50	1:100
catchment						

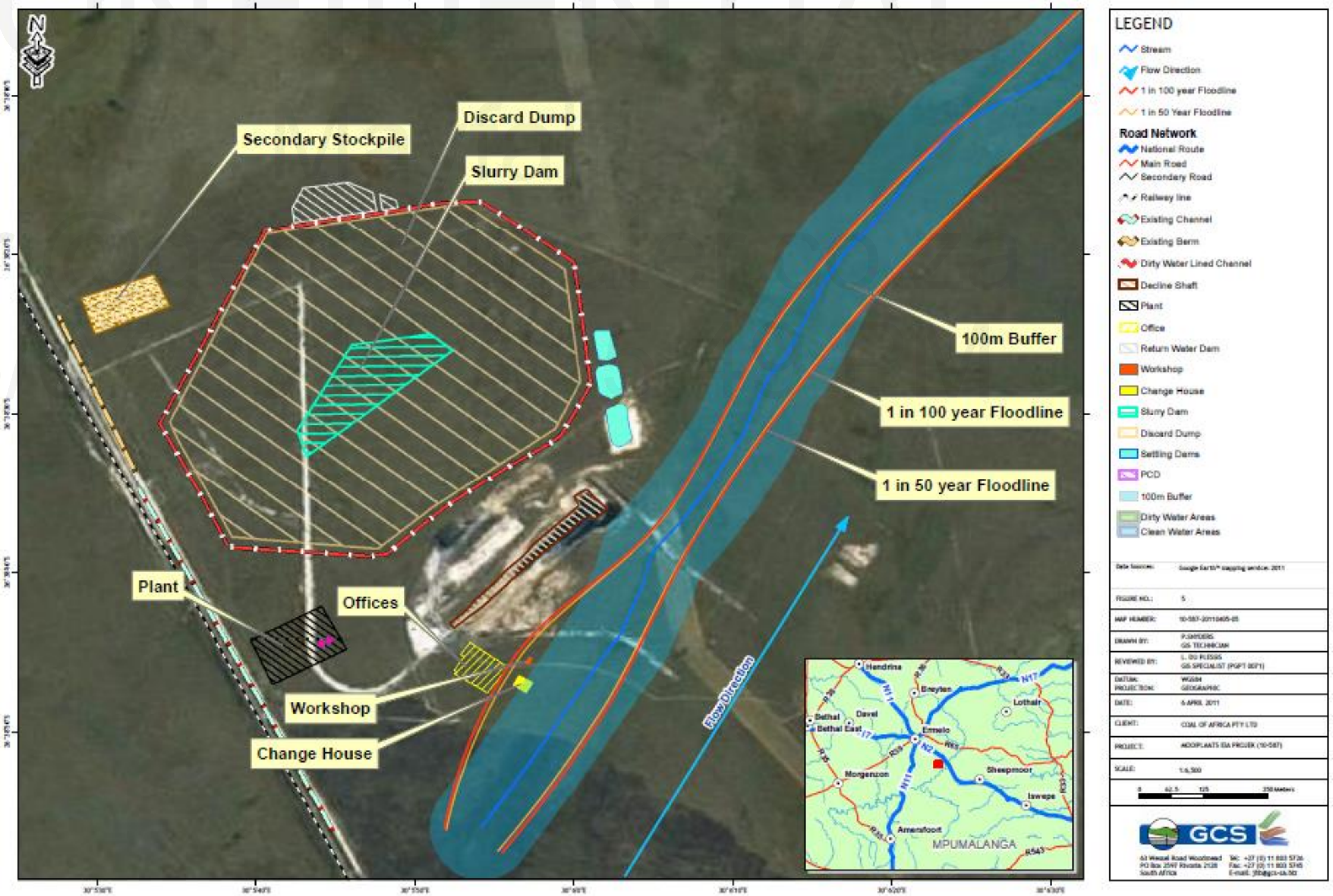
Table 13: Sub-catchment flood flows

Catchment	Area (km^2)	1:50 (m^3/s)	1:100 (m^3/s)
Main Catchment	5.74	78.13	99.99
Total potential impacting catchment	0.70	9.53	12.19
Sub-catchment 1	0.38	5.17	6.62
Sub-catchment 2	0.16	2.18	2.79
Sub-catchment 3	0.02	0.27	0.35
Sub-catchment 4	0.04	0.54	0.70
Sub-catchment 5	5	68.06	87.10
Sub-catchment 6	0.02	0.27	0.35
Sub-catchment 7	0.6	8.17	10.45

4.7.1.5 River diversions

No river diversions have been constructed on site.

Figure 10: Flood lines



4.7.1 Surface water quality (Plan 12)

Surface water sampling was conducted on many occasions in the area. The data has been summarised and discussed below for each point. It must be noted that the upstream water quality of the Witpuntspruit has unacceptable levels for Conductivity and Sulphate before it flows past the mining area, with respect to the Grootdraai Dam/Vaal quality guidelines ((as is noted in the Mooiplaats South Surface Water report C.G.T.S, 2009 and the Historical water quality sampling data from DWA monitoring point WITPUNTSPRUIT AT R29/N2 CAMDEN BRIDGE (GDDC09)). Therefore the upstream and surrounding water quality data must be taken into account when assessing the surface water qualities as discussed below.

4.7.1.1 Low Water Bridge

From Table 14 one can see that the samples from this point are at unacceptable levels for Chlorides, Total Alkalinity as $CaCO_3$, Fluoride, Sulphate and Conductivity when compared to the Grootdraai Dam/Vaal quality guidelines. All these values, other than Fluoride are still within the Class I SANS limits and Fluoride levels are within Class II limits, and therefore water quality at this point should have no impact on human health. Objectives for the Grootdraai Dam/Vaal need to be attained.

4.7.1.2 Spruit leaving property

This is the wetland area in close proximity to the mine infrastructure area. From Table 15 one can see that the samples from this point are at unacceptable levels for Chlorides, Total Alkalinity as $CaCO_3$, Fluoride, Sulphate, and Conductivity when compared to the Grootdraai Dam/Vaal quality guidelines. All these values, other than Fluoride, sulphate and conductivity are still within the Class I SANS limits. Sulphate and conductivity are within Class II limits, and therefore water quality with regard to these constituents at this point should have no impact on human health. Fluoride levels are elevated and potential sources need to be identified and managed. Objectives for the Grootdraai Dam/Vaal need to be attained.

4.7.1.3 Settling dams

Table 16, Table 17 and Table 18 summarise quality data for settling dams 1, 2 and 3 respectively. These settling dams receive the water from underground dewatering and quality is expected to be impaired to some extent. One can see from the tables that at all three sites the samples are at elevated to unacceptable levels for Chlorides, Total Alkalinity as $CaCO_3$, Fluoride, Sulphate, Conductivity and pH when compared to the Grootdraai Dam/Vaal quality guidelines. These dams are however lined and water from these dams should therefore not seep into the surrounding environment. Should these dams overflow then they will impact on the sample point discussed above, it is therefore necessary that these dams be operated correctly to ensure no overflow occurs.

4.7.1.4 Sewage Effluent Qualities

Table 19 indicates that the sewage effluent qualities also have elevated levels of Chlorides, Total Alkalinity as $CaCO_3$, Fluoride, Sulphate, Conductivity and pH when compared to the Grootdraai Dam/Vaal quality guidelines.

4.7.1.5 Farm Dam

Table 20 indicates that the water quality from the farm dam is also elevated for Chlorides, Total Alkalinity as $CaCO_3$, Fluoride, Sulphate, Conductivity and pH when compared to the Grootdraai Dam/Vaal quality guidelines.

4.7.1.6 Security Trench

Table 21 indicates that the water quality from the security trench is also elevated for Chlorides, Total Alkalinity as $CaCO_3$, Fluoride, Sulphate, Conductivity and pH when compared to the Grootdraai Dam/Vaal quality guidelines.

4.7.1.7 Clean Water Trench

Table 22 indicates that the water quality from the clean water trench is also elevated for Chlorides, Total Alkalinity as $CaCO_3$, Fluoride, Sulphate, Conductivity and pH when compared to the Grootdraai Dam/Vaal quality guidelines.

4.7.1.8 Return Water dam

Table 23 indicates that the water quality from the return water dam is also elevated for Chlorides, Total Alkalinity as $CaCO_3$, Fluoride, Sulphate, Conductivity and pH when compared to the Grootdraai Dam/Vaal quality guidelines.

Plan 12: Current surface and groundwater monitoring points at Mooiplaats North Colliery

Table 14: Low Water Bridge site

							Grootdraai Dam Catchment-Vaal Origin Guidelines			
Analysis Results mg/l	**1 Jul 10**	**23 Aug 10**	**28 Oct 10**	**31 Oct 10**	**25 Nov 10**	**22 Dec 10**	**Ideal catchment background**	**Acceptable Management Target**	**Tolerable interim target**	**Unacceptable**
Total Dissolved Solids	638	1064	1040	892	976	634				
Suspended Solids	215	4.8	ND	9.2						
Nitrate & Nitrite as N	0.14	<0.1	<0.1	<0.1	0.22	1.7				
Chlorides as Cl	72	77	75.0	64	52	34	<10	10-15	15-20	>20
Total Alkalinity as $CaCO_3$	483	501	477	425	222	61	<20	20-45	45-75	>75
Fluoride as F	0.94	1.41	1.38	0.94	0.76	0.23	<0.05	0.05-0.20	0.2-0.4	>0.4
Sulphate as SO_4	72	243	245.0	201	430	330	<10	10-20	20-30	>30
Total hardness as $CaCO_3$	272	311	314	272	410.0	300.6				
Calcium Hardness as $CaCO_3$	145	192	ND	148						
Magnesium Hardness as	127	119	ND	124						

							Grootdraai Dam Catchment-Vaal Origin Guidelines			
Analysis Results mg/l	**1 Jul 10**	**23 Aug 10**	**28 Oct 10**	**31 Oct 10**	**25 Nov 10**	**22 Dec 10**	**Ideal catchment background**	**Acceptable Management Target**	**Tolerable interim target**	**Unacceptable**
$CaCO_3$										
Calcium as Ca	57.9	77.0	71	59.3	104	74.9				
Magnesium as Mg	30.8	28.8	33.30	30.1	36.5	27.6				
Sodium as Na	143	231	217.00	199	137	62.2				
Potassium as K	2.84	8.72	8.77	7.95	8.33	4.92				
Iron as Fe	0.33	0.09	0.05	<0.01	0.02	<0.01				
Manganese as Mn	0.67	0.33	0.19	<0.01	0.67	0.24				
Conductivityat25°C in mS/m	104	148	147.00	127	131	80	<10	10-15	15-25	>25
pH-Value at 25°C	8.04	8.31	8	8.11	7.92	7.41	6.4-8.5			<6.5;>8.5
pH by 21°Celsius	6.72	6.60	ND	6.78						
Langelier Saturation Index	+1.32	+1.71	ND	+1.33						

							Grootdraai Dam Catchment-Vaal Origin Guidelines			
Analysis Results mg/l	**1 Jul 10**	**23 Aug 10**	**28 Oct 10**	**31 Oct 10**	**25 Nov 10**	**22 Dec 10**	**Ideal catchment background**	**Acceptable Management Target**	**Tolerable interim target**	**Unacceptable**
Turbidity as N.T.U.	59	2.2	ND	3.5						
Free Residual Chlorine Cl2	0.01	0.1	ND	0.2						
Aluminium as Al		0.17	ND	<0.01	0.01	0.01				

Table 15: Spruit leaving the property

					Grootdraai Dam Catchment - Vaal Origin Guidelines			
Analysis Results mg/l	**23 Aug 10**	**28 Oct 10**	**25 Nov 10**	**22 Dec 10**	**Ideal catchment background**	**Acceptable Management Target**	**Tolerable interim target**	**Unacceptable**
Total Dissolved Solids	1946	1786	1022	1416				
Suspended Solids	154							
Nitrate & Nitrite as N	<0.1	0.86	3.00	1.5				
Chlorides as Cl	92	100.0	30.0	38.0	<10	10 - 15	15 - 20	> 20

					Grootdraai Dam Catchment - Vaal Origin Guidelines			
Analysis Results mg/l	**23 Aug 10**	**28 Oct 10**	**25 Nov 10**	**22 Dec 10**	**Ideal catchment background**	**Acceptable Management Target**	**Tolerable interim target**	**Unacceptable**
Total Alkalinity as $CaCO_3$	687	388	125	221	<20	20 - 45	45 - 75	> 75
Fluoride as F	1.99	2.73	0.43	1.40	< 0.05	0.05 - 0.20	0.2 - 0.4	>0.4
Sulphate as SO_4	590	724.0	531.0	724	<10	10 - 20	20 - 30	> 30
Total Hardness as $CaCO_3$	185	254	472	341				
Calcium Hardness as $CaCO_3$	90							
Magnesium Hardness as $CaCO_3$	95							
Calcium as Ca	35.9	51.7	103	70				
Magnesium as Mg	23.1	30.3	52.1	0.02				
Sodium as Na	629	519.0	120.0	307				
Potassium as K	5.43	6.67	4.34	5.61				
Iron as Fe	0.79	0.05	<0.01	0.05				
Manganese as Mn	0.10	0.04	0.08	40.5				

					Grootdraai Dam Catchment - Vaal Origin Guidelines			
Analysis Results mg/l	**23 Aug 10**	**28 Oct 10**	**25 Nov 10**	**22 Dec 10**	**Ideal catchment background**	**Acceptable Management Target**	**Tolerable interim target**	**Unacceptable**
Conductivity at 25° C in mS/m	283	273.0	132.0	180	<10	10 - 15	15 - 25	> 25
pH-Value at 25 ° C	8.62	8.83	7.93	7.93	6.4 - 8.5			<6.5;>8.5
pHs by 21° Celsius	7.00							
Langelier Saturation Index	+1.62							
Turbidity as N.T.U.	58							
Free Residual Chlorine Cl2	<0.1							
Aluminium as Al	0.37	0.14	0.03	0.10				

Table 16: Settling Dam 1

										Grootdraai Dam Catchment - Vaal Origin Guidelines			
Analysis Results mg/l	**16 Nov 09**	**22 Dec 09**	**22 Jan 10**	**23 Feb 10**	**26 Mar 10**	**21 May 10**	**1 Jul 10**	**23 Jul 10**	**23 Aug 10**	**Ideal catchment background**	**Acceptable Management Target**	**Tolerable interim target**	**Unacceptable**
Total Dissolved Solids	1856	1552	1168	1288	1546	2250	2762	2876	2828				
Suspended Solids	2619	2140	38.8	16.0	43.6	33.2	22.8	31.6	74.4				
Nitrate & Nitrite as N	4.3	4.80	3.5	2.4	2.1	1.8	2.6	2.9	3.1				
Chlorides as Cl	89	58	37	31	39	45	74	90	86	<10	10 - 15	15 - 20	> 20
Total Alkalinity as $CaCO_3$	528	474	204	149	254	275	604	860	777	<20	20 - 45	45 - 75	> 75
Fluoride as F	5.0	2.79	2.30	1.5	2.13	2.85	4.17	4.78	4.73	< 0.05	0.05 - 0.20	0.2 - 0.4	>0.4
Sulphate as SO_4	658	642	554	740	755	1182	1284	998	1042	<10	10 - 20	20 - 30	> 30
Total Hardness as $CaCO_3$	65	35	204	400	379	210	174	142	143				
Calcium Hardness as $CaCO_3$	31	24	147	280	255	126	80	61	59				
Magnesium Hardness as $CaCO_3$	34	11	57	120	124	84	94	81	84				
Calcium as Ca	12.5	9.59	58.7	112	102	50.6	32.2	24.5	23.8				
Magnesium as Mg	8.32	2.71	13.9	29.1	30.1	20.4	22.8	19.7	20.5				
Sodium as Na	636	514	330	286	384	585	791	881	787				
Potassium as K	5.92	4.56	4.37	5.38	7.28	7.46	7.48	7.29	7.48				
Iron as Fe	8.31	1.78	0.11	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
Manganese as Mn	0.06	0.02	0.04	<0.01	0.01	<0.01	<0.01	<0.01	<0.01				
Conductivity at 25° C in mS/m	282	229	175	188	232	286	381	383	368	<10	10 - 15	15 - 25	> 25
pH-Value at 25 ° C	8.91	8.73	8.46	8.17	8.10	8.49	8.78	8.91	8.91	6.4 - 8.5			<6.5;>8.5
pHs by 21° Celsius	7.63	7.65	8.17	7.03	6.96	7.24	7.22	7.17	7.21				
Langelier Saturation Index	+1.28	+1.08	+1.28	+1.14	+1.14	+1.25	+1.56	+1.74	+1.70				

										Grootdraai Dam Catchment - Vaal Origin Guidelines			
Analysis Results mg/l	**16 Nov 09**	**22 Dec 09**	**22 Jan 10**	**23 Feb 10**	**26 Mar 10**	**21 May 10**	**1 Jul 10**	**23 Jul 10**	**23 Aug 10**	**Ideal catchment background**	**Acceptable Management Target**	**Tolerable interim target**	**Unacceptable**
Turbidity as N.T.U.	NATD	NATD	48	10	33	26	18	44.0	69				
Aluminium as Al	3.85	-	0.08	<0.01	<0.01	0.05	<0.01	0.04					

Table 17: Settling Dam 2

										Grootdraai Dam Catchment - Vaal Origin Guidelines			
Analysis Results mg/l	**16 Nov 09**	**22 Dec 09**	**22 Jan 10**	**23 Feb 10**	**26 Mar 10**	**21 May 10**	**1 Jul 10**	**23 Jul 10**	**23 Aug 10**	**Ideal catchment background**	**Acceptable Management Target**	**Tolerable interim target**	**Unacceptable**
Total Dissolved Solids	2058	1470	1268	1204	1664	2198	2304	2562	2270				
Suspended Solids	1103	2219	24.8	18.4	19.6	26.4	18.4	25.2	134				
Nitrate & Nitrite as N	3.5	4.54	3.9	2.5	1.7	1.8	0.42	1.4	2.5				
Chlorides as Cl	84	56	43	30	47	44	81	90	75	<10	10 - 15	15 - 20	> 20
Total Alkalinity as $CaCO_3$	970	503	239	147	349	271	1162	1081	625	<20	20 - 45	45 - 75	> 75
Fluoride as F	5.5	2.81	2.70	1.6	2.65	2.82	5.79	5.42	3.91	< 0.05	0.05 - 0.20	0.2 - 0.4	>0.4
Sulphate as SO_4	539	569	563	682	772	1047	536	726	930	<10	10 - 20	20 - 30	> 30
Total Hardness as $CaCO_3$	78	42	182	359	326	212	126	157	110				
Calcium Hardness as $CaCO_3$	40	27	130	250	199	128	70	80	37				
Magnesium Hardness as $CaCO_3$	38	15	52	109	127	84	56	77	73				
Calcium as Ca	16.0	11.0	52.0	99.9	79.6	51.4	28.2	31.9	14.8				
Magnesium as Mg	9.3	3.54	12.6	26.5	30.8	20.4	13.6	18.8	17.8				
Sodium as Na	682	485	370	287	438	599	845	750	662				
Potassium as K	5.42	4.72	4.16	5.20	6.45	7.45	5.16	6.32	6.61				

										Grootdraai Dam Catchment - Vaal Origin Guidelines			
Analysis Results mg/l	**16 Nov 09**	**22 Dec 09**	**22 Jan 10**	**23 Feb 10**	**26 Mar 10**	**21 May 10**	**1 Jul 10**	**23 Jul 10**	**23 Aug 10**	**Ideal catchment background**	**Acceptable Management Target**	**Tolerable interim target**	**Unacceptable**
Iron as Fe	5.49	2.10	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
Manganese as Mn	0.04	0.04	0.02	<0.01	0.02	<0.01	<0.01	<0.01	<0.01				
Conductivity at 25° C in mS/m	303	229	194	184	240	279	346	364	317	<10	10 - 15	15 - 25	> 25
pH-Value at 25 ° C	8.60	8.80	8.60	8.19	8.11	8.49	8.30	8.41	8.86	6.4 - 8.5			<6.5;>8.5
pHs by 21° Celsius	7.19	7.59	7.16	7.06	6.84	7.24	6.92	6.95	7.43				
Langelier Saturation Index	+1.41	+1.21	+1.44	+1.13	+1.24	+125	+1.38	+1.46	+1.43				
Turbidity as N.T.U.	1986	NATD	27	13	12	20	7.2	20	139				
Aluminium as Al	2.76	1.41	0.15	<0.01	<0.01		0.05		0.16				

Table 18: Settling Dam 3

										Grootdraai Dam Catchment - Vaal Origin Guidelines			
Analysis Results mg/l	**16 Nov 09**	**22 Dec 09**	**22 Jan 10**	**23 Feb 10**	**26 Mar 10**	**21 May 10**	**1 Jul 10**	**23 Jul 10**	**23 Aug 10**	**Ideal catchment background**	**Acceptable Management Target**	**Tolerable interim target**	**Unacceptable**
Total Dissolved Solids	2012	1510	1400	1398	1686	2190	2308	2584	2244				
Suspended Solids	1195	2143	35	11.6	29.6	17.2	18.8	17.6	102				
Nitrate & Nitrite as N	3.5	4.4	4.0	3.0	1.5	1.6	0.74	1.4	2.0				
Chlorides as Cl	85	59	50	34	52	50	82	88	74	<10	10 - 15	15 - 20	> 20
Total Alkalinity as $CaCO_3$	922	516	322	148	440	422	1200	1028	771	<20	20 - 45	45 - 75	> 75
Fluoride as F	5.8	3.1	3.20	1.7	2.98	3.3	5.82	5.32	4.0	< 0.05	0.05 - 0.20	0.2 - 0.4	>0.4
Sulphate as SO_4	536	569	588	816	714	910	598	718	786	<10	10 - 20	20 - 30	> 30
Total Hardness as $CaCO_3$	81	38	121	293	253	198	128	141	107				

										Grootdraai Dam Catchment - Vaal Origin Guidelines			
Analysis Results mg/l	**16 Nov 09**	**22 Dec 09**	**22 Jan 10**	**23 Feb 10**	**26 Mar 10**	**21 May 10**	**1 Jul 10**	**23 Jul 10**	**23 Aug 10**	**Ideal catchment background**	**Acceptable Management Target**	**Tolerable interim target**	**Unacceptable**
Calcium Hardness as $CaCO_3$	40	25	86	199	140	121	70	72	40				
Magnesium Hardness as $CaCO_3$	41	13	35	94	113	77	58	69	67				
Calcium as Ca	16.1	9.9	34.5	79.6	56.1	48.4	28.2	28.8	15.9				
Magnesium as Mg	10.0	3.15	8.43	22.8	27.4	18.8	14.1	16.7	16.2				
Sodium as Na	661	519	426	305	470	601	775	809	718				
Potassium as K	5.77	4.71	4.37	4.70	5.90	6.93	5.31	6.34	6.18				
Iron as Fe	14.1	1.24	0.31	<0.01	<0.01	<0.01	<0.01	<0.01	0.05				
Manganese as Mn	0.11	0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01				
Conductivity at 25° C in mS/m	292	236	203	179	244	279	349	366	309	<10	10 - 15	15 - 25	> 25
pH-Value at 25 ° C	8.77	8.85	8.74	8.27	8.12	8.42	8.51	8.64	8.71	6.4 - 8.5			<6.5;>8.5
pHs by 21° Celsius	7.22	7.59	7.22	7.12	6.91	7.07	6.91	6.97	7.31				
Langelier Saturation Index	+1.55	+1.26	+1.52	+1.15	+1.18	+1.35	+1.60	+1.67	+1.40				
Turbidity as N.T.U.	2532	NATD	48	8.2	15	29	5.8	10	124				
Aluminium as Al	5.82	0.93	1.44	<0.01					0.38				

Table 19: Sewage Water Dam

									Grootdraai Dam Catchment - Vaal Origin Guidelines			
Analysis Results mg/l	**16 Nov 09**	**22 Dec 09**	**22 Jan 10**	**22 Feb 10**	**26 Mar 10**	**21 May 10**	**23 Jul 10**	**23 Aug 10**	**Ideal catchment background**	**Acceptable Management Target**	**Tolerable interim target**	**Unacceptable**
Total Dissolved Solids	402	326	416	286	368	2096	2752	2718				
Suspended Solids	98.0	282	101	216	67.2	62.0	103	77.6				

									Grootdraai Dam Catchment - Vaal Origin Guidelines			
Analysis Results mg/l	**16 Nov 09**	**22 Dec 09**	**22 Jan 10**	**22 Feb 10**	**26 Mar 10**	**21 May 10**	**23 Jul 10**	**23 Aug 10**	**Ideal catchment background**	**Acceptable Management Target**	**Tolerable interim target**	**Unacceptable**
Nitrate & Nitrite as N	1.0	2.8	0.4	2.4	1.0	0.2	0.2	0.2				
Chlorides as Cl	73.2	56.7	73.5	57.4	62.9	317	426	376	<10	10 - 15	15 - 20	> 20
Total Alkalinity as $CaCO_3$	14.0	19.0	17.0	30.6	15.0	23.8	30.0	47.0	<20	20 - 45	45 - 75	> 75
Fluoride as F	141	160	121	228	73	131	169	253	< 0.05	0.05 - 0.20	0.2 - 0.4	>0.4
Sulphate as SO_4	14.8	15.6	6.8	12.1	11.0	16.2	12.3	20.9	<10	10 - 20	20 - 30	> 30
Total Hardness as $CaCO_3$	<0.1	0.45	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				
Calcium Hardness as $CaCO_3$	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				
Magnesium Hardness as $CaCO_3$	1.5	1.4	0.6	2.5	1.1	4.3	2.0	4.7				
Calcium as Ca	88	41	115	49	73	173	283	234				
Magnesium as Mg	230	220	201	209	219	529	1202	1049				
Sodium as Na	7.39	7.38	7.34	7.40	7.41	7.76	8.37	8.22				
Potassium as K	90.2	54.5	86.9	59.1	86.2	658	954	679				
Iron as Fe	7.02	7.02	5.81	7.05	6.43	14.5	11.8	13.9				
Manganese as Mn	19.7	37.8	15.6	23.1	7.4	854	640	596				
Conductivity at 25° C in mS/m	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<10	10 - 15	15 - 25	> 25
pH-Value at 25 ° C	>1000	Nil	>1000	>1000	>1000	>1000	>1000	>1000	6.4 - 8.5			<6.5;>8.5
pHs by 21° Celsius	402	326	416	286	368	2096	2752	2718				
Langelier Saturation Index	98.0	282	101	216	67.2	62.0	103	77.6				
Turbidity as N.T.U.	1.0	2.8	0.4	2.4	1.0	0.2	0.2	0.2				
Aluminium as Al	73.2	56.7	73.5	57.4	62.9	317	426	376				

Table 20: Farm dam

					Grootdraai Dam Catchment - Vaal Origin Guidelines			
Analysis Results mg/l	**23 Aug 10**	**28 Oct 10**	**25 Nov 10**	**22 Dec 10**	**Ideal catchment background**	**Acceptable Management Target**	**Tolerable interim target**	**Unacceptable**
Total Dissolved Solids	1422	2190	1722	1220				
Suspended Solids	59.6							
Nitrate & Nitrite as N	<0.1	0.23	0	0				
Chlorides as Cl	50	83	65	43	<10	10 - 15	15 - 20	> 20
Total Alkalinity as $CaCO_3$	543	554	385	286	<20	20 - 45	45 - 75	> 75
Fluoride as F	1.84	2.15	1.74	1.30	< 0.05	0.05 - 0.20	0.2 - 0.4	>0.4
Sulphate as SO_4	387	794	802	477	<10	10 - 20	20 - 30	> 30
Total Hardness as $CaCO_3$	170	237	217	165				
Calcium Hardness as $CaCO_3$	86							
Magnesium Hardness as $CaCO_3$	84							
Calcium as Ca	34.5	50.9	46	35				
Magnesium as Mg	20.4	26.7	25	19				
Sodium as Na	433	646	450	335				
Potassium as K	6.25	9.59	7	4				
Iron as Fe	0.09	0.15	1	1				
Manganese as Mn	<0.01	0.05	0	0				
Conductivity at 25° C in mS/m	203	301	235	161	<10	10 - 15	15 - 25	> 25
pH-Value at 25 ° C	8.66	8.51	8	8	6.4 - 8.5			<6.5;>8.5
pHs by 21° Celsius	7.00							
Langelier Saturation Index	+1.66							
Turbidity as N.T.U.	48							

					Grootdraai Dam Catchment - Vaal Origin Guidelines			
Analysis Results mg/l	**23 Aug 10**	**28 Oct 10**	**25 Nov 10**	**22 Dec 10**	**Ideal catchment background**	**Acceptable Management Target**	**Tolerable interim target**	**Unacceptable**
Free Residual Chlorine Cl2								
Aluminium as Al	0.27	0.27	1	0				

Table 21: Security trench

							Grootdraai Dam Catchment - Vaal Origin Guidelines			
Analysis Results mg/l	**1 Jul 10**	**23 Jul 10**	**23 Aug 10**	**28 Oct 10**	**25 Nov 10**	**22 Dec 10**	**Ideal catchment background**	**Acceptable Management Target**	**Tolerable interim target**	**Unacceptable**
Total Dissolved Solids	394	684	1936	1412	1180	732				
Suspended Solids	22.4	196	53.6							
Nitrate & Nitrite as N	<0.1	<0.1	1.5	2.00	1.10	0.71				
Chlorides as Cl	17	26	70	62.0	45.0	27.0	<10	10 - 15	15 - 20	> 20
Total Alkalinity as $CaCO_3$	140	174	403	222	186	118	<20	20 - 45	45 - 75	> 75
Fluoride as F	0.41	0.50	1.85	1.3	0.8	0.6	< 0.05	0.05 - 0.20	0.2 - 0.4	>0.4
Sulphate as SO_4	168	278	890	744	571	357	<10	10 - 20	20 - 30	> 30
Total Hardness as $CaCO_3$	231	284	270	359	315	192				
Calcium Hardness as $CaCO_3$	128	160	126							
Magnesium Hardness as $CaCO_3$	103	124	144							
Calcium as Ca	51.1	63.9	50.6	74.6	66.4	39.5				
Magnesium as Mg	25.0	30.2	34.9	42.0	36.2	22.7				
Sodium as Na	54.5	90.6	516	370.0	239.0	154.0				
Potassium as K	1.41	1.62	4.16	3.10	2.58	1.98				
Iron as Fe	<0.01	<0.01	<0.01	<0.01	<0.01	0.07				

							Grootdraai Dam Catchment - Vaal Origin Guidelines			
Analysis Results mg/l	**1 Jul 10**	**23 Jul 10**	**23 Aug 10**	**28 Oct 10**	**25 Nov 10**	**22 Dec 10**	**Ideal catchment background**	**Acceptable Management Target**	**Tolerable interim target**	**Unacceptable**
Manganese as Mn	<0.01	<0.01	<0.01	<0.01	<0.01	0.01				
Conductivity at 25° C in mS/m	65.0	92.1	256	222.0	157.0	97.8	<10	10 - 15	15 - 25	> 25
pH-Value at 25 ° C	8.30	8.20	8.64	8.47	8.46	8.39	6.4 - 8.5			<6.5;>8.5
pHs by 21° Celsius	7.28	7.12	7.04							
Langelier Saturation Index	+1.02	+1.08	+1.60							
Turbidity as N.T.U.	13	52	34							
Aluminium as Al	0.1		<0.1	0.08	0.03	0.12				

Table 22: Clean water trench/Unnamed Tributary

													Grootdraai Dam Catchment - Vaal Origin Guidelines			
Analysis Results mg/l	**16 Nov 09**	**22 Dec 09**	**22 Jan 10**	**23 Feb 10**	**26 Mar 10**	**21 May 10**	**1 Jul 10**	**23 Jul 10**	**23 Aug 10**	**28 Oct 10**	**25 Nov 10**	**22 Dec 10**	**Ideal catchment background**	**Acceptable Management Target**	**Tolerable interim target**	**Unacceptable**
Total Dissolved Solids	312	No flow	340	330	384	2228	1894	3050	2680	1852	1026	1424				
Suspended Solids	180		204	26.4	106	72.8	1344	108	133							
Nitrate & Nitrite as N	3.0		0.12	<0.1	<0.1	<0.1	0.45	<0.1	<0.1	<0.1	2.90	1.30				
Chlorides as Cl	23		40	46	73	179	144	292	263	103	30	34	<10	10 - 15	15 - 20	> 20
Total Alkalinity as $CaCO_3$	127		148	170	211	546	740	1155	1003	400	125	232	<20	20 - 45	45 - 75	> 75
Fluoride as F	0.4		0.48	0.32	0.21	3.03	3.30	5.12	4.50	3	0	1	< 0.05	0.05 - 0.20	0.2 - 0.4	>0.4
Sulphate as SO_4	78.6		78	38.2	12.2	812	555	756	668	706	534	650	<10	10 - 20	20 - 30	> 30
Total Hardness as $CaCO_3$	159		164	114	113	198	183	174	128	248	479	348				
Calcium Hardness as $CaCO_3$	90		98	67	78	117	95	76	56							

													Grootdraai Dam Catchment - Vaal Origin Guidelines			
Analysis Results mg/l	**16 Nov 09**	**22 Dec 09**	**22 Jan 10**	**23 Feb 10**	**26 Mar 10**	**21 May 10**	**1 Jul 10**	**23 Jul 10**	**23 Aug 10**	**28 Oct 10**	**25 Nov 10**	**22 Dec 10**	**Ideal catchment background**	**Acceptable Management Target**	**Tolerable interim target**	**Unacceptable**
Magnesium Hardness as $CaCO_3$	69		66	47	35	81	88	98	72							
Calcium as Ca	36.1		39.4	26.8	31.2	46.8	38.0	30.4	22.6	48.7	105	71.3				
Magnesium as Mg	16.8		16.0	11.3	8.43	19.6	21.5	23.8	17.6	30.6	52.6	41.2				
Sodium as Na	38.8		53.6	58.8	85.2	668	606	898	800	529.0	120.0	316.0				
Potassium as K	3.94		4.18	6.25	6.24	14.3	7.90	13.2	12.0	7.27	4.38	5.77				
Iron as Fe	0.03		0.20	0.10	0.06	0.03	0.17	<0.01	0.09	0.16	<0.01	0.05				
Manganese as Mn	<0.01		0.04	0.02	0.07	0.13	0.44	0.05	0.14	0.10	0.08	0.02				
Conductivity at 25° C in mS/m	47.7		54.9	56.5	63.3	317	298	423	385	277	132	180	<10	10 - 15	15 - 25	> 25
pH-Value at 25 ° C	7.55		7.52	7.42	7.34	7.95	8.53	8.40	8.25	7.62	7.89	7.97	6.4 - 8.5			<6.5;>8.5
pHs by 21° Celsius	7.47		7.37	7.44	7.50	6.98	6.93	7.10	7.16							
Langelier Saturation Index	+0.08		+1.15	-0.02	-0.16	+0.97	+1.60	+1.30	+1.09							
Turbidity as N.T.U.	61		136	16	40	45.0	1455	58	81							
Aluminium as Al	0.07		0.23	0.08	<0.01	<0.1		0.08	<0.1	0.41	0.03	0.10				

Table 23: Return water dam

													Grootdraai Dam Catchment - Vaal Origin Guidelines			
Analysis Results mg/l	**16 Nov 209**	**22 Dec 09**	**22 Jan 10**	**23 Feb 10**	**26 Mar 10**	**21 May 10**	**1 Jul 10**	**23 Jul 10**	**23 Aug 10**	**28 Oct 10**	**25 Nov 10**	**22 Dec 10**	**Ideal catchment background**	**Acceptable Management Target**	**Tolerable interim target**	**Unacceptable**
Total Dissolved Solids	1930	1536	1282	1386	1868	1868	2654	2626	2828	2666	2892	2510				
Suspended Solids	4982	2070	34.8	14.4	21.2	21.2	76.0	124	81.6							
Nitrate & Nitrite as N	4.3	4.7	2.60	2.7	2.2	2.2	1.6	2.2	3.1	2.9	2	2.1				

													Grootdraai Dam Catchment - Vaal Origin Guidelines			
Analysis Results mg/l	**16 Nov 209**	**22 Dec 09**	**22 Jan 10**	**23 Feb 10**	**26 Mar 10**	**21 May 10**	**1 Jul 10**	**23 Jul 10**	**23 Aug 10**	**28 Oct 10**	**25 Nov 10**	**22 Dec 10**	**Ideal catchment background**	**Acceptable Management Target**	**Tolerable interim target**	**Unacceptable**
Chlorides as Cl	80	56	30	32	42	42	80	92	88	86	85	81	<10	10 - 15	15 - 20	> 20
Total Alkalinity as $CaCO_3$	641	460	159	141	230	230	802	809	754	593	520	531	<20	20 - 45	45 - 75	> 75
Fluoride as F	5.01	3.01	1.40	1.6	2.3	2.3	4.76	4.73	4.41	5	4	4	< 0.05	0.05 - 0.20	0.2 - 0.4	>0.4
Sulphate as SO_4	624	652	597	810	950	950	1077	960	1152	1110	1427	1340	<10	10 - 20	20 - 30	> 30
Total Hardness as $CaCO_3$	59	34	259	464	424	424	138	134	145	155	149	137				
Calcium Hardness as $CaCO_3$	30	23	180	327	275	275	59	49	61	28.9	25.8	20.4				
Magnesium Hardness as $CaCO_3$	29	11	79	137	149	149	78	85	84							
Calcium as Ca	12.0	9.23	72.2	131	110	110	23.8	19.6	24.5							
Magnesium as Mg	7.07	2.63	19.3	33.2	36.2	36.2	19.0	20.7	20.5	20.2	20.5	21				
Sodium as Na	681	495	285	290	418	418	863	783	872	884	824	795				
Potassium as K	5.73	4.56	4.95	5.35	7.53	7.53	7.41	7.34	7.51	8.15	8.13	8.53				
Iron as Fe	4.63	1.74	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01				
Manganese as Mn	0.03	0.02	0.06	<0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01				
Conductivity at 25° C in mS/m	292	229	166	202	245	245	379	380	368	400	365	343	<10	10 - 15	15 - 25	> 25
pH-Value at 25 ° C	8.81	8.73	8.36	8.21	8.29	8.29	8.80	8.81	8.91	8.89	8.88	8.97	6.4 - 8.5			<6.5;>8.5
pHs by 21° Celsius	7.51	7.69	8.17	7.00	6.96	6.96	7.21	7.26	7.24							
Langelier Saturation Index	+1.30	+1.04	+1.19	+1.21	+1.33	+1.33	+1.59	+1.55	+1.67							
Turbidity as N.T.U.	NATD	NATD	29	12	8.8	8.8	88	29	68							
Aluminium as Al	2.33	1.54	-	0.02	<0.01	<0.01	0.09	0.06	0.09	0.09	0.04	0.02				

4.7.2 Surface water use

The main utilisation of water in the study area is for livestock watering, predominantly cattle and other mining industries in the area.

4.7.3 Water authority

The local surface water authority is:

The Department of Water Affairs and Forestry – Mpumalanga Division

Private Bag X11259

Nelspruit

1200

4.7.4 Wetlands

These have been further described in the sensitive landscapes section below.

4.8 Groundwater (Plan 12)

A Geohydrological investigation was undertaken for the Mooiplaats North Colliery by Geostratum Groundwater and Geochemistry Consulting (Geostratum, 2011) (Appendix F). The information below is extracted from this report, supplemented by the study conducted for the Mooiplaats South operation dated August 2009 (Appendix G) as well as current water quality monitoring data where available.

4.8.1 Presence of dykes and faults

The Geostratum Report compiled for Mooiplaats North, dated November 2011 states that dykes and faults that stretch beyond the mine boundary may form preferential flow zones for groundwater (and potential contaminant transport) along their strike. Dykes may often form a no-flow boundary in terms of groundwater flow perpendicular to its strike.

No regional faults that stretch beyond the boundary of the area have been identified in the area. Only localised faults/fractures have been indicated in some borehole logs.

Several dolerite dykes and sills have been inferred in the area. A major dyke is present between MPN and the old Usutu underground workings. A sill breakthrough also occurs between MPN and proposed MPS (Mooiplaats South Colliery). This has resulted in the compartmentalisation of the MPN underground workings as the dolerite will form no-flow boundaries with relation to inter-mine flow.

A study of the frequency and orientation of dolerite intersections on both the B lower and C upper coal seams indicates that the two major structural trends are coherent with the structural fabric created prior to the breakup of Gondwanaland i.e. NNE – SSW and NW – SE.

The dolerite intrusions related to the Lesotho basalts have resulted in the emplacement of dolerite sills that are essentially conformable with the stratigraphy although there are breakthroughs of the economic coal horizons of the No. 4 Dolerite and the No. 8 dolerite sills. The sills are correlated according to their physical appearance of crystal size and phenocryst size and type. The dolerite sills that occur in the area have been correlated to the B4 and B8 sills, which are of different ages.

The B4 dolerite sill is by far the most prevalent and its thickness is on average 30 – 50 m. Where it has broken through it has been eroded by the current surface erosion in the major river valleys.

4.8.1.1 Geophysical survey

A geophysical survey was carried out by Geostratum in April 2011. In total, four traverses of direct current resistivity (using the 10m electrode spacing) and magnetic profiling were performed to image the subsurface resistivity/conductivity in order to investigate the geological structure of the area (especially the presence of the dyke) between the Usutu and MPN boundaries. This was performed in order to identify drilling targets for the construction of monitoring boreholes. The cross-sections in Traverse 1- 4 and the positions of the drilled boreholes are shown in Figure 11.

The survey confirmed the presence of a dyke between the Usutu and MPN underground mines, as well as the approximate depth of the dyke. These boreholes will monitor the groundwater level and quality between the two mines, as well as any potential impact (on the aquifer) caused by pumping of the Usutu mine water by MPN.

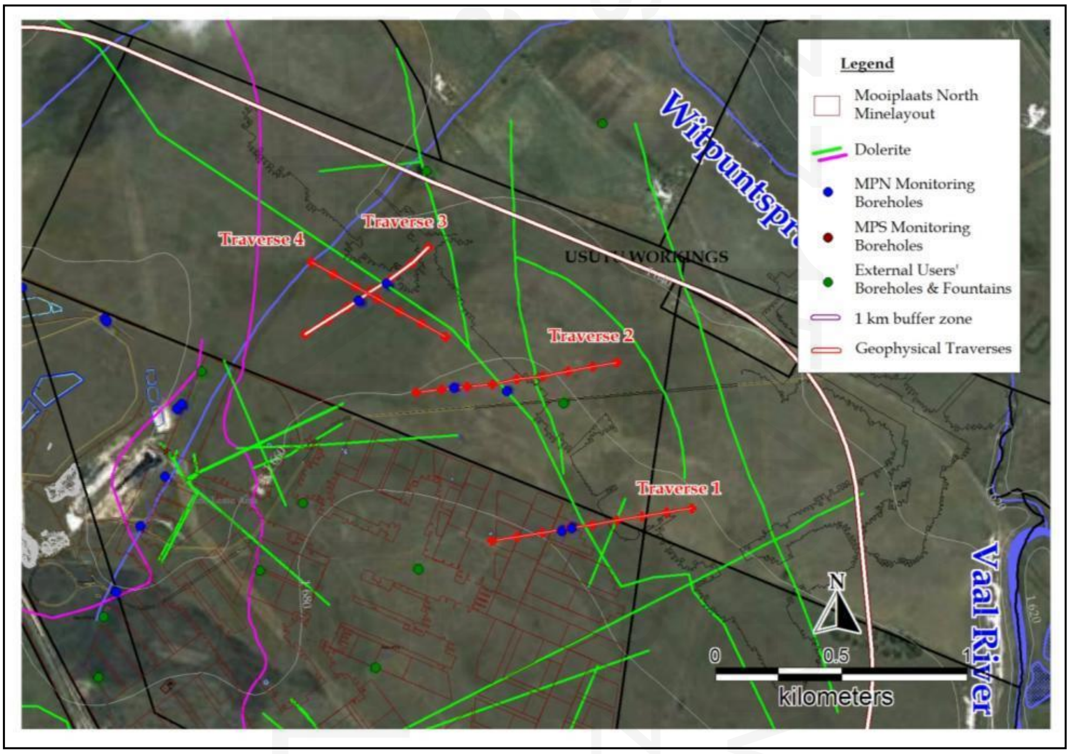


Figure 11: Location of geophysical traverses between MPN and the Usutu underground (Geostratum, 2011)

4.8.2 Presence of boreholes and springs and their estimated yields

4.8.2.1 Monitoring boreholes

A total of 19 monitoring boreholes are present at MPN, 14 being newly drilled monitoring boreholes. Of the 19 boreholes, 13 boreholes (18 - 50 m deep) are present in both the shallow weathered zone aquifer and deeper fractured aquifer; 6 boreholes (80 – 120 deep) were drilled into the deeper fractured aquifer with the shallow weathered aquifer cased off with solid casing.

The presence of the monitoring boreholes at MPN is depicted in Figure 12 below.

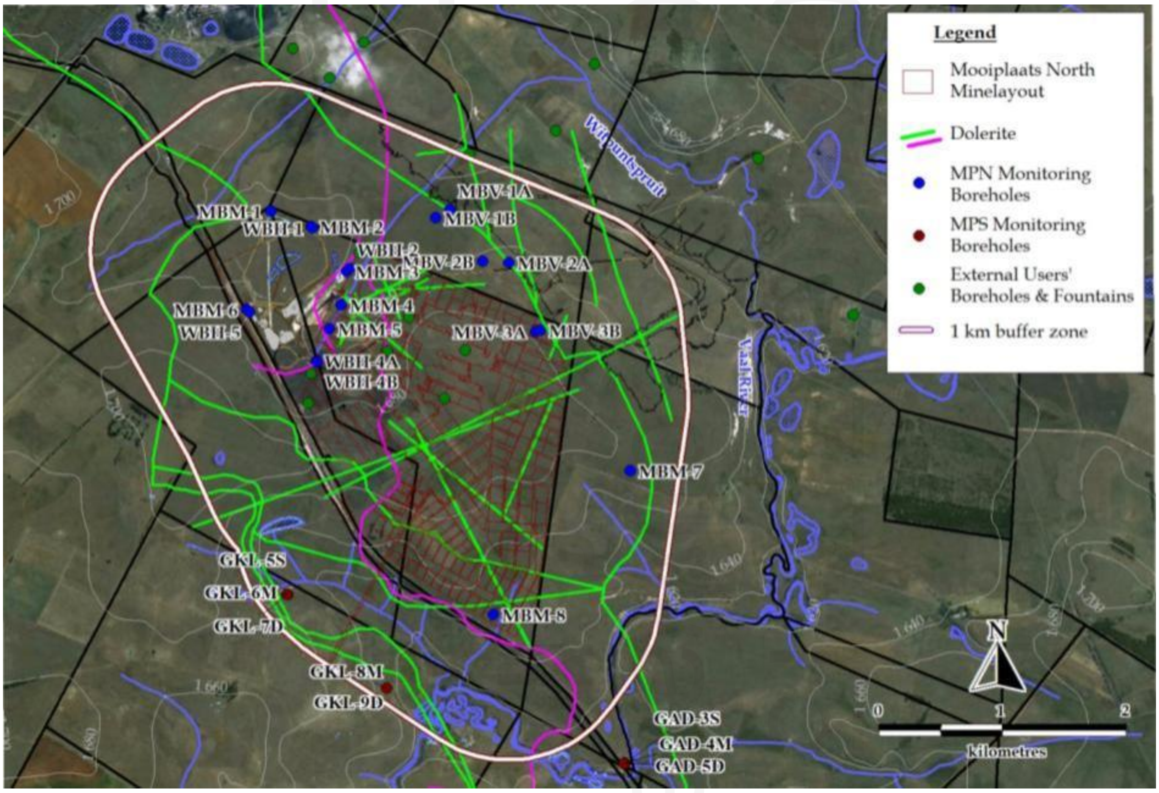


Figure 12: Presence of monitoring boreholes at Mooiplaats North

4.8.2.2 External users' boreholes and fountains

A hydro-census was completed in April 2011 in order to identify groundwater use in a 1 km zone around the mine.

- A total of 11 external users' boreholes were surveyed that are located around MPN, near homesteads, or present in the farming fields. Of these only 3 are currently pumped which indicates the low level of groundwater use in the area.
- A total of 3 fountains occur in the surveyed area. The fountains were associated with rock outcrops or situated in the upper reaches of streams. The perennial status of the fountains could not be confirmed but flow is expected to be significantly lower during the dry season.

- 2 earth dams are present in the area used for small scale irrigation and stock watering respectively.

The external users' boreholes and fountains at MPN are depicted in Figure 13.

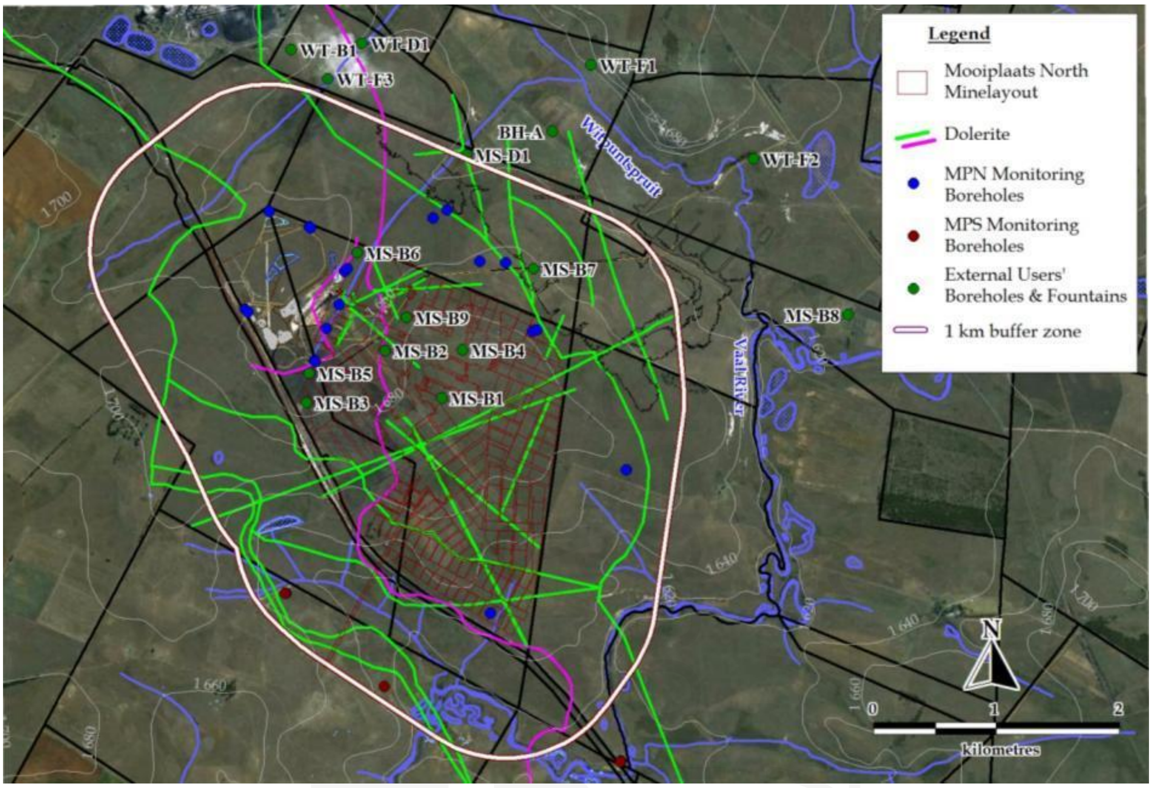


Figure 13: Presence of external users' boreholes and fountains at Mooiplaats North

4.8.2.3 Borehole and fountain yields

The following observations could be made with respect to the user yield of boreholes in the area:

- Borehole MS-B7 is used by MPN for pumping water from the old Usutu East workings to the MPN colliery plant. The approximate pump rate is 0.60 l/s although pumping is erratic and conducted more during the dry season than during the wet season.
- Only three boreholes are pumped and no significant groundwater use is present in the area.
- MS-B4 is equipped with a windmill and is use for stock watering. MS-B4 replaced the function of MS-B1.
- WT-B1 is used by a guesthouse and supplies roughly 10 people with water. This borehole is pumped at approximately 2,500 l/h for 20 minutes before becoming dry.

The estimated blow yields from water strikes were recorded during the drilling of 14 new monitoring boreholes at MPN (Table 24). With regard to the blow yields of the monitoring boreholes the following comments could be made:

- Water strikes give valuable information on the aquifer and the conditions under which groundwater is hosted. Two water strikes were associated with fractures in fresh shale and/or sandstone.
- Two water strikes were recorded at the contact between the weathered and fresh shale and/or sandstone. Fractures often occur at this contact as rock generally first forms small fractures upon weathering.
- Four water strikes were associated with dolerite intersections. Fracturing and weathering along dolerite dyke contacts often result in preferential flow zones along the dolerite dyke strike.

Table 24: Estimated blow yield information of monitoring boreholes*

No on map	Water Strike			Weathered depth	Lithology	Water strike description
	Top (m)	Bottom (m)	Blow Yield			
MBM-2	22	23	1.45	12	Sandstone and shale	Fracture in fresh rock
MBM-3	12	14	0.05	12	Sandstone	Contact between weathered/fresh rock
MBM-5	25	25.1	1.5	7	Shale	Fracture in fresh rock
MBM-6	15	18	0.35	18	Dolerite	Weathered/fractured dolerite
MBV-1A	7	12	0.2	12	Sandstone and shale	Contact between weathered/fresh rock
MBV-1B	27	29	0.25	13	Shale/dolerite	Contact between shale and dolerite
MBV-3A	58	68	1.55	17	Dolerite	Series of water strikes in dolerite
MBV-3B	10	19	0.97	19	Dolerite	Contact between weathered/fresh dolerite

*** 14 monitoring boreholes drilled between November 2010 and April 2011**

4.8.3 Aquifer Description

4.8.3.1 Aquifer type

The Karoo sedimentary aquifer in the study area can be separated into three different zones:

- Perched conditions in the soil horizon: The shallow perched conditions are essentially restricted to finite extending clay lenses present in the soil (soft overburden) horizon. The perched aquifer has unconfined conditions. No major lateral extensions of these zones were found.
- The shallow weathered zone Karoo aquifer and the deep fractured Karoo aquifer: The host rock for these two aquifer types is the Karoo sedimentary rocks. A large range of grain-size distribution is present for the argillic (grain size < 0.0625 mm) to arenaceous (grain size 0.0625 to 2 mm) sedimentary rocks. The shallow weathered zone aquifer displays unconfined to semi-confined conditions, while the deep aquifer predominantly displays semi-confined to confined conditions.

Groundwater flow in all three aquifer types is essentially horizontal. However, interconnection between the aquifer types can introduce vertical flow components.

Dolerite dykes and sills are present in the Karoo aquifer that may cause localised compartmentalisation. The presence of the dykes and sills may also influence the yielding capacity in some areas.

4.8.3.2 Lateral aquifer delineation

The lateral extent of the aquifers is important in order to set definable limits of any potential contaminant transport and lowering of water levels within the Karoo aquifers as the aquifer boundaries (and therefore potential contaminant transport/water level lowering) are often beyond the property boundaries of mines.

The shallow weathered aquifer zone is identified as the aquifer wherein contaminants from surface activities will migrate. Any contaminant transport will be identified by continuous monitoring of the shallow and deep Karoo aquifer.

Two types of aquifer boundaries exist within the study area zone of influence:

- Physical aquifer boundaries such as impermeable dolerite dykes and sills, or other geological discontinuities.
- Hydraulic aquifer boundaries such as surface water features which act as groundwater discharge boundaries or groundwater divides.

The lateral aquifer boundaries for the shallow weathered aquifer are depicted in Figure 14. In terms of the shallow weathered aquifer boundaries the following observations could be made:

- The groundwater elevation correlates roughly with the topography. Therefore, groundwater will generally flow from higher towards lower topographical areas. Groundwater flow will not continue infinitely in a certain direction and will be confined to boundaries due to the groundwater's interaction with surface water, topography and geological features.

- The aquifer boundaries for the shallow weathered aquifer in the study area are as follows:
  - On the northern, north-eastern and north-western side, for ±9 km, the Witpunt Spruit and a tributary thereof;
  - On the southern, south-eastern and south-western side, for ±9.3 km, the Vaal River and tributary thereof; and
  - On the western side, for ±2.7 km, a groundwater divide.
- The rivers and streams form a local discharge boundary for the aquifer (groundwater discharge to river) and no flow from the river alluvial system towards the aquifer is supposed.
- Dolerite dykes and sills present within the aquifer boundaries may act as localized no-flow boundaries or preferential pathways depending on the degree of weathering of the dolerite and fracturing associated with the intrusions. The dolerite will also form a no-flow boundary for the deep aquifer.

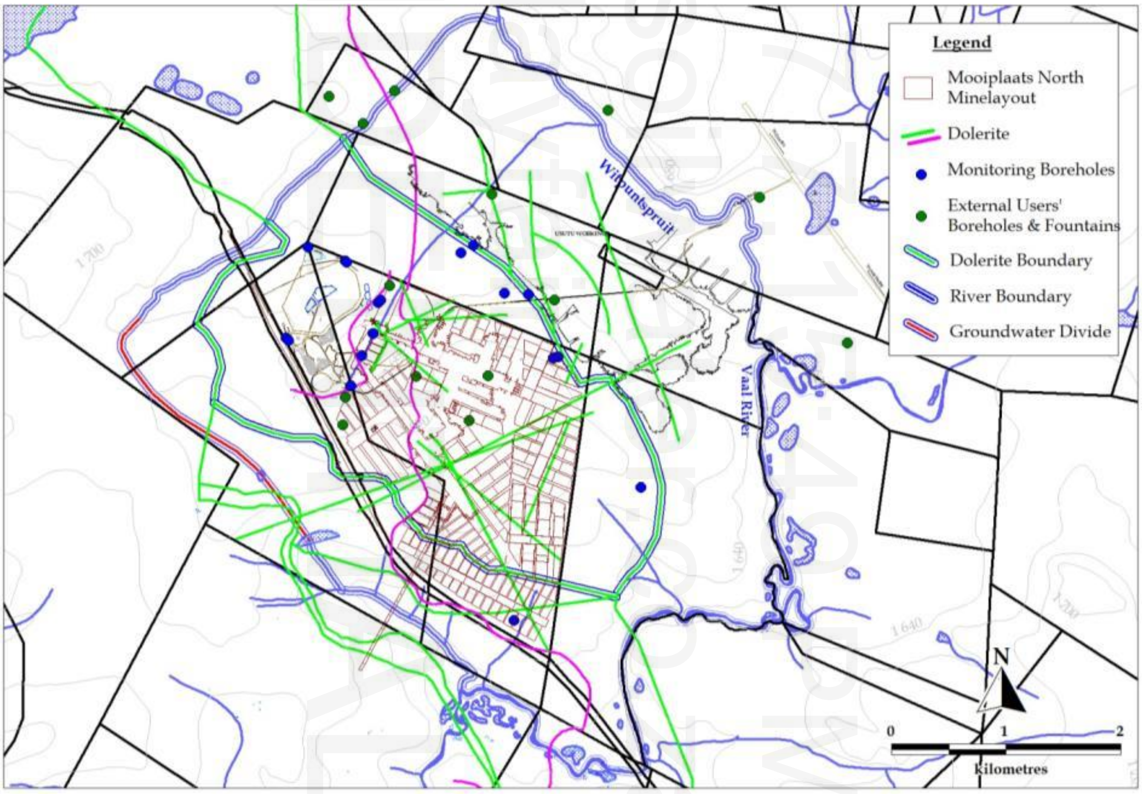


Figure 14: Shallow weathered aquifer boundaries

4.8.3.3 *Aquifer thickness*

The aquifer thickness as logged during the drilling of the monitoring boreholes is given in Table 25.

- The average depth of the soil horizon is 5 meters below surface (mbs) in monitoring boreholes. Perched conditions will be present in clay lenses within the soil horizon.
- The shallow weathered aquifer is on average present between 5 to 22 mbs.
- The deep fractured aquifer is present below 22 mbs. The depth of the aquifer is taken as the bottom of the Karoo sedimentary rocks that may be present at a further 100 - 150 m below the average depth of the exploration boreholes (140 m) drilled in the area.

Table 25: Aquifer thickness at Mooiplaats North

Aquifer	Depth From (m)	Depth To (m)	Average Thickness (m)
Perched Aquifer	0	5	<5
Shallow Weathered Aquifer	5	22	17
Deep Fractured Aquifer	22	>140*	>113

*** Average depth of exploration boreholes in Vryheid Formation**

4.8.3.4 *Aquifer parameters*

Porosity:

Porosity of a rock is its property of containing pores or voids. Aquifer effective porosity indicates the volume of water that can be released/the volume of connected pores that is present within an aquifer. Effective porosity is an important parameter to determine since it is used in groundwater calculations within the aquifer. Generally, the effective porosity of the shallow weathered zone aquifer is about half that of the total porosity but about an order smaller for the deeper Karoo aquifer.

Hydraulic conductivity:

Slug tests were performed in April 2011 on all monitoring boreholes drilled.

- In the shallow weathered aquifer the hydraulic conductivity ranges between 0.0048 and 5.855 m/d. The data has a lognormal distribution. The chosen hydraulic conductivity for the shallow weathered zone is taken as 0.03 m/d.
- In the deep fractured aquifer the hydraulic conductivity ranges between 0.0048 and 5.855 m/d. The data has a lognormal distribution. The chosen hydraulic conductivity for the shallow weathered zone is taken as 0.007 m/d.

- In the alluvium/soils the hydraulic conductivity ranges between 0.2735 and 5.93 m/d. The chosen hydraulic conductivity for the shallow weathered zone is taken as 4 m/d.

4.8.3.5 Aquifer classification

The Karoo aquifer at Mooiplaats has only been classified in terms of its permeability and potential groundwater use in accordance with the following definitions:

- Sole Aquifer System: An aquifer which is used to supply 50 per cent or more of domestic water for a given area, and for which there are no reasonably available alternative sources should the aquifer be impacted upon or depleted. Aquifer yields and natural water quality are immaterial.
- Major Aquifer System: Highly permeable formations, usually with a known or probable presence of significant fracturing. They may be highly productive and able to support large abstractions for public supply and other purposes. Water quality is generally very good (less than 150 mS/m Electrical Conductivity).
- Minor Aquifer System: These can be fractured or potentially fractured rocks which do not have a high primary permeability, or other formations of variable permeability. Aquifer extent may be limited and water quality variable. Although these aquifers seldom produce large quantities of water, they are important for local supplies and in supplying base flow for rivers.
- Non-Aquifer System: These are formations with negligible permeability that are regarded as not containing groundwater in exploitable quantities. Water quality may also be such that it renders the aquifer unusable. However, groundwater flow through such rocks, although imperceptible, does take place, and needs to be considered when assessing the risk associated with persistent pollutants.

Subject to the baseline information, the following overall classification of the Karoo aquifer in the area could be made in terms of its potential groundwater use:

- The Karoo Formation aquifer of the Mooiplaats area can in general be classified as a low yielding aquifer. It does have a viable exploitation potential for domestic and stock-watering application and as such is the main water resource for these applications to the farming communities in the area. The aquifers will however not support formal irrigation application over any extensive area (> 10 ha). The shallow weathered aquifer can therefore be classified as a minor aquifer system in terms of aquifer management as discussed above.

4.8.4 Groundwater level distribution

The groundwater level was measured in external users' boreholes during the hydro-census and in monitoring boreholes two weeks after drilling was completed (end April 2009). A summary of groundwater levels measured in monitoring and external users' boreholes is given in Table 26 and 27 below. The groundwater level distribution is depicted in Figure 15, and the relation between the topography and the groundwater elevation in Figure 16.

- In external users' boreholes the maximum depth of the groundwater level is 9.3 mbs, averaging at 4.95 mbs (excluding outliers). No depletion in the groundwater level due to pumping is present except for borehole MS-B7 with a water level of 35.08 mbs. The water level measurements are in excellent agreement with the measurements at MPS.
- The depth to the groundwater level is slightly deeper in monitoring boreholes drilled into the deep fractured aquifer (maximum water level 13.28 mbs, average 8.09 mbs - excluding outliers) than in boreholes drilled into the shallow weathered aquifer (maximum water level 9.06 mbs, average 5.73 mbs - excluding outliers). Difference in water levels between shallow and deep boreholes indicates that the deep aquifer is semi-confined/confined.
- MBV-2A is the closest to the pumped borehole MS-B7 and shows a slight depletion in groundwater level. The water level in MS-B7 is 35.08 mbs and in MBV-2A it is 28.12 mbs.
- The outliers in the shallow weathered aquifer include outliers MBM-4, 5 and WBH-4A with groundwater levels of 15.77 mbs, 23.11 mbs and 13 mbs respectively. These boreholes are situated close to each other and were pumped briefly during the time of measurement for water supply by the mine.
- MPS monitoring boreholes drilled into the perched aquifer have water levels of 0.98 to 3.85 mbs, averaging at 2.27 mbs. These boreholes were drilled close to the river. It was evident that there is dynamic interaction between the river water and the surrounding alluvium as contamination present in the river was also detected in one of the shallow boreholes - see MPS EMPR.

Table 26: Depth to water level (mbs) in MPS and MPN monitoring boreholes

Monitoring boreholes	Minimum (mbs)	Maximum (mbs)	Average (mbs)	Number of water levels measured
MPS - Softs/Soil (bh depth = 6 m)	0.98	3.85	2.27	3
MPN - Shallow Weathered Aquifer (bh depth = 30 – 40 m)	3.07	9.06	5.73	9*

Monitoring boreholes	Minimum (mbs)	Maximum (mbs)	Average (mbs)	Number of water levels measured
MPS - Shallow Weathered Aquifer (bh depth = 30 – 40 m)	0.00	6.14	3.74	6**
MPN - Deep Fractured Aquifer (bh depth = 80 – 86 m)	2.83	13.28	8.09	6***
MPS - Deep Fractured Aquifer (bh depth = 80 – 86 m)	0.00	14.06	7.69	4

*** Excluding outliers MBM-4, 5 and WBH-4A with groundwater levels of 15.77 mbs, 23.11 mbs and 13 mbs respectively.**
**** Excluding outlier GKL-1 with a groundwater level of 23.90 mbs.**
***** Excluding outlier MBV-2A with a groundwater level of 28.12 mbs.**

Table 27: Depth to water level (mbs) in MPS and MPN external users' boreholes

Range in all external users' boreholes	Minimum (mbs)	Maximum (mbs)	Average (mbs)	Number of water levels measured
MPN	0.00	9.30	4.95	7*
MPS	0.00	11.43	4.08	11

*** Excluding outlier MS-B7 with a groundwater level of 35.08 mbs.**

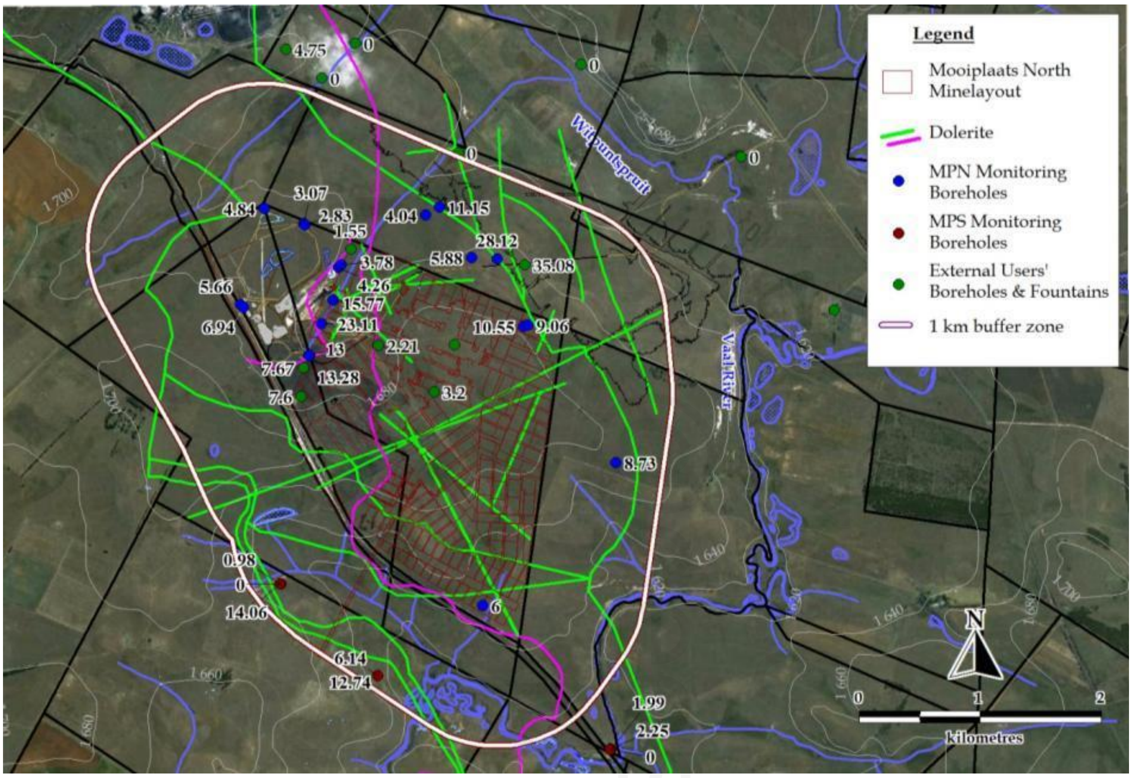


Figure 15: Depth to water level (mbs) in boreholes and fountains

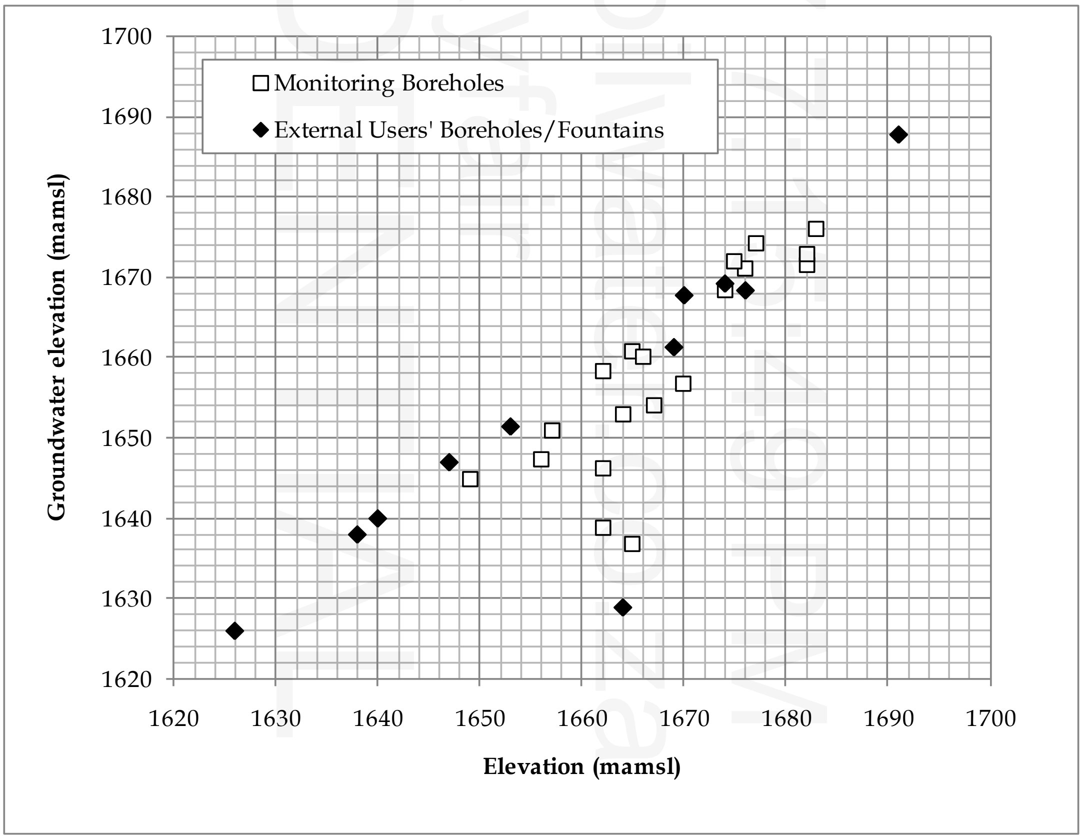


Figure 16: Relation between topography and groundwater level elevation

4.8.5 Groundwater Use

Groundwater use at Mooiplaats North is fairly limited. Borehole and fountain use and the user application are summarized in Table 28 and 29 respectively below.

- Borehole MS-B7 is used by MPN for pumping water from the old Usutu East workings to the MPN colliery plant.
- Five boreholes have been used by MPN to pump water to the change house. All of these boreholes delivered a low yield and is no longer in use.
- One borehole (BH-A) is a monitoring borehole of the closed Usutu Mine.
- Two external user boreholes, WT-B1 and MS-B4, are currently in use for domestic (as a guesthouse) and stock watering purposes respectively.
- Two fountains, WT-F1 and F2, are used for domestic and stock watering purposes respectively.
- The 2 earth dams, WT-D1 and MS-D1, are used for irrigation and stock watering respectively.

Table 28: Borehole and fountain use - numbers indicate recent historical use and number in brackets indicate current use

Water Use	Number of Boreholes	Number of Fountains	Earth Dams
Agriculture - Irrigation	-	-	1 (1)
Agriculture - Stock watering	2 (1)	1 (1)	1 (1)
Domestic	1 (1)	1 (1)	-
Mining – Water pumped to plant	1 (1)	-	-
Mining – Water pumped to change house	5 (0)	-	-
Mining – Monitoring borehole of the defunct Usutu UG mine	1 (1)	-	-

Table 29: User application*

Water Use	People	LSU	SSU	Irrigation
Boreholes	10	500	1000	-
Fountains	-	No info	No info	-
Earth dams	-	No info	No info	2 ha

*** LSU – Large Stock Units, SSU – Small Stock Units.**

4.8.6 Groundwater quality

Groundwater monitoring is being undertaken at Mooiplaats North Colliery. Due to the lack of monitoring data available it is not yet possible to determine whether any trends exist. Trends will be reported as part of the EMP performance assessment reports. The available data has been summarised and discussed below.

Geostratum (2011) also conducted sampling on the additional newly drilled boreholes. Details of their findings can be found in Appendix A of the EMP. Their overall conclusions are as follow:

"<u>Overall the groundwater in the area is of good quality with only 1) the Usutu monitoring borehole that has non-compliant concentration of Na and F, as well as marginally elevated SO_4, and 2) a slightly elevated SO_4 in one plant monitoring borehole. Erratic elevation in Al, Fe and Mn may be attributed to natural causes.</u>"

4.8.6.1 WBH01

WBH01 is situated north east of the return water dam and co-disposal dump. The pH increased dramatically from November to December 2010 however, without additional monitoring data no trends can be established. All other constituents are within acceptable levels.

4.8.6.2 WBH02

WBH02 is east of the three settling dams, this water is of good quality with all constituents falling well within the acceptable levels. The manganese levels may however cause staining and taste problems.

4.8.6.3 WBH04a and WBH04b

WBH04a and WBH04b are situated south-south-east of the sewage water dam. Water quality data indicates elevated levels for pH, conductivity, fluoride and total alkalinity which may cause health effects if this water is consumed. Additional monitoring will be undertaken to establish trends.

4.8.6.4 WBH05

WBH05 is south west of the co-disposal dam, high alkalinity is indicated. All the constituents are within acceptable levels however, the manganese may cause staining and taste problems.

4.8.6.5 Usutu Water

This is the old Usutu underground workings, Mooiplaats Colliery abstracts water from these workings for use within the process plant. Available data indicates this water has been impacted on by mining activities, with excessively high levels of sulphates, chlorides, fluoride, conductivity and alkalinity.

Table 30: WBH 01

Analysis Results mg/l	Limit	25/11/2010	22/12/10
pH-Value at 25 ° C	<6.5;>8.5	6.88	8.76
Conductivity at 25° C in mS/m	> 25	8.4	8.71
Total Dissolved Solids		58	66
Total Acidity as CaCO3 to pH 8.3		6.7	Nil
Total Hardness as $CaCO_3$		16.45	4.73
Calcium as Ca		3.21	0.84
Magnesium as Mg		2.05	0.64
Sodium as Na		13.6	15.9
Potassium as K		1.69	8
Sulphate as SO_4	> 30	2.2	5
Chlorides as Cl	> 20	2	6
Fluoride as F	>0.4	0.38	<0.20
Iron as Fe		0.27	0.24
Manganese as Mn		0.18	0.05
Aluminium as Al		0.03	<0.01
Nitrate & Nitrite as N		<0.1	<0.1
Sodium Absorption Ratio (SAR)		1.46	3.18
Total Alkalinity as $CaCO_3$	> 75	42	40

Table 31: WBH 02

Analysis Results mg/l	Limit	28/10/2010	25/11/2010	22/12/10
pH-Value at 25 ° C	<6.5;>8.5	6.88	7.06	6.88
Conductivity at 25° C in mS/m	> 25	8.4	8.4	7.64

Analysis Results mg/l	Limit	28/10/2010	25/11/2010	22/12/10
Total Dissolved Solids		58	66	64
Total Acidity as CaCO3 to pH 8.3		6.7	5.3	5.5
Total Hardness as $CaCO_3$		16.45	19.75	17.91
Calcium as Ca		3.21	4.07	3.35
Magnesium as Mg		2.05	2.33	2.32
Sodium as Na		13.6	14.7	12.6
Potassium as K		1.69	2.11	1.93
Sulphate as SO_4	> 30	2.2	1.8	11.2
Chlorides as Cl	> 20	2	4	11
Fluoride as F	>0.4	0.38	0.22	<0.20
Iron as Fe		0.27	0.09	0.19
Manganese as Mn		0.18	0.2	0.27
Aluminium as Al		0.03	<0.01	<0.01
Nitrate & Nitrite as N		<0.1	0.21	0.81
Sodium Absorption Ratio (SAR)		1.46	1.44	1.3
Total Alkalinity as $CaCO_3$	> 75	42	49	22

Table 32: WBH 04a

Analysis Results mg/l	Limit	25/11/2010	22/12/10
pH-Value at 25 ° C	<6.5;>8.5	9.26	8.83
Conductivity at 25° C in mS/m	> 25	21.1	27.4
Total Dissolved Solids		138	212
Total Acidity as CaCO3 to pH 8.3		Nil	Nil

Analysis Results mg/l	**Limit**	**25/11/2010**	**22/12/10**
Total Hardness as $CaCO_3$		39.03	66.30
Calcium as Ca		5.1	13.2
Magnesium as Mg		6.39	8.1
Sodium as Na		36	45.3
Potassium as K		0.67	1.29
Sulphate as SO_4	> 30	1.1	14.3
Chlorides as Cl	> 20	7	6
Fluoride as F	>0.4	0.44	0.2
Iron as Fe		0.03	0.09
Manganese as Mn		<0.01	0.1
Aluminium as Al		<0.01	<0.01
Nitrate & Nitrite as N		0.21	<0.1
Sodium Absorption Ratio (SAR)		2.51	2.42
Total Alkalinity as $CaCO_3$	> 75	108	160

Table 33: WBH 04b

Analysis Results mg/l	**Limit**	**25/11/2010**	**22/12/10**
pH-Value at 25 ° C	<6.5;>8.5	9.51	9.59
Conductivity at 25° C in mS/m	> 25	27.6	20.9
Total Dissolved Solids		182	136
Total Acidity as CaCO3 to pH 8.3		Nil	Nil
Total Hardness as $CaCO_3$		37.27	36.61
Calcium as Ca		6.52	4.18

Analysis Results mg/l	**Limit**	**25/11/2010**	**22/12/10**
Magnesium as Mg		5.1	6.36
Sodium as Na		50.6	35.4
Potassium as K		1.51	0.69
Sulphate as SO_4	> 30	2.4	1.2
Chlorides as Cl	> 20	6	7
Fluoride as F	>0.4	0.23	0.32
Iron as Fe		0.05	<0.01
Manganese as Mn		<0.01	<0.01
Aluminium as Al		<0.01	<0.01
Nitrate & Nitrite as N		0.23	<0.1
Sodium Absorption Ratio (SAR)		3.61	2.55
Total Alkalinity as $CaCO_3$	> 75	148	112

Table 34: WBH 05

Analysis Results mg/l	**Limit**	**25/11/2010**	**22/12/10**
pH-Value at 25 ° C	<6.5;>8.5	8.29	8.38
Conductivity at 25° C in mS/m	> 25	23.7	24.1
Total Dissolved Solids		154	158
Total Acidity as CaCO3 to pH 8.3		<2.0	Nil
Total Hardness as $CaCO_3$		82.61	89.00
Calcium as Ca		19.4	20
Magnesium as Mg		8.3	9.49
Sodium as Na		20	19.3

Analysis Results mg/l	Limit	25/11/2010	22/12/10
Potassium as K		3.6	4.13
Sulphate as SO_4	> 30	5.5	19.7
Chlorides as Cl	> 20	5	4
Fluoride as F	>0.4	<0.20	<0.20
Iron as Fe		<0.01	0.06
Manganese as Mn		0.14	0.13
Aluminium as Al		<0.01	<0.01
Nitrate & Nitrite as N		0.18	<0.1
Sodium Absorption Ratio (SAR)		0.96	0.89
Total Alkalinity as $CaCO_3$	> 75	129	119

Table 35: Usutu Water

Analysis Results mg/l	Limit	16/11/09	22/12/09	22/01/10	23/02/10	26/03/10	02/04/10	21/05/10	1/07/10	23/07/10	23/08/10	02/09/10	28/10/10	25/11/10	02/12/10	22/12/10
Total Dissolved Solids		2386	Water not flowing	2240	2320		Water not flowing		2386	2486	2362	No Sample taken	184	No Sample taken	352	2188
Aluminium as Al		<0.01		<0.01	<0.01				<0.01	0.02	0.11		0.04		0.07	0.01
Calcium as Ca		28		22.8	19.9				28.0	31.9	35.1		24.7		25.9	115.0
Chlorides as Cl	> 20	93		97	98				88	90	85		8		11	39
Conductivity at 25° C in mS/m	> 25	353		344	340				338	352	333		29		54	261
Fluoride as F	>0.4	6.7		6.6	7.9				6.42	6.86	6.06		0		1	2
Iron as Fe		<0.01		<0.01	0.01				<0.01	<0.01	<0.01		0.03		0.14	<0.01
Magnesium as Mg		12.3		10.9	10.7				13.1	14.1	14.00		10.3		37.4	65.9
Manganese as Mn		<0.01		<0.01	<0.01				<0.01	0.01	0.01		<0.01		0.02	0.12
Nitrate & Nitrite as N		<0.1		0.10	<0.01				0.15	<0.1	<0.1		<0.1		0.35	0.98
pH-Value at 25 ° C	<6.5;>8.5	8.12		8.14	8.36				7.83	7.96	8.16		7.85		8.18	8.01
Potassium as K		4.93		4.59	4.65				4.91	5.12	5.02		2.34		3.88	7.60
Sodium as Na		872		768	818				807	803	790		23.4		36.8	446.0
Sulphate as SO_4	> 30	441		377	380				194	536	451		9		95	1235
Suspended Solids		12.4		19.6	12.4				9.6	13.2	8.8					
Total Acidity as CaCO3 to pH 8.3													4.7		<2.0	4.3
Total Alkalinity as $CaCO_3$	> 75	1327		1403	1511				1330	1323	1295		138		201	265
Total Hardness as $CaCO_3$		0		7	94				124	138	145		104		219	558
Turbidity as N.T.U.		0		7	10				1	0	1					
Calcium Hardness as $CaCO_3$		69		57	50				70	80	88					
Magnesium Hardness as $CaCO_3$		51		45	44				54	58	58					

Analysis Results mg/l	Limit	16/11/09	22/12/09	22/01/10	23/02/10	26/03/10	02/04/10	21/05/10	1/07/10	23/07/10	23/08/10	02/09/10	28/10/10	25/11/10	02/12/10	22/12/10
pHs by 21° Celsius		7		7	7				7	7	7					
Langelier Saturation Index		+1.25		+1.21	+1.39				+0.98	+1.14	+1.40					
Turbidity as N.T.U.		0		7	10				1	0	1					
Free Residual Chlorine Cl2		-			-				<0.4		<0.1					

4.8.6.6 Groundwater type

A piper diagram was drawn for all borehole and fountain hydro-chemical samples in Figure 17 below. With regard to the groundwater type, the following comments could be made:

- Na is the more dominant cation in about half of the samples. Both Na and Ca are the dominant cations in the other samples.
- Alkalinity in the form of CO_3 is the most dominant anion in fountains and boreholes. However, WT-F3 has more recently recharged water and less alkalinity dominance than WT-F1 and F2.
- Overall, boreholes and fountains show similar parameter dominance and could be classified as Na(Ca)-CO_3 water.

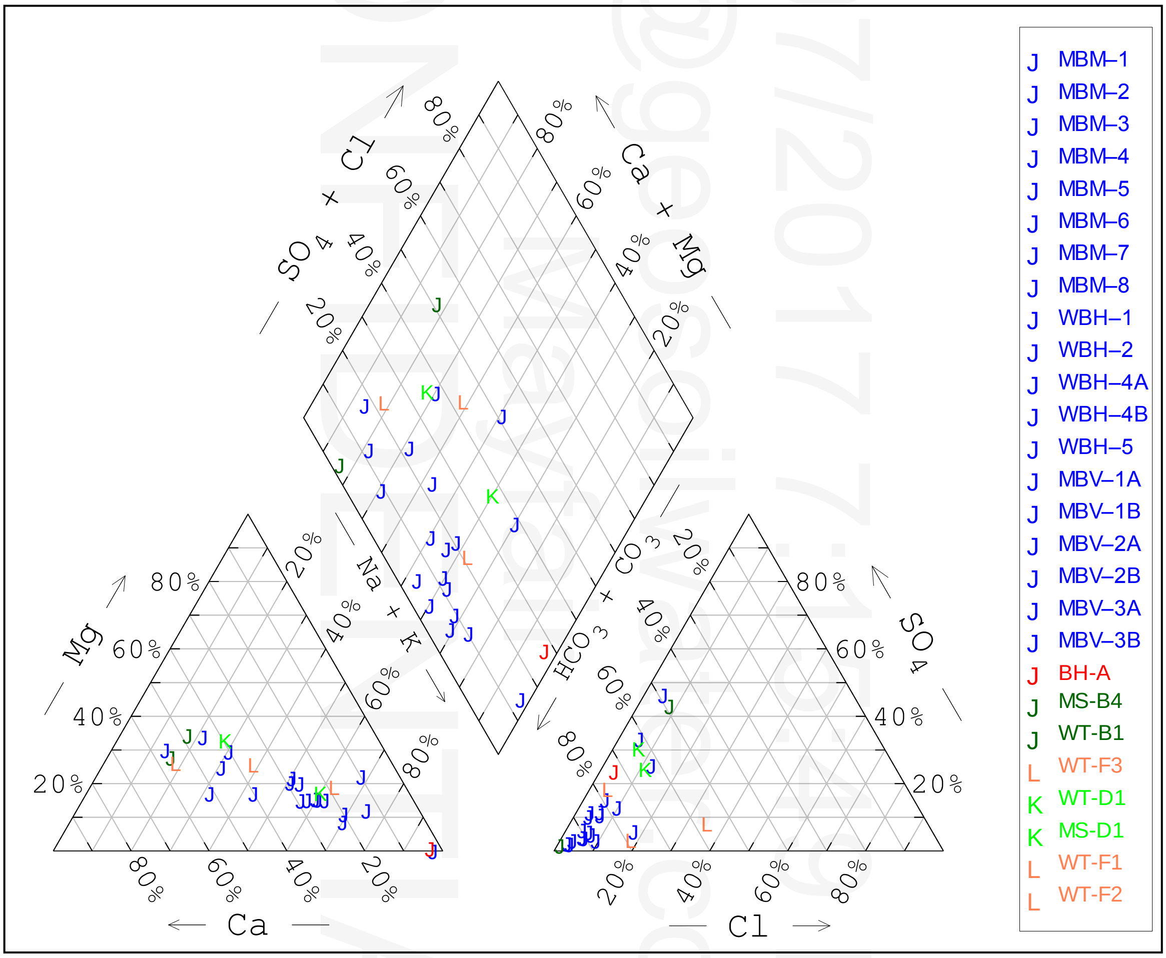


Figure 17: Piper diagram of all borehole and fountain hydro-chemical samples

4.8.6.7 Background groundwater quality

After the assessment of the groundwater quality, samples that are believed to represent natural groundwater (no surface water or water impacted upon) could be classified as representing background groundwater quality. A summary of the background groundwater quality is given in Table 36 below. A piper plot depicting background and non-background samples is given in Figure 18 below. The following comments could be made with regard to the background groundwater quality:

- As with the groundwater samples above the background groundwater could also be classified as Na(Ca)-CO_3 dominated water.
- Groundwater with SO_4 contamination could be distinguished from the background groundwater as SO_4 becomes the dominant anion. Any future mining impact could therefore easily be identified on a piper diagram.
- The background groundwater may have naturally elevated pH, TDS, Na, alkalinity, Al, Fe and Mn.

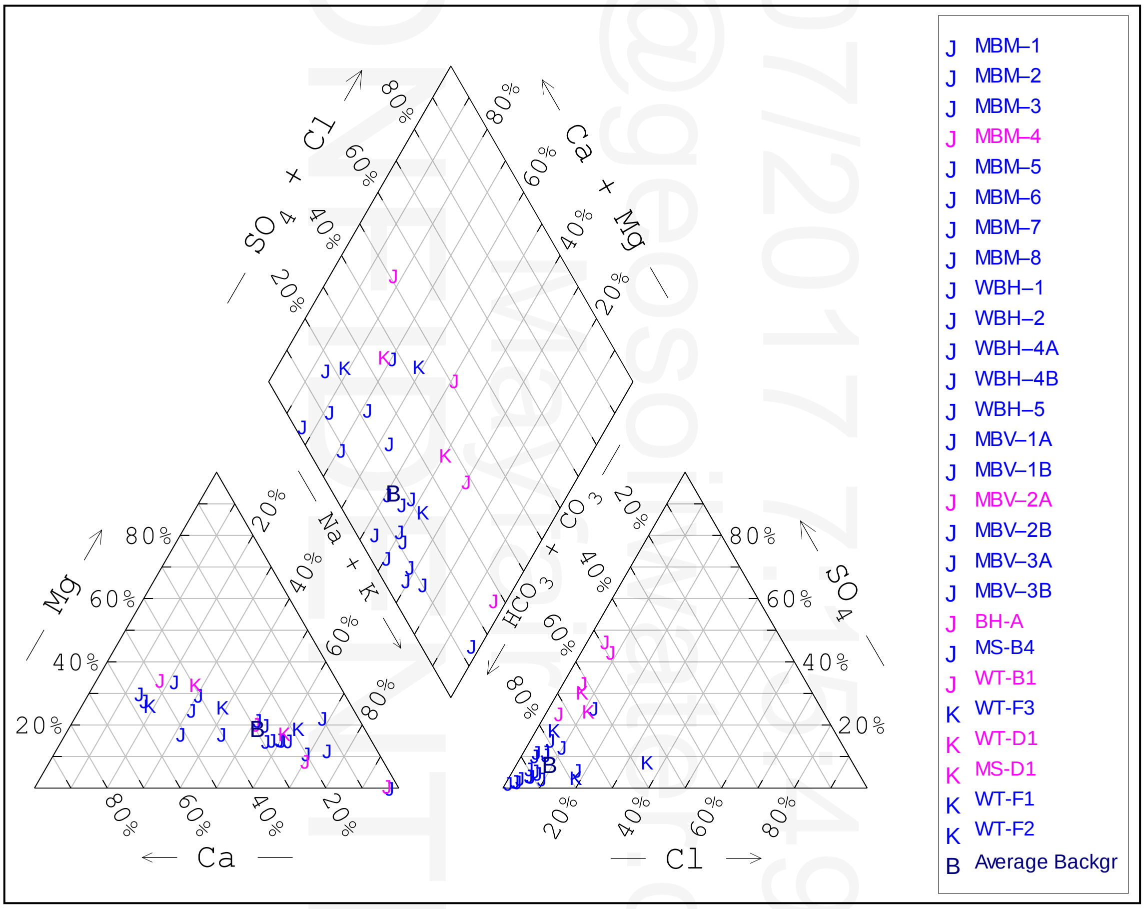


Figure 18: Piper diagram of background (blue) vs. non-background (pink) samples

Table 36: Background groundwater quality

Variable (mg/l)	Minimum	Maximum	Average
pH (value)	6.6	9.4	7.6
EC (mS/m)	10	121	28

Variable (mg/l)	Minimum	Maximum	Average
TDS	59	736	162
Ca	1	51	17
Mg	0	35	7
Na	7	213	36
K	1	3	2
Total Alkalinity	38	530	126
Cl	2	90	10
SO_4	4	41	13
NO_3	0.2	2.9	0.5
F	0.0	0.8	0.2
Al	0.01	2.12	0.24
Fe	0.01	2.44	0.56
Mn	0.01	0.49	0.06

4.8.7 Mineralogy and total element analyses

The mineralogical and elemental composition for a selection of samples was determined by means of X-ray Diffraction (XRD) and X-ray Fluorescence (XRF). The detailed results can be found in the groundwater report (Appendix A) and a summary of the findings is given below.

- Kaolinite ($Al_2Si_2O_5(OH)_4$) is present as a minor to dominant mineral in the clastic rock and coal samples. Generally a good correlation between the ash and the kaolinite content in the coal is present in the Vryheid Formation coal. Kaolinite is generally precipitated by authigenic processes during coal formation.
- Quartz (SiO_2) is present as a major to dominant mineral in the rock. Quartz is the highest in the sandstone and these rocks also therefore has elevated SiO_2. The quartz grains generally have a detrital origin and originate from the felsic mother rock.
- Mica (muscovite - $KAl_2(Si_3Al)O_{10}(OH,F)_2$) is present as a minor to major mineral in the samples. K-feldspar ($KAlSi_3O_8$) is present as a minor mineral in most of the samples. The K-feldspar and muscovite are most often the highest in the sandstone samples and these rocks also have elevated K_2O.

- Generally K-feldspar occurs frequently in both coal and clastic rocks of the Vryheid Formation, although they are slightly more frequent in clastic rocks. K-feldspar forms an incomplete solution series with albite, and K-feldspar will often contain small amounts of Na.
- Plagioclase ($(Ca,Na)(Al,Si)_4O_8$) as absent in the coal samples but present as a minor mineral in the sandstone samples. The plagioclase is also of detrital origin.
- Calcite and dolomite ($CaMg(CO_3)_2$) are present as trace to minor minerals. These minerals are important in the neutralization of acid mine drainage. Siderite ($FeCO_3$) is generally lower in coal itself where the Fe generally rather forms pyrite. Siderite may contribute to Mn in the mine water as Mn often replaces the Fe in the siderite.
- Pyrite as a trace mineral is generally the highest in the coal and other carbonaceous rocks which formed under reducing conditions. Generally, pyrite can form during or very shortly after peat accumulation (autigenic) or as veins later in the coal's burial history (epigenetic).
- Chlorite $(Fe^{2+},Mg,Fe^{3+})_5Al(Si_3Al)O_{10}(OH,O)_8$ may form from recrystallisation of clays and occur in the same samples as the sepiolite ($Mg_4Si_6O_{15}(OH)_2.6H_2O$) which is a sedimentary clay mineral.
- Several trace elements are elevated in the rock samples above the average upper crust of Rudnick and Gao (2003).

4.8.8 Potential Residual Impacts Specific to Groundwater

4.8.8.1 Acid Base Accounting

In order to assess the long term potential of the mine to produce acid-mine drainage (AMD), acid-base accounting (ABA) was performed on rock samples from Mooiplaats North (MPN) in 2011 and Mooiplaats South (MPS) in 2007. The samples include the following:

- A total of 30 rock samples;
- 1 discard sample from the MPN plant;
- 5 coal seam samples; 4 of them are from the B Upper coal seam - 2 were sampled from the MPN plant, 1 was sampled from a drilled monitoring borehole at MPS, and 1 was obtained from the geologist at Usutu.
- 10 sandstone samples;
- 14 shale samples.

The following comments relate to the ABA terminology and methodology:

- ABA is a static test where the net potential of the rock in order to produce acidic drainage is assessed. The %S, the Acid Potential (AP), the Neutralization Potential (NP) as well as the Net Neutralization Potential (NNP) of the rock material is determined in this test. This test is an important first order assessment of the potential leachate that could be expected from the rock material.
- AP is determined by multiplying the %S with a factor of 31.25. The unit of AP is kg $CaCO_3$/t rock and indicates the theoretical amount of calcite neutralized by the acid produced.

- The NP (Neutralization Potential) is determined by treating a sample with a known excess of standardized hydrochloric or sulfuric acid (the sample and acid are heated to insure reaction completion) and then back-titrated with standardized sodium hydroxide in order to determine the amount of unconsumed acid. NP is also expressed as kg $CaCO_3$/t rock as to represent the amount of calcite theoretically available to neutralize the acidic drainage.
- NNP is determined by subtracting AP from NP. Therefore, a rock with NNP < 0 kg $CaCO_3$/t will have a net potential for acidic drainage and a rock with NNP > 0 kg $CaCO_3$/t rock will have a net potential for the neutralization of acidic drainage.

In order for the material to be classified in terms of their AMD potential, the ABA data could be screened in terms of its NNP, %S and NP:AP ratio as discussed below:

- NNP is determined by subtracting AP from NP. Therefore, a rock with NNP < 0 kg $CaCO_3$/t will have a net potential for acidic drainage and a rock with NNP > 0 kg $CaCO_3$/t rock will have a net potential for the neutralization of acidic drainage. Because of the uncertainty related to the exposure of the carbonate minerals or the pyrite for reaction, the interpretation of whether a rock will actually be net acid generating or neutralizing is more complex. Research has shown that a range from -20 kg $CaCO_3$/t to 20 kg $CaCO_3$/t exists that are defined as a "grey" area in determining the net acid generation or neutralization potential of a rock. Material with a NNP above this range is classified as Rock Type IV - No Potential for Acid Generation and with a NNP below this range as Rock Type I - Likely Acid Generating.
- Further screening criteria could be used that attempts to classify the rock in terms of its net potential for acid production or neutralization. The following screening method, given in Table 37 below, as proposed by Price (1997), uses the NP:AP ratio to classify the rock in terms of its potential for acid generation.
- Soregaroli and Lawrence (1998) further states that samples with less than 0.3% sulphide sulphur are regarded as having insufficient oxidisable sulphides to sustain long term acid generation. Material with a %S below 0.3% is therefore classified as Rock Type IV - No Potential for Acid Generation and material with a %S of above 0.3%, as Rock Type I - Likely Acid Generating.

Table 37: Screening methods using the NP:AP ratio (Price, 1997)

Potential for Acid Generation	NP:AP screening criteria	Comments
Rock Type I. Likely Acid Generating.	< 1:1	Likely AMD generating.
Rock Type II. Possibly Acid Generating.	1:1 – 2:1	Possibly AMD generating if NP is insufficiently reactive or is depleted at a faster rate than sulphides.

Potential for Acid Generation	NP:AP screening criteria	Comments
Rock Type III. Low Potential for Acid Generation.	2:1 – 4:1	Not potentially AMD generating unless significant preferential exposure of sulphides along fracture planes, or extremely reactive sulphides in combination with insufficient reactive NP.
Rock Type IV. No Potential for Acid Generation.	>4:1	No further AMD testing required unless materials are to be used as a source of alkalinity.

The ABA results for the rock samples are given in Table 38 below. From these results the following conclusions could be made:

- 1 coal discard sample was obtained from the plant. The discard sample shows a high potential to produce acidic drainage. The samples has a %S of above 0.3 and a NP/AP of below 1. The discard will have a significant potential to generate AMD seepage.
- A total of 5 coal samples were tested. The 4 B Upper coal seam samples show a high potential to produce acidic drainage. All 4 samples have a %S of above 0.3 and two have a NP/AP of below 1. This unit will be the major contributor of AMD products in the mine water.
- A total of 14 carbonaceous shale samples were tested. The rock shows a high potential to produce acidic drainage. From the 14 samples 5 samples have a %S of above 0.3, and all 5 also have a NP/AP of below 1. Together with the coal that remains as pillars, this unit will be a major contributor of AMD products in the mine water.
- A total of 10 sandstone samples were tested. The rock shows no long term potential to produce acidic drainage. From the 10 samples none have a %S of above 0.3, but 8 have a NP/AP of below 1. The low neutralization potential of the sandstone indicates that this rock will not be able to neutralize the AMD from the carbonaceous shale and coal.

Table 38: Acid-base accounting results

Borehole/Site	Depth (m)	Description	*	Paste pH	Total (%S)	AP $CaCO_3$ (kg/t)	NP $CaCO_3$ (kg/t)	NNP $CaCO_3$ (kg/t)	NP/AP	Rock Type NNP	Rock Type (%S)	Rock Type NP/AP
MPN Coal Discard	Plant	Coal Discard		8.1	3.06	95.63	30.89	-64.74	0.00	I	I	I
MPN ROM Coal 2007	Plant	B Upper Coal Seam		8.2	1.74	54.38	24.77	-29.61	0.00	I	I	I
MPN ROM Coal 2011	Plant	B Upper Coal Seam		8.1	1.66	51.88	22	-29.88	0.42	I	I	I
PTN 630 Usutu	Plant	B Upper Coal Seam		8.0	1.43	44.69	31.38	-13.31	0.00	Uncertain	I	I
MBV-2A	94-96	Sandstone		9.1	0.19	5.94	8.10	2.16	0.00	Uncertain	IV	I
MBV-2A	96-98	Sandstone		9.1	0.13	4.06	7.51	3.45	0.00	Uncertain	IV	I
MBV-2A	98-100	Sandstone		8.0	0.04	1.25	6.48	5.23	0.00	Uncertain	IV	I
MBV-3A	97-98	Shale		8.4	0.05	1.56	35.30	33.74	0.00	IV	IV	I
MBV-3A	98-100	Shale		8.8	0.17	5.31	18.89	13.58	0.00	Uncertain	IV	I
MBV-3A	100-101	Sandstone		8.7	0.05	1.56	4.77	3.21	0.00	Uncertain	IV	I

Borehole/Site	Depth (m)	Description	*	Paste pH	Total (%S)	AP $CaCO_3$ (kg/t)	NP $CaCO_3$ (kg/t)	NNP $CaCO_3$ (kg/t)	NP/AP	Rock Type NNP	Rock Type (%S)	Rock Type NP/AP
GAD – 5D10	30 - 34	Shale		7.9	0.61	19.06	1.4	-17.66	0.07	Uncertain	I	I
GAD – 5D11	41 - 49	Sandstone		9.15	0.13	4.06	22.96	18.9	5.65	Uncertain	IV	IV
GAD – 5D12	50 - 55	Shale		7.67	1.31	40.94	5.1	-35.84	0.12	I	I	I
GAD – 5D13	55 - 58	Sandstone		8.1	0.25	7.81	2.68	-5.13	0.34	Uncertain	IV	I
GAD – 5D14	60 - 61	Shale		8.08	1	31.25	7.34	-23.91	0.23	I	I	I
GAD – 5D15	61 - 62	B Upper Coal Seam		8.2	1	31.25	21.66	-9.59	0.69	Uncertain	I	I
GAD – 5D16	63 - 64	Sandstone		6.56	0.23	7.19	1	-6.19	0.14	Uncertain	IV	I
GKL – 7D17	9-10	Sandstone		7.8	0.04	1.25	0.76	-0.49	0.61	Uncertain	IV	I
GKL – 7D18	10-11	Sandstone		7.83	0.15	4.69	2.92	-1.77	0.62	Uncertain	IV	I
GKL – 7D19	12-15	Sandstone		8.41	0.19	5.94	9.02	3.08	1.52	Uncertain	IV	II
GKL – 7D20	19 - 20	Coal		9.11	0.08	2.5	5.8	3.3	2.32	Uncertain	IV	III
GKL – 7D21	31 - 38	Shale		9.59	0.27	8.44	4.5	-3.94	0.53	Uncertain	IV	I
GKL – 7D22	38 - 42	Shale		9.2	0.19	5.94	4	-1.94	0.67	Uncertain	IV	I

Borehole/Site	Depth (m)	Description	*	Paste pH	Total (%S)	AP $CaCO_3$ (kg/t)	NP $CaCO_3$ (kg/t)	NNP $CaCO_3$ (kg/t)	NP/AP	Rock Type NNP	Rock Type (%S)	Rock Type NP/AP
GKL – 7D23	49 - 51	Shale		9.61	0.46	14.38	9.5	-4.88	0.66	Uncertain	I	I
GKL – 7D24	51 - 53	Shale		7.75	1.79	55.94	2	-53.94	0.04	I	I	I
GKL – 7D25	59 - 60	Shale		8.96	0.07	2.19	0.25	-1.94	0.11	Uncertain	IV	I
GKL – 7D26	69 - 70	Shale		8.89	0.03	0.94	3	2.06	3.2	Uncertain	IV	III
GKL – 9D27	13 - 24	Shale		8.8	0.23	7.19	3.75	-3.44	0.52	Uncertain	IV	I
GKL – 9D28	24 - 31	Shale		9.29	0.02	0.63	30.25	29.63	48.4	IV	IV	IV
GKL – 9D29	38 - 41	Shale		9.57	0.03	0.94	24.75	23.81	26.4	IV	IV	IV

***Black = Coal, Orange = Sandstone, Grey = Shale**

4.8.8.2 Leaching tests

Selected material was submitted for leach testing. System parameters and anions measured in the leachate are listed in Table 39 and 40, with the ICP-OES analytical results listed in Table 41 and 42. The following pertain to the leaching test methods used:

- Leaching tests were performed by Waterlab (Pty) Ltd, Pretoria.
- Leaching tests identify the elements that will leach out of waste but do not reflect the site-specific concentration of these elements in actual seepage as a different water/rock ratio and contact time will be present in the field.
- The material was leached by distilled water and peroxide extractions.
- For the peroxide extraction a rock/water ratio of 1:100 was used where 2.5 g of the sample was reacted with 250 ml of 15% hydrogen peroxide.
- For the distilled water leach a water/rock ratio of 1:4 was used where 250 g of the waste sample was reacted with 1 litres of solution for 20 h.
- Duplicates for both the extraction tests were performed.

From the leaching test results the following observations could be made:

- It is important to note that the peroxide extraction simulates extreme conditions where all the sulphide minerals are oxidised at once, which will never happen under field conditions. Under field conditions:
  - Not all sulphides will be oxidised as some minerals are physically shielded by the rock matrix; and
  - Oxidation will occur over a longer period of time;
- In the extraction tests the elevation of SO_4 is a direct result of the sulphide oxidation. As a result, the SO_4 is higher in the leachate from the coal and coal discard than in the sandstone and shale samples;
- The source of the elevated NO_3 in the peroxide extraction is unknown. Generally, it could be attributed to one or a combination of the following:
  - Blasting in the mine;
  - Additives in plant;
  - Concentration of NO_3 in recirculating plant water;
  - Natural leachable NO_3; and
  - Contamination in the laboratory.
- The peroxide extraction shows elevation for various parameters. The distilled water extraction does not show significant elevation in parameters. Elevated parameters with respect to SANS 241 are summarized below (black - some samples show full compliance; yellow - some samples show marginal compliance; red - some samples show non-compliance):

Peroxide Extraction Test

Major parameters

pH/**pH**/**pH,**
SO_4/**SO_4,**
NO_3 /**NO_3**

Distilled Water Extraction Test

Major parameters

SO_4/**SO_4**
NO_3 /**NO_3**

Metals	Metals (from sandstone & shale)
Al,	Al/Al/**Al**
Fe/Fe,	As/**As,**
Mn,	Fe/**Fe,**
Cd,	Mn/**Mn,**
Sb/**Sb/Sb,**	Pb/**Pb**
Se/**Se/Se**	

- From the leaching test results it is shown that very few metals will leach out from the coal and coal discard. In the distilled water extraction almost no metals leached out and in the peroxide extraction Al, Fe and Mn significantly leached out. Some Cd, Sb and Se also leached out but it is not foreseen that these metals will be present at non-compliant concentrations in drainage from the plant or mine material.

Table 39: System parameters and anions in distilled water extraction

Borehole/ Site	Depth (m)	Description	*	pH value	EC mS/m	TDS (mg/l)	Total Alkalinity (mg/l)	SO_4 (mg/l)	Cl (mg/l)	NO_3 as N (mg/l)	F (mg/l)
MPN Coal Discard	Plant	Coal Discard		8.2	81.50	496.00	72.00	285.00	21.00	20.00	0.80
MPN ROM Coal	Plant	B Coal Seam		8.2	50.40	295.00	72.00	154.00	18.00	<0.2	0.60
PTN 630 Usutu	Plant	B Coal Seam		8.2	115.00	730.00	100.00	486.00	19.00	20.00	0.30
MBV-2A	94-96	Sandstone		9.7	27.40	280.00	128.00	86.00	17.00	<0.2	<0.2
MBV-2A	96-98	Sandstone		9.4	25.00	222.00	120.00	53.00	11.00	20.00	<0.2
MBV-2A	98-100	Sandstone		9.5	24.80	306.00	128.00	105.00	24.00	<0.2	0.30
MBV-3A	97-98	Shale		8.3	10.30	55.00	40.00	8.00	<5	<0.2	<0.02
MBV-3A	98-100	Shale		9.2	23.80	138.00	100.00	21.00	<5	<0.2	<0.02
MBV-3A	100-101	Sandstone		9.4	23.10	150.00	100.00	28.00	6.00	<0.2	0.20
SANS 241:2006		**Class I**		5.0-9.5	<150	<1000	-	<400	<200	<10	<1.0
		Class II		**4-5; 9.5**	**150-370**	**1000-2400**	**-**	**400-600**	**200-600**	**10-20**	**1.0-1.5**
		Non-compliant		**<4; >10**	**>370**	**>2400**	**-**	**>600**	**>600**	**>20**	**>1.5**

***Black = Coal, Orange = Sandstone, Grey = Shale**

Table 40: System parameters and anions in peroxide extraction

Sample name	Depth (m)	Description	*	pH value	EC mS/m	TDS (mg/l)	Total Alkalinity (mg/l)	SO_4 (mg/l)	Cl (mg/l)	NO_3 as N (mg/l)	F (mg/l)
MPN Coal Discard	Plant	Coal Discard		2.8	261.00	1670	<5	1454	11.00	20.00	<0.02
MPN ROM Coal	Plant	B Coal Seam		2.0	384.00	2458	<5	1032	14.00	<0.2	<0.02
PTN 630 Usutu	Plant	B Coal Seam		2.0	380.00	2432	<5	1147	23.00	<0.2	0.30
MBV-2A	**94-96**	Sandstone		3.9	49.80	319.00	<5	77.00	<5	<0.2	<0.02
MBV-2A	**96-98**	Sandstone		3.0	59.60	381.00	<5	35.00	<5	<0.2	<0.02
MBV-2A	**98-100**	Sandstone		3.5	41.50	266.00	<5	10.00	<5	<0.2	<0.02
MBV-3A	**97-98**	Shale		5.9	51.90	332.00	88.00	22.00	5.00	<0.2	<0.02
MBV-3A	**98-100**	Shale		4.9	60.80	389.00	72.00	72.00	5.00	<0.2	<0.02
MBV-3A	**100-101**	Sandstone		3.6	48.90	313.00	<5	20.00	<5	<0.2	<0.02
SANS 241:2006		**Class I**		5.0-9.5	<150	<1000	-	<400	<200	<10	<1.0
		Class II		4-5; 9.5	150-370	1000-2400	-	400-600	200-600	10-20	1.0-1.5
		Non-compliant		<4; >10	>370	>2400	-	>600	>600	>20	>1.5

***Black = Coal, Orange = Sandstone, Grey = Shale**

Table 41: ICP-OES metal analyses in distilled water extraction

Borehole /Site	MPN Coal Discard	MPN ROM Coal	PTN 630 Usutu	MBV-2A 94-96	MBV-2A 96-98	MBV-2A 98-100	MBV-3A 97-98	MBV-3A 98-100	MBV-3A 100-101	SANS 241: 2006		
Parameters (ppm)	Coal Discard	B Coal Seam	B Coal Seam	Sandstone	Sandstone	Sandstone	Shale	Shale	Sandstone	Class I	Class II	Non-compliant
Ag	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	-	-	-
Al	<0.100	<0.100	<0.100	2.380	3.040	5.440	0.473	0.682	1.060	<0.3	0.3-0.5	>0.5
As	<0.010	<0.010	<0.010	0.027	0.016	0.024	<0.010	0.012	0.014	<0.01	0.01-0.05	>0.05
B	0.129	0.065	0.067	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	-	-	-
Ba	0.040	0.076	0.096	0.868	0.726	0.680	<0.025	0.045	0.263	-	-	-
Be	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	-	-	-
Bi	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	-	-	-
Ca	20.0	21.0	118.0	9.0	6.0	8.0	6.0	2.0	<2	<150	150-300	>300
Cd	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005-0.01	>0.01
Co	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.5	0.5-1	>1
Cr	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.1	0.1-0.5	>0.5
Cu	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<1	1-2	>2
Fe	<0.025	<0.025	<0.025	4.030	5.740	8.040	1.470	1.700	1.690	<0.2	0.2-2	>2
K	3.1	2.6	2.3	5.5	2.9	3.9	1.8	1.2	1.3	<50	50-100	>100
Li	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	-	-	-
Mg	7.0	7.0	42.0	<2	2.0	3.0	<2	<2	<2	<70	70-100	>100
Mn	<0.025	<0.025	0.123	0.241	0.171	0.208	0.028	0.032	0.033	<0.1	0.1-1	>1
Mo	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.031	-	-	-
Na	116.0	47.0	2.0	54.0	51.0	48.0	8.0	46.0	43.0	<200	200-400	>400
Ni	<0.025	<0.025	0.028	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.15	0.15-0.35	>0.35

Borehole /Site	MPN Coal Discard	MPN ROM Coal	PTN 630 Usutu	MBV-2A 94-96	MBV-2A 96-98	MBV-2A 98-100	MBV-3A 97-98	MBV-3A 98-100	MBV-3A 100-101	SANS 241: 2006		
Parameters (ppm)	**Coal Discard**	**B Coal Seam**	**B Coal Seam**	**Sandstone**	**Sandstone**	**Sandstone**	**Shale**	**Shale**	**Sandstone**	**Class I**	**Class II**	**Non-compliant**
Pb	<0.020	<0.020	<0.020	0.027	0.026	0.043	<0.025	<0.020	<0.025	<0.02	0.02-0.05	>0.05
S	94.0	47.0	162.0	4.7	5.3	4.2	1.6	5.3	5.3	-	-	-
Sb	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.01	0.01-0.05	>0.05
Se	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.02	0.02-0.05	>0.05
Si	0.3	0.5	0.6	10.2	7.1	11.0	2.0	2.0	2.8	-	-	-
Sn	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	-	-	-
Sr	0.902	0.838	2.060	0.399	0.202	0.351	0.156	0.057	0.066	-	-	-
Ti	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	-	-	-
V	<0.025	<0.025	<0.025	<0.025	<0.025	0.041	<0.025	<0.025	0.039	<0.2	0.2-0.5	>0.5
W	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	-	-	-
Zn	<0.025	<0.025	<0.025	0.148	0.141	0.178	<0.025	<0.025	0.065	<5	5-10	>10
Zr	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	-	-	-

***Black = Coal, Orange = Sandstone, Grey = Shale**

Table 42: ICP-OES metal analyses in peroxide extraction

Sample name	MPN Coal Discard	MPN ROM Coal	PTN 630 Usutu	MBV-2A 94-96	MBV-2A 96-98	MBV-2A 98-100	MBV-3A 97-98	MBV-3A 98-100	MBV-3A 100-101	SANS 241: 2006		
Description	Coal Discard	B Coal Seam	B Coal Seam	Sandstone	Sandstone	Sandstone	Shale	Shale	Sandstone			
Parameters (ppm)	**Coal Discard**	**B Coal Seam**	**B Coal Seam**	**Sandstone**	**Sandstone**	**Sandstone**	**Shale**	**Shale**	**Sandstone**	**Class I**	**Class II**	**Non-compliant**
Ag	<0.025	<0.026	<0.027	<0.028	<0.029	<0.030	<0.031	<0.032	<0.025	-	-	-
Al	0.97	1.97	2.97	3.97	4.97	5.97	6.97	7.97	1.19	<0.3	0.3-0.5	>0.5
As	<0.010	<0.011	<0.012	<0.013	<0.014	<0.015	<0.016	<0.017	<0.010	<0.01	0.01-0.05	>0.05
B	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.13	-	-	-
Ba	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04	-	-	-
Be	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	-	-	-
Bi	<0.025	<0.026	<0.027	<0.028	<0.029	<0.030	<0.031	<0.032	<0.025	-	-	-
Ca	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.00	<150	150-300	>300
Cd	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	<0.005	0.005-0.01	>0.01
Co	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.05	<0.5	0.5-1	>1
Cr	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.1	0.1-0.5	>0.5
Cu	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<1	1-2	>2
Fe	1.53	2.53	3.53	4.53	5.53	6.53	7.53	8.53	2.68	<0.2	0.2-2	>2
K	<1.0	<1.1	<1.2	<1.3	<1.4	<1.5	<1.6	<1.7	<1.0	<50	50-100	>100
Li	<0.025	<0.026	<0.027	<0.028	<0.029	<0.030	<0.031	<0.032	<0.025	-	-	-
Mg	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	<70	70-100	>100
Mn	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.44	<0.1	0.1-1	>1
Mo	<0.025	<0.026	<0.027	<0.028	<0.029	<0.030	<0.031	<0.032	<0.025	-	-	-
Na	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	<2	<200	200-400	>400

Sample name	MPN Coal Discard	MPN ROM Coal	PTN 630 Usutu	MBV-2A 94-96	MBV-2A 96-98	MBV-2A 98-100	MBV-3A 97-98	MBV-3A 98-100	MBV-3A 100-101	SANS 241: 2006		
Description	Coal Discard	B Coal Seam	B Coal Seam	Sandstone	Sandstone	Sandstone	Shale	Shale	Sandstone			
Parameters (ppm)	**Coal Discard**	**B Coal Seam**	**B Coal Seam**	**Sandstone**	**Sandstone**	**Sandstone**	**Shale**	**Shale**	**Sandstone**	**Class I**	**Class II**	**Non-compliant**
Ni	<0.025	<0.026	<0.027	<0.028	<0.029	<0.030	<0.031	<0.032	<0.025	<0.15	0.15-0.35	>0.35
P	0.23	1.23	2.23	3.23	4.23	5.23	6.23	7.23	0.23	-	-	-
Pb	<0.020	<0.021	<0.022	<0.023	<0.024	<0.025	<0.026	<0.027	<0.020	<0.02	0.02-0.05	>0.05
S	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	0.98	-	-	-
Sb	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	<0.01	0.01-0.05	>0.05
Se	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	<0.02	0.02-0.05	>0.05
Si	10.30	10.30	10.30	10.30	10.30	10.30	10.30	10.30	7.60	-	-	-
Sn	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.04	-	-	-
Sr	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	-	-	-
Ti	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	-	-	-
V	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.2	0.2-0.5	>0.5
W	0.04	1.04	2.04	3.04	4.04	5.04	6.04	7.04	0.06	-	-	-
Zn	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<5	5-10	>10
Zr	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	-	-	-

***Black = Coal, Orange = Sandstone, Grey = Shale**

4.8.8.3 Expected Mine Water Quality

The expected mine water quality at MPN is given in Table 43 below.

Table 43: Average and maximum estimated values for water quality parameters

Parameter	**Post-closure Mine Water Quality**	
	Average	**Maximum**
pH	6.0	5.5
TDS (mg/l)	3 000	4 500
Ca (mg/l)	~300	~300
Mg (mg/l)	~200	~200
Na (mg/l)	~500	~700
K (mg/l)	20	50
SO_4 (mg/l)	1 500	2 500
T.Alk. (mg/l)	50	<50
Al (mg/l)	< 5	< 5
Fe (mg/l)	< 5	< 5
Mn (mg/l)	< 1	< 1

The following relates to the mine water quality:

- The underground mine water will show an increase in the total dissolved solids with SO_4 as the dominant anion but will most likely not acidify; and
- No significant elevation of metals will occur in the near-neutral mine water.

Generally, polluted water from underground mines may potentially contaminate surface water as follows:

- Through transport via the aquifer towards surface water features;
- Through surface decant of mine water.

The following comments could be made with respect to transport of contamination through the aquifer:

- Only after the mine is flooded will it be possible for contamination to be transported to the adjacent aquifer;
- Because of the compartmentalisation of MPN the plume will be contained within the deep aquifer boundaries; and
- The extent of the contamination plume from MPN is depicted 20 and 100 years after closure respectively in Figure 19 and 20 below.
- From the figures it is shown that the contamination plume will not develop further than about 100 - 200 m horizontally from the mine boundary within 100 years.

With respect to mine water surface decant the following comments could be made:

- As the mine workings are flooded, no further oxygen ingress would be possible and the mine water quality will not deteriorate further. The depth and geometry of the underground MPN mine allows 100% of the mine to be flooded;
- The mine will be flooded and the mine water level will rise until a decant point is reached. The decant point is the lowest topographical point on top of the mine layout that connects the underground mine workings with the surface. The decant point(s) of an underground mine maybe a shaft or exploration boreholes. However, if these features are fully rehabilitated no point will exist for surface decant to occur post-closure; and
- Potential decant points will be rehabilitated and/or measures will be put in place to ensure that water is abstracted from shafts or boreholes and treated before decant levels are reached with neutralising agents such as lime.

With cognisance of their depth and distribution, existing external users' boreholes will not be contaminated with the underground mine water. However, if existing boreholes are drilled deeper or new boreholes are drilled, a reassessment needs to be made. The underground mine water will most likely not acidify but will definitely show an increase in the total dissolved solids with SO_4 as the dominant anion. With mitigation there will be no decant of mine water from the study area and no transport of contamination via the aquifer towards surface water features.

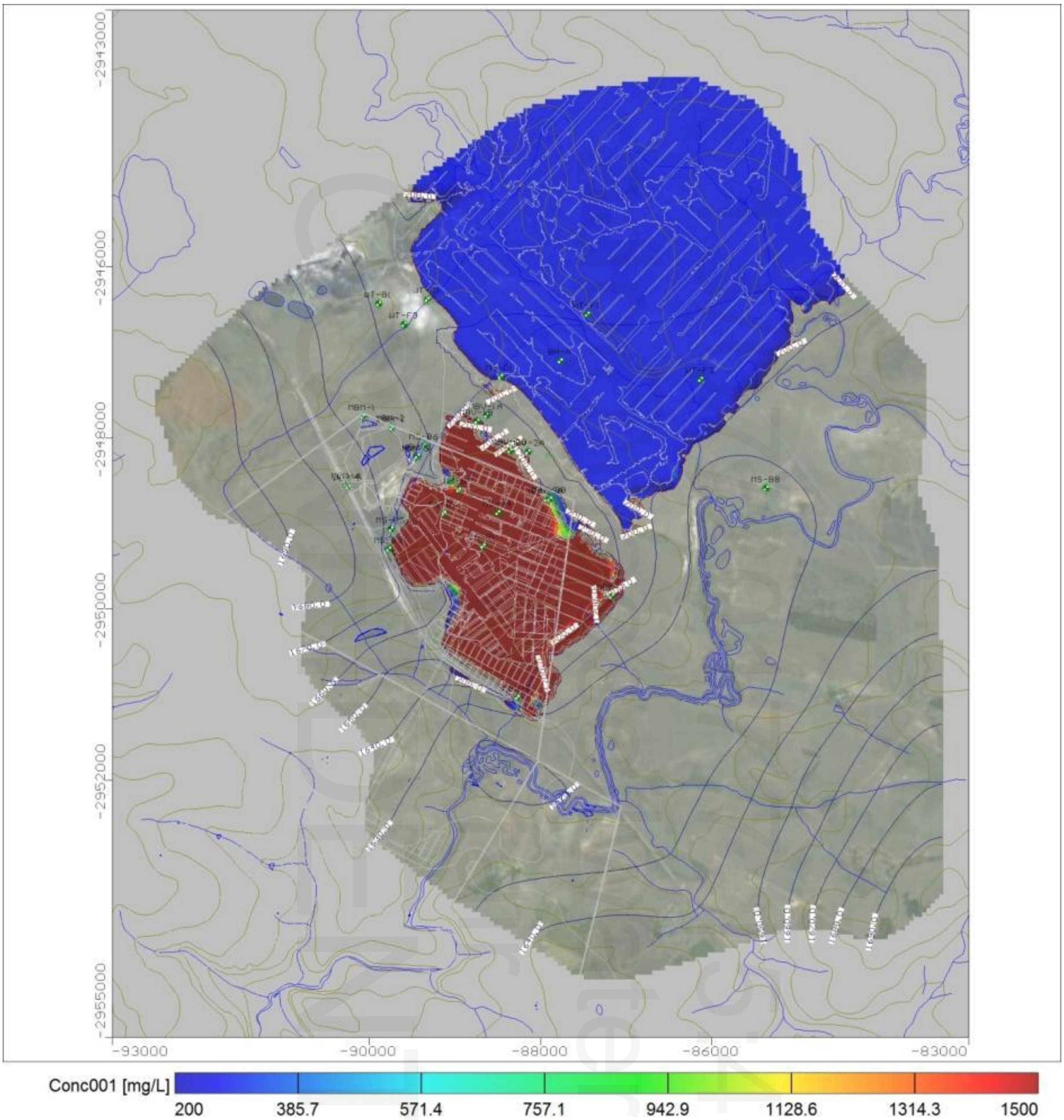


Figure 19: SO_4 plume development in the deep fractured aquifer 20 years after closure

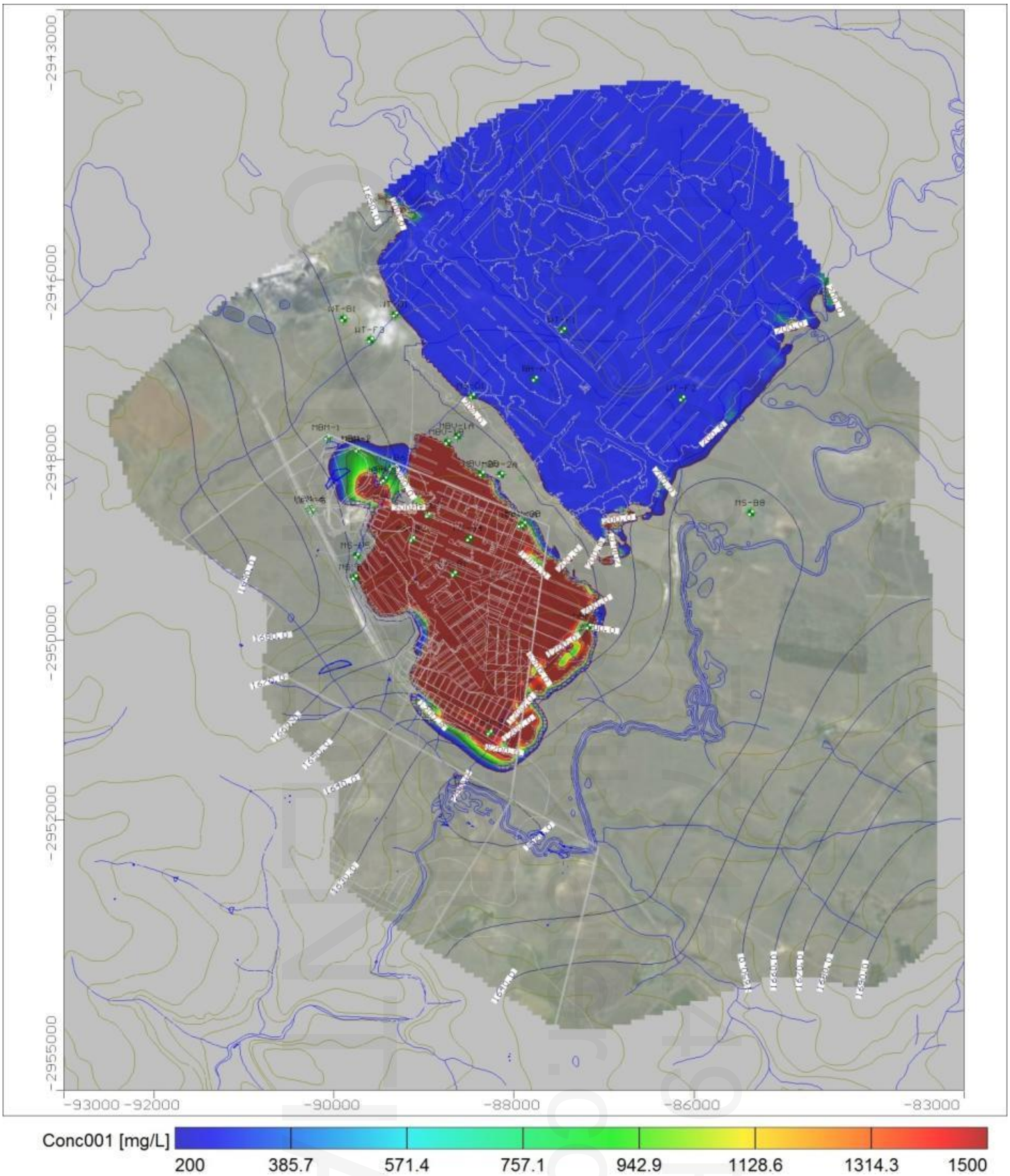


Figure 20: SO_4 plume development in the deep fractured aquifer 100 years after closure

4.8.8.4 Expected Co-disposal Seepage Quality

The expected seepage quality from the co-disposal at MPN is given in Table 44.

Table 44: Minimum and maximum estimated seepage quality from co-disposal

Parameter	Minimum	Maximum
pH	5.5	3.5
TDS (mg/l)	3 500	8 500
Ca (mg/l)	~300	~900
Mg (mg/l)	~200	~200
Na (mg/l)	~500	~700
K (mg/l)	20	50
SO_4 (mg/l)	2 000	5 000
T.Alk. (mg/l)	~150	<50
Al (mg/l)	< 10	< 200
Fe (mg/l)	< 10	< 200
Mn (mg/l)	< 1	< 20

The following relates to the seepage quality from the co-disposal:

- The co-disposal will show an increase in the total dissolved solids with SO_4 as the dominant anion and will most likely acidify after closure; and
- Significant elevation of Al, Fe and Mn will occur. Other metals such as Cd, Sb and Se may also be present in seepage but most probably not at non-compliant concentrations.

Generally, seepage water from the co-disposal will contaminate the ground water as follows:

- Rainfall recharge will infiltrate the co-disposal and seepage will occur towards the underlying aquifer.
- A contamination plume may develop in the aquifer in the direction of surface water streams.
- The presence of the contamination plume is depicted in Figure 21 and 22 respectively 20 and 100 years after closure.

- The co-disposal facility will most likely impact on the aquifer and tributary of the Witpunt Spruit. The contamination plume will not reach the Witpunt Spruit.
- With cognisance of their distribution, existing external users' boreholes will not be contaminated by the contamination plume.

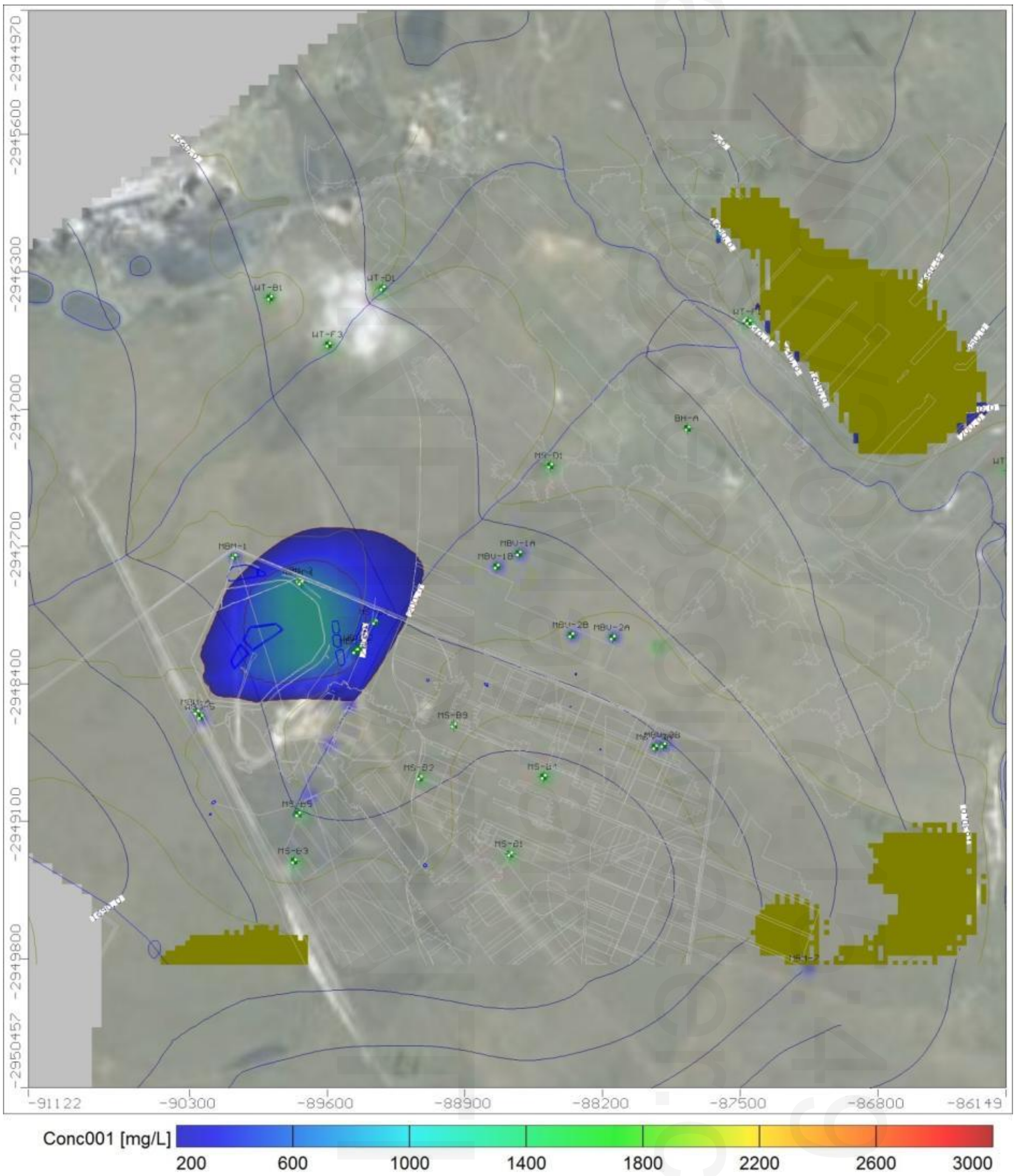


Figure 21: SO4 plume development down-gradient of the co-disposal facility in the shallow weathered aquifer 20 years after closure

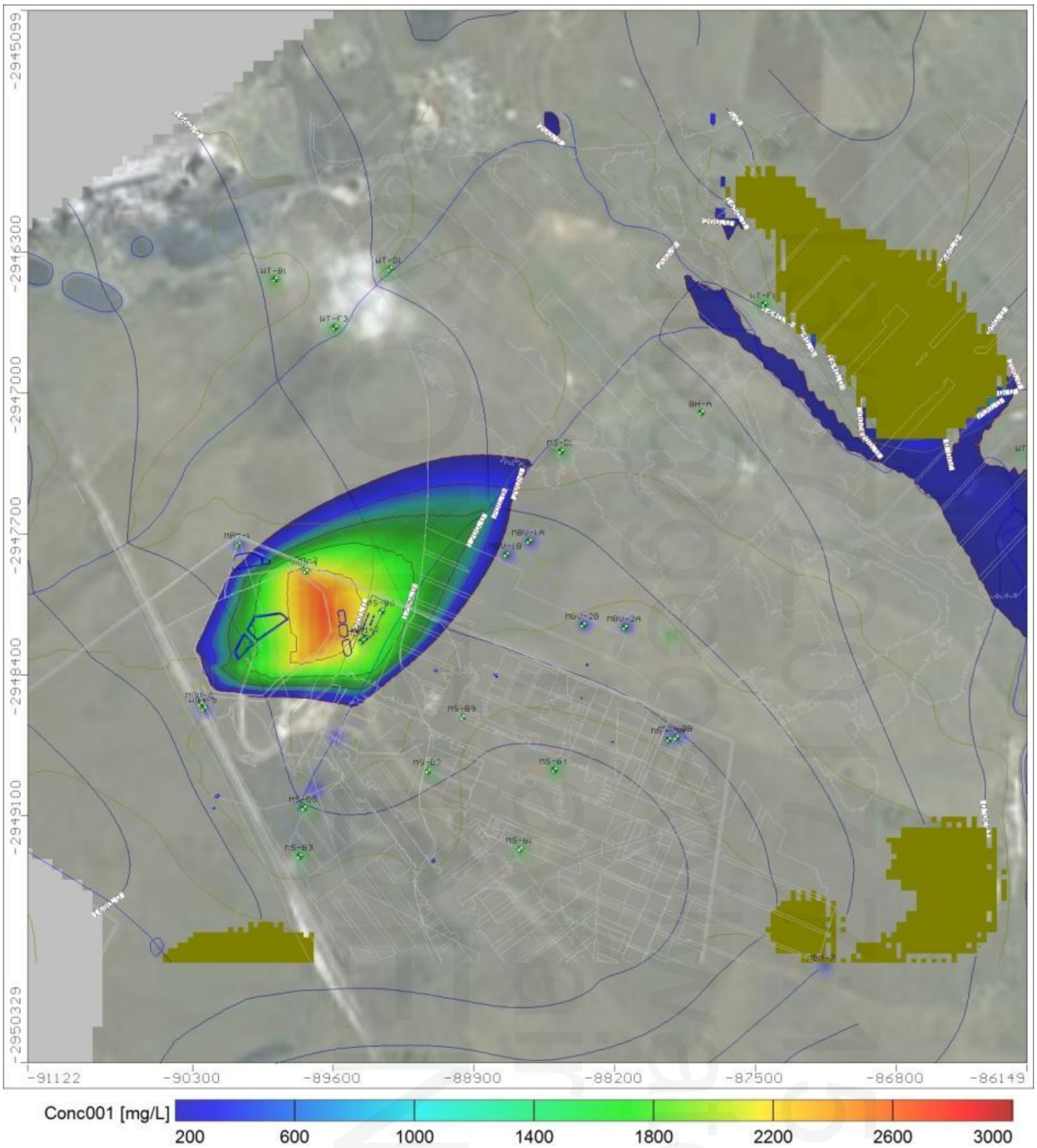


Figure 22: SO4 plume development down-gradient of the co-disposal facility in the shallow weathered aquifer 100 years after closure

4.9 Air Quality (Plan 13)

The area would be classed as rural agricultural as much of the surrounding areas are still utilised predominantly for various agricultural activities which would contribute to elevated dust levels. Some coal mining activities and the Camden Power Station are located within the immediate vicinity of Mooiplaats North Colliery and these activities would contribute to dust in the area.

A four-band scale is used in the evaluation of dust fallout (Table 45). Target, alert and action levels are indicated in Table 46. These environmental limits for dust levels were established to minimize effects such as air pollution and to prevent any development that may have a severe impact on the environment or impact negatively on society.

Table 45: Dust fallout limits

Band Number	Band Description Label	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 exceedance. Incident report to be submitted to relevant authority.

Table 46: Target, alert and actions thresholds

Level	Dust-Fall Rate (D) (mg m-2 day-1, 30-day average	Averaging Period	Permitted Frequency of exceedance
Target	300	Annual	-
Action residential	400	30 days	Three within any year, no two sequential months
Action industrial	1200	30 days	Three within any year, not sequential months
Alert threshold	2400	30 days	None. First exceedance requires remediation and compulsory report to authorities.

Table 47 below indicates the dust levels recorded at the various sites prior to mining. The Department of Environmental Affairs and Tourism have an annual average target of 300 mg/m^2/day as a guideline, with action being required if levels exceed 400 mg/m^2/day in residential and 1200 mg/m^2/day in industrial areas.

Plan 13: Dust monitoring points

Table 47: Dust fall out levels measured around the area with shaded areas indicating dust levels above dust fallout limits

Mooiplaats Dust monitoring									
Dust Fallout (mg/m2/day)									
Sampling points	**Jan-10**	**Feb-10**	**Mar-10**	**Apr-10**	**May-10**	**Jun-10**	**Jul-10**	**Aug-10**	**Sep-10**
North	266	754	57	27	101	121	89	137	270
East	21	640	142	20	144	299	164	155	181
South	66	562	65	47	172	266	135	183	45
West	46	217	43	27	65	92	12	366	164
South Border	35	41	69	73	169	55	40	251	142
West	59	184	180	62	940	182	201	295	126
Boundary	179	484	199	453	93	249	46	283	132
Mooiplaats East	712	189	24	116	152	219	120	345	152
Shaft	32	54	139	69	46	216	288	554	282
Office	66	ND	273	678	112	2857	ND	ND	ND

One can see from Table 47 that mining and coal processing activities in the area have contributed to slightly elevated dust levels. Most recorded dust levels are still within the 1200mg/m^2/day limits for industrial areas and even within the 600 mg/m^2/day for residential areas. Target and action levels indicate that the accepted frequency of exceedance is three per year with no consecutive exceedances. Although this has not been observed at a single dust monitoring point, this has occurred in the area with regard to residential levels, but not yet with industrial levels. Being an agricultural area, Mooiplaats Colliery will strive to attain residential levels, but it should be noted that other activities in the surrounding areas may also contribute to elevated dust levels. Dust suppression must take place continuously at problem areas.

4.10 Noise

The current activities which contribute to elevated noise levels in the area include: traffic on tarred roads, farm roads and mine haul and access roads; agricultural activities including ploughing, reaping and seeding activities; mining activities including underground mining activities in the area; coal processing at wash plants and activities at Camden Power Station. The processing activities are currently contributing to elevated noise levels and therefore will not alter the current noise profile of the area.

4.11 Vegetation

Strategic Environmental Focus (Pty) Ltd (March, 2011) was appointed to undertake ecological assessments for the Mooiplaats Colliery EMP amendment process, to assess the current status quo of the vegetation and faunal habitat on the study site and to assess impacts and propose possible mitigation measures. Their findings are summarised below and their full report is attached as **Appendix B.**

The study area falls within the Grassland Biome with dominant vegetation type being the Eastern Highveld Grassland. Eastern Temperate Freshwater Wetlands also occur in the region in flat landscapes or shallow depressions filled with water (Figure 23). The Grassland Biome is dominated by grasses and forbs with sparse to no tree cover. The majority of protected plant species in the summer rainfall regions are restricted to high-rainfall grasslands, making this the vegetation type of conservation importance. Frost, fire and grazing maintain the herbaceous grass and forb layer and prevent the establishment of thickets (Tainton, 1999) and essential for maintaining the structure and biodiversity and reducing risk of alien species establishment and encroachment.

The Eastern Highveld Grassland includes highveld grasses such as *Themeda triandra* (Red Grass), *Aristida congesta*, *Digitaria species* as well as *Tristachya leucothrix* and *T. rehmanni* (Mucina & Rutherford, 2006), and trees such as *Acacia caffra* (Sweet Thorn), *Celtis Africana* (White Stinkwood) and *Diospyros lycioides* subsp. *lycioides* (Blue Bush). Eastern Temperate Freshwater Wetlands occur in flat landscapes or shallow depressions filled with water. The outer parts of water bodies are lined with hygrophilous vegetation typical of temporary flooded grasslands and provide suitable habitat for numerous avifaunal species (Mucina & Rutherford, 2006).

Both vegetation types are classified as Endangered vegetation units, and listed as Vulnerable ecosystems in terms of Section 52 of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (Government Gazette, 2009). According to the Mpumalanga Biodiversity Conservation Plan, the Mooiplaats Coal Mine directly impacts on both “Highly Significant Ecosystems” and “Areas with No Natural Habitat Remaining”.

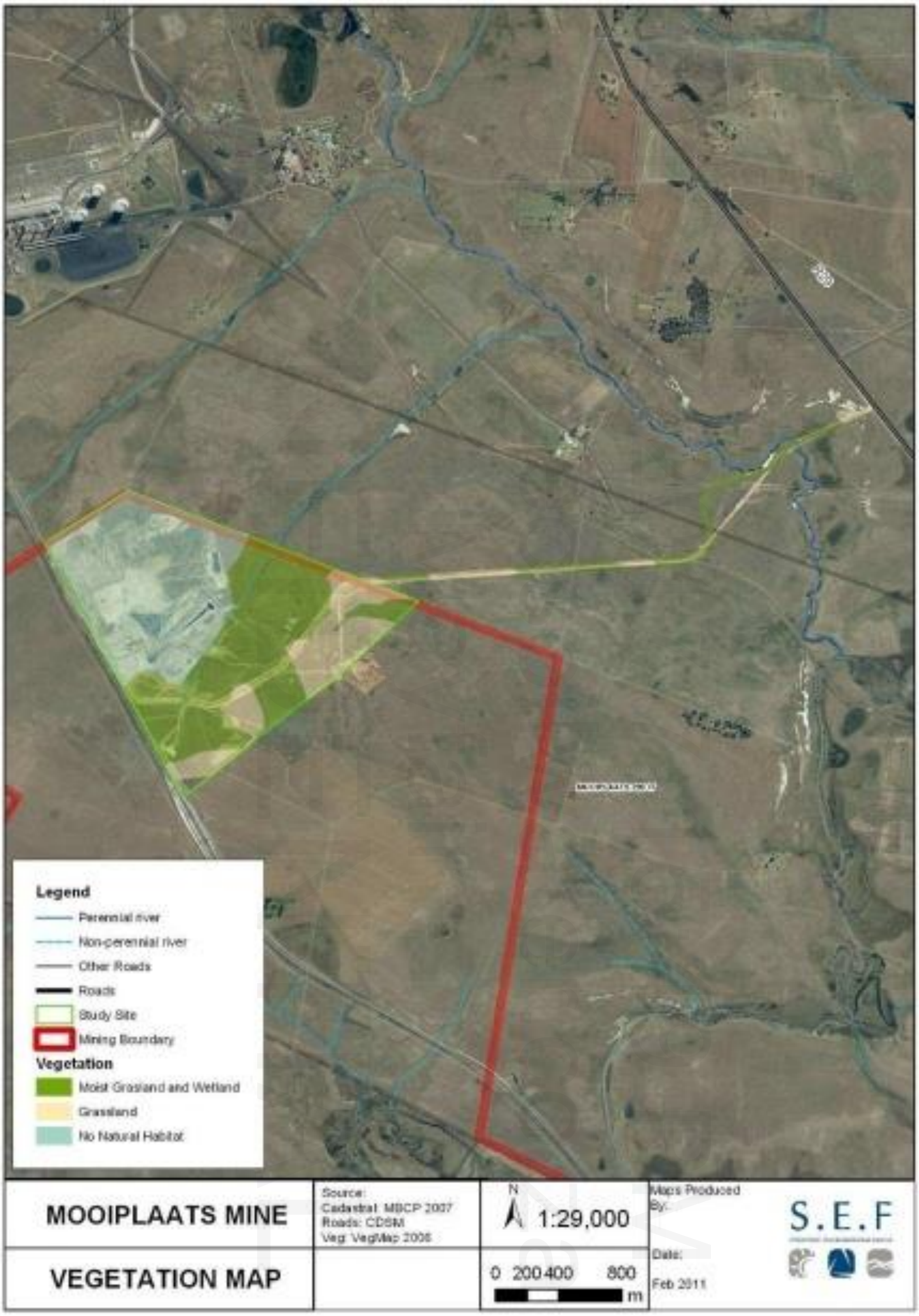


Figure 23: Moist grassland and wetland (green) and grassland (pink) areas within the study site

The moist grasslands and wetlands have a high ecological function as these maintain ecological integrity while providing suitable habitat to threatened plant species and faunal species. Therefore all wetlands (including moist grasslands) along with their corresponding buffer zones (minimum 32m) are designated as highly sensitive areas. The protective buffer is aimed at filtering edge effects from surrounding activities and is accordingly designated as sensitive. In addition, the grasslands on the study site, which form part of the Eastern Highveld Grassland, are catchment areas to these wetland areas and subsequently the Witpuntspruit and Vaal River. In addition, the connectivity of the grasslands to wetlands and large un-fragmented open spaces affords the grasslands a high ecological function, and therefore the grasslands in the study area are classified as being of Medium to High Sensitivity (Figure 24).

Typical grassland vegetation was found to occur in the area with a wetland-area in close proximity to the mine and several patches of moist grassland along the main access road of the mine. Disturbances were noted within both of these vegetation communities throughout the area, due to various activities other than CoAL's mining related activities.

Two plant species of conservation concern (Declining - *Boophane disti*chia and *Eucomis autumnalis*) and ten provincially protected plant species (including *Brunsvigia radulosa*, *Watsonia densiflorus*, *Gladiolus* species and at least three grass Orchid species) were identified within the grassland and moist grassland vegetation types in the study site. The species occurred scattered throughout the site, irrespective of previous disturbances to the sites. Due to the nature of the site and the connectedness of the vegetation units which provide suitable habitat for additional protected plants or plants of conservation, more than those observed during surveys may occur on site. Follow-up studies are recommended in order to compile a comprehensive plant list.

Cirsium vulgare (Scotch Thistle) and *Solanum sisymbriifolium* (Wild Tomato) are two declared weeds listed as Category 1 weeds and must therefore be eradicated from the study site.

The vegetation in and around the wetlands as well as the moist grassland play an important role in water catchments, assimilation of phosphates, nitrates and toxins as well as a possible role in flood attenuation and have a high ecological function and are designated as highly sensitive.

The natural grasslands that were found on the study site were habitat to two plants of conservation concern and protected plants and are catchments areas to the surrounding wetlands and are classified as being of high conservation importance and as being of Medium to High Sensitivity from a faunal and floral point of view.

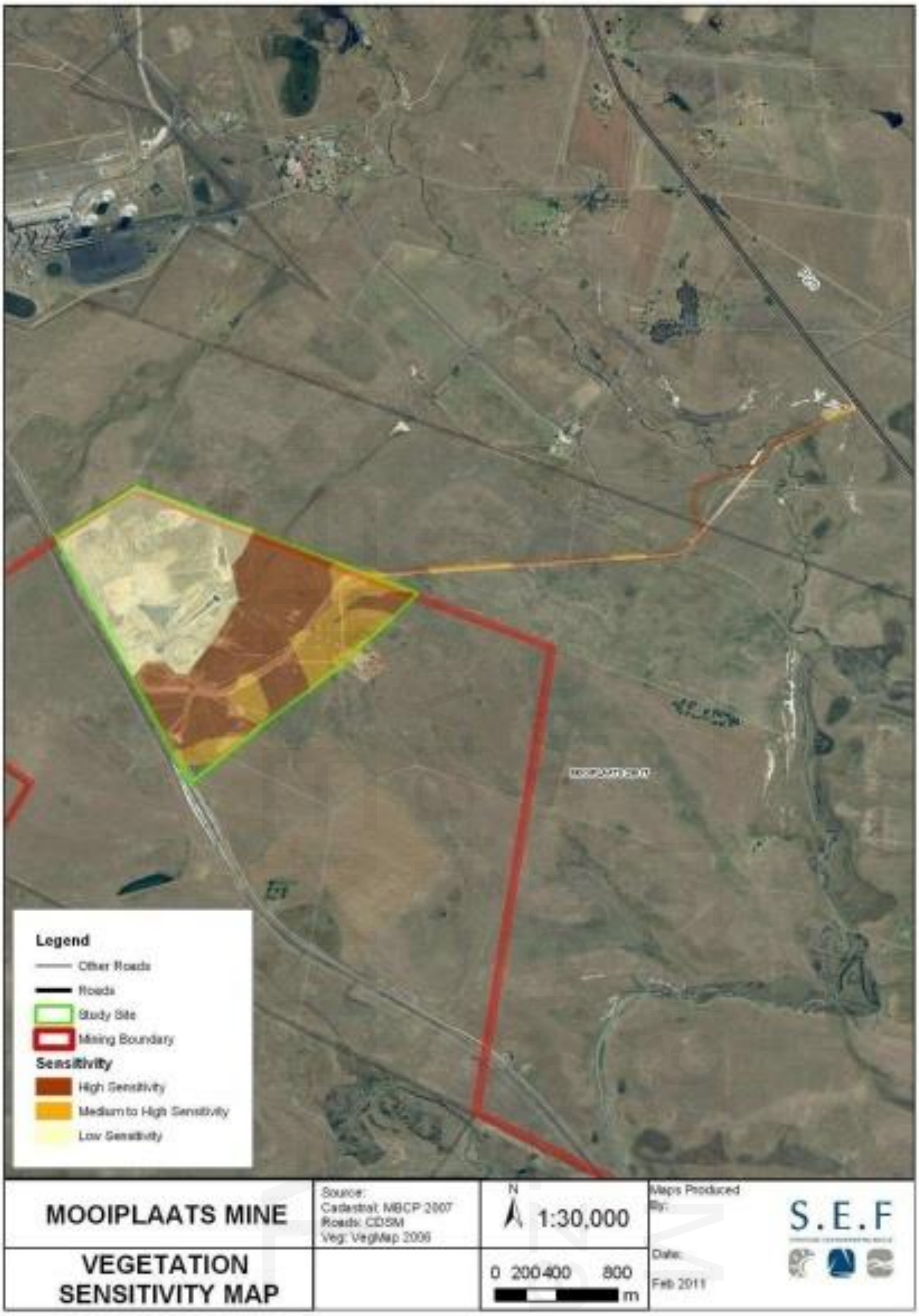


Figure 24: Areas of high sensitivity (brown), medium-high sensitivity (orange) and low sensitivity (beige) in the study area

The majority of the existing mine infrastructure are surrounded by “Highly Significant Ecosystems” which contribute to conservation within Mpumalanga as well as support the ecological function of “Irreplaceable” sites. These areas must be maintained as natural vegetation cover. Permissible land uses should be limited to those that are least harmful to biodiversity, and are conservation orientated. No agriculture or other land transformation activities should be allowed within these ecosystems. Mooiplaats Colliery is currently impacting on the grasslands and wetlands in the area and ongoing impact will seriously degrade these areas and reduce their ecological functioning. Mitigation and management measures within this report need to be followed to reduce impacts and allow the ecological systems to recover.

4.12 Fauna

Strategic Environmental Focus (Pty) Ltd (March, 2011) was appointed to undertake ecological assessments for the Mooiplaats Colliery EMP amendment process, to assess the current status quo of the faunal assemblages on the study site and to assess impacts and propose possible mitigation measures. Their findings are summarised below and their full report is attached as **Appendix B**.

The only species of conservation concern recorded during the survey was *Sagittarius serpentarius* (Secretary Bird), the habitat present around the site may support a number of other species of conservation concern, such as *Tyto capensis* (African Grass Owl)

Wetland habitats are extremely sensitive eco-systems which need to be protected from impacts associated with mining to ensure the integrity of these systems is not impaired. There is a delicate balance between the floral and faunal systems within wetlands and any impacts can degrade these systems rapidly, especially where more sensitive species occur. From a faunal perspective the highly sensitive areas included the seepage wetlands and the areas adjacent and downstream of the Witpuntspruit, which is likely to act as a natural corridor for a number of faunal species. The wetlands and moist grasslands present on the study site may also support a wide range of specialised insect, bird, mammal and amphibian species.

4.12.1 Birds

A total of 149 bird species have been recorded in the relevant QDS, including five species of conservation concern (three Vulnerable, two Near-Threatened) (Barnes, 2000). *Sagittarius serpentarius* (Secretary Bird) was the only protected bird species observed foraging next to the access road. Suitable habitat is present for *Tyto capensis* (African Grass Owl) *Eupodotis caerulescens* (Blue Korhaan) and Geronticus calvus (Southern Bald Ibis), all protected species.

4.12.2 Mammals

Fifty six (56) mammal species are expected within the relevant QDS, 6 of which are protected, including *Ourebia ourebia* (Oribi) and *Vulpes chama* (Cape Fox). *Sylvicapra grimmia* (Grey Duiker), *Raphiceros campestris* (Steenbok), Cynictis peniciilata (Yellow Mongoose) and *Suricata suricatta* (Meerkat - Near-Threatened in the Mpumalanga) were observed on site. Ecological indicators suggest that *Gerbilliscus brantsii* (Highveld Gerbil), *Hystrix africaeaustralis* (Porcupine), *Canis mesomelas* (Black-backed Jackal), *Pedetes* *capensis* (Springhare) and possibly *Cryptomys hottentotus* (African Mole Rat) and *Vulpes chama* (Cape Fox) occur in the area.

4.12.3 Reptiles

A total of nine reptile species could potentially occur in the area, none of which are of conservation concern. During the survey no reptile species were encountered.

4.12.4 Amphibians

Amphibians are most likely to occur in the habitats adjacent to the Witpuntspruit or in moist grassland areas. The Near-Threatened *Pyxicephalus adspersus* (Giant Bullfrog) has been recorded in the vicinity of the study site and could possibly also occur in the area, although confirmation is needed. Eleven amphibian species have been recorded in the relevant QDS; however, none of these are of conservation concern and none were observed.

4.13 Site of Archaeological and Cultural Interest

This is an operational mine, with an active footprint of activity. This footprint will not be extended from its current position and no cultural and heritage studies are required. No such sites occur in the immediate area.

4.14 Sensitive landscapes

The only sensitive landscapes in the area are the wetlands which have also been discussed under surface water and floral sections of the report. Detail of the wetland delineation study, regarding the soil profiles and floral perspectives, is detailed below.

4.14.1 Wetland delineation based on soil properties (Rehab Green, 2010)

This study was conducted by Rehab Green in September 2010 and the details below have been extracted from this report. The detailed report is attached as **Appendix C**.

4.14.1.1 Wetland indicators

The topography consists of a gently sloping valley bottom of approximately 80 m wide and gentle to moderate foot slopes of 3-7% and slope lengths of 100-300 m which defines a prominent water course or drainage channel. The terrain unit of the streambed and sloped edges were classified as an upland valley bottom and foot slope respectively which is a normal position for wetlands to occur.

A total of 9 soil types, based on dominant soil form, terrain unit and slope percentage were identified during field observations and were symbolised as: Kd1, Kd2, Lo1, Lo2, Wa1, Wa2, Dr1, Av1 and Gc1. The extent and location of these soil types are shown on the soil map Figure 25. The soil types are summarised in Table 48. All the soil types found in the wetland are characterised by at least 3 of the following properties which are directly related to wetland conditions.

Dark grey coloured A-horizons

The A-horizon is the upper 200-300 mm of the soil profile and is usually defined by a slight darker colour due to a greater or lesser amount of humified organic matter. The dark grey A-horizon is common to all the soils found in the permanent and seasonal zones. The dark grey colour appears only in the moist state and rapidly fades in to a plain grey colour when it dries out. The dark appearance is due to high organic carbon content which build up under the long term moist conditions in a wetland system. The carbon and also fine organic matter loses its dark colour in the dry state and the grey colour of the soil particles became prominent. The grey soil colour is the result of the removal of soluble constituents (iron oxides, silicate clay) by percolating water. The dark grey A-horizon is common in permanent, seasonal and temporary wetland zones.

Grey to pale grey E-horizons

The E-horizon underlies the A-horizon having a lower content of colloidal matter (clay, sesquioxides, organic matter) usually reflected by a pale colour and a relative accumulation of quarts and/or other resistant minerals of sand or silt sizes. The E-horizon develops under high lateral flow (permanent or periodic) of water in the soil profile which removes some colloidal matter to the lower soil profile and some further down the wetland system. The E-horizon is thus the flow path for shallow groundwater in the wetland zone. The grey and pale grey E-horizon is common in permanent and seasonal wetland zones and less common in temporary zones.

Yellowish grey E-horizons

The colour of the E-horizon reflects the intensity of removal of colloidal matter from the horizon. This results in the phenomenon that some E-horizons have a yellowish colour in the moist state but become grey in the dry state. The yellowish colour in the moist state is due to an incomplete covering of the mineral soil particle by ferric oxides which indicates a less leached state and less anaerobic (saturated conditions) conditions and the yellowish E-horizon are therefore strongly related to temporary wetland zones and occurs less in seasonal or permanent wetland zones.

Plinthic horizons

Plinthic horizons is characterised by localization and accumulation of iron and manganese oxides under conditions of a fluctuating water table resulting in distinct reddish brown, yellowish brown and/or black mottles, with or without hardening to form sesquioxide concretions. Plinthic horizons are the result of fluctuating water tables which implies wetter and dryer phases and are therefore found commonly in seasonal and temporary wetland zones and less in permanent wetland zones.

G-horizons

Gleying is the process of reduction of ferric oxides and hydrated oxides under anaerobic conditions resulting in grey, low chroma matrix colours, which usually goes along with clay illuviation from the upper horizon which results in a grey clay horizon which is called a G-horizon. G-horizons are commonly found in permanent wetland zones, occasionally in seasonal zones and rarely in temporary wetland zones.

4.14.1.2 Wetland zones

The extent and location of permanent, seasonal and temporary wetland zones is shown in Figure 26, with associated soil types shown in Table 49.

Soil type Kd1 is dominated by the Kroonstad 1000 soil form and family and was classified as a permanent wetland zone.

Soil types Kd2, Lo1 and Wa1 are dominated by the Kroonstad 2000, Longlands 1000 and Wasbank 1000 soil forms and families respectively and were classified as seasonal wetland zones.

Soil types Lo2, Wa2 and Dr1 are dominated by the Longlands 2000, Wasbank 2000 and Dresden 1000 soil forms and families respectively and were classified as temporary wetland zones.

Soil types Av1 and Gc1 are dominated by the Avalon 2100 and Glencoe 2100 soil form and family and show no signs of wetness in the A or B1-horizons and were classified as terrestrial land.

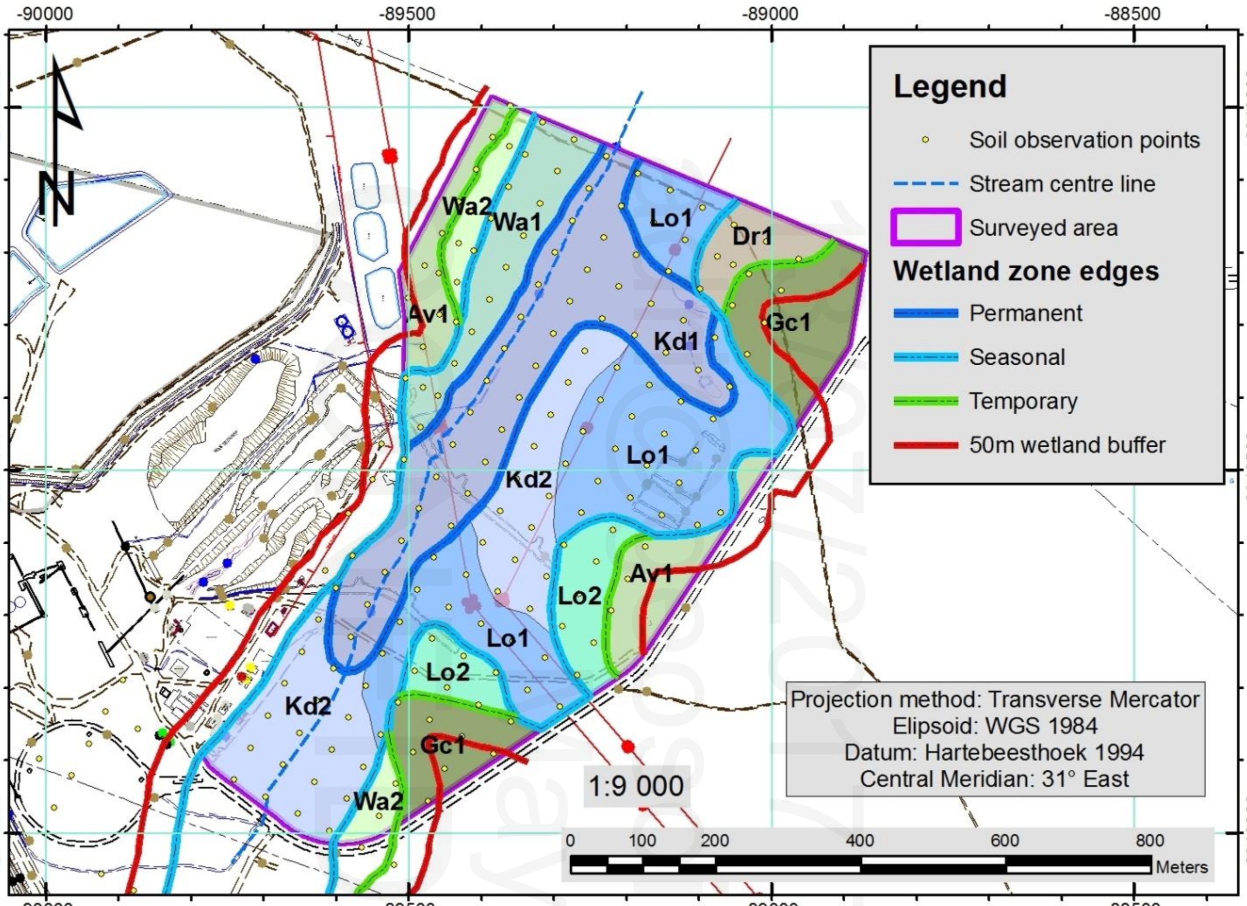
Table 48: Soil Legend

Soil Type Code	Dominant Soil Form and Family	Summarized Description of Dominant Soil Form	Wetland zone	Number of units	Area (ha)	Area (%)
Kd1	**Kroonstad 1000**	Saturated to poorly drained soils: A dark grey, sandy A-horizon, overlying a grey to greyish white, leached, pure sand E-horizon overlying a grey, slightly mottled clay G-horizon.	Permanent wetland	1	9.60	20.804
Kd2	**Kroonstad 2000**	Somewhat poorly drained soils: A dark grey, sandy A-horizon, overlying a yellowish grey, leached, pure sand E-horizon overlying a grey, mottled clay G-horizon.	Seasonal wetland	2	7.84	16.980
Lo1	**Longlands 1000**	Somewhat poorly drained soils: A dark grey, sandy A-horizon, overlying a grey to greyish white, leached, pure sand E-horizon overlying a grey, mottled soft plinthic B-horizon.	Seasonal wetland	3	10.66	23.107

Soil Type Code	Dominant Soil Form and Family	Summarized Description of Dominant Soil Form	Wetland zone	Number of units	Area (ha)	Area (%)
Lo2	**Longlands 2000**	Imperfectly drained soils: A dark grey, sandy A-horizon, overlying a yellowish grey, leached, pure sand E-horizon overlying a grey, mottled soft plinthic B-horizon.	Temporary wetland	2	2.90	6.298
Wa1	**Wasbank 1000**	Somewhat poorly drained soils: A dark grey, sandy A-horizon, overlying a grey to greyish white, leached, pure sand E-horizon overlying a hard plinthic B-horizon.	Seasonal wetland	1	3.29	7.134
Wa2	**Wasbank 2000**	Imperfectly drained soils: A dark grey, sandy A-horizon, overlying a yellowish grey, leached, pure sand E-horizon overlying a hard plinthic B-horizon.	Temporary wetland	2	1.76	3.821
Dr1	**Dresden 2000**	Imperfectly drained soils: A grey, sandy A-horizon, overlying a hard plinthic B-horizon.	Temporary wetland	1	1.39	3.010
Av1	**Avalon 2100**	Moderately well-drained soils: A brownish yellow loamy sand A-horizon overlying a yellow brown, sandy loam B1-horizon, overlying a yellowish grey, mottled soft plinthic B2-horizon.	Terrestrial land	2	3.75	8.115
Gc1	**Glencoe 2100**	Moderately well-drained soils: A brownish yellow loamy sand A-horizon overlying a yellow brown, sandy loam B1-horizon, overlying a hard plinthic B2-horizon.	Terrestrial land	2	4.95	10.729
			TOTAL	16	46.14	100.0

Table 49: Wetland zones and associated soil types

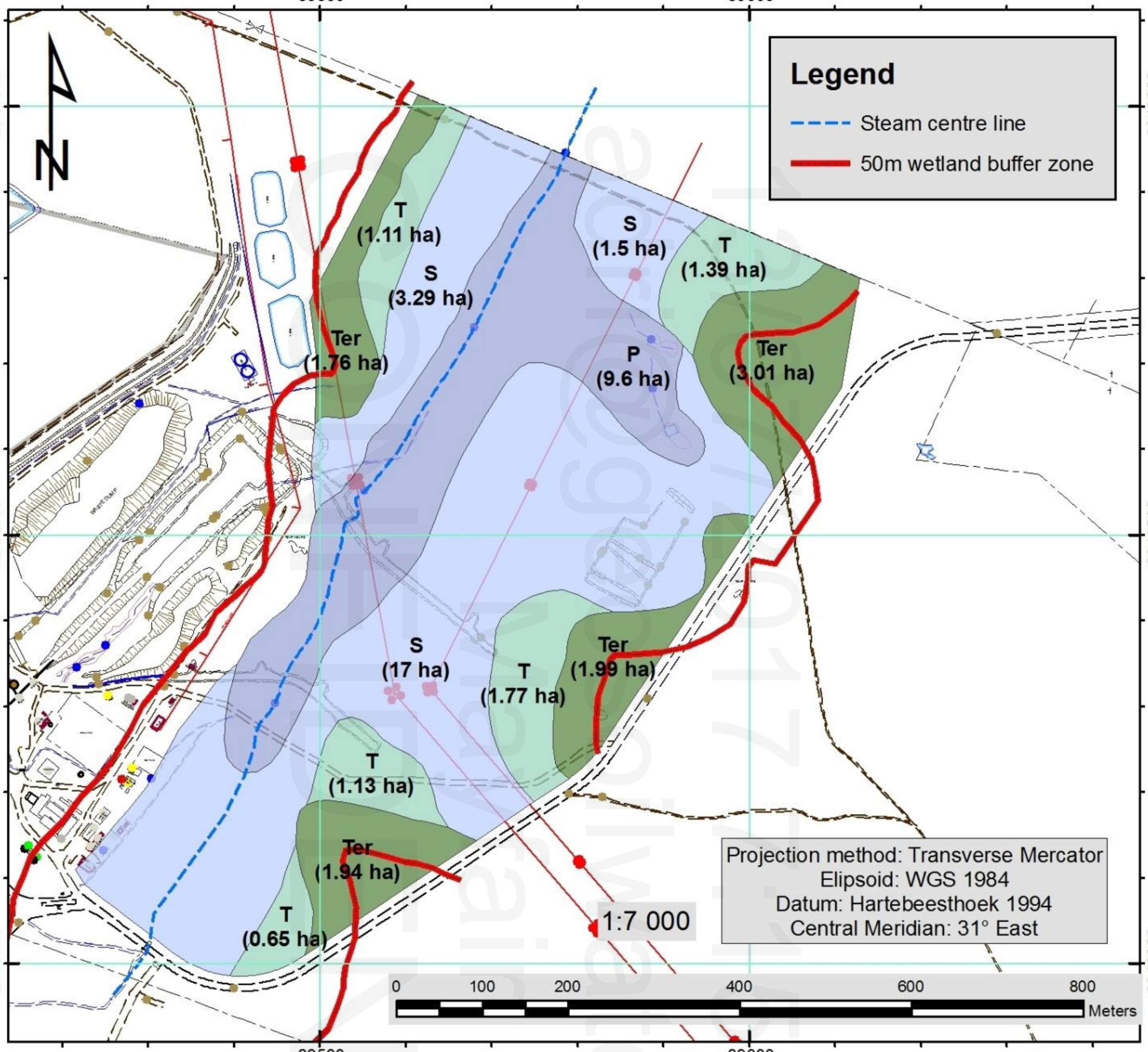
Wetland zone code	Wetland zone	Brief Definition	*Soil Types	Terrain unit	Area (ha)	Area (%)
P	**Permanent**	Permanent wetland zones are characterized by prolonged wetness which is not necessarily associated with surface water.	Kd1	Valley bottom	9.60	20.804
S	**Seasonal**	Seasonal zones are subject to significant periods of wetness for at least 3 months of the year.	Kd2, Lo1, Wa1	Valley bottom, foot slope, lower midslope	21.79	47.221
T	**Temporary**	Temporary zones are subject to short periods of wetness (less than 3 months per year).	Lo2, Wa2, Dr1	Foot slope, lower midslope	6.05	13.129
Ter	**Terrestrial**	Areas not subject to wetness	Av1, Gc1	Lower midslope	8.70	18.844
* See soil map Figure 26				Total	46.14	100.0



ABBREVIATED SOIL LEGEND (For full legend see soil report)						
Soil Type Code	Dominant Soil Form and Family	Summarized Description of Dominant Soil Form	Wetland zone	Number of units	Area (ha)	Area (%)
Kd1	Kroonstad 1000	Saturated to poorly drained soils: A dark grey, sandy A-horizon, overlying a grey to greyish white, leached, pure sand E-horizon overlying a grey, slightly mottled clay G-horizon.	Permanent wetland	1	9.60	20.804
Kd2	Kroonstad 2000	Somewhat poorly drained soils: A dark grey, sandy A-horizon, overlying a yellowish grey, leached, pure sand E-horizon overlying a grey, mottled clay G-horizon.	Seasonal wetland	2	7.84	16.980
Lo1	Longlands 1000	Somewhat poorly drained soils: A dark grey, sandy A-horizon, overlying a grey to greyish white, leached, pure sand E-horizon overlying a grey, mottled soft plinthic B-horizon.	Seasonal wetland	3	10.66	23.107
Lo2	Longlands 2000	Imperfectly drained soils: A dark grey, sandy A-horizon, overlying a yellowish grey, leached, pure sand E-horizon overlying a grey, mottled soft plinthic B-horizon.	Temporary wetland	2	2.90	6.298
Wa1	Wasbank 1000	Somewhat poorly drained soils: A dark grey, sandy A-horizon, overlying a grey to greyish white, leached, pure sand E-horizon overlying a hard plinthic B-horizon.	Seasonal wetland	1	3.29	7.134
Wa2	Wasbank 2000	Imperfectly drained soils: A dark grey, sandy A-horizon, overlying a yellowish grey, leached, pure sand E-horizon overlying a hard plinthic B-horizon.	Temporary wetland	2	1.76	3.821
Dr1	Dresden 2000	Imperfectly drained soils: A grey, sandy A-horizon, overlying a hard plinthic B-horizon.	Temporary wetland	1	1.39	3.010
Av1	Avalon 2100	Moderately well-drained soils: A brownish yellow loamy sand A-horizon overlying a yellow brown, sandy loam B1-horizon, overlying a yellowish grey, mottled soft plinthic B2-horizon.	Terrestrial land	2	3.75	8.115
Gc1	Glencoe 2100	Moderately well-drained soils: A brownish yellow loamy sand A-horizon overlying a yellow brown, sandy loam B1-horizon, overlying a hard plinthic B2-horizon.	Terrestrial land	2	4.95	10.729
			TOTAL	16	46.14	100.0

Figure 2: Soil map of the wetland situated east of Mooiplaats Colliery

Figure 25: Soil forms identified in the wetland area near Mooiplaats Colliery



LEGEND: WETLAND ZONES

Wetland zone code	Wetland zone	Brief Definition	*Soil Types	Terrain unit	Area (ha)	Area (%)
P	Permanent	Permanent wetland zones are characterized by prolonged wetness which is not necessarily associated with surface water.	Kd1	Valley bottom	9.60	20.804
S	Seasonal	Seasonal zones are subject to significant periods of wetness for at least 3 months of the year.	Kd2, Lo1, Wa1	Valley bottom, footslope, lower midslope	21.79	47.221
T	Temporary	Temporary zones are subject to short periods of wetness (less than 3 months per year).	Lo2, Wa2, Dr1	Footslope, lower midslope	6.05	13.129
Ter	Terrestrial	Areas not subject to wetness	Av1, Gc1	Lower midslope	8.70	18.844
* See soil map Figure 2				**Total**	**46.14**	**100.0**

Figure 3: Wetland zones based on soil properties - Mooiplaats Colliery

Figure 26: Wetland zones based on soils

4.14.2 Wetland delineation assessment from floral perspective (SEF, 2011)

SEF (2011) conducted an assessment of the wetlands in the area. A brief summary of findings is extracted from their report which is attached as **appendix C**.

4.14.2.1 Wetland types

Four different types of wetland areas were classified within the study area categorised into hydro-geomorphic (HGM) units, which included valley bottom wetlands without a channel, hill slope seepage wetlands feeding a watercourse, floodplain and hill slope seepage wetlands not feeding a watercourse. A total of nine HGM units were delineated and classified within the study area, and are presented graphically in Figure 27. These units have been described by SEF as follows:

> *HGM 1 comprised a valley bottom wetland without a channel situated in the centre of the study area. The current delineation process confirmed the boundaries of HGM 1 as per a previous delineation done by Steenkamp (2010) which focused on hydric soils as the major wetland indicator. A major valley head seepage, HGM 2, is located towards the south east and contributes through hydrological flow to HGM 1. A portion of HGM 2 of unknown size has been affected through the historic construction of a railway as well as the construction of the current mining operation. Several hill slope seepages, HGM 3, HGM 4, HGM 5, HGM 6, HGM 7 and HGM 8, are linked to valley bottom wetlands and therefore contribute to the various watercourses through ground and surface water flows. HGM 8's extent was also affected through the construction of the railway as well as through the establishment of the mining operation while HGM 7's extent was also impacted by the establishment of mining operations. The floodplain in the eastern portion of the study area is represented by HGM 9.*

4.14.2.1.1 *Floodplain*

Floodplains generally receive most of their water during high flow events when waters overtop the stream banks (Kotze *et al.*, 2005), floodplains in the study area are considered to be important for flood attenuation because of the nature of the vegetation and the topographic setting. The most evident resource use within the floodplain was its use for extensive grazing. Floodplains play an important role in the maintenance of biodiversity, as several species from various taxa are dependent on wetlands for breeding and feeding purposes. Floodplains also provide important ecological corridors along which transfer genes between populations takes place, resulting in higher genetic diversity (Palmer et al, 2002), confirmed for the study area due to the presence of protected species.

4.14.2.1.2 *Hill slope seepage wetlands feeding a watercourse*

These systems are normally associated with groundwater discharges, although flows may be supplemented by surface water contributions (Kotze et al., 2005). They contribute to some surface flow attenuation until the soils are saturated (WRP, 1993; McCartney et al., 1998; McCartney, 2000). Batchelor (2007) states that seepage wetlands represent an important indicator of water retained in the landscape, and reflect the extended and diffused release of water which would otherwise runoff the landscape. The hill slope seepages at site complimented the hydrology of the valley bottom wetland and floodplain, but also improved biodiversity through increased connectivity within the study area.

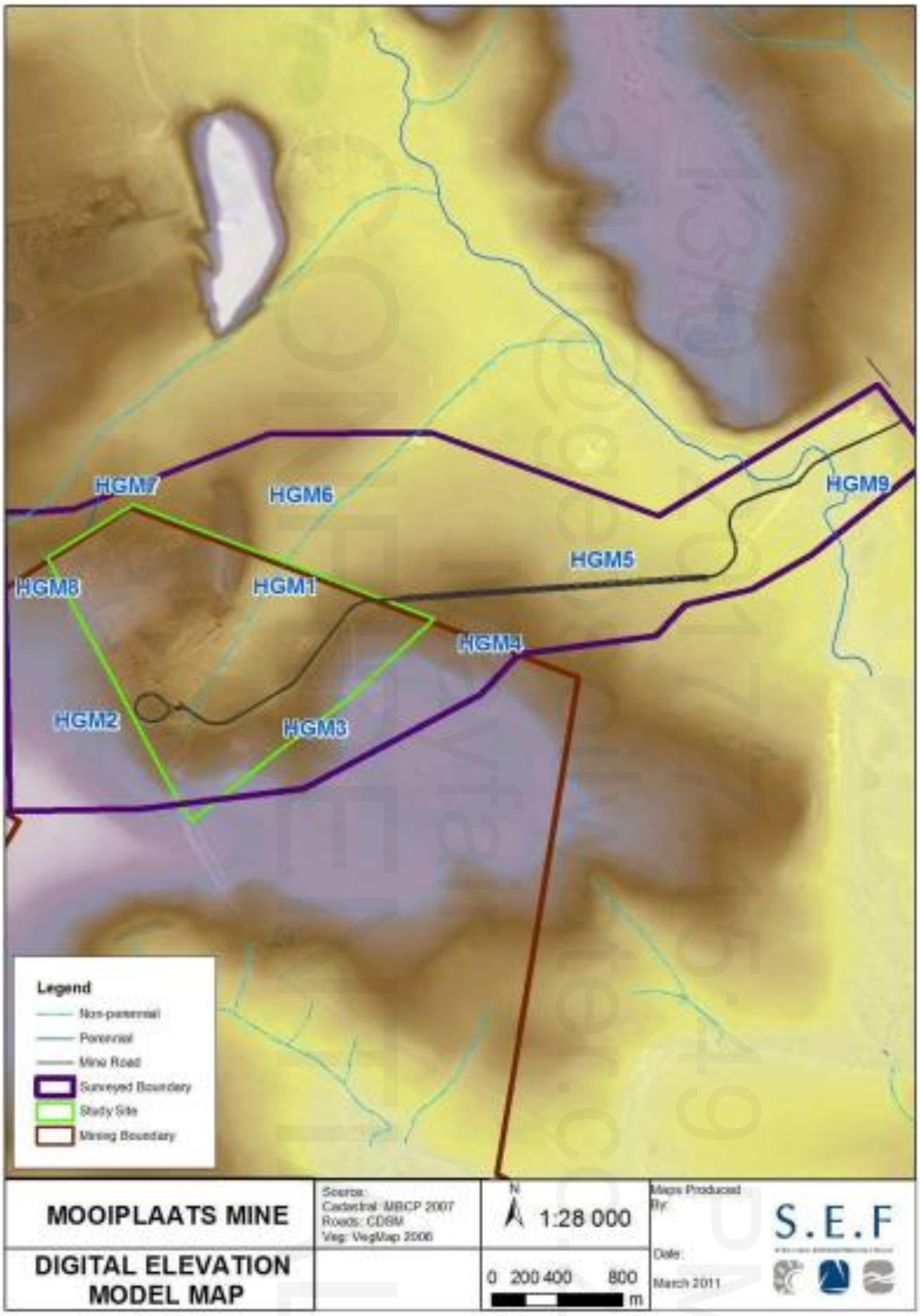


Figure 27: Location of identified hydro-geomorphic units (SEF, 2011)

4.14.2.1.3 Valley bottom wetlands without a channel

Ecosystem services provided by valley bottom wetlands without a channel include maintenance of biodiversity, water supply, stream flow regulation, sediment trapping, toxicant and nitrate removal. During rainfall this wetland's stream channel input is spread diffusely across the wetland, resulting in extensive areas of the wetland remaining permanently saturated and tending to have high levels of soil organic matter (Kotze *et al*., 2005). This HGM in the study area plays important roles in stream flow regulation, flood attenuation and for the maintenance of biodiversity.

4.14.2.1.4 Hill slope seepage wetlands not feeding a watercourse

These systems are normally associated with groundwater discharges, although flows through them may be supplemented by surface water contributions (*Kotze et al.*, 2005). These seeps tend to have a lower degree of wetness, but do often contribute to stream flow regulation by sub-flow water flow (*Kotze et al.*, 2005). Maintenance of biodiversity was the highest function of these seeps in the area, although it should be kept in mind that the total contribution of the seeps are considerably less than other wetland units within the study area due to the seeps small size.

4.14.2.2 Ecological sensitivity and importance

Several of the wetlands within the study area provide habitat for a variety of taxa including protected species and are highly valuable from a biodiversity point of view. Further, the vegetation in and around the rivers and drainage lines play an important role in water catchments, assimilation of phosphates, nitrates and toxins as well as flood attenuation and all flood lines, riparian zones and wetlands and associated buffer zones must be designated as sensitive (Figure 28). Quality, quantity and sustainability of water resources are fully dependent on good land management practices.

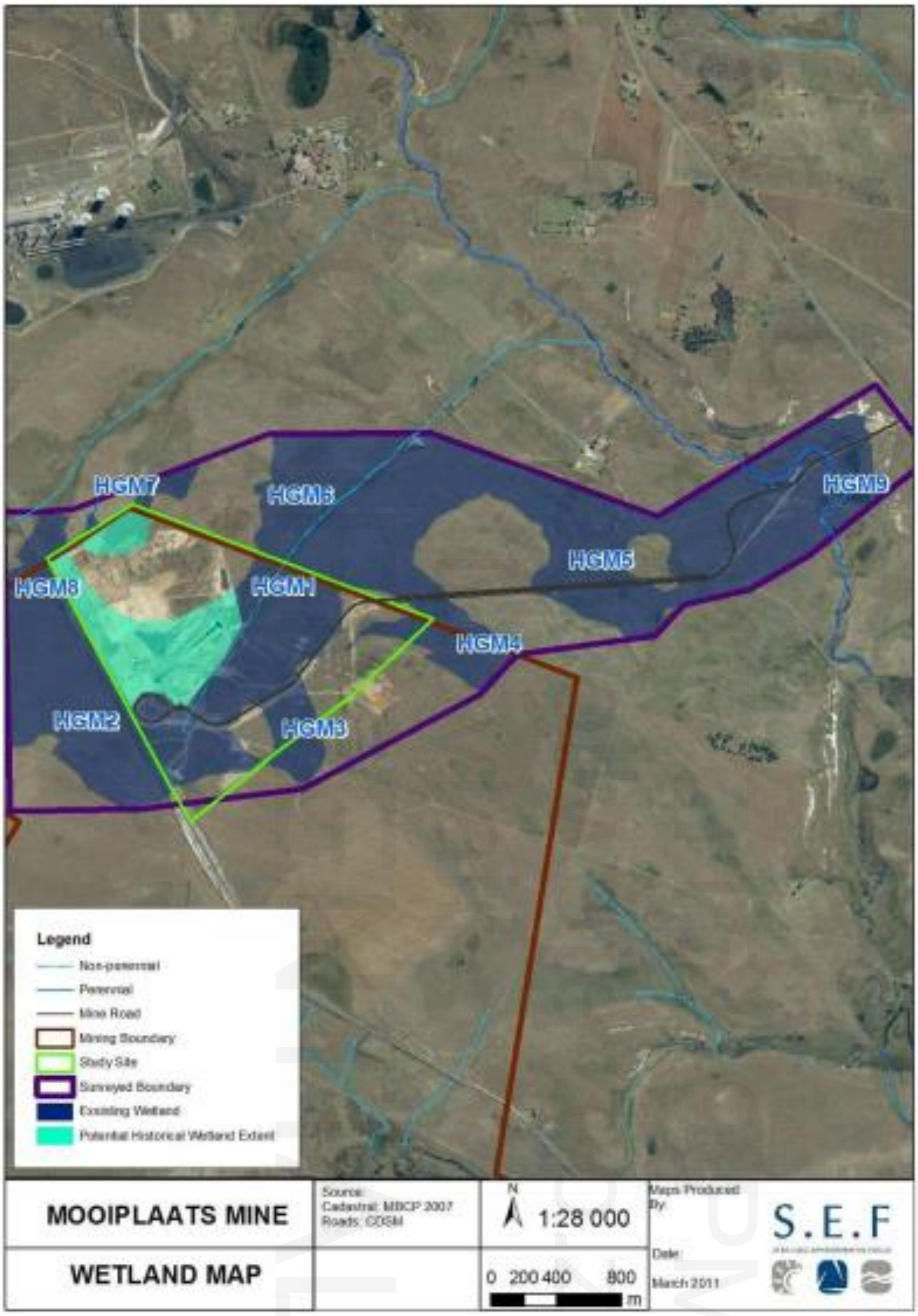


Figure 28: Wetlands delineated

4.15 Visual aspects

The current visual aspect of the area will be unaffected as the only new activity proposed is that of a pollution control dam and upgrading of the surface water management plan. This dam will be constructed within the existing footprint area. The mine has already impacted on the visual aesthetics, although this has been limited to the area of disturbance due to the mine being an underground mining development. The wash plant currently exists in the area and will not contribute to further impacts on the current visual aesthetics of the area.

4.16 Vibrations

There are no new activities being undertaken that may cause vibrations which could impact negatively on the social or physical environment.

4.17 Traffic and Safety

The current traffic situation in the area will not be altered nor will traffic on the roads increase.

4.18 Regional Socio- Economic structure (CT Environmental, 2009)

The mine falls within the Gert Sibande District Municipality, one of three district municipalities in the Mpumalanga Province. It is situated on the eastern boundary of Mpumalanga and borders Swaziland in the east, Kwa-Zulu Natal in the south-east, the Free State to the south-west and Gauteng to the west (http://www.gsibande.gov.za).

The Gert Sibande District Municipality comprises an area of approximately 31 842km² and has a total population of 900 008 individuals residing in 127 different towns and settlement areas throughout the region (Census Data, 2001). It is made up of the following local municipal areas:

- Dipaleseng Municipality
- Govan Mbeki Municipality
- Msukaligwa Municipality
- Lekwa Municipality
- Albert Luthuli Municipality
- Pixley Ka Seme Municipality
- Mkhondo Municipality

The Msukaligwa Municipality is the relevant local municipality. It is 830 957 ha in extent and forms 13% of the Gert Sibande District Municipality. The Municipality comprises the following towns:

- Ermelo
- Breyten
- Davel
- Sheepmoor
- Lothair
- Chrissiesmeer
- Warburton

- Surrounding rural or farm lands

4.18.1 Population density, growth and location (CT Environmental, 2009)

The population and household figures within the Msukaligwa Municipality, as derived from the 2001 census statistics are reflected in Table 50 below. The municipality is predominantly rural in nature with key anchor towns that dominate the urban settlements. This creates a challenge for the municipality to provide services to the rural and farmland areas as coordinated planning and development becomes expensive in services provision.

Table 50: Demographics per settlement type - Msukaligwa Municipality

Admin unit	Urban	Dense	Village	Scattered	Farmland	Total
Ermelo	46 425	4 912	750	0	45 210	97 297
Breyten	12 036	54	0	0	See Ermelo	12 090
Chrissiesmeer	2 497	0	0	0	See Ermelo	2 497
Lothair	5 439	0	0	0	See Ermelo	5 439
Davel	3 633	0	0	0	See Ermelo	3 633
Sheepmoor	1 233	0	0	0	See Ermelo	1 233
Warburton	2 130	0	0	0	See Ermelo	2 130
Total population	73 393	4 966	750	-	45 210	124 319
No of household consumer units	21 718	1 280	180	-	6 712	29 890

Source: Statistic South Africa (2001)

4.18.2 Race and gender (CT Environmental, 2009)

The majority of the population (89.2%) in the Msukaligwa Municipality is black with coloured, Indian, Asian and white people in the minority (Table 51).

Table 51: Population groups – Msukaligwa Municipality

Population groups	2001	Percentage
Black African	111 414	89.2
Coloured	378	9.8
Indian or Asian	823	0.3
White	12 195	0.7
Total	**124 810**	**100**

Source: Statistics South Africa (2001)

As indicated in Table 52 below, youth and female residents comprise 39% and 52% of the total population of Msukaligwa Municipality respectively. Taking into consideration the unemployment rate of 38% in Msukaligwa as per 2001 statistics, as well as the 2% estimated population growth, this is creating a challenge for the municipality's strategies for job creation, provision of land for housing, infrastructure and sanitary services. The other challenge is the increase of squatter settlements as a result of population growth.

Table 52: Population breakdown – Msukaligwa Municipality

Permanent resident population	Aged residents (>65 years)	Youth residents (<18 years)	Male residents	Female residents
124 812	76 654	48 158	60 132	64 680

Source: Statistics South Africa (2001)

4.18.3 Languages (CT Environmental, 2009)

The language most spoken in the municipal area is IsiZulu, followed by SiSwati. This is due to the close proximity to the Natal Province, a traditionally Zulu dominated province, and Swaziland.

Table 53: Language distribution – Msukaligwa Municipality

Description	2001	Percentage
Afrikaans	11 721	9.39

Description	2001	Percentage
English	1 728	1.38
IsiNdebele	1 388	1.11
IsiXhosa	879	0.70
IsiZulu	83 919	67.24
Sepedi	439	0.35
Sesotho	872	0.70
Setswana	420	0.34
SiSwati	22 672	18.16
Tshivenda	78	0.08
Xitsonga	299	0.24
Other	393	0.31
Total	**124 808**	**100**

Source: Statistics South Africa (2001)

4.18.4 Marital Status (CT Environmental, 2009)

In terms of marital status (Table 54), it was noted that polygamous relationships, as well as separations and divorces, are in the minority. Majority of the population sampled during the census have never been married.

Table 54: Marital status – Msukaligwa Municipality

Marital status	2001	Percentage
Civil/religious	14 502	11.62
Traditional	11 411	9.14
Polygamous	140	0.11
Living together	9 069	7.27

Marital status	2001	Percentage
Never married	83 712	67.07
Widower/widow	4 393	3.52
Separated	759	0.61
Divorced	822	0.66
Total	**124 808**	**100**

Source: Statistics South Africa (2001)

4.18.5 Household Size (CT Environmental, 2009)

Household sizes range from one to over ten members (Table 55). As would be expected, the trend is towards smaller households, with the majority of households only having between one and five members.

Table 55: Household size – Msukaligwa Municipality

Household size	2001	Percentage
One	5 480	18.10
Two	5 556	18.34
Three	4 615	15.23
Four	4 539	14.98
Five	3 363	11.10
Six	2 252	7.43
Seven	1 497	4.94
Eight	1 057	3.49
Nine	688	2.27
Ten and over	1 249	4.12
Total	**30 296**	**100**

Source: Statistics South Africa (2001)

4.18.6 Education and Skills (CT Environmental, 2009)

It must be noted from Table 56 that the majority of the population sampled has had no formal schooling (26.45%), or has only had some secondary schooling (28.42%). Very few (5.5%) have had the opportunity of receiving an education higher than Grade 12.

Table 56: Education levels – Msukaligwa Municipality

Education	2001	Percentage
No schooling	17 755	26.45
Some primary	11 380	17.0
Complete primary	4 021	6.0
Some secondary	19 078	28.42
Std 10/Grade 12	11 160	16.63
Higher	3 733	5.5
Total	**67 127**	**100**

Source: Statistics South Africa (2001)

4.18.7 Employment and Occupations (CT Environmental, 2009)

The labour force within Msukaligwa Municipality is reflected below in Table 57. Nearly half the population surveyed is not economically active. Dealing with the unemployment problem is a challenge that the district municipality, local municipality, business/private sector and government sectors need to address collectively.

Table 57: Economically active population – Msukaligwa Municipality

Employment status	2001	Percentage
Employed	28 083	36.63
Unemployed	17 361	22.65
Not Economically Active	31 208	40.72
Total	**76 652**	**100**

Source: Gert Sibande District Municipality Water Services Development Programme (2006)

From Table 58 below it was noted that majority of the population sampled worked in an undetermined sector. It was assumed that many workers, whom are unable to find work in the formal sector, hope to find some income from work in the informal sector. This could be in the form of day labourers, hawkers, “tuck shops”, mobile vendors, service activities (such as hairdressers, shoe repairs, clothing alterations and painters), and even manufacturing (such as welding, vehicle repairs, production of hand crafts and construction). The agricultural sector employs only 6.3% and mining only 1.6%.

Table 58: Employment sectors – Msukaligwa Municipality

Industry	2001	Percentage
Agricultural related work	7 461	6.3
Mining, quarrying	1 852	1.6
Manufacturing	2 241	2.0
Electricity, gas, water	218	0.2
Construction	923	0.8
Wholesale, retail	3 746	3.2
Transport, communication	1 431	1.2
Business services	1 460	1.2
Community services	6 398	5.5
Undetermined	96 180	78
Representative of foreign Gov	0	0
Total	**121 910**	**100**

Source: Statistics South Africa (2001)

The results of the table above are reflected in Table 59 below. Only a small percentage of the population surveyed is involved in occupations as professionals, officials and skilled labour. A large percentage (31.19%) listed their occupation as elementary. These occupations include unskilled farm workers and mine labourers, waiters, shop assistants, warehouse assistants, house cleaners, gardeners, etc.

Table 59: Occupations – Msukaligwa Municipality

Occupation	2001	Percentage
Senior officials	1 060	3.70
Professionals	1 078	3.77
Technical/Associate professionals	1 940	6.78
Clerks	2 276	7.95
Service workers	2 334	8.15
Skilled agricultural work	3 097	10.82
Other	3 107	10.85
Elementary occupation	8 928	31.19
Occupations NEC	1 533	5.35
Plant operators	3 274	11.44
Total	**28 627**	**100**

Source: Statistics South Africa (2001)

4.18.8 Household Income (CT Environmental, 2009)

The household income trend (Table 60) is what would be expected from a municipality such as Msukaligwa, and the area in which it is situated. A fairly large percentage of the sample population (19.31%) has no income, with a further 50% living on less that R 19 200 per annum.

Table 60: Household Income – Msukaligwa Municipality

Household income per annum	2001	Percentage
No income	5 851	19.31
R 1 – R 4 800	3 423	11.30
R 4 801 – R 9 600	6 272	20.70

Household income per annum	2001	Percentage
R 9 601 – R 19 200	5 727	18.90
R 19 201 – R 38 400	4 170	13.76
R 38 401 – R 76 800	2 382	7.86
R 76 801 – R 153 600	1 592	5.25
R 153 601 – R 307 200	624	2.09
R 307 201 – R 614 400	110	0.36
R 614 401 – R 1 228 800	41	0.13
R 1 228 801 – R 2 457 600	37	0.12
R 2 457 601 – more	27	0.09
Not Applicable	41	0.13
Total	**30 297**	**100**

Source: Statistics South Africa (2001)

4.18.9 Living Standards (CT Environmental, 2009)

Table 61 below reflects the challenge that the Msukaligwa Municipality is faced with regarding people living below minimum living standards, this impacts negatively on revenue collection and service delivery to the community.

Table 61: Extent, population, and people below minimum living standard and household income – Msukaligwa Municipality

Municipality	Extent(ha)	Population	People below minimum living standards	% People below minimum living standards	Total household income	% of household income in relation to total household income for GSDM
Msukaligwa	601 566	124 525	67 720	54,38	973 950 375	13,55

Source: Gert Sibande District Municipality Water Services Development Programme (2006)

4.18.10 Water and Sanitation (CT Environmental, 2009)

Table 62 below reflects the level of service delivery mechanisms for the municipality in providing water to its communities. The municipality still needs to do a lot of work with regards to providing water in rural areas. As can be seen, 22% of the surveyed population still relies on water from communal taps.

Table 62: Water supply – Msukaligwa Municipality

Water supply	2001	Percentage
In-house	10 340	35.00
Yard connection	9 720	32.90
Communal tap (< 200 m)	3 262	11.04
Communal tap (> 200 m)	3 262	11.04
Boreholes	250	0.85
Spring	425	1.44
Rain water tank	67	0.25
Dam/pool	828	2.80
Rivers/streams	610	2.06
Vendor	297	1.00
Other	478	1.62
Total	**29 539**	**100**

Source: Gert Sibande District Municipality Water Services Development Programme (2006)

A large percentage (64.28%) of the population surveyed has access to flush toilets with sewers. However, 20% still make use of pit latrines (Table 63).

Table 63: Sanitation – Msukaligwa Municipality

Toilet facilities	2001	Percentage
Flush toilet sewer	19 478	64.28
Flush toil tank	1 237	4.08
Chemical toilet	103	0.33
Pit latrine (with vent)	1 143	3.77
Pit latrine (without vent)	4 963	16.38
Bucket latrine	803	2.65
None	2 571	8.48
Not Applicable	2	0.03
Total	**30 300**	**100**

Source: Statistics South Africa (2001)

4.18.11 Waste Disposal (CT Environmental, 2009)

Even though the majority (60.57%) of the sampled population have their refuse removed once a week, there is still a larger percentage (26.53%) that uses their own refuse dump (Table 64). This type of disposal leads to pollution, litter and local community health problems.

Table 64: Waste disposal – Msukaligwa Municipality

Waste disposal	2001	Percentage
Removed once week	18 353	60.57
Removed less often	1 400	4.62
Communal dump	736	2.43
Own refuse dump	8 038	26.53
No Disposal	1 771	5.84
Not Applicable	2	0.01

Waste disposal	2001	Percentage
Total	**30 300**	**100**

Source: Statistics South Africa (2001)

4.18.12 Sources of Energy (CT Environmental, 2009)

The surveyed population uses a variety of energy sources for their cooking, heating and lighting requirements (Table 65). Electricity as a source of energy, however, only makes up between 30% and 50% of that. A very large percentage (approximately 62%) still uses wood and coal for their cooking and heating needs and 44% uses candles for their lighting needs.

Table 65: Sources of energy – Msukaligwa Municipality

Energy	Energy – Cooking	%	Energy - Heating	%	Energy - Lighting	%
Electricity	8 915	29.42	8 131	26.84	16 053	52.98
Gas	472	1.56	349	1.15	75	0.25
Paraffin	1 964	6.48	1 549	5.11	552	1.82
Wood	8 488	28.01	8 738	28.84	Na	-
Coal	10 154	33.51	11 027	36.40	Na	-
Animal dung	133	0.44	86	0.28	Na	-
Solar	73	0.24	36	0.12	74	0.24
Candles	Na	-	Na	-	13 348	44.05
Other	98	0.32	380	1.25	196	0.65
Not Applicable	2	0.02	2	0.01	2	0.01
Total	**30 299**	**100**	**30 298**	**100**	**30 300**	**100**

Source: Statistics South Africa (2001)

4.18.13 Transportation (CT Environmental, 2009)

From Table 66 below it can be seen that a fairly large percentage (33.35%) of the surveyed population considers walking their mode of transport.

Table 66: Transportation – Msukaligwa Municipality

Mode of transport	2001	Percentage
Not applicable	61 374	49.17
On foot	41 619	33.35
Bicycle	859	0.69
Motorcycle	236	0.19
Car as a driver	4 431	3.55
Car passenger	6 901	5.53
Minibus/taxi	5 554	4.45
Bus	2 317	1.86
Train	157	0.12
Other	1 361	1.09
Total	**124 809**	**100**

Source: Statistics South Africa (2001)

5 PUBLIC PARTICIPATION PROCESS

The public participation for this EMP Amendment was initiated in February 2011 following instruction from the Department of Mineral Resources to amend the existing EMP.

The following is an outline of the public participation process (PPP) that was followed during the amendment process. All relative documents are attached in **Appendix E.**

5.1 Identifying Regulatory Authorities:

The existing database for Mooiplaats North Colliery was utilised. Although numerous environmental legislation is applicable to this operation, DMR is considered to be the lead authority on mining.

The authorities contacted with regards to this project include:

- The Department of Mineral Resources (DMR);
- The Department of Agriculture, Rural Development and Land Administration;
- The Department of Water Affairs and Forestry (DWA);
- The Mpumalanga Parks Board (MPB);
- The South African Heritage Resources Agency (SAHRA); and
- The Department of Public Works, Roads and Transport.

A copy of the information letter forwarded to the authorities is attached in **Appendix E – Annexure 2.**

5.2 Identifying all Interested and Affected Parties (I&AP's):

The existing I&AP database was updated following responses received from press advertisements and Background Information Document (BID) distribution. The I&AP register includes a broad database of farmers, adjacent landowners, communities, local authorities and other interest groups. Please refer to **Appendix E – Annexure 1.**

A process of engagement was followed in order to ensure that all I&AP's were given the opportunity to raise issues, ideas and concerns regarding the proposed amendment. Consultation with the I&AP's took place by the following means:

5.2.1 Background Information Letter (BID):

A letter notifying registered I&AP's of the amendment process was compiled in English and distributed to all I&AP's via E-mail, post and fax. Persons who did not have access to a computer, fax machine or postal service were notified of the project via SMS and/or telephone.

The purpose of the letter was to:

- Invite members of the public to register as I&AP's;
- Inform them of the proposed amendment process;
- Initiate a process of public consultation to record perceptions and issues; and

- Invite I&AP's to attend the public meeting.

A copy of the letter has been included in **Appendix E – Annexure 2.**

5.2.2 Notices:

Further to this, A2 Posters written in English and Afrikaans were erected and displayed on site (Mooiplaats Colliery) as well as at the entrance to the Mooiplaats Colliery on the N4 Piet Retief Road, the Local Municipality, the Local Library, and at the entrance to the Indawo Game Reserve. These posters informed the public of the proposed amendment process, invited the I&AP's to attend the public meeting and requested the public to register as I&AP's.

Copies of the posters are attached in **Appendix E – Annexure 3.**

5.2.3 Advertisements:

An advertisement written in English, informing the public of the proposed amendment process, requesting readers to register as I&AP's and Inviting readers to attend the public meeting was placed in one (1) local newspaper, "Highveld Tribune" on the 01st March 2011. Please refer to **Appendix E – Annexure 4** for the advert).

5.3 Public Meeting:

All I&AP's were invited to attend a public meeting held on the 16th March 2011 at the Indawo Game Reserve in Ermelo. Please refer to **Appendix E – Annexure 5** for a copy of the minutes as well as the presentation given on the day.

5.4 Micro Consultation:

CoAL holds regular farmers forum meetings with the surrounding landowners where issues are raised and discussed. These meetings are held every two months. Should any additional individual meetings with CoAL be requested by the I&AP's, these will be scheduled.

5.5 Document Review:

The amended EIA/EMP will be made available for public review for a period of thirty (30) days. This review period will run concurrently with the authorities review period due to the timeframes stipulated by the DMR.

All registered I&AP's will be informed of the reports availability. A copy of the EIA/EMP report will be made available at the Local Library in Ermelo, as well as at the Mooiplaats Colliery in Ermelo. Electronic copies (Adobe PDF and CD's) will also be made available to I&AP's upon written request.

5.6 Synthesis of issues raised

A detailed issues and response table has been included in the PPP report , **Appendix E**. Table 67 and Table 68 below summarise the main issues raised during the public participation process, as well as the relevant responses.

No issues or responses have been received to date from the relative authorities on the amendment process.

Table 67: Summary of Issues raise by the Authorities

COMMENT / ISSUE:	RESPONSE:
No issues have been raised to date by the Authorities.	n/a

Table 68: Summary of issues raised by the I&APs

COMMENT / ISSUE:	RESPONSE:
Surface and Groundwater	
Requested copies of the mine's GN 704 audit report	Request for copies of audit reports was forwarded to CoAL for consideration. Impacts in terms of the surface and ground water have been assessed in the EIA and management measures are proposed in the EMP. A hydrological investigation has been undertaken, **Appendix D**, whereby a conceptual Surface Water Management Plan is proposed. A Geohydrological investigation is currently underway, and will be forwarded to the relevant authorities as an annexure to this report on completion.
Mineral Rights	
Requested information on listed activities in terms of NEMA, areas not included in MRA, mined out areas not included in the MRA and non-compliance with the acts (requested copies of audits).	The approved mining right areas for the Mooiplaats North Colliery include Mooiplaats portions 1 and 9. Information with regards to the listed activities occurring on site in terms of NEMA, and the associated applications were provided. Request for copies of audit reports was forwarded to CoAL for consideration.

COMMENT / ISSUE:	RESPONSE:
Fauna & Flora	
Several threatened species occur in the affected area.	Requested to attend the public meeting so as to specify the different threatened species. Did not attend the public meeting. A specialist ecological assessment (**Appendix B**) and Wetland Assessment (**Appendix C**) were undertaken by Strategic Environmental Focus (SEF), these reports have assessed what threatened and/or endangered species may/do occur on site. The EIA and EMP has taken these into consideration.
Public Participation Process	
How can I&AP's comment on the EIA/EMP report?	The report will be made available for public review (concurrently with the authorities review) for thirty day and all registered I&AP's will be notified of its availability.
Which newspaper was the advert placed in?	The Highveld Tribune on the 01st March 2011.
EMP Amendment Process	
EAP's must comply with regulation 16(1) and 18 of the act.	Cabanga Concepts and subcontractors/specialist are independent and are not subsidiaries of CoAL. Cabanga are aware of the relative sections of NEMA, MPRDA and NWA.

6 ASSESSMENT OF IMPACTS RESULTING FROM IDENTIFIED ALTERNATIVE LAND USES AND DEVELOPMENTS

6.1 Project motivation

The Mooiplaats Colliery underground mine currently supports 450 staff. Closure of the mine would result in job losses and a negative impact to the socio-economics of the area through the loss of these jobs, the indirect job loss to contractors and the indirect loss to dependents of staff through the multiplier effect. The mine is expected to provide continued employment for the next 7 years, which will extend to an additional 5 years should Mooiplaats South be granted. The society will also benefit through the commitments made in the Social and Labour Plan, which will be adhered to.

6.2 Land use alternatives

In accordance with the MPRDA, alternative land uses in the area must be identified and their potential impacts identified, including cumulative impacts. The current land use is one of underground mining and associated processing facilities, and alternative land uses have assumed the closure and rehabilitation of the mine. Underground areas will not impact on the surface and other land uses can continue concurrently to mining. The land use alternatives therefore focus on the disturbed footprint of the boxcut, processing facilities and associated infrastructure. The mine footprint boundary is 200 ha. The land uses that were considered as part of this evaluation include crop and stock farming and continued mining activities (Table 69).

6.3 Project alternatives

There are no project alternatives. The mine is an active mine with existing activities and process.

6.4 Site alternatives

There are no project alternatives. The mine is an active mine with existing activities and processes. A pollution control dam is being erected on site to contain contaminated runoff from the dirty footprint, but due to the limited area and the proximity to wetlands, the location for the PCD is limited to their current proposed locations and thus no alternatives have been considered.

Table 69: Identified alternative land use and developments

Aspect	Agriculture - crops	Agriculture - Stock	Mining
Topography	With rehabilitation of the area to make it available for crop farming there will be some improvement to topography, however topography will not be returned to natural status as the area would be contoured to allow for crop farming. **Status:** Neutral **Duration:** - **Extent:** - **Probability:** - **Affect:** - **Significance:** -	With rehabilitation of the area to make it available for stock farming there will be some improvement to topography. **Status:** +ve **Duration:** Long term **Extent:** Local **Probability:** Probable **Affect:** Slight **Significance:** Low	Mining will continue to have impacts on topography as the co-disposal facility progresses and with continued stockpiling and removal of coal stockpiles. **Status:** -ve **Duration:** Medium term **Extent:** Site specific **Probability:** Definite **Severity:** Slight **Significance:** Low
Soils and land capability	With rehabilitation of the area to make it available for crop farming there will be some improvement to soil, however crop farming does stress soils and requires constant additions of fertilisers and will result in alteration of soils and impacting on land capability. **Status:** -ve **Duration:** Long term **Extent:** Site specific **Probability:** Highly probable **Severity:** Slight to moderate **Significance:** Moderate to low	With rehabilitation of the area to make it available for stock farming there will be some improvement to soils in the area, although this would depend on the level of rehabilitation. **Status:** +ve **Duration:** Long term **Extent:** Site specific **Probability:** Highly probable **Affect:** Slight **Significance:** Moderate to low	Mining will continue to pose a risk to neighbouring soils through potential contamination through dust settling in the area and through contaminants transported in surface runoff and any potential leaks and spills that may occur. **Status:** -ve **Duration:** Medium term **Extent:** Local **Probability:** Possible **Severity:** Moderate **Significance:** Moderate to low

Aspect	Agriculture - crops	Agriculture - Stock	Mining
Surface water	Crop farming requires constant additions of fertilisers and in some instances pesticides which will pose a significant risk to nearby and downstream water sources. **Status:** -ve **Duration:** Long term **Extent:** Local **Probability:** Highly probable **Severity:** Moderate to high **Significance:** Moderate to high	With rehabilitation of the area to make it available for stock farming there will be associated lower risk to surrounding surface water bodies. **Status:** Neutral **Duration:** - **Extent:** - **Probability:** - **Affect:** - **Significance:** -	Mining will continue to pose a risk to surface water bodies through potential contamination through dust settling in the area and through contaminants transported in surface runoff and any potential leaks and spills that may occur. **Status:** -ve **Duration:** Medium term **Extent:** Local **Probability:** Highly probable **Severity:** Moderate to high **Significance:** High
Groundwater	Crop farming requires constant additions of fertilisers and in some instances pesticides which may leach into the shallower aquifers and impact on groundwater quality. **Status:** -ve **Duration:** Short term **Extent:** Local **Probability:** Possible **Severity:** Slight **Significance:** Low	With rehabilitation of the area to make it available for stock farming risk to groundwater will be negated. **Status:** Neutral **Duration:** - **Extent:** - **Probability:** - **Affect:** - **Significance:** -	Mining will continue to pose a risk to groundwater bodies through leaching of contaminated water into groundwater aquifers and will impact on groundwater flow through continued mining. **Status:** -ve **Duration:** Medium term **Extent:** Local **Probability:** Definite **Severity:** Moderate to high **Significance:** Moderate to high
Air quality	Crop farming will contribute to elevated dust in the area. **Status:** -ve **Duration:** Short term	With rehabilitation of the area to make it available for stock farming dust levels will be reduced and no further impacts are expected.	Mining will continue to contribute to elevated dust levels. Existing monitoring has only indicated sporadic events of dust levels above residential targets and only a

Aspect	Agriculture - crops	Agriculture - Stock	Mining
	Extent: Local **Probability:** Definite **Severity:** Moderate to low **Significance:** Moderate to low	**Status:** +ve **Duration:** Long term **Extent:** Site specific **Probability:** Highly probable **Affect:** Slight **Significance:** Moderate to low	single occasion where dust was above industrial targets, so dust generation is largely managed on site. **Status:** -ve **Duration:** Medium term **Extent:** Local **Probability:** Definite **Severity:** Moderate to low **Significance:** Moderate to low
Noise	Crop farming will contribute to sporadic incidences of elevated noise levels. **Status:** -ve **Duration:** Short term **Extent:** Local **Probability:** Definite **Severity:** Slight **Significance:** Low	With rehabilitation of the area to make it available for stock farming noise levels will be reduced and no further impacts are expected. **Status:** +ve **Duration:** Long term **Extent:** Site specific **Probability:** Highly probable **Affect:** Slight **Significance:** Low	Mining will continue to contribute to elevated noise levels. Sensitive receptors are mostly impacted by truck activity which is however sporadic. **Status:** -ve **Duration:** Medium term **Extent:** Local **Probability:** Definite **Severity:** Moderate to Low **Significance:** Moderate to low
Flora and Fauna	Crop farming will improve immediate flora and fauna attracted to crops. The site will however not support indigenous flora and utilisation of herbicides and pesticides could impact on neighbouring areas. **Status:** -ve **Duration:** Long term **Extent:** Site specific	With rehabilitation of the area to make it available for stock farming grassland-type vegetation would need to be restored. This would include introduction of indigenous grass species which in turn would attract smaller fauna species. **Status:** +ve **Duration:** Long term	Mining will continue to pose a risk to neighbouring vegetation communities through potential contamination through contaminants transported in surface runoff and any potential leaks and spills that may occur, as well as any irresponsible activity in neighbouring areas, such as poaching. **Status:** -ve

Aspect	Agriculture - crops	Agriculture - Stock	Mining
	Probability: Possible **Severity:** Low **Significance:** Low	**Extent:** Site specific **Probability:** Probable **Affect:** Slight **Significance:** Moderate to low	**Duration:** Medium term **Extent:** Local **Probability:** Possible **Severity:** Moderate to low **Significance:** Moderate to low
Sensitive landscapes	Crop farming requires constant additions of fertilisers and in some instances pesticides which will pose a significant risk to sensitive landscapes in close proximity to the site. **Status:** -ve **Duration:** Long term **Extent:** Local **Probability:** Highly probable **Severity:** Moderate to high **Significance:** Moderate to high	With rehabilitation of the area to make it available for stock farming there will be associated lower risk to sensitive landscapes. Over stocking the area may result in trampling of wetland areas which support protected species. **Status:** -ve **Duration:** Long term **Extent:** Local **Probability:** Possible **Severity:** Moderate to high **Significance:** Moderate	Mining will continue to pose a risk to surface water bodies through potential contamination through dust settling in the area and through contaminants transported in surface runoff and any potential leaks and spills that may occur. This will inadvertently impact on the sensitive wetland areas in close proximity of the mine. **Status:** -ve **Duration:** Medium term **Extent:** Local **Probability:** Probable **Severity:** Moderate to high **Significance:** High
Visual aspect	With rehabilitation of the area to make it available for crop farming there will be some improvement to the visual aesthetics, although due to the proximity of the site to the Camden Power station impacts are negligible. **Status:** Neutral	With rehabilitation of the area to make it available for stock farming there will be some improvement to the visual aesthetics, although due to the proximity of the site to the Camden Power station impacts are negligible. **Status:** Neutral	Mining will continue to have impacts on the visual aesthetics as the co-disposal facility progresses. Due to the proximity of the site to the Camden Power station impacts are of low significance. **Status:** -ve **Duration:** Long term

Aspect	Agriculture - crops	Agriculture - Stock	Mining
	Duration: - **Extent:** - **Probability:** - **Affect:** - **Significance:** -	**Duration:** - **Extent:** - **Probability:** - **Affect:** - **Significance:** -	**Extent:** Site specific **Probability:** Definite **Severity:** Slight **Significance:** Low
Traffic and safety	Traffic will be reduced should agricultural land use be considered instead of mining. **Status:** +ve **Duration:** Long term **Extent:** Local **Probability:** Definite **Affect:** Slight **Significance:** Moderate to low	Traffic will be reduced should agricultural land use be considered instead of mining. **Status:** +ve **Duration:** Long term **Extent:** Local **Probability:** Definite **Affect:** Slight **Significance:** Moderate to low	Traffic will continue as is with the existing mining activities and no further impacts are expected. Status: -ve **Status:** Neutral **Duration:** - **Extent:** - **Probability:** - **Affect:** - **Significance:** -
Regional socio-economics	The area of impact is so small that it would only provide additional land for existing farmers, or utilised for subsistence level farming. The impact to socio-economics is therefore minimal. **Status:** +ve **Duration:** Long term **Extent:** Local **Probability:** Possible **Severity:** Slight **Significance:** Low	The area of impact is so small that it would only provide additional land for existing farmers, or utilised for subsistence level farming. The impact to socio-economics is therefore minimal. **Status:** +ve **Duration:** Long term **Extent:** Local **Probability:** Possible **Severity:** Slight **Significance:** Low	The mine provides direct employment for around 450 people. Through the multiplier effect and through utilisation of local business their impact on the local economy is highly significant. Export of coal further contributes to GDP. **Status:** +ve **Duration:** Medium term **Extent:** Regional **Probability:** Definite **Severity:** Moderate to high **Significance:** High

7 ENVIRONMENTAL IMPACT ASSESSMENT

7.1 Construction Phase

During the construction phase the main activity will be the construction of the PCD and associated drainage systems to divert dirty water runoff to the PCD. Some additional maintenance and upgrade activities may take place as per the EMP audit but most of these activities will be conducted to ensure protection of the surrounding environment and reduce impacts.

Table 70 lists the impacts on various environmental aspects based on activities proposed during the construction phase. Impacts of high, moderate to high and moderate significance are further discussed below. Details of the remaining impacts can be seen in Table 70.

7.1.1 Impacts of high significance

No impacts of high significance are expected.

7.1.2 Impacts of moderate to high significance

The only impact of moderate to high significance will be the potential impacts to the nearby wetland systems (sensitive areas) which supports red data species. Currently dirty water diversion and containment on site is in place but is not adequate or in accordance with regulation GN 704. For this reason, a properly designed PCD needs to be established on site. This will result in the reduced risk of contaminated runoff draining into the nearby wetland and reduce contamination to the water body and reduce risk of further deterioration and destruction of the ecological functioning of the wetland and destruction of red data species. The impact currently is quite likely due to the fact that water management systems in place are inadequate, the impact will be regional due to the risk of loss of protected species, will be a medium term impact that can only be rectified with active rehabilitation and reintroduction of red data species once the environment has been corrected. The impacts can be considered severe and is of moderate to high significance and management systems need to be established to reduce risk to the wetlands.

7.1.3 Impacts of Moderate significance

During the initial phases of construction prior to proper establishment of PCD, there will be a high risk to the surrounding surface water environment. Currently dirty water diversion and containment on site is in place but is not adequate or in accordance with regulation GN 704. For this reason, the impacts to surrounding surface water bodies are highly probable and will be highly severe due to associated impacts on the ecology, local in extent due to the impact on downstream users, will have a medium term duration and only reversible with some rehabilitation or with high rainfall and dilution affect. In order to effectively manage dirty water runoff, mitigation is required and A PCD need to be erected on site in accordance with regulation GN 704.

With the establishment of PCD, the dirty water will accumulate within this dam. The containment of dirty water will result in protection of the surrounding water resources and wetlands, which will be an overall positive impact. However, if PCD is inadequately constructed, or if leaks and spills should occur from PCD, then the impacts will continue to extend to surface water bodies and associated wetlands, and to the groundwater environment through ingression of any poor quality water. PCD must therefore be constructed as per GN 704 requirements with regards to required capacities and be adequately lined.

Overall activities discussed above could extend to general loss of biodiversity in the area, specifically general biodiversity associated with the wetland systems, including non-protected species, but including species which are key wetland species. The overall impact to flora in the area can therefore also be regarded as being of moderate significance. Mitigation measures will be required to protect the wetland areas from further deterioration.

7.2 Operation Phase

During the operations phase the main activity will be the extraction of underground coal reserves, the processing of the extracted coal, the transport of product from the site and all associated activities.

Table 71 lists the impacts on various environmental aspects based on activities proposed during the operations phase. Impacts of high, moderate to high and moderate significance are further discussed below.

7.2.1 Impacts of high significance

The only impacts of high significance will be the removal of the coal seam and the complete alteration of the geological environment of the area and the reduction of water in boreholes intersecting mine works. There are no mitigation measures possible, but adequate safety factors will reduce risk of overlying strata collapsing and thus further affecting the geological layers. No external users' boreholes intersect the mine workings and therefore no impacts to users.

Table 70: Construction Phase Activities and aspects which will be impacted on through those activities

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation Possible	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
ACTIVITY 1: Construction of PCD and related water management features																						
SUB ACTIVITY 1.1: Upgrade of diversion trenches for dirty water diversion to PCD																						
Air quality	Dust generation	Neg	2	1	1	1	5	5	25	Y	Speed limits will be established on the dirt road to minimise dust generation. All contractors will enforce speed limits.	2	1	1	1	5	3	15	Site manager	Speed inspections	Sporadicall y	Running cost
Air quality	Dust generation	Neg	2	2	1	1	6	5	30	Y	Dust suppression by water cart will be undertaken during times of high dust generation.	2	1	1	1	5	3	15	Environmental manager	Dust monitoring	Monthly	R 80,000.00
Air quality	Emissions	Neg	1	1	1	1	4	5	20	Y	All vehicles will be regularly serviced to ensure they are in proper working condition and to reduce risk of excessive emissions.	1	1	1	1	4	4	16	Site manager	Ensure service plans are maintained	Every 6 months	Contractors cost
Groundwat er	Potential hydrocarbon contamination leaching into the water table	Neg	2	2	1	3	8	3	24	Y	All vehicles will be regularly serviced to ensure they are in proper working condition to reduce risk of leaks. Activity will be limited to the dirty footprint of the existing mine. All leaks will be cleaned up immediately using an absorbent material.	2	2	1	3	8	2	16	Site manager	Ensure service plans are maintained & Groundwater monitoring	Every 6 months & Quarterly	Contractors cost & R200,000.00
Noise	Increased noise levels	Neg	1	2	1	1	5	5	25	Y	Vehicles will be regularly serviced to ensure acceptable noise levels are not exceeded. Silencers will be utilised where possible. Construction activities will be conducted during the day-time hours as far as possible.	2	1	1	1	5	4	20	Site manager	Ensure service plans are maintained	Every 6 months	Contractors cost
Socio-economics	Reduced risk to downstream water users	Pos	4	2	3	3	12	4	48	Y	Water is/will be monitored and any observed deterioration caused by the mine attended to immediately with consultation from specialists if necessary.	4	2	3	3	12	4	48	Environmental manager	Surface water monitoring	Monthly	R 180,000.00

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation Possible	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
Soils	Potential compaction of soils in neighbouring areas	Neg	3	1	1	3	8	2	16	Y	Activity will be limited to area of disturbance. Where required the compacted soils will be disked to an adequate depth and re-vegetated with indigenous plants.	3	1	1	3	8	2	16	Site manager	Inspect area for erosion and soil compaction	Monthly	Running cost
Soils	Soil erosion	Neg	3	1	1	1	6	3	18	Y	Minimal soil will be disturbed as most trenches are already existing. All soils which are excavated and are clean will be stockpiled or utilised for berm construction and vegetated to reduce erosion.	3	1	1	1	6	2	12	Site manager	Inspect area for erosion and soil compaction	Monthly	Running cost
Soils	Potential hydrocarbon contamination to soils	Neg	3	1	1	3	8	3	24	Y	All vehicles will be regularly serviced to ensure they are in proper working condition to reduce risk of leaks. Activity will be limited to the dirty footprint of the existing mine. All leaks will be cleaned up immediately using an absorbent material.	3	1	1	3	8	2	16	Site manager	Ensure service plans are maintained	Every 6 months	Contractors cost
Surface water	Soil disturbance could cause siltation to the surface water resource during soil turning activities.	Neg	3	3	5	3	14	4	56	Y	Ensuring clean and dirty water infrastructure is in place prior to the commencement of the construction activities. Compaction of the area during base preparation.	1	1	4	2	8	2	16	Site manager	Inspect area for erosion	Monthly	Running cost
Surface water	Slope could significantly contribute to erosion and siltation during the construction phase.	Neg	2	2	4	3	11	5	55	Y	Sloping of the areas as to allow for free run-off either towards a pollution control structure or away from the site pending on whether the water is clean or dirty. Management of speed versus velocity aspects if and when required as to prevent erosion gullies from forming.	1	1	4	2	8	2	16	Site manager	Inspect area for erosion.	Monthly	Running cost
Surface water	Potential contaminated water runoff may	Neg	5	2	3	3	13	4	52	Y	PCD need to be erected on site as a matter of urgency to ensure all contaminated runoff is contained on site.	5	2	3	1	11	2	22	Site manager	Monitor construction	Weekly	Running cost

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation Possible	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
	reach downstream water bodies causing contamination and siltation of these bodies.										These will be sized to contain at least a 1:50 year 24hr storm event and they must be adequately lined.									activities		
Surface water	Potential hydrocarbon contamination which may reach downstream surface water bodies	Neg	3	2	3	3	11	3	33	Y	All vehicles will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. Activity will be limited to the dirty footprint of the existing mine. All leaks will be cleaned up immediately using an absorbent material.	3	2	3	1	9	1	9	Site manager	Ensure service plans are maintained & Surface water monitoring	Every 6 months & Monthly	Contractors cost & R 180,000.00
Topography	Alteration of topography	Neg	1	1	1	1	4	5	20	N		1	1	1	1	4	5	20				
Traffic & safety	Increased potential for road incidences	Neg	3	1	1	5	10	2	20	Y	All intersections with main tarred roads will be clearly signposted. Drivers will be enforced to keep to set speed limits. Trucks will be in road-worthy condition with reflective strips.	3	1	1	5	10	1	10	Site manager	Inspect intersections and roads	Monthly	Running cost
Traffic & safety	Road degradation	Neg	3	2	1	3	9	2	18	Y	A fund will be set aside to maintain the serviceability of the road verge where the trucks approach or depart from the main road.	3	2	1	3	9	1	9	Site manager	Inspect intersections and roads	Monthly	Running cost
Wetlands	Potential contaminated water runoff may reach downstream water bodies causing contamination and siltation of these bodies and	Neg	5	3	3	5	16	4	64	Y	PCD need to be erected on site as a matter of urgency to ensure all contaminated runoff is contained on site. These will be sized to contain at least a 1:50 year 24hr storm event and they must be adequately lined. Adequate protection measures must be implemented around wetland areas, as per specialist recommendation, to reduce risk of degradation and	5	2	3	1	11	2	22	Site manager	Monitor construction activities	Weekly	Running cost

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation Possible	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
	damage to the ecological functioning of these systems.										deterioration to these systems.											
SUB ACTIVITY 1.2: Construction of PCD																						
Air quality	Dust generation	Neg	2	1	1	1	5	5	25	Y	Speed limits will be established on the dirt road to minimise dust generation. All contractors will enforce speed limits.	2	1	1	1	5	3	15	Site manager	Speed inspections	Sporadically	Running cost
Air quality	Dust generation	Neg	2	2	1	1	6	5	30	Y	Dust suppression by water cart will be undertaken during times of high dust generation.	2	1	1	1	5	3	15	Environmental manager	Dust monitoring	Monthly	R 80,000.00
Air quality	Emissions	Neg	1	1	1	1	4	5	20	Y	All vehicles will be regularly serviced to ensure they are in proper working condition and to reduce risk of excessive emissions.	1	1	1	1	4	4	16	Site manager	Ensure service plans are maintained	Every 6 months	Contractors cost
Groundwater	Potential hydrocarbon contamination leeching into the water table.	Neg	2	2	1	3	8	3	24	Y	All vehicles will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. Activity will be limited to the dirty footprint of the existing mine. All leaks will be cleaned up immediately using an absorbent material.	2	2	1	3	8	2	16	Site manager	Ensure service plans are maintained	Every 6 months	Contractors cost
Groundwater	Potential leaching of dirty water collecting in the PCD once erected	Neg	5	2	3	3	13	4	52	Y	PCD must be lined.	3	2	3	3	11	3	33	Site manager	PCD will be inspected regularly and lining integrity tested	Monthly & Annually	Running cost & R 200,000.00
Noise	Increased noise levels	Neg	1	2	1	1	5	5	25	Y	Vehicles will be regularly serviced to ensure acceptable noise levels are not exceeded. Silencers will be utilised where possible. Construction activities will be conducted during the day-time hours as far as possible.	2	1	1	1	5	4	20	Site manager	Ensure service plans are maintained	Every 6 months	Contractors cost

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation Possible	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
Socio-economics	Reduced risk to downstream water users	Pos	4	2	3	3	12	4	48	Y	Water is/will be monitored and any observed deterioration caused by the mine attended to immediately with consultation from specialists if necessary.	4	2	3	3	12	4	48	Environmental manager	Surface water monitoring	Monthly	R 180,000.00
Soils	Potential compaction of soils in neighbouring areas	Neg	3	1	1	3	8	2	16	Y	Activity will be limited to area of disturbance. Where required the compacted soils will be disked to an adequate depth and re-vegetated with indigenous plants.	3	1	1	3	8	2	16	Site manager	Inspect area for erosion and soil compaction	Monthly	Running cost
Soils	Soil erosion	Neg	3	1	1	1	6	3	18	Y	Minimal soil will be disturbed as most trenches are already existing. All soils which are excavated and are clean will be stockpiled or utilised for berm construction and vegetated to reduce erosion.	3	1	1	1	6	2	12	Site manager	Inspect area for erosion and soil compaction	Monthly	Running cost
Soils	Potential hydrocarbon contamination to soils	Neg	3	1	1	3	8	3	24	Y	All vehicles will be regularly serviced to ensure they are in proper working condition to reduce risk of leaks. Activity will be limited to the dirty footprint of the existing mine. All leaks will be cleaned up immediately using an absorbent material.	3	1	1	3	8	2	16	Site manager	Ensure service plans are maintained	Every 6 months	Contractors cost
Surface water	Containment of contaminated surface water runoff from the mine area and reduced risk of contamination to the surrounding environment	Pos	4	2	3	3	12	4	48	Y	Water is/will be monitored and any observed deterioration caused by the mine attended to immediately with consultation from specialists if necessary.	4	2	3	3	12	4	48	Environmental manager	Surface water monitoring	Monthly	R 180,000.00
Surface water	Potential contaminated water runoff may	Neg	5	2	3	3	13	4	52	Y	PCD need to be erected on site as a matter of urgency to ensure all contaminated runoff is contained on site.	5	2	3	1	11	2	22	Site manager	Monitor construction activities and	Weekly & Monthly	Running cost

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation Possible	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
	reach downstream water bodies causing contamination and siltation of these bodies should spills or leaks occur.										These should be sized to contain at least a 1:50 year 24hr storm event and they must be adequately lined.									the PCD		
Surface water	Potential hydrocarbon contamination which may reach downstream surface water bodies	Neg	3	2	3	3	11	3	33	Y	All vehicles will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. Activity will be limited to the dirty footprint of the existing mine. All leaks will be cleaned up immediately using an absorbent material.	3	2	3	1	9	1	9	Site manager	Ensure service plans are maintained & Surface water monitoring	Every 6 months & Monthly	Contractors cost & R 180,000.00
Topography	Alteration of topography	Neg	1	1	1	1	4	5	20	N		1	1	1	1	4	5	20				
Traffic & safety	Increased potential for road incidences	Neg	3	1	1	5	10	2	20	Y	All intersections with main tarred roads will be clearly signposted. Drivers will be enforced to keep to set speed limits. Trucks will be in road-worthy condition with reflective strips.	3	1	1	5	10	1	10	Site manager	Inspect intersections and roads	Monthly	Running cost
Traffic & safety	Road degradation	Neg	3	2	1	3	9	2	18	Y	A fund will be set aside to maintain the serviceability of the road verge where the trucks approach or depart from the main road.	3	2	1	3	9	1	9	Site manager	Inspect intersections and roads	Monthly	Running cost
Wetlands	Containment of contaminated surface water runoff from the mine area and reduced risk of contamination to the surrounding	Pos	4	2	3	3	12	4	48	Y	Water is/will be monitored and any observed deterioration caused by the mine attended to immediately with consultation from specialists if necessary.	4	2	3	3	12	4	48	Environmental manager	Surface water monitoring & visual assessments of wetland areas	Monthly	R 180,000.00

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation Possible	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
	environment																					
Wetlands	Potential contaminated water runoff may reach downstream water bodies causing deterioration of ecological functioning of these systems should spills or leaks occur.	Neg	5	3	3	3	14	4	56	Y	PCD need to be erected on site as a matter of urgency to ensure all contaminated runoff is contained on site. These should be sized to contain at least a 1:50 year 24hr storm event and they must be adequately lined. Adequate protection measures must be implemented around wetland areas, as per specialist recommendation, to reduce risk of degradation and deterioration to these systems.	5	2	3	1	11	2	22	Site manager	Monitor construction activities and the PCD	Weekly & Monthly	Running cost
SUB ACTIVITY 1.3: Truck and heavy machinery operation																						
Air quality	Dust generation	Neg	3	2	1	1	7	5	35	Y	A water cart will be used to spray relevant areas when dust levels are high.	1	1	1	1	4	3	12	Environmental manager	Dust monitoring	Monthly	R 140,000.00
Air quality	Dust generation	Neg	3	2	1	1	7	5	35	Y	Speed limits will be established on the dirt road to minimise dust generation.	1	1	1	1	4	3	12	Site manager	Speed trapping	Sporadicall y	Running cost
Air quality	Nuisance Emissions	Neg	2	2	1	1	6	4	24	Y	Machinery and equipment will be regularly serviced to ensure they are in proper working condition and to reduce risk of excessive emissions.	1	1	1	1	4	3	12	Site manager	Ensure service plans are maintained	Every 6 months	Contractors cost
Groundwat er	Potential hydrocarbon contamination leaching into the water table	Neg	3	2	1	3	9	3	27	Y	Truck, machinery and equipment will be regularly serviced to reduce risk of leaks. Any leakages will be reported and treated as per the emergency response plan. For large spills Hazmat will called in.	2	1	1	3	7	2	14	Site & Environmental manager	Ensure service plans are maintained. Groundwater monitoring.	Every 6 months & Monthly	Contractors cost & R 200,000.00
Noise	Increased noise levels	Neg	3	2	1	1	7	4	28	Y	Trucks, machinery and equipment will be regularly serviced to ensure acceptable noise levels are not	2	1	1	1	5	3	15	Site manager	Environmental noise monitoring.	Quarterly	R 90,000.00

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation Possible	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
											exceeded. Silencers will be utilised where possible. Point sources will be enclosed where possible. Screens will be considered if I&AP complaints are received.											
Soils	Potential compaction of soils in neighbouring areas	Neg	3	1	1	3	8	3	24	Y	Activity will be limited to area of disturbance. Where required the compacted soils will be disked to an adequate depth and re-vegetated with indigenous plants.	2	1	1	3	7	2	14	Environmental manager	Inspect area for erosion and soil compaction	Monthly	Running cost
Soils	Potential hydrocarbon contamination to soils	Neg	3	1	1	3	8	3	24	Y	Truck, machinery and equipment will be regularly serviced to reduce risk of leaks. Any leakages will be reported and treated as per the emergency response plan. For large spills Hazmat will called in.	2	1	1	3	7	2	14	Site manager	Ensure service plans are maintained	Every 6 months	Contractors cost
Surface water	Potential hydrocarbon contamination which may reach downstream surface water bodies	Neg	3	2	1	3	9	1	9	Y	Truck, machinery and equipment will be regularly serviced to reduce risk of leaks. Any leakages will be reported and treated as per the emergency response plan. For large spills Hazmat will called in.	2	2	1	3	8	1	8	Site & Environmental manager	Ensure service plans are maintained & Surface water monitoring	Every 6 months & Monthly	Contractors cost & R 180,000.00
Traffic & safety	Increased potential for road incidences	Neg	3	1	1	5	10	2	20	Y	All intersections with main tarred roads will be clearly signposted. Drivers will be enforced to keep to set speed limits. Trucks will be in road-worthy condition with reflective strips.	3	1	1	5	10	1	10	Site manager	Inspect intersections and roads	Monthly	Running cost
Traffic & safety	Road degradation	Neg	3	2	1	3	9	2	18	Y	A fund will be set aside to maintain the serviceability of the road verge where the trucks approach or depart from the main road.	3	2	1	3	9	1	9	Site manager	Inspect intersections and roads	Monthly	Running cost
ACTIVITY 2: General activities																						

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation Possible	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
SUB ACTIVITY 2.1: General activities																						
Fauna	Alienation of animals from the area	Neg	2	2	3	3	10	4	40	Y	Inform staff, contractors and visitors to not harm fauna in the area.	1	1	1	3	6	3	18	Environmental manager	Monitor any ecologically sensitive species should they be observed on site	As and when required	Running cost
Flora	Potential damage to vegetation in neighbouring areas which may support protected species	Neg	5	2	5	3	15	3	45	Y	Limit activity to area of disturbance and re-vegetate impacted areas as soon as possible. Ensure measures are in place to protect areas where protected species occur as per specialist recommendations, such as berms around perimeters of such areas.	1	1	1	3	6	2	12	Environmental manager	Inspect area for damage to flora species.	Monthly	Running cost
Social	Potential for more employment	Pos	4	2	3	1	10	5	50	Y	Labourers/contractors will initially be sought locally and only regionally if skills are not available. Employ as per SLP.	4	2	3	1	10	5	50	Social Manager	Ensure employment is in line with SLP initiatives	As required	Running cost
Social	Multiplier effect - improved livelihoods	Pos	4	2	3	1	10	5	50	N		4	2	3	1	10	5	50	Social Manager			

7.2.2 Impacts of moderate to high significance

Blasting activities will also have impacts on the geological layers in the area. As blasting is controlled the impact is considered to be of moderate to high significance. No mitigation measures can be implemented.

Mining related activities, including blasting, underground mining and associated dewatering of mining sections, will all impact on the groundwater levels in the area. Several impacts can occur, including the alteration of flow of groundwater into the mining sections, as the mine is dewatered, due to the drawdown cone will impact on groundwater levels in surrounding areas. Blasting activities may crack overlying strata and affect groundwater flow dynamics within the aquifers. All these impacts could reduce groundwater quantity in surrounding areas and is considered an impact of moderate to high significance.

Various activities on site could lead to generation of poor quality leachate or contaminated water which may ingress into underlying aquifers. Substances which could cause deterioration in groundwater quality in the area should leaks or spills occur include slurry, poor quality leachate from the co-disposal facility, poor quality leachate from the various dirty water containment facilities, and any leaks from pipelines or dams containing dirty water. The greatest risk to groundwater quality is the co-disposal facility. The impacts are of moderate to high significance and mitigation and management plans need to be implemented.

Finally, some social impacts are of moderate to high significance, including any deaths that may result from people handling exposed power lines or power generating equipment and substations and the potential for influx of unsuccessful job seekers, although the likelihood of the latter is low. Mitigation measures must be implemented for both potential impacts.

7.2.3 Impacts of Moderate significance

Abstraction of groundwater for potable use and abstraction of water from the old Usutu underground mine will further impact on groundwater levels within the area. The impact is of moderate significance and mitigation measures must be put in place to monitor water usage, to ensure water is recycled and reduce water wastage on site.

Various activities on site could lead to the generation of contaminated water which may flow into surrounding water bodies, the nearest being a wetland area which supports red data species. This would result in impacts of moderate significance to flora, wetlands and surface water quality. Substances which could cause deterioration in these environments should leaks or spills occur include slurry, poor quality leachate from the co-disposal facility, poor quality leachate from the various dirty water containment facilities and from the processing plant, and any leaks from pipelines or dams containing dirty water. Mitigation and management plans need to be implemented to protect the wetlands and flora within these systems and to conserve water quality within these.

Various water management measures that have been or will be established on site will impact on downstream surface water quantity by preventing runoff from areas of activity from escaping to the surrounding environment. As much as this is an overall positive impact, the impact due to the reduction of downstream and catchment water quantity is considered moderate, especially due to the number of other activities in the area that may have already contributed to reduced water volumes to this catchment and the stressed nature of the catchment.

Flora will be further inadvertently impacted by alien invasive species introduction, establishment and encroachment. Mitigation will be required in the form of an alien invasive management plan which needs to be implemented as soon as possible to prevent alien species from establishing and spreading in the area, especially due to the proximity of wetlands and tributaries in the area.

Crushing and coal stockpiling at the processing facility will impact negatively on air quality through dust generation. The impact is of moderate significance and mitigation measures and monitoring of these sites must be implemented.

Any power lines erected will pose a risk to avifauna in the area, especially lines that traverse over or near habitats where birds are likely to converge. Mitigation will be considered if high mortalities are observed around power lines, or if protected species are noted to be affected.

Soil stockpiles must be adequately managed in order to prevent loss of soil and ensure adequate soil is available for rehabilitation of the site. Stockpiles will be prone to erosion by wind and water and mitigation measures need to be implemented around stockpiles to prevent soil erosion. Adequate measures will also ensure that eroded soils are not transported to downstream water bodies and impact on wetlands associated with these water bodies. Other impacts to soil as indicated by Rehab Green (2011) must also be managed and include:

- Loss of soil profile and associated topography and runoff of the area which will need to be seriously considered during rehabilitation of the area.
- Loss of the natural functioning of the soil and soil characteristics which will need to be monitored in the soil stockpiles on site and adequately managed.
- Compaction of soil during placement by heavy mechanical equipment.
- Contamination of soils by various transported contaminants from site, either by wind or surface water runoff.

The on-site sewage treatment facility must be managed according to the specifications of the unit. Sewage spills will impact on various environmental aspects, the most significant being the social impacts associated with potential biological hazards and health risks.

As the co-disposal facility is constructed throughout operations, the visual aspect of the area will be permanently altered, impacting on the visual aesthetics of the area. The co-disposal dump will be covered with topsoil and re-vegetated with a grass mixture as development of the co-disposal dump proceeds. No further mitigation measures can be implemented but final rehabilitation plans will consider the visual aesthetics of the dump in relation to the surrounding environment.

Table 71: Operations Phase Activities and aspects which will be impacted on through those activities

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
ACTIVITY 1: Boxcut area and underground mining																						
SUB ACTIVITY 1.1: Blasting activities																						
Air quality	Dust generation	Neg	2	1	1	1	5	2	10	N	Blasting will be underground and should not contribute significantly to dust generation. A water cart will be used to spray relevant areas when dust levels are high.	2	1	1	1	5	2	10	Mine manager			
Geology	Disturbance of geological strata	Neg	4	1	3	5	13	5	65	N	-	4	1	3	5	13	5	65	Site manager			
Groundwater	Potential damage to groundwater aquifers and alteration of groundwater flow	Neg	4	2	5	5	16	4	64	N	No mitigation. Ensure registered affected water users are compensated in some way, either with alternative water supply or monetary equivalent.	4	2	5	5	16	4	64	Site & Environmental manager	Groundwater monitoring	Quarterly	R 200,000.00
Social	Vibrations may damage structures in the area	Neg	3	1	3	3	10	2	20	Y	Blasting will be underground and should not damage any surface infrastructure. Ensure baseline photographs are taken of all structures which may be impacted for photographic evidence prior to any blasting. Ensure procedures in place to compensate for damage.	3	1	3	3	10	2	20	Environmental manager	Inspect all complaints received and compare against photographic evidence.	As required	Running costs & dependent on extent of damage.
Topography	Alteration of topography through potential subsidence of surface layers	Neg	4	1	1	1	7	2	14	Y	Application of stone dust on pillars to prevent spontaneous combustion. Any severe subsidence will be rehabilitated.	2	1	1	1	5	2	10	Environmental manager	Monitor surface areas where underground mining is taking place for subsidence or sinkholes	Monthly	Running costs
SUB ACTIVITY 1.2: Bord-and-pillar underground mining of the B-seam																						

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
Geology	Removal of coal seam and alteration of geological strata	Neg	5	2	5	5	17	5	85	N		5	2	5	5	17	5	85	Mine manager			
Groundwater	Potential damage to groundwater aquifers and alteration of groundwater flow	Neg	5	2	5	5	17	4	68	N	No mitigation. Ensure registered affected water users are compensated in some way, either with alternative water supply or monetary equivalent.	5	2	5	5	17	4	68	Environmental manager	Groundwater monitoring	Quarterly	R 200,000.00
Groundwater	Potential contamination plume of groundwater	Neg	5	2	3	5	15	1	15	N	No mitigation. Contamination plume only expected at closure. Ensure registered affected water users are compensated in some way, either with alternative water supply or monetary equivalent.	5	2	3	5	15	1	15	Site & Environmental manager	Groundwater monitoring	Quarterly	R 200,000.00
Topography	Alteration of topography through potential subsidence of surface layers	Neg	4	1	1	1	7	2	14	Y	Application of stone dust on pillars to prevent spontaneous combustion. Any severe subsidence will be rehabilitated.	2	1	1	1	5	2	10	Environmental manager	Monitor surface areas where underground mining is taking place for subsidence or sinkholes	Monthly	Running costs
SUB ACTIVITY 1.3: Operation of underground equipment and machinery																						
Air quality	Dust generation	Neg	2	1	1	1	5	2	10	N	Underground activities should not contribute significantly to dust generation. A water cart will be used to spray relevant areas when dust levels are high.	2	1	1	1	5	2	10	Mine manager			
Groundwater	Potential hydrocarbon spills will impact on groundwater within the pit and may contaminate aquifers	Neg	3	2	3	3	11	1	11	N	No mitigation. With dewatering it is likely that all the hydrocarbons will be pumped out of the underground workings with the water. Ensure registered affected water users are compensated in some way, either with alternative water supply or	3	2	3	3	11	1	11	Environmental manager	Groundwater monitoring	Quarterly	R 200,000.00

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
											monetary equivalent.											
Noise	Increased noise levels	Neg	3	2	1	1	7	2	14	Y	Equipment will be regularly serviced to ensure acceptable noise levels are not exceeded. Silencers will be utilised where possible.	2	2	1	1	6	2	12	Mine manager			
SUB ACTIVITY 1.4: Maintenance of the boxcut																						
Air quality	Dust generation	Neg	2	2	3	1	8	3	24	Y	A water cart will be used to spray relevant areas when dust levels are high.	2	2	3	1	8	2	16	Site & Environmental manager	Dust monitoring	Monthly	R 80,000.00
Noise	Increased noise levels	Neg	5	2	3	1	11	3	33	Y	Equipment will be regularly serviced to ensure acceptable noise levels are not exceeded. Silencers will be utilised where possible.	3	2	3	1	9	2	18	Site & Environmental manager	Environmental noise monitoring.	Quarterly	R 90,000.00
SUB ACTIVITY 1.5 Dewatering of the underground workings																						
Groundwater	Reduction of local groundwater	Neg	5	2	5	3	15	5	75	N	No mitigation. Ensure registered affected water users are compensated in some way, either with alternative water supply or monetary equivalent.	5	2	5	3	15	5	75	Environmental manager	Groundwater monitoring	Quarterly	R 200,000.00
Groundwater	Alteration of groundwater flow	Neg	5	2	5	3	15	5	75	N	No mitigation. Ensure registered affected water users are compensated in some way, either with alternative water supply or monetary equivalent.	5	2	5	3	15	5	75	Environmental manager	Groundwater monitoring	Quarterly	R 200,000.00
SUB ACTIVITY 1.6: Utilisation of settling dams and Erikson dams																						
Flora	Wetland species may be affected if leaks or spills reach nearby wetland systems,	Neg	5	1	5	3	14	3	42	Y	Adequate buffer zones will be maintained and berms/trenches will be erected around the perimeters of the Erikson dams to ensure any spills	5	1	5	3	14	2	28	Environmental manager	Inspect berms/trenches to ensure adequate	Weekly	Running costs

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
	affecting overall biodiversity										or leaks or contained within the dirty footprint area.									functioning of these		
Groundwater	Reduction of local groundwater	Neg	5	2	5	3	15	5	75	N	No mitigation. Ensure registered affected water users are compensated in some way, either with alternative water supply or monetary equivalent.	5	2	5	3	15	5	75	Environmental manager	Groundwater monitoring	Quarterly	R 199,999.00
Groundwater	Alteration of groundwater flow	Neg	5	2	5	3	15	5	75	N	No mitigation. Ensure registered affected water users are compensated in some way, either with alternative water supply or monetary equivalent.	5	2	5	3	15	5	75	Environmental manager	Groundwater monitoring	Quarterly	R 200,000.00
Noise	Increased noise levels	Neg	5	2	1	1	9	2	18	Y	Equipment will be regularly serviced to ensure acceptable noise levels are not exceeded. Silencers will be utilised where possible. Point sources will be enclosed where possible.	1	2	1	1	5	2	10	Environmental manager	Environmental noise monitoring.	Quarterly	R 90,000.00
Surface water	Potential contamination to surrounding water bodies should these leak or spill	Neg	5	2	3	3	13	3	39	Y	Adequate buffer zones will be maintained and berms/trenches will be erected around the perimeters of the Erikson dams to ensure any spills or leaks or contained within the dirty footprint area.	5	1	3	3	12	2	24	Site manager	Inspect Erikson dams & pipelines to and from Erikson dams	Weekly	Running costs
Wetlands	Potential contaminated water runoff through spills or leaks can cause deterioration of ecological functioning of these systems.	Neg	5	1	5	3	14	3	42		Adequate buffer zones will be maintained and berms/trenches will be erected around the perimeters of the Erikson dams to ensure any spills or leaks or contained within the dirty footprint area.	5	1	5	3	14	2	28	Environmental manager	Inspect berms/trenches to ensure adequate functioning of these	Weekly	Running costs
SUB ACTIVITY 1.7: Conveyance of coal to surface																						
Air quality	Dust generation	Neg	2	2	3	1	8	2	16	Y	A water cart will be used to spray relevant areas when dust levels are high.	2	1	1	1	5	2	10	Site & Environmental manager	Dust monitoring	Monthly	R 80,000.00

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
Noise	Increased noise levels	Neg	5	2	3	1	11	3	33	Y	Equipment will be regularly serviced to ensure acceptable noise levels are not exceeded. Silencers will be utilised where possible. Point sources will be enclosed where possible.	2	2	3	1	8	2	16	Site & Environmental manager	Environmental noise monitoring.	Quarterly	R 90,000.00
ACTIVITY 2: Coal Processing, stockpiling and discard handling																						
SUB ACTIVITY 2.1: Conveyance of coal to the crusher/wash plant																						
Air quality	Dust generation	Neg	2	2	3	1	8	2	16	Y	A water cart will be used to spray relevant areas when dust levels are high.	2	1	1	1	5	2	10	Site & Environmental manager	Dust monitoring	Monthly	R 80,000.00
Noise	Increased noise levels	Neg	5	2	3	1	11	3	33	Y	Equipment will be regularly serviced to ensure acceptable noise levels are not exceeded. Silencers will be utilised where possible. Point sources will be enclosed where possible.	2	2	3	1	8	2	16	Site & Environmental manager	Environmental noise monitoring.	Quarterly	R 90,000.00
SUB ACTIVITY 2.2: The crushing and beneficiation of coal																						
Air quality	Dust generation	Neg	5	3	4	3	15	3	45	Y	A water cart will be used to spray relevant areas when dust levels are high.	3	2	3	1	9	3	27	Environmental manager	Dust monitoring	Monthly	R 80,000.00
Flora	Wetland species may be affected if leaks or spills reach nearby wetland systems, affecting overall biodiversity	Neg	5	1	5	3	14	3	42	Y	Ensure water management facilities are operating adequately. Ensure berms/trenches are erected between active area and wetland areas to contain all dirty water runoff and divert to PCD. Clean out silt build up over dry season.	3	2	3	3	11	2	22	Environmental manager	Surface water monitoring & inspect water management facilities	Monthly & weekly	R 180,000.00
Groundwater	Contamination of groundwater table should dirty water infiltrate the aquifers in the area	Neg	4	2	4	3	13	3	39	Y	Ensure water management facilities are operating adequately.	3	2	4	3	12	2	24	Environmental manager	Groundwater monitoring	Quarterly	R 200,000.00

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
Noise	Increased noise levels	Neg	3	2	3	1	9	4	36	Y	Equipment will be regularly serviced to ensure acceptable noise levels are not exceeded. Silencers will be utilised where possible. Point sources will be enclosed where possible. Screens will be considered if I&AP complaints are received.	2	2	3	1	8	3	24	Environmental manager	Environmental noise monitoring.	Quarterly	R 90,000.00
Soils	Potential contamination by coal dust	Neg	3	2	3	3	11	3	33	Y	A water cart will be used to spray relevant areas when dust levels are high.	2	2	3	3	10	3	30	Environmental manager	Dust monitoring	Monthly	R 80,000.00
Surface water	Potential contamination of surface water runoff which may reach downstream surface water bodies	Neg	4	2	3	3	12	4	48	Y	Ensure water management facilities are operating adequately. Ensure berms/trenches are erected between active area and wetland areas to contain all dirty water runoff and divert to PCD. Clean out silt build up over dry season.	3	2	3	3	11	2	22	Environmental manager	Surface water monitoring & inspect water management facilities	Monthly & weekly	R 180,000.00
Wetlands	Potential contaminated water runoff may reach downstream water bodies causing deterioration of ecological functioning of these systems should spills or leaks occur.	Neg	4	2	3	3	12	3	36	Y	Ensure water management facilities are operating adequately. Ensure berms/trenches are erected between active area and wetland areas to contain all dirty water runoff and divert to PCD. Clean out silt build up over dry season.	3	2	3	3	11	2	22	Environmental manager	Surface water monitoring & inspect water management facilities	Monthly & weekly	R 180,000.00
SUB ACTIVITY 2.3: Discard trucked to co-disposal facility																						
Air quality	Dust generation	Neg	3	2	4	1	10	3	30	Y	A water cart will be used to spray relevant areas when dust levels are high.	2	1	1	1	5	3	15	Environmental manager	Dust monitoring	Monthly	R 80,000.00
Air quality	Dust generation	Neg	3	2	4	1	10	4	40	Y	Speed limits will be established on the dirt road to minimise dust generation.	1	1	1	1	4	3	12	Site manager	Speed trapping	Sporadically	Running cost

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
Air quality	Nuisance Emissions	Neg	2	2	4	1	9	2	18	Y	Machinery and equipment will be regularly serviced to ensure they are in proper working condition and to reduce risk of excessive emissions.	1	1	1	1	4	2	8	Site manager	Ensure service plans are maintained	Every 6 months	Contractors cost
Noise	Increased noise levels	Neg	2	2	4	1	9	3	27	Y	Trucks, machinery and equipment will be regularly serviced to ensure acceptable noise levels are not exceeded. Silencers will be utilised where possible.	2	1	1	1	5	3	15	Site manager	Environmental noise monitoring.	Quarterly	R 90,000.00
SUB ACTIVITY 2.4: Slurry pumped to co-disposal facility																						
Flora	Wetland species may be affected if leaks or spills reach nearby wetland systems, affecting overall biodiversity	Neg	5	1	5	5	16	3	48	Y	Ensure water management facilities around the co-disposal facility are operating adequately. Ensure berms/trenches are erected between active area and wetland areas to contain all dirty water runoff and divert to RWD. Clean out silt build up over dry season.	4	2	3	3	12	1	12	Environmental manager	Surface water monitoring & inspect water management facilities	Monthly & weekly	R 180,000.00
Groundwater	Ingression of poor quality, low pH leachate into water table should leaks occur	Neg	5	2	4	5	16	4	64	Y	Ensure water management facilities around slurry pipes are established and functioning adequately. Ensure co-disposal facility is constructed and maintained as per the design.	5	2	3	3	13	3	39	Environmental manager	Groundwater monitoring & inspection of co-disposal dump development against design	Quarterly & monthly	R 200,000.00 & part of running cost
Noise	Increased noise levels	Neg	2	1	3	1	7	3	21	Y	Equipment will be regularly serviced to ensure acceptable noise levels are not exceeded. Silencers will be utilised where possible. Point sources will be enclosed where possible.	1	1	3	1	6	2	12	Environmental manager	Environmental noise monitoring.	Quarterly	R 90,000.00
Surface water	Potential contamination by surface water runoff from area escaping into surrounding	Neg	5	2	3	5	15	3	45	Y	Ensure water management facilities around the co-disposal facility are operating adequately. Ensure berms/trenches are erected between active area and wetland areas to	4	2	3	3	12	1	12	Environmental manager	Surface water monitoring & inspect water management	Monthly & weekly	R 180,000.00

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
	environment should leaks occur										contain all dirty water runoff and divert to RWD. Clean out silt build up over dry season.									facilities		
Wetlands	Potential contaminated water runoff may reach downstream water bodies causing deterioration of ecological functioning of these systems should spills or leaks occur.	Neg	5	2	3	5	15	3	45	Y	Ensure water management facilities around the co-disposal facility are operating adequately. Ensure berms/trenches are erected between active area and wetland areas to contain all dirty water runoff and divert this to RWD. Clean out silt build up over dry season.	4	2	3	3	12	1	12	Site manager	Surface water monitoring & inspect water management facilities.	Monthly, & weekly	R 180,000.00 & Running Costs
SUB ACTIVITY 2.5: Use and maintenance of the co-disposal dump																						
Air quality	Dust generation	Neg	3	3	3	3	12	3	36	Y	A water cart will be used to spray relevant areas when dust levels are high. The dump will be cladded and vegetated as construction progresses.	1	2	3	1	7	2	14	Environmental manager	Dust monitoring	Monthly	R 80,000.00
Flora	Wetland species may be affected if poor quality water runoff reach nearby wetland systems, affecting overall biodiversity	Neg	5	1	5	5	16	3	48	Y	Ensure water management facilities around the co-disposal facility are operating adequately. Ensure berms/trenches are erected between active area and wetland areas to contain all dirty water runoff and divert to RWD. Clean out silt build up over dry season.	4	2	3	3	12	1	12	Environmental manager	Surface water monitoring, &inspect water management facilities.	Monthly,& weekly	R 180,000.00 & operating costs
Groundwater	Ingression of poor quality, low pH leachate into water table should leaks occur	Neg	5	2	4	5	16	4	64	Y	Ensure water management facilities around the co-disposal facility are operating adequately. Ensure berms/trenches are erected between active area and wetland areas to contain all dirty water runoff and divert to RWD. Clean out silt build up over dry season.	5	2	3	3	13	3	39	Environmental manager	Groundwater monitoring & inspection of co-disposal dump development against design	Quarterly & monthly	R 200,000.00 & part of running cost

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
Noise	Increased noise levels	Neg	2	2	1	1	6	3	18	Y	Screens will be considered if I&AP complaints are received.	2	2	1	1	6	2	12	Environmental manager	Environmental noise monitoring.	Quarterly	R 90,000.00
Surface water	Potential contamination by surface water runoff from dirty area escaping into surrounding environment should leaks occur	Neg	5	2	3	5	15	3	45	Y	Ensure water management facilities around the co-disposal facility are operating adequately. Ensure berms/trenches are erected between active area and wetland areas to contain all dirty water runoff and divert to RWD. Clean out silt build up over dry season.	4	2	3	3	12	1	12	Environmental manager	Surface water monitoring & inspect water management facilities	Monthly & weekly	R 180,000.00
Topography	Alteration of topography	Neg	3	1	3	1	8	5	40	Y		3	1	3	1	8	5	40	Site manager			
Visual Aspect	Development of discard mound	Neg	3	2	5	5	15	4	60	N	No mitigation. Adequate vegetation of the dump should reduce visual impact.	3	2	5	5	15	4	60	Environmental manager	Vegetation cover	Weekly	Running cost
Wetlands	Potential contaminated water runoff may reach downstream water bodies causing deterioration of ecological functioning of these systems should spills or leaks occur.	Neg	5	2	3	5	15	3	45	Y	Ensure water management facilities around the co-disposal facility are operating adequately. Ensure berms/trenches are erected between active area and wetland areas to contain all dirty water runoff and divert to RWD. Clean out silt build up over dry season.	4	2	3	3	12	1	12	Site manager	Surface water monitoring & inspect water management facilities	Monthly & weekly	R 180,000.00
SUB ACTIVITY 2.6: Operation of the return water dam																						
Flora	Wetland species may be affected if poor quality water runoff reaches nearby wetland systems, affecting overall biodiversity	Neg	5	1	5	5	16	3	48	Y	Ensure berms/trenches are erected between active area and wetland areas to contain all dirty water runoff and divert to RWD. Clean out silt build up over dry season. Ensure adequate capacity in the RWD.	4	2	3	3	12	1	12	Environmental manager	Surface water monitoring & inspect water management facilities	Monthly & weekly	R 180,000.00

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
Groundwate r	Ingression of poor quality, low pH leachate into water table should leaks occur	Neg	5	2	4	5	16	4	64	Y	Ensure water management facilities around the co-disposal facility are operating adequately. Ensure all dirty water runoff is diverted to RWD. Ensure integrity of any lining is not compromised.	5	2	3	3	13	3	39	Environmenta l manager	Groundwater monitoring & inspection of co-disposal dump development against design & inspect lining integrity	Quarterly & monthly & annually	R 200,000.00 & part of running cost
Noise	Increased noise levels	Neg	2	2	1	1	6	3	18	Y	Screens will be considered if I&AP complaints are received.	2	2	1	1	6	2	12	Environmenta l manager	Environmental noise monitoring.	Quarterly	R 90,000.00
Soils	Potential contamination of soils if dirty water escapes into environment	Neg	4	2	1	3	10	3	30	Y	Ensure berms/trenches are erected between active area and wetland areas to contain all dirty water runoff and divert to RWD. Clean out silt build up over dry season. Ensure adequate capacity in the RWD.	4	2	1	3	10	2	20	Environmenta l manager	Inspect water management features	Weekly	Running cost
Surface water	Potential contamination of water resources through accidental spillage of clean and dirty water containment facilities.	Neg	4	4	3	3	14	4	56	Y	Design water management facilities in terms of GN704 requirements, and to handle a 1:50 flood event. Construct overflow facilities. Dirty water areas to be kept to a minimum. Management of the water and salt balance.	4	2	4	3	13	2	26	Environmenta l manager	Inspect water management features	Weekly	Running cost
Surface water	Potential surface water contamination if leaks escape into the environment	Neg	4	2	3	3	12	4	48	Y	Ensure berms/trenches are erected between active area and wetland areas to contain all dirty water runoff and divert to RWD. Clean out silt build up over dry season. Ensure adequate capacity in the RWD. Expected water qualities will be used to define liner and monitoring requirements.	4	2	3	3	12	1	12	Environmenta l manager	Surface water monitoring. Test integrity of water management structures.	Monthly & in the dry season	R 180,000.00 & running costs
Surface	Downstream water quantity of catchment	Neg	4	2	3	1	10	5	50	N		4	2	3	1	10	5	50	Environmenta	Surface water	Monthly	R

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
water	reduced																		l manager	monitoring		180,000.00
Wetlands	Potential contaminated water runoff may reach downstream water bodies causing deterioration of ecological functioning of these systems should spills or leaks occur.	Neg	5	2	3	5	15	3	45	Y	Ensure berms/trenches are erected between active area and wetland areas to contain all dirty water runoff and divert to RWD. Clean out silt build up over dry season. Ensure adequate capacity in the RWD.	4	2	3	3	12	1	12	Site manager	Surface water monitoring & inspect water management facilities	Monthly & weekly	R 180,000.00
ACTIVITY 3: Plant infrastructure area and associated activities																						
SUB ACTIVITY 3.1: The continuous loading and transport of coal along access and haul roads																						
Air quality	Dust generation	Neg	3	2	4	1	10	3	30	Y	A water cart will be used to spray relevant areas when dust levels are high.	2	1	1	1	5	3	15	Environmenta l manager	Dust monitoring	Monthly	R 80,000.00
Air quality	Dust generation	Neg	3	2	4	1	10	4	40	Y	Speed limits will be established on the dirt road to minimise dust generation.	1	1	1	1	4	3	12	Site manager	Speed trapping	Sporadically	Running cost
Air quality	Nuisance Emissions	Neg	2	2	4	1	9	2	18	Y	Machinery and equipment will be regularly serviced to ensure they are in proper working condition and to reduce risk of excessive emissions.	1	1	1	1	4	2	8	Site manager	Ensure service plans are maintained	Every 6 months	Contractors cost
Noise	Increased noise levels	Neg	2	2	4	1	9	3	27	Y	Trucks, machinery and equipment will be regularly serviced to ensure acceptable noise levels are not exceeded. Silencers will be utilised where possible.	2	1	1	1	5	3	15	Site manager	Environmental noise monitoring.	Quarterly	R 90,000.00
Soils	Potential compaction of soils in neighbouring areas	Neg	3	1	4	3	11	3	33	Y	Activity will be limited to area of disturbance. Where required the compacted soils will be disked to an adequate depth and re-vegetated with indigenous plants.	2	1	1	3	7	2	14	Environmenta l manager	Inspect area for erosion and soil compaction	Monthly	Running cost

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
Soils	Potential hydrocarbon or coal dust contamination to soils	Neg	3	1	4	3	11	3	33	Y	Truck, machinery and equipment will be regularly serviced to reduce risk of leaks. Any leakages will be reported and treated as per the emergency response plan. For large spills Hazmat will called in. Trucks will be fitted with tarpaulins.	2	1	1	3	7	2	14	Site manager	Ensure service plans are maintained	Every 6 months	Contractors cost
SUB ACTIVITY 3.2: Coal Transportation																						
Air quality	Dust generation	Neg	3	2	4	1	10	3	30	Y	A water cart will be used to spray relevant areas when dust levels are high.	2	1	1	1	5	3	15	Environmental manager	Dust monitoring	Monthly	R 80,000.00
Air quality	Nuisance Emissions	Neg	2	2	4	1	9	2	18	Y	Machinery and equipment will be regularly serviced to ensure they are in proper working condition and to reduce risk of excessive emissions.	1	1	1	1	4	2	8	Site manager	Ensure service plans are maintained	Every 6 months	Contractors cost
Noise	Increased noise levels	Neg	2	2	4	1	9	3	27	Y	Trucks, machinery and equipment will be regularly serviced to ensure acceptable noise levels are not exceeded. Silencers will be utilised where possible.	2	1	1	1	5	3	15	Site manager	Environmental noise monitoring.	Quarterly	R 90,000.00
Soils	Potential contamination of surrounding areas with coal dust	Neg	3	1	3	3	10	4	40	Y	A water cart will be used to spray when dust levels are high. Clean roads utilised for coal transportation. Trucks will be fitted with tarpaulins.	2	1	3	3	9	2	18	Environmental manager	Dust monitoring & inspect roads	Monthly	R 80,000.00 & operating costs
Traffic & safety	Increased potential for road incidences	Neg	3	1	4	5	13	2	26	Y	All intersections with main tarred roads will be clearly signposted. Drivers will be enforced to keep to set speed limits. Trucks will be in road-worthy condition with reflective strips.	3	1	1	5	10	1	10	Site manager	Inspect intersections and roads	Monthly	Running cost
Traffic & safety	Road degradation	Neg	3	2	4	3	12	2	24	Y	A fund will be set aside to maintain the serviceability of the road verge where the trucks approach or depart	3	2	1	3	9	1	9	Site manager	Inspect intersections	Monthly	Running cost

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
											from the main road.									and roads		
SUB ACTIVITY 3.3: Maintenance of the access and haul roads																						
Air quality	Dust generation	Neg	2	2	3	1	8	2	16	Y	A water cart will be used to spray relevant areas when dust levels are high.	2	1	1	1	5	2	10	Site & Environmental manager	Dust monitoring	Monthly	R 80,000.00
Noise	Increased noise levels	Neg	5	2	3	1	11	3	33	Y	Equipment will be regularly serviced to ensure acceptable noise levels are not exceeded. Silencers will be utilised where possible. Point sources will be enclosed where possible.	2	2	3	1	8	2	16	Site & Environmental manager	Environmental noise monitoring.	Quarterly	R 90,000.00
SUB ACTIVITY 3.4: Use and Maintenance of the weighbridges																						
Air quality	Dust generation	Neg	2	2	3	1	8	2	16	Y	A water cart will be used to spray relevant areas when dust levels are high.	2	1	1	1	5	2	10	Site & Environmental manager	Dust monitoring	Monthly	R 80,000.00
Noise	Increased noise levels	Neg	5	2	3	1	11	3	33	Y	Equipment will be regularly serviced to ensure acceptable noise levels are not exceeded. Silencers will be utilised where possible. Point sources will be enclosed where possible.	2	2	3	1	8	2	16	Site & Environmental manager	Environmental noise monitoring.	Quarterly	R 90,000.00
SUB ACTIVITY 3.5: Diesel storage																						
Groundwater	Potential hydrocarbon contamination leaching into the water table	Neg	4	2	4	3	13	3	39	Y	All hydrocarbons will be stored in concrete bunded areas fitted with taps and oil traps. Bunded areas will be to SABS standards, and bunded area will have adequate capacity to contain leaks.	3	2	3	3	11	1	11	Site & Environmental manager	Inspect bunded areas to ensure taps are closed and bunded areas are not flooded. Inspect integrity of bunding.	Weekly, after rainfalls and annually	Running cost

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
Soils	Potential hydrocarbon contamination to soils	Neg	3	1	4	3	11	3	33	Y	All hydrocarbons will be stored in concrete bunded areas fitted with taps and oil traps. Bunded areas will be to SABS standards, and bunded area will have adequate capacity to contain leaks.	2	1	3	3	9	2	18	Site & Environmental manager	Inspect bunded areas to ensure taps are closed and bunded areas are not flooded. Inspect integrity of bunding.	Weekly, after rainfalls & annually	Running cost
Surface water	Potential hydrocarbon contamination which may reach downstream surface water bodies	Neg	4	2	4	3	13	3	39	Y	All hydrocarbons will be stored in concrete bunded areas fitted with taps and oil traps. Bunded areas will be to SABS standards, and bunded area will have adequate capacity to contain leaks.	2	2	3	3	10	1	10	Site & Environmental manager	Inspect bunded areas to ensure taps are closed and bunded areas are not flooded. Inspect integrity of bunding.	Weekly, after rainfalls & annually	Running cost
Wetlands	Potential contaminated water runoff may reach downstream water bodies causing deterioration of ecological functioning of these systems should spills or leaks occur.	Neg	3	2	3	3	11	3	33	Y	All hydrocarbons will be stored in concrete bunded areas fitted with taps and oil traps. Bunded areas will be to SABS standards, and bunded area will have adequate capacity to contain leaks. Berms/trenches will be erected between active areas and natural areas to capture any potential dirty water runoff from active areas and divert this to PCD.	3	2	3	3	11	1	11	Site manager	Inspect bunded areas to ensure taps are closed and bunded areas are not flooded. Inspect integrity of bunding.	Monthly	Running cost
SUB ACTIVITY 3.6: Electricity generation through substations or generators during power failures																						
Fauna	Potential risk to avifauna	Neg	5	2	4	3	14	3	42	Y	Consider the use of bird flappers and balls on the power lines to reduce risk of birds colliding with power lines, especially if bird mortality is high in areas with power lines.	2	2	1	3	8	2	16	Environmental manager	Monitor any ecologically sensitive species should they be observed on site. Inspect power line areas for any	As and when required	Running cost

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
																				significant bird mortalities.		
Groundwater	Potential hydrocarbon contamination leaching into the water table should leaks occur	Neg	3	2	1	3	9	3	27	Y	Equipment will be regularly serviced to reduce risk of leaks. Generators will be kept in bunded areas erected per SABS standards. Any leakages will be reported and treated immediately in a reputable manner. For large spills Hazmat will called in.	2	2	1	3	8	2	16	Site & Environmental Manager	Inspect bunded areas to ensure taps are closed and bunded areas are not flooded. Inspect integrity of bunding.	Weekly, after rainfalls and annually	Running cost
Noise	Increased noise levels	Neg	3	2	3	1	9	4	36	Y	Point sources will be enclosed where possible. Screens will be considered if I&AP complaints are received.	1	2	3	1	7	2	14	Environmental manager	Environmental noise monitoring.	Quarterly	R 90,000.00
Soils	Potential hydrocarbon contamination to soils	Neg	3	1	1	3	8	3	24	Y	Equipment will be regularly serviced to reduce risk of leaks. Generators will be kept in bunded areas erected per SABS standards. Any leakages will be reported and treated immediately in a reputable manner. For large spills Hazmat will called in.	2	1	1	3	7	2	14	Site & Environmental Manager	Inspect bunded areas to ensure taps are closed and bunded areas are not flooded. Inspect integrity of bunding.	Weekly, after rainfalls and annually	Running cost
Social	Potential danger to surrounding communities	Neg	5	2	5	5	17	4	68	Y	Ensure all power lines and pylons are within specifications. Ensure that all power-related structures are adequately marked with relevant signs and warnings and fenced off with access control.	5	2	5	5	17	2	34	Environmental manager	Inspect areas: ensure fences are not damaged & no illegal connections have been added to lines	Monthly	Running cost
Surface water	Potential hydrocarbon contamination which may reach downstream surface water bodies	Neg	4	2	4	3	13	3	39	Y	Equipment will be regularly serviced to reduce risk of leaks. Generators will be kept in bunded areas erected per SABS standards. Any leakages will be reported and treated immediately in a reputable manner.	2	2	3	3	10	1	10	Site & Environmental Manager	Inspect bunded areas to ensure taps are closed and bunded areas are not flooded. Inspect	Weekly, after rainfalls and annually	Running cost

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
											For large spills Hazmat will called in.									integrity of bunding.		
Wetlands	Potential contaminated water runoff may reach downstream water bodies causing deterioration of ecological functioning of these systems should spills or leaks occur.	Neg	3	2	3	3	11	3	33	Y	Equipment will be regularly serviced to reduce risk of leaks. Generators will be kept in bunded areas erected per SABS standards. Any leakages will be reported and treated immediately in a reputable manner. For large spills Hazmat will called in. Berms/trenches will be erected between active areas and natural areas to capture any potential dirty water runoff from active areas and divert this to PCD.	3	2	3	3	11	1	11	Site manager	Inspect bunded areas to ensure taps are closed and bunded areas are not flooded. Inspect integrity of bunding.	Weekly, after rainfalls and annually	Running cost
SUB ACTIVITY 3.7: Use and maintenance of the laboratory, plant office and administration block																						
Groundwater	Potential contamination leaching into the water table	Neg	3	2	4	3	12	3	36	Y	All hazardous substances will be stored according to SABS standards. All containers and storage areas will be to SABS standards. Handling of substances will be done in accordance with the specifications for that particular substance.	2	2	3	3	10	2	20	Site & Environmental manager	Inspect containment facilities and check for leaks from any containers	Weekly	Running cost
Soils	Potential contamination to soils should chemicals spill or leak.	Neg	3	1	4	3	11	2	22	Y	All hazardous substances will be stored according to SABS standards. All containers and storage areas will be to SABS standards. Handling of substances will be done in accordance with the specifications for that particular substance.	2	1	3	3	9	1	9	Site & Environmental manager	Inspect containment facilities and check for leaks from any containers	Weekly	Running cost
Surface water	Potential chemical contamination which may reach downstream surface	Neg	4	2	4	3	13	2	26	Y	All hazardous substances will be stored according to SABS standards. All containers and storage areas will be to SABS standards. Handling of substances will be done in	2	2	3	3	10	1	10	Site & Environmental manager	Inspect containment facilities and check for leaks from any	Weekly	Running cost

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
	water bodies										accordance with the specifications for that particular substance.									containers		
Wetlands	Potential contaminated water runoff may reach downstream water bodies causing deterioration of ecological functioning of these systems should spills or leaks occur.	Neg	3	2	3	3	11	2	22	Y	All hazardous substances will be stored according to SABS standards. All containers and storage areas will be to SABS standards. Handling of substances will be done in accordance with the specifications for that particular substance.	3	2	3	3	11	1	11	Site manager	Inspect containment facilities and check for leaks from any containers	Weekly	Running cost
SUB ACTIVITY 3.8: Domestic and industrial waste generation and removal																						
Fauna	Potential harm through littering or hazardous substance poisoning	Neg	4	2	4	3	13	3	39	Y	Waste generated on site will be recycled as far as possible and sold/given to interested contractors. Recyclable waste will not be stored on site for excessive periods to reduced risk of environmental contamination. Refuse bins will be placed around site to collect all non-recyclable waste for disposal at the municipality.	2	1	1	3	7	2	14	Environmental manager	Monitor any ecologically sensitive species should they be observed on site	As and when required	Running cost
Groundwater	Potential contamination through littering and potential generation of poor quality leachate	Neg	3	2	4	3	12	3	36	Y	Waste generated on site will be recycled as far as possible and sold/given to interested contractors. Recyclable waste will not be stored on site for excessive periods to reduced risk of environmental contamination. Refuse bins will be placed around site to collect all non-recyclable waste for disposal at the municipality.	2	1	4	1	8	2	16	Environmental manager	Inspect area for illegal littering and dumping	Monthly	Running cost
Soils	Potential contamination through littering and potential	Neg	3	1	4	3	11	3	33	Y	Waste generated on site will be recycled as far as possible and sold/given to interested contractors.	2	1	4	3	10	2	20	Environmental manager	Inspect area for illegal littering and dumping	Monthly	Running cost

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
	generation of poor quality leachate										Recyclable waste will not be stored on site for excessive periods to reduced risk of environmental contamination. Refuse bins will be placed around site to collect all non-recyclable waste for disposal at the municipality.											
Surface water	Potential contamination through littering and potential generation of poor quality leachate	Neg	3	2	4	3	12	1	12	Y	Waste generated on site will be recycled as far as possible and sold/given to interested contractors. Recyclable waste will not be stored on site for excessive periods to reduced risk of environmental contamination. Refuse bins will be placed around site to collect all non-recyclable waste for disposal at the municipality.	2	2	4	1	9	1	9	Environmental manager	Inspect area for illegal littering and dumping	Monthly	Running cost
Visual Aspect	Loss of aesthetics	Neg	3	1	4	3	11	3	33	Y	Waste generated on site will be recycled as far as possible and sold/given to interested contractors. Recyclable waste will not be stored on site for excessive periods to reduced risk of environmental contamination. Refuse bins will be placed around site to collect all non-recyclable waste for disposal at the municipality.	2	1	4	3	10	2	20	Environmental manager	Inspect area for illegal littering and dumping	Monthly	Running cost
Wetlands	Potential contaminated water runoff may reach downstream water bodies causing deterioration of ecological functioning of these systems should spills or leaks occur.	Neg	3	2	3	3	11	1	11	Y	Waste generated on site will be recycled as far as possible and sold/given to interested contractors. Recyclable waste will not be stored on site for excessive periods to reduced risk of environmental contamination. Refuse bins will be placed around site to collect all non-recyclable waste for disposal at the municipality.	3	2	3	3	11	1	11	Site manager	Inspect area for illegal littering and dumping	Monthly	Running cost

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
SUB ACTIVITY 3.9: Servicing of machinery and vehicles at the workshop area & washing of equipment and vehicles at wash bay																						
Groundwater	Potential hydrocarbon contamination leaching into the water table	Neg	3	2	4	3	12	3	36	Y	Truck, machinery and equipment will be regularly serviced to reduce risk of leaks. Any leakages will be reported and treated as per the emergency response plan. For large spills Hazmat will called in. Wash bays and workshops will have oil traps fitted to capture any hydrocarbon runoff.	2	1	1	3	7	2	14	Site & Environmental manager	Ensure service plans are maintained. Groundwater monitoring.	Every 6 months & Quarterly	Contractors cost & R 200,000.00
Groundwater	Irresponsible use of water during mining activities will impact on groundwater quantity	Neg	2	2	5	1	10	2	20	Y	Saving water initiatives will be included in environmental awareness training. Utilise water on site responsibly. Ensure all pipelines and water containment facilities are adequately sealed to prevent leaks. Record all water usage on site.	2	2	3	1	8	2	16	Environmental manager	Inspect all water facilities for leaks & groundwater monitoring	Weekly & Quarterly	Part of running cost & R 200,000.00
Noise	Increased noise levels	Neg	3	2	4	1	10	2	20	Y	Trucks, machinery and equipment will be regularly serviced to ensure acceptable noise levels are not exceeded. Silencers will be utilised where possible. Point sources will be enclosed where possible. Screens will be considered if I&AP complaints are received.	2	1	1	1	5	3	15	Site manager	Environmental noise monitoring.	Quarterly	R 90,000.00
Soils	Potential hydrocarbon contamination to soils	Neg	3	1	4	3	11	3	33	Y	Truck, machinery and equipment will be regularly serviced to reduce risk of leaks. Any leakages will be reported and treated as per the emergency response plan. For large spills Hazmat will be called in. Wash bays and workshops will have oil traps fitted to capture any hydrocarbon runoff.	2	1	1	3	7	2	14	Site manager	Ensure service plans are maintained	Every 6 months	Contractors cost
Surface	Potential hydrocarbon contamination which	Neg	3	2	4	3	12	2	24	Y	Truck, machinery and equipment will be regularly serviced to reduce risk of	2	2	1	3	8	1	8	Site & Environmenta	Ensure service plans are	Every 6 months &	Contractors cost & R

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
water	may reach downstream surface water bodies										leaks. Any leakages will be reported and treated as per the emergency response plan. For large spills Hazmat will called in. Wash bays and workshops will have oil traps fitted to capture any hydrocarbon runoff.								l manager	maintained & Surface water monitoring	Monthly	180,000.00
Surface water	Irresponsible use of water during mining activities will impact on surface water quantity	Neg	3	2	3	1	9	2	18	Y	Saving water initiatives will be included in environmental awareness training. Utilise water on site responsibly. Ensure all pipelines and water containment facilities are adequately sealed to prevent leaks. Record all water usage on site.	3	2	3	1	9	1	9	Environmental manager	Inspect all water facilities for leaks & groundwater monitoring	Weekly & Monthly	Running cost
Wetlands	Potential contaminated water runoff may reach downstream water bodies causing deterioration of ecological functioning of these systems should spills or leaks occur.	Neg	3	2	3	1	9	2	18	Y	Truck, machinery and equipment will be regularly serviced to reduce risk of leaks. Any leakages will be reported and treated as per the emergency response plan. For large spills Hazmat will be called in. Wash bays and workshops will have oil traps fitted to capture any hydrocarbon runoff.	3	2	3	3	11	1	11	Site manager	Monitor and manage PCD to ensure no spillages and adequate functioning of PCD. PCD must be operated at optimum capacity.	Monthly	Running cost
SUB ACTIVITY 3.10: Operation of floodlights at night																						
Fauna	Hindrance to nocturnal animals	Neg	3	2	4	3	12	3	36	Y	Ensure directional floodlights are utilised that focus light on the necessary areas and reduce light pollution to surrounding environment.	2	2	3	3	10	2	20	Environmental manager	Monitor any ecologically sensitive species should they be observed on site	As and when required	Running cost
Visual Aspect	Increased visibility of the site	Neg	4	2	4	1	11	3	33	Y	Ensure directional floodlights are utilised that focus light on the necessary areas and reduce light pollution to surrounding environment.	2	1	3	1	7	2	14	Site manager			

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SUB ACTIVITY 3.11: Management of the stockpiles (overburden, topsoil and subsoil)																						
Soils	Erosion and loss of soil	Neg	4	1	3	3	11	4	44	Y	Soil stockpiles will be managed and maintained as per the specifications of the pedologist. They will be well vegetated to reduce risk of erosion.	3	1	3	1	8	3	24	Environmental manager	Soil stockpiles will be inspected for erosion and vegetation cover	Monthly	Running costs
Surface water	Potential silt-loading of drainage lines and downstream water bodies	Neg	3	2	3	3	11	2	22	Y	Soil stockpiles will be managed and maintained as per the specifications of the pedologist. They will be well vegetated to reduce risk of erosion.	2	2	3	3	10	1	10	Environmental manager	Soil stockpiles will be inspected for erosion and vegetation cover & surface water monitoring	Monthly	R 180,000.00
Wetlands	Potential silt loading of water bodies will deteriorate ecological functioning of these systems.	Neg	3	2	3	3	11	2	22	Y	Soil stockpiles will be managed and maintained as per the specifications of the pedologist. They will be well vegetated to reduce risk of erosion.	3	2	3	3	11	1	11	Site manager	Soil stockpiles will be inspected for erosion and vegetation cover	Monthly	Running cost
SUB ACTIVITY 3.12: Utilisation of ablutions and sewage treatment																						
Groundwater	Irresponsible use of water will impact on groundwater quantity	Neg	4	2	4	1	11	3	33	Y	Saving water initiatives will be included in environmental awareness training. Fit potable water areas with meters to record water use.	3	2	2	1	8	2	16	Environmental manager	Inspect all potable water works for leaks. Monitor water use.	Weekly	Running cost
Groundwater	Potential harm through sewage leaks	Neg	4	2	4	1	11	3	33	Y	Portable toilets will be managed by reputable contractors and inspected for any potential leaks.	3	1	2	1	7	2	14	Environmental manager	Inspect toilets and related piping for leaks & Groundwater monitoring	Weekly & Quarterly	Part of running cost & R 200,000.00
Social	Potential nuisance due to odours	Neg	3	2	5	1	11	3	33	Y	Ensure reputable contractors are utilised for management of facilities.	2	2	5	1	10	3	30	Environmental manager	Monitor water quality and include bacterial monitoring	Monthly	R 20,000.00
Social	Potential biological	Neg	4	2	4	3	13	4	52	Y	Ensure all water containment	2	2	3	3	10	2	20	Environmenta	Monitor water	Monthly	R

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
	hazards										facilities are functioning adequately and no leaks in pipelines. Water will not be released into the surrounding environmental and will be contained on site and recycled.								l manager	quality and include bacterial monitoring		20,000.00
Soils	Potential harm through sewage leaks	Neg	3	1	4	3	11	3	33	Y	Portable toilets will be managed by reputable contractors and inspected daily for any potential leaks.	3	1	3	3	10	2	20	Environmental manager	Inspect toilets and related piping for leaks	Weekly	Contractors cost
Surface water	Potential harm through sewage leaks	Neg	3	2	4	1	10	2	20	Y	Portable toilets will be managed by reputable contractors and inspected for any potential leaks.	3	2	3	1	9	1	9	Environmental manager	Inspect toilets and related piping for leaks & Surface water monitoring	Weekly & Monthly	Contractors cost & R 180,000.00
Wetlands	Potential sewage water runoff may reach downstream water bodies, deteriorating ecological functioning of these systems.	Neg	3	2	3	3	11	2	22	Y	Portable toilets will be managed by reputable contractors and inspected for any potential leaks.	3	2	3	3	11	1	11	Site manager	Inspect toilets and related piping for leaks & Surface water monitoring	Weekly & Monthly	Contractors cost & R 180,000.00
SUB ACTIVITY 3.13: Access and security control																						
Social	Safety of any persons entering the area	Pos	4	1	3	1	9	5	45	N		3	2	2	1	8	2	16				
ACTIVITY 4: Water management activities																						
SUB ACTIVITY 4.1: Abstraction, storage and transfer of potable water from boreholes																						
Noise	Increased noise levels	Neg	2	1	3	1	7	2	14	Y	Equipment will be regularly serviced to ensure acceptable noise levels are not exceeded. Silencers will be utilised where possible. Point sources will be enclosed where possible. Screens will be considered if I&AP	1	1	3	1	6	1	6	Site manager	Environmental noise monitoring.	Quarterly	R 90,000.00

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											complaints are received.											
Groundwater	Reduction of local groundwater	Neg	3	2	4	1	10	5	50	Y	Utilise water on site responsibly. Ensure all pipelines and water containment facilities are adequately sealed to prevent leaks. Record water usage by attaching meters to all pumps.	2	2	3	1	8	3	24	Environmental manager	Monitor water usage. Inspect all water pipelines and water containment facilities for leaks & groundwater level monitoring.	Weekly & Quarterly	Part of running cost & R 200,000.00
Groundwater	Water wastage should leaks occur	Neg	2	2	3	1	8	4	32	Y	Utilise water on site responsibly. Ensure all pipelines and water containment facilities are adequately sealed to prevent leaks. Record water usage by attaching meters to all pumps.	2	2	3	1	8	3	24	Environmental manager	Inspect all water pipelines and water containment facilities for leaks & groundwater monitoring	Weekly & Quarterly	Part of running cost & R 200,000.00
SUB ACTIVITY 4.2: Abstraction, storage and transfer of water from the old Usutu underground workings																						
Noise	Increased noise levels	Neg	2	1	3	1	7	2	14	Y	Equipment will be regularly serviced to ensure acceptable noise levels are not exceeded. Silencers will be utilised where possible. Point sources will be enclosed where possible. Screens will be considered if I&AP complaints are received.	1	1	3	1	6	1	6	Site manager	Environmental noise monitoring.	Quarterly	R 90,000.00
Groundwater	Reduction of local groundwater	Neg	3	2	4	1	10	5	50	Y	Utilise water on site responsibly. Ensure all pipelines and water containment facilities are adequately sealed to prevent leaks. Record water usage by attaching meters to all pumps.	2	2	3	1	8	3	24	Environmental manager	Monitor water usage. Inspect all water pipelines and water containment facilities for leaks &	Weekly & Quarterly	Part of running cost & R 200,000.00

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
																				groundwater level monitoring.		
Groundwater	Water wastage should leaks occur	Neg	2	2	3	1	8	4	32	Y	Utilise water on site responsibly. Ensure all pipelines and water containment facilities are adequately sealed to prevent leaks. Record water usage by attaching meters to all pumps.	2	2	3	1	8	3	24	Environmental manager	Inspect all water pipelines and water containment facilities for leaks & groundwater monitoring	Weekly & Quarterly	Part of running cost & R 200,000.00
Groundwater	Potential infiltration of contaminated water into groundwater table if leaks occur	Neg	4	2	3	3	12	3	36	Y	Ensure all pipelines and water containment facilities are adequately sealed to prevent leaks. Record water usage by attaching meters to all pumps.	3	2	3	3	11	3	33	Environmental manager	Inspect all water pipelines and water containment facilities for leaks & groundwater monitoring	Weekly & Quarterly	Part of running cost & R 200,000.00
Soils	Potential contamination of soils if dirty water escapes into environment	Neg	4	2	1	3	10	3	30	Y	Ensure all pipelines and water containment facilities are adequately sealed to prevent leaks. Record water usage by attaching meters to all pumps.	4	2	1	3	10	2	20	Environmental manager	Inspect all water pipelines and water containment facilities for leaks	Weekly	Running cost
Surface water	Potential surface water contamination if leaks escape into the environment	Neg	3	2	3	3	11	2	22	Y	Ensure all pipelines and water containment facilities are adequately sealed to prevent leaks. Record water usage by attaching meters to all pumps.	2	2	3	3	10	1	10	Environmental manager	Inspect all water pipelines and water containment facilities for leaks & surface water monitoring	Weekly & Monthly	Running cost & R 180,000.00
Wetlands	Potential surface water contamination if leaks escape into the	Neg	3	2	3	3	11	2	22	Y	Ensure all pipelines and water containment facilities are adequately sealed to prevent leaks. Record	3	2	3	3	11	1	11	Site manager	Inspect all water pipelines and water	Weekly & Monthly	Contractors cost & R 180,000.00

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
	environment										water usage by attaching meters to all pumps.									containment facilities for leaks & surface water monitoring		
SUB ACTIVITY 4.3: Separation of clean and dirty water management																						
Flora	Wetland species may be affected if poor quality water runoff reach nearby wetland systems, affecting overall biodiversity	Neg	5	1	5	5	16	3	48	Y	Ensure berms/trenches are erected between active area and wetland areas to contain all dirty water runoff and divert to PCD. Clean out silt build up over dry season. Ensure adequate capacity in the PCD.	4	2	3	3	12	1	12	Environmental manager	Surface water monitoring & inspect water management facilities	Monthly & weekly	R 180,000.00
Groundwater	Ingression of poor quality, low pH leachate into water table should leaks occur	Neg	5	2	4	5	16	4	64	Y	Ensure water management facilities are operating adequately. Clean out silt build up over dry season. Test for integrity of lining and management structures	5	2	3	3	13	3	39	Environmental manager	Groundwater monitoring & inspection of water management features & inspect lining integrity	Quarterly & monthly & annually	R 200,000.00 & part of running cost
Soils	Erosion of diversion channels through intense storm water run-off in clean diversion trenches	Neg	3	2	4	3	12	5	60	Y	Management of speed versus velocity in all diversion channels and trenches. Installation of energy dissipaters if and when required.	1	1	4	3	9	2	18	Environmental manager	Inspect water management features	Weekly	Running cost
Soils	Containment of dirty water within dirty footprint area	Pos	4	1	3	1	9	5	45	N	-	4	1	3	1	9	5	45	Environmental manager	-	-	-
Soils	Potential contamination of soils if dirty water escapes into environment	Neg	3	2	1	3	9	3	27	Y	Ensure water management facilities are operating adequately and capacity is not compromised through silt build-up. Clean out silt build up over dry season.	4	2	1	3	10	2	20	Environmental manager	Inspect water management features	Weekly	Running cost

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
Surface water	Containment of dirty water within dirty footprint area	Pos	4	2	3	1	10	4	40	N	-	4	2	3	1	10	4	40	Environmental manager	Surface water monitoring	Monthly	R 180,000.00
Surface water	Potential surface water contamination if leaks escape into the environment	Neg	4	2	3	3	12	4	48	Y	Ensure water management facilities are operating adequately and capacity is not compromised through silt build-up. Clean out silt build up over dry season.	3	2	3	3	11	1	11	Environmental manager	Surface water monitoring	Monthly	R 180,000.00
Surface water	Potential silt-loading of drainage lines and downstream water bodies	Neg	3	2	3	3	11	2	22	Y	Ensure water management facilities are operating adequately and capacity is not compromised through silt build-up. Clean out silt build up over dry season.	2	2	3	3	10	1	10	Environmental manager	Surface water monitoring& inspect water management facilities	Monthly & weekly	R 180,000.00 & Running costs
Surface water	Downstream water quantity of catchment reduced	Neg	3	2	3	1	9	5	45	N	-	4	2	3	1	10	5	50	Environmental manager	Surface water monitoring	Monthly	R 180,000.00
Wetlands	Potential contaminated water runoff may reach downstream water bodies causing deterioration of ecological functioning of these systems should spills or leaks occur.	Neg	5	2	3	5	15	3	45	Y	Ensure berms/trenches are erected between active area and wetland areas to contain all dirty water runoff and divert to PCD. Clean out silt build up over dry season. Ensure adequate capacity in the PCD.	4	2	3	3	12	3	36	Site manager	Surface water monitoring & inspect water management facilities	Monthly & weekly	R 180,000.00 & running costs
SUB ACTIVITY 4.4: Operation and maintenance of pollution control dam																						
Flora	Wetland species may be affected if poor quality water runoff reach nearby wetland systems, affecting overall biodiversity	Neg	4	1	5	3	13	3	39	Y	Ensure berms/trenches are erected between active area and wetland areas to contain all dirty water runoff and divert to PCD. Clean out silt build up over dry season. Ensure adequate capacity in the PCD.	4	2	3	3	12	1	12	Environmental manager	Surface water monitoring & inspect water management facilities	Monthly & weekly	R 180,000.00 & running costs
Groundwate	Ingression of poor	Neg	5	2	4	5	16	4	64	Y	Ensure water management facilities	5	2	3	3	13	3	39	Environmenta	Groundwater	Quarterly &	R

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
r	quality, low pH leachate into water table should leaks occur										are operating adequately. Clean out silt build up over dry season. Test for integrity of lining and management structures								l manager	monitoring & inspection of water management features & inspect lining integrity	monthly & annually	200,000.00 & part of running cost
Soils	Containment of dirty water within dirty footprint area	Pos	4	1	3	1	9	5	45	N	-	4	1	3	1	9	5	45	Environmental manager	-	-	-
Soils	Potential contamination of soils if dirty water escapes into environment	Neg	3	2	1	3	9	3	27	Y	Ensure water management facilities are operating adequately and capacity is not compromised through silt build-up. Clean out silt build up over dry season.	4	2	1	3	10	2	20	Environmental manager	Inspect water management features	Weekly	Running cost
Surface water	Containment of dirty water within dirty footprint area	Pos	4	2	3	1	10	4	40	N	-	4	2	3	1	10	4	40	Environmental manager	Surface water monitoring	Monthly	R 180,000.00
Surface water	Potential surface water contamination if leaks escape into the environment	Neg	4	2	3	3	12	4	48	Y	Ensure water management facilities are operating adequately and capacity is not compromised through silt build-up. Clean out silt build up over dry season.	3	2	3	3	11	1	11	Environmental manager	Surface water monitoring	Monthly	R 180,000.00
Surface water	Potential silt-loading of drainage lines and downstream water bodies	Neg	3	2	3	3	11	2	22	Y	Ensure water management facilities are operating adequately and capacity is not compromised through silt build-up. Clean out silt build up over dry season.	2	2	3	3	10	1	10	Environmental manager	Surface water monitoring	Monthly	R 180,000.00
Surface water	Downstream water quantity of catchment reduced	Neg	3	2	3	1	9	5	45	N	-	3	2	3	1	9	5	45	Environmental manager	Surface water monitoring	Monthly	R 180,000.00
Wetlands	Potential contaminated water runoff may reach	Neg	4	2	3	3	12	2	24	Y	Ensure berms/trenches are erected between active area and wetland	3	2	3	3	11	2	22	Site manager	Surface water monitoring &	Monthly & weekly	R 180,000.00

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
	downstream water bodies causing deterioration of ecological functioning of these systems should spills or leaks occur.										areas to contain all dirty water runoff and divert to PCD. Clean out silt build up over dry season. Ensure adequate capacity in the PCD.									inspect water management facilities		& running costs
SUB ACTIVITY 4.5: Maintenance of pipelines and pumps																						
Groundwater	Potential infiltration of contaminated water into groundwater table if leaks occur	Neg	4	2	4	3	12	5	65	Y	Ensure all pipelines and water containment facilities are adequately sealed to prevent leaks. Record water usage by attaching meters to all pumps.	4	2	3	3	12	3	36	Environmental manager	Groundwater monitoring. Inspect lining of containment facilities.	Quarterly & annually	R 200,000.00 & part of running cost
Noise	Increased noise levels	Neg	1	1	3	1	6	5	30	Y	Equipment will be regularly serviced to ensure acceptable noise levels are not exceeded. Silencers will be utilised where possible. Point sources will be enclosed where possible.	1	1	3	1	6	3	18	Environmental manager	Environmental noise monitoring.	Quarterly	R 90,000.00
Soils	Potential contamination of soils if dirty water escapes into environment	Neg	4	2	1	3	10	3	30	Y	Ensure all pipelines and water containment facilities are adequately sealed to prevent leaks. Record water usage by attaching meters to all pumps.	4	2	1	3	10	2	20	Environmental manager	Inspect water management features	Weekly	Running cost
Surface water	Potential surface water contamination if leaks escape into the environment	Neg	3	2	3	3	11	2	22	Y	Ensure all pipelines and water containment facilities are adequately sealed to prevent leaks. Record water usage by attaching meters to all pumps.	2	2	3	3	10	1	10	Environmental manager	Surface water monitoring. Test integrity of water management structures.	Monthly & in the dry season	R 180,000.00 & running costs
Wetlands	Potential contaminated water runoff may reach downstream water bodies causing deterioration of ecological functioning	Neg	4	2	3	3	12	2	24	Y	Ensure all pipelines and water containment facilities are adequately sealed to prevent leaks. Record water usage by attaching meters to all pumps.	3	2	3	3	11	2	22	Site manager	Surface water monitoring & inspect water management facilities	Monthly & weekly	R 180,000.00 & running costs

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
	of these systems should spills or leaks occur.																					
ACTIVITY 5: Environmental Monitoring (dust, surface water and groundwater)																						
Air quality	Improved response to issues relating to dust generation	Pos	3	1	5	1	10	4	40	Y	Target thresholds as per regulations must be maintained and action plans devised around areas where targets are exceeded	3	1	5	1	10	4	40	Environmental manager	Dust monitoring	Monthly	R 80,000.00
Groundwater	Improved response to issues relating to deterioration of groundwater quality or quantity	Pos	3	2	5	1	11	3	33	Y	Specialists must be consulted if issues with groundwater are observed and qualities do not fall within DWA target qualities or water qualities for livestock watering. Any affected registered water users must be compensated if levels and quality are impacted by the mining activities.	2	2	5	1	10	5	50	Environmental manager	Groundwater monitoring	Quarterly	R 200,000.00
Surface water	Improved response to issues relating to deterioration of surface water quality	Pos	2	2	3	1	8	5	40	Y	Specialists must be consulted if issues with surface water are observed and qualities do not fall within DWA target qualities or water qualities for livestock watering. Any affected registered water users must be compensated if levels and quality are impacted by the mining activities.	2	2	3	1	8	5	40	Environmental manager	Surface water monitoring	Monthly	R 180,000.00
ACTIVITY 6: General activities																						
Fauna	Alienation of animals from the area	Neg	2	2	3	3	10	4	40	Y	Inform staff, contractors and visitors to not harm fauna in the area.	1	1	1	3	6	3	18	Environmental manager	Monitor any ecologically sensitive species should they be observed on site	As and when required	Running cost
Flora	Alien invasive encroachment	Neg	4	2	3	3	12	4	48	Y	Eradicate and control all alien invasive species on site. Rehabilitate	3	2	3	3	11	3	33	Environmental manager	Establish alien invasive	Every 6 months	Running cost

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
											and re-vegetate all areas where alien invasive species were removed.									monitoring programme	depending on species	
Flora	Potential damage to vegetation in neighbouring areas	Neg	3	1	1	3	8	3	24	Y	Limit activity to area of disturbance and re-vegetate impacted areas as soon as possible.	1	1	1	3	6	2	12	Environmental manager	Inspect area for damage to flora species.	Monthly	Running cost
Social	Potential for more employment	Pos	4	2	3	1	10	5	50	Y	Labourers will initially be sought locally and only regionally if skills are not available. Employ as per SLP.	4	2	3	1	10	5	50	Social Manager	Ensure employment is in line with SLP initiatives	As required	Running cost
Social	Multiplier effect - improved livelihoods	Pos	4	2	3	1	10	5	50	N		4	2	3	1	10	5	50	Social Manager			
Social	Influx of unsuccessful job seekers which may informally settle in area	Neg	4	3	5	3	15	5	75	Y	Ensure advertising is limited to local and regional areas, and only specifically advertise for Jobs nationally if skills are not available. Employ as per SLP.	3	2	5	3	13	3	39	Social Manager	Ensure employment is in line with SLP initiatives	As required	Running cost
Visual aspect	Deterioration in visual aesthetics of the area	Neg	3	1	3	1	8	5	40	Y	Consider use of screens if I&AP complaints are received	1	1	3	1	6	3	18	Environmental manager			

7.3 Decommissioning Phase

During decommissioning all infrastructures no longer required will be demolished and the area rehabilitated. The mine will be sealed and the boxcut will be filled and rehabilitated. The road, if no longer required by the land owner, will be demolished and rehabilitated. The PCD will remain on site to monitor for residual impacts and environmental monitoring will continue into the closure phase.

Table 72 lists the impacts on various environmental aspects based on activities proposed during the decommissioning phase. Impacts of high, moderate to high and moderate significance are further discussed below.

7.3.1 Impacts of high significance

Impacts of high significance are centred on groundwater quality. As the mine fills with water it is highly likely that a contamination plume will develop from the mine area into surrounding areas, should the mine fill with water quickly, the conditions for creating acidic water will be reduced and water quality will be less impaired. With the development of the plume, surrounding land owners' boreholes may be impacted, although this has a very low likelihood unless newer boreholes are drilled in the area. No mitigation measures can be put in place; however affected users must be compensated.

Should the co-disposal facility not be adequately rehabilitated and properly capped a contamination plume will develop in the aquifer that will reach the Witpunt Spruit tributary. The impact is considered to be of high significance.

7.3.2 Impacts of moderate to high significance

The only impact of moderate to high significance will be the social impacts associated with job losses that will accompany the decommissioning of the mine. Mitigation measures need to be put in place and Social and Labour Plan (SLP) initiatives followed throughout the life of mine to ensure relevant training is received by staff so that they can enter other occupations. Staff will be utilised at other operations as far as is practical.

7.3.3 Impacts of Moderate significance

As the coal stockpiles are removed from site, and the overburden stockpiles are mobilised for filling of the boxcut, air quality will be impaired, especially if these activities take place during the dry season. The impact is of moderate significance as these activities will be of short-term duration.

Various rehabilitation activities will result in the mobilisation of soils and increase risk of silt loading into the wetlands. This will impact negatively on these systems and deteriorate ecological functioning of these systems, especially where rehabilitation activities will take place in close proximity to the wetlands. According to the groundwater study, with proper sealing and rehabilitation of shafts and exploration boreholes, the likelihood of decant is negligible. Should decant occur, it is highly likely that this will also run into wetlands associated with drainage lines and surrounding tributaries. The PCD and associated berms and trenches will remain on site to capture water runoff and monitor for any potential residual impacts. Should water within these systems be of inadequate quality and spills or leaks occur, then it is also highly likely that this contaminated water will flow into the wetlands and deteriorate ecological functioning and biodiversity. These impacts are of moderate significance and mitigation measures will be needed.

Finally, with the temporary increased activity on site, the risk for the establishment and spread of alien invasive species will increase and result in a negative impact to flora in the area. Mitigation and management needs to be implemented during construction and carried on through the life of mine so as to reduce risks associated with establishment of such species.

7.4 Closure and Post Closure Phases

Residual impacts above will continue into post closure phases. During closure and post-closure phases, the main activities will be monitoring and maintenance. No further impacts are expected and impacts associated with maintenance and addressing any issues observed on site are expected to be positive. Table 73 addresses activities of relevance during closure.

Any residual impacts, particularly those discussed in the decommissioning phase regarding groundwater will be monitored and specialist advice will be obtained should any issues arise.

Table 72: Decommissioning Phase Activities and aspects which will be impacted on through those activities

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
ACTIVITY 1: Dismantling of infrastructure																						
SUB ACTIVITY 1.1: Increased vehicle activity																						
Air quality	Dust generation	Neg	3	2	1	1	7	5	35	Y	A water cart will be used to spray relevant areas when dust levels are high.	2	1	1	1	5	3	15	Environmental manager	Dust monitoring	Monthly	R 80,000.00
Air quality	Dust generation	Neg	3	2	1	1	7	5	35	Y	Speed limits will be established on the dirt road to minimise dust generation.	1	1	1	1	4	3	12	Site manager	Speed trapping	Sporadically	Running cost
Air quality	Nuisance Emissions	Neg	2	2	1	1	6	4	24	Y	Vehicles, machinery and equipment will be regularly serviced to ensure they are in proper working condition and to reduce risk of excessive emissions.	1	1	1	1	4	3	12	Site manager	Ensure service plans are maintained	Every 6 months	Contractors cost
Groundwater	Potential hydrocarbon contamination leaching into the water table	Neg	3	2	1	3	9	3	27	Y	Trucks, machinery and equipment will be regularly serviced to reduce risk of leaks. Any leakages will be reported and treated as per the emergency response plan. For large spills Hazmat will called in.	2	1	1	3	7	2	14	Site & Environmental manager	Ensure service plans are maintained. Groundwater monitoring.	Every 6 months & Quarterly	Contractors cost & R 200,000.00
Noise	Increased noise levels	Neg	3	2	1	1	7	4	28	Y	Trucks, machinery and equipment will be regularly serviced to ensure acceptable noise levels are not exceeded. Silencers will be utilised where possible.	2	1	1	1	5	3	15	Site manager	Environmental noise monitoring.	Quarterly	R 90,000.00
Soils	Potential compaction of soils in neighbouring areas	Neg	3	1	1	3	8	3	24	Y	Activity will be limited to area of disturbance. Where required the compacted soils	2	1	1	3	7	2	14	Environmental manager	Inspect area for erosion and soil compaction	Monthly	Running cost

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
											will be disked to an adequate depth and re-vegetated with indigenous plants.											
Soils	Potential hydrocarbon contamination to soils	Neg	3	1	1	3	8	3	24	Y	Trucks, machinery and equipment will be regularly serviced to reduce risk of leaks. Any leakages will be reported and treated as per the emergency response plan. For large spills Hazmat will called in.	2	1	1	3	7	2	14	Site manager	Ensure service plans are maintained	Every 6 months	Contractors cost
Surface water	Potential hydrocarbon contamination which may reach downstream surface water bodies	Neg	3	2	1	3	9	1	9	Y	Trucks, machinery and equipment will be regularly serviced to reduce risk of leaks. Any leakages will be reported and treated as per the emergency response plan. For large spills Hazmat will called in.	2	2	1	3	8	1	8	Site & Environmental manager	Ensure service plans are maintained & Surface water monitoring	Every 6 months & Monthly	Contractors cost & R 180,000.00
Traffic & safety	Increased potential for road incidences	Neg	3	1	1	5	10	2	20	Y	All intersections with main tarred roads will be clearly signposted. Drivers will be enforced to keep to set speed limits. Trucks will be in road-worthy condition with reflective strips.	3	1	1	5	10	1	10	Site manager	Inspect intersections and roads	Monthly	Running cost
Traffic & safety	Road degradation	Neg	3	2	1	3	9	2	18	Y	A fund will be set aside to maintain the serviceability of the road verge where the trucks approach or depart from the main road.	3	2	1	3	9	1	9	Site manager	Inspect intersections and roads	Monthly	Running cost
Wetlands	Potential contaminated water runoff may reach downstream water bodies causing deterioration of	Neg	4	2	3	3	12	3	36	Y	Trucks, machinery and equipment will be regularly serviced to reduce risk of leaks. Any leakages will be	3	2	3	3	11	2	22	Environmental manager	Surface water monitoring	Monthly	R 180,000.00

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
	ecological functioning of these systems should spills or leaks occur.										reported and treated as per the emergency response plan. For large spills Hazmat will called in.											
SUB ACTIVITY 1.2: Removal of all surface / mining infrastructure not being use																						
Air quality	Dust generation	Neg	3	2	1	1	7	5	35	Y	A water cart will be used to spray relevant areas when dust levels are high.	2	1	1	1	5	3	15	Environmental manager	Dust monitoring	Monthly	R 80,000.00
Noise	Increased noise levels	Neg	3	2	1	1	7	5	35	N		3	2	1	1	7	5	35	Environmental manager	Environmental noise monitoring.	Quarterly	R 90,000.00
Visual Aspect	Altered aesthetics	Pos	3	2	3	3	11	5	55	N		3	2	3	3	11	5	55	Environmental manager			
SUB ACTIVITY 1.3: Final removal of coal product																						
Air quality	Dust generation	Neg	4	2	2	1	9	5	45	Y	A water cart will be used to spray relevant areas when dust levels are high.	2	2	1	1	6	3	18	Environmental manager	Dust monitoring	Monthly	R 80,000.00
Noise	Increased noise levels	Neg	2	2	1	1	6	5	30	Y	Trucks, machinery and equipment will be regularly serviced to ensure acceptable noise levels are not exceeded. Silencers will be utilised where possible.	2	2	1	1	6	4	24	Environmental manager	Environmental noise monitoring.	Quarterly	R 90,000.00
Topography	Eradication of stockpiles	Pos	3	1	3	3	10	4	40	N		3	1	3	3	10	4	40	Environmental manager			
Visual Aspect	Improved aesthetics through removal of stockpiles	Pos	3	1	5	1	10	2	20	N		3	1	5	1	10	2	20	Environmental manager			
SUB ACTIVITY 1.4: Final rehabilitation of roads no longer required																						

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
Air quality	Dust generation	Neg	4	2	2	1	9	4	36	Y	A water cart will be used to spray relevant areas when dust levels are high.	2	2	1	1	6	3	18	Environmental manager	Dust monitoring	Monthly	R 80,000.00
Noise	Increased noise levels	Neg	2	2	1	1	6	5	30	Y	Trucks, machinery and equipment will be regularly serviced to ensure acceptable noise levels are not exceeded. Silencers will be utilised where possible.	2	2	1	1	6	3	18	Environmental manager	Environmental noise monitoring.	Quarterly	R 90,000.00
Soils	Soils replaced and ameliorated	Pos	3	1	2	3	9	4	36	Y	Ensure soils are replaced to an adequate depth and ensure soil quality is adequate.	4	1	2	3	10	4	40	Environmental manager	Soil survey and soil quality and depth monitoring	Annually	R 45,000.00
Surface water	Re-vegetation of rehabilitated areas reduces risk of silt loading on downstream water bodies	Pos	2	2	2	3	9	2	18	Y	Monitor area for erosion and pooling and rehabilitate if necessary. Continue with Surface water monitoring.	3	2	2	3	10	2	20	Environmental manager	Inspect area for erosion and pooling. Surface water monitoring.	After rain & monthly	Rehab cost & R 180,000.00
Topography	Re-contouring of area for free surface water drainage	Pos	2	1	2	3	8	4	32	Y	Monitor, especially after first heavy rain falls to ensure adequate surface water drainage.	2	1	2	3	8	4	32	Environmental manager	Inspect area for erosion and pooling.	After rain.	Running cost
Visual Aspect	Improved aesthetics through rehabilitation	Pos	2	1	2	3	8	4	32	N		2	1	2	3	8	4	32	Environmental manager			
Wetlands	Potential contaminated/silt-loaded water runoff may reach downstream water bodies causing deterioration of ecological functioning of these systems should spills or leaks occur.	Neg	4	2	3	3	12	4	48	Y	Monitor area for erosion and pooling and rehabilitate if necessary. Erect temporary berm between area of activity and wetland areas to protect the wetland areas. Continue with Surface water monitoring.	3	2	3	3	11	2	22	Environmental manager	Surface water monitoring	Monthly	R 180,000.00
SUB ACTIVITY 1.5: Disposal of contaminated surface material onto the co-disposal facility																						

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
Air quality	Dust generation	Neg	4	2	2	1	9	4	36	Y	A water cart will be used to spray relevant areas when dust levels are high.	2	2	1	1	6	3	18	Environmental manager	Dust monitoring	Monthly	R 80,000.00
Noise	Increased noise levels	Neg	3	2	1	1	7	5	35	Y	Trucks, machinery and equipment will be regularly serviced to ensure acceptable noise levels are not exceeded. Silencers will be utilised where possible.	2	2	1	1	6	3	18	Environmental manager	Environmental noise monitoring.	Quarterly	R 90,000.00
SUB ACTIVITY 1.6: Ripping/discing of all levelled areas																						
Fauna	Reintroduction of flora to the area	Pos	1	1	2	3	7	2	14	N		1	1	2	3	7	2	14	Environmental manager	Monitor vegetation cover	Monthly	Rehab cost
Flora	Reintroduction of vegetation in rehabilitated areas	Pos	3	1	2	1	7	4	28	Y	Rehabilitate disturbed areas with natural indigenous flora. Monitor for cover abundance.	4	1	2	1	8	4	32	Environmental manager	Floral surveys need to be conducted to monitor cover abundance, plant succession and community structure	Annually	R 80,000.00
Soils	Soils replaced and ameliorated	Pos	3	1	2	3	9	4	36	Y	Ensure soils are replaced to an adequate depth and ensure soil quality is adequate.	4	1	2	3	10	4	40	Environmental manager	Soil survey and soil quality and depth monitoring	Annually	R 45,000.00
Surface water	Re-vegetation of areas mined out reduces risk of silt loading on downstream water bodies	Pos	2	2	2	3	9	2	18	Y	Monitor area for erosion and pooling and rehabilitate if necessary. Continue with Surface water monitoring.	3	2	2	3	10	2	20	Environmental manager	Inspect area for erosion and pooling. Surface water monitoring.	After rain & monthly	Rehab cost & R 180,000.00
Topography	Re-contouring of area for free surface water	Pos	2	1	2	3	8	4	32	Y	Monitor, especially after first heavy rain falls to ensure	2	1	2	3	8	4	32	Environmental manager	Inspect area for erosion and	After rain.	Running cost

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
	drainage										adequate surface water drainage.									pooling.		
Visual Aspect	Improved aesthetics through rehabilitation	Pos	2	1	2	3	8	4	32	N		2	1	2	3	8	4	32	Environmental manager			
SUB ACTIVITY 1.7: Cladding of the co-disposal dump																						
Air quality	Dust generation	Neg	4	2	2	1	9	4	36	Y	A water cart will be used to spray relevant areas when dust levels are high.	2	2	1	1	6	3	18	Environmental manager	Dust monitoring	Monthly	R 80,000.00
Noise	Increased noise levels	Neg	2	2	1	1	6	5	30	Y	Silencers will be utilised where possible. Point sources will be enclosed where possible. Screens will be considered if I&AP complaints are received.	2	2	1	1	6	3	18	Environmental manager	Environmental noise monitoring.	Quarterly	R 90,000.00
Visual Aspect	Altered aesthetics	Pos	1	2	3	3	9	3	27	N		1	2	3	3	9	3	27	Environmental manager			
SUB ACTIVITY 1.8: Rehabilitation																						
Flora	Reintroduction of vegetation in rehabilitated areas	Pos	3	1	4	1	9	5	45	Y	Rehabilitate disturbed areas with natural indigenous flora. Monitor for cover abundance.	3	1	4	1	9	5	45	Environmental manager	Floral surveys need to be conducted to monitor cover abundance, plant succession and community structure	Annually	R 80,000.00
Fauna	Reintroduction of flora to the area	Pos	3	1	2	3	9	2	18	N		3	1	2	3	9	2	18	Environmental manager	Monitor vegetation cover	Monthly	Rehab cost
Groundwater	Potential for contamination reduced	Pos	2	2	3	1	8	3	24	N		2	2	3	1	8	3	24				

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
Soils	Soils replaced and ameliorated	Pos	3	1	2	3	9	5	45	Y	Ensure soils are replaced to an adequate depth and ensure soil quality is adequate.	3	1	2	3	9	5	45	Environmental manager	Soil survey and soil quality and depth monitoring	Annually	R 45,000.00
Surface water	Re-vegetation of areas mined out reduces risk of silt loading on downstream water bodies	Pos	2	2	2	3	9	3	27	Y	Monitor area for erosion and pooling and rehabilitate if necessary. Continue with Surface water monitoring.	2	2	2	3	9	3	27	Environmental manager	Inspect area for erosion and pooling. Surface water monitoring.	After rain & monthly	Rehab cost & R 180,000.00
Visual Aspect	Improved aesthetics through rehabilitation	Pos	4	1	5	3	13	4	52	N		4	1	5	3	13	4	52	Environmental manager			
ACTIVITY 2: Sealing of mine access and filling/profiling of boxcut																						
SUB ACTIVITY 2.1: Truck activity and operation of machinery																						
Air quality	Dust generation	Neg	3	2	1	1	7	5	35	Y	A water cart will be used to spray relevant areas when dust levels are high.	2	1	1	1	5	3	15	Environmental manager	Dust monitoring	Monthly	R 80,000.00
Air quality	Dust generation	Neg	3	2	1	1	7	5	35	Y	Speed limits will be established on the dirt road to minimise dust generation.	1	1	1	1	4	3	12	Site manager	Speed trapping	Sporadically	Running cost
Air quality	Nuisance Emissions	Neg	2	2	1	1	6	4	24	Y	Vehicles, machinery and equipment will be regularly serviced to ensure they are in proper working condition and to reduce risk of excessive emissions.	1	1	1	1	4	3	12	Site manager	Ensure service plans are maintained	Every 6 months	Contractors cost
Groundwater	Potential hydrocarbon contamination leaching into the water table	Neg	3	2	1	3	9	3	27	Y	Trucks, machinery and equipment will be regularly serviced to reduce risk of leaks. Any leakages will be reported and treated as per the emergency response plan. For large spills Hazmat will	2	1	1	3	7	2	14	Site & Environmental manager	Ensure service plans are maintained. Groundwater monitoring.	Every 6 months & Quarterly	Contractors cost & R 200,000.00

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
											called in.											
Noise	Increased noise levels	Neg	3	2	1	1	7	4	28	Y	Trucks, machinery and equipment will be regularly serviced to ensure acceptable noise levels are not exceeded. Silencers will be utilised where possible.	2	1	1	1	5	3	15	Site manager	Environmental noise monitoring.	Quarterly	R 90,000.00
Soils	Potential compaction of soils in neighbouring areas	Neg	3	1	1	3	8	3	24	Y	Activity will be limited to area of disturbance. Where required the compacted soils will be disked to an adequate depth and re-vegetated with indigenous plants.	2	1	1	3	7	2	14	Environmental manager	Inspect area for erosion and soil compaction	Monthly	Running cost
Soils	Potential hydrocarbon contamination to soils	Neg	3	1	1	3	8	3	24	Y	Trucks, machinery and equipment will be regularly serviced to reduce risk of leaks. Any leakages will be reported and treated as per the emergency response plan. For large spills Hazmat will called in.	2	1	1	3	7	2	14	Site manager	Ensure service plans are maintained	Every 6 months	Contractors cost
Surface water	Potential hydrocarbon contamination which may reach downstream surface water bodies	Neg	3	2	1	3	9	1	9	Y	Trucks, machinery and equipment will be regularly serviced to reduce risk of leaks. Any leakages will be reported and treated as per the emergency response plan. For large spills Hazmat will called in.	2	2	1	3	8	1	8	Site & Environmental manager	Ensure service plans are maintained & Surface water monitoring	Every 6 months & Monthly	Contractors cost & R 180,000.00
Traffic & safety	Increased potential for road incidences	Neg	3	1	1	5	10	2	20	Y	All intersections with main tarred roads will be clearly signposted. Drivers will be enforced to keep to set speed limits. Trucks will be in road-worthy condition with reflective	3	1	1	5	10	1	10	Site manager	Inspect intersections and roads	Monthly	Running cost

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
											strips.											
Traffic & safety	Road degradation	Neg	3	2	1	3	9	2	18	Y	A fund will be set aside to maintain the serviceability of the road verge where the trucks approach or depart from the main road.	3	2	1	3	9	1	9	Site manager	Inspect intersections and roads	Monthly	Running cost
Wetlands	Potential contaminated water runoff may reach downstream water bodies causing deterioration of ecological functioning of these systems should spills or leaks occur.	Neg	4	2	3	3	12	3	36	Y	Trucks, machinery and equipment will be regularly serviced to reduce risk of leaks. Any leakages will be reported and treated as per the emergency response plan. For large spills Hazmat will called in.	3	2	3	3	11	2	22	Environmental manager	Surface water monitoring	Monthly	R 180,000.00
SUB ACTIVITY 2.2: Sealing of underground workings																						
Groundwater	Rebound of groundwater levels	Pos	3	2	3	3	11	3	33	N		3	2	3	3	11	3	33	Environmental manager	Groundwater monitoring	Quarterly	R 200,000.00
Groundwater	Potential contamination plume from mining areas	Neg	5	2	5	5	17	5	85	N	No mitigation. Ensure registered affected water users are compensated in some way, either with alternative water supply or monetary equivalent.	5	2	5	5	17	5	85	Environmental manager	Groundwater monitoring	Quarterly	R 200,000.00
Surface water	Potential contamination plume from mining areas surfaces into surface water areas	Neg	5	2	3	3	13	3	39	N		3	2	3	1	9	3	27	Environmental manager	Surface water monitoring	Monthly	R 180,000.00
Wetlands	Potential decant into wetland areas	Neg	5	2	3	5	15	3	45	Y	Proper sealing and rehabilitation of shafts and exploration boreholes will prevent the establishment of decant points.	3	2	3	3	11	2	22	Environmental manager	Surface water monitoring	Monthly	R 180,000.00

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
SUB ACTIVITY 2.3: Mobilisation of overburden and subsoils																						
Air quality	Dust generation	Neg	4	2	2	1	9	5	45	Y	A water cart will be used to spray relevant areas when dust levels are high.	2	2	1	1	6	3	18	Environmental manager	Dust monitoring	Monthly	R 80,000.00
Noise	Increased noise levels	Neg	2	2	1	1	6	5	30	Y	Trucks, machinery and equipment will be regularly serviced to ensure acceptable noise levels are not exceeded. Silencers will be utilised where possible.	2	2	1	1	6	4	24	Environmental manager	Environmental noise monitoring.	Quarterly	R 90,000.00
Topography	Eradication of stockpiles	Pos	3	1	3	3	10	4	40	N		3	1	3	3	10	4	40	Environmental manager			
Visual Aspect	Improved aesthetics through removal of stockpiles	Pos	3	1	1	1	6	5	30	N		3	1	1	1	6	5	30	Environmental manager			
SUB ACTIVITY 2.4: Filling of voids																						
Air quality	Dust generation	Neg	4	2	2	1	9	5	45	Y	A water cart will be used to spray relevant areas when dust levels are high.	2	2	1	1	6	3	18	Environmental manager	Dust monitoring	Monthly	R 80,000.00
Noise	Increased noise levels	Neg	2	2	1	1	6	5	30	Y	Trucks, machinery and equipment will be regularly serviced to ensure acceptable noise levels are not exceeded. Silencers will be utilised where possible.	2	2	1	1	6	4	24	Environmental manager	Environmental noise monitoring.	Quarterly	R 90,000.00
Topography	Eradication of voids	Pos	3	1	3	3	10	4	40	N		3	1	3	3	10	4	40	Environmental manager			
Visual Aspect	Improved aesthetics through rehabilitation	Pos	3	1	1	1	6	5	30	N		3	1	1	1	6	5	30	Environmental manager			
ACTIVITY 3: Rehabilitation of all surface areas																						

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
SUB ACTIVITY 3.1: Removal of all waste																						
Fauna	Reduced risk to fauna through clearing of waste from the area	Pos	4	2	1	3	10	3	30	Y	Waste generated on site will be recycled as far as possible and sold/given to interested contractors. Recyclable waste will not be stored on site for excessive periods to reduced risk of environmental contamination. Refuse bins will be placed around site to collect all non-recyclable waste for disposal at a licensed facility.	2	1	1	3	7	2	14	Environmental manager	Monitor any ecologically sensitive species should they be observed on site	As and when required	Running cost
Groundwater	Reduced risk of poor quality leachate through clearing of waste from the area	Pos	3	2	1	3	9	3	27	Y	Waste generated on site will be recycled as far as possible and sold/given to interested contractors. Recyclable waste will not be stored on site for excessive periods to reduced risk of environmental contamination. Refuse bins will be placed around site to collect all non-recyclable waste for disposal at a licensed facility.	2	1	1	1	5	2	10	Environmental manager	Inspect area for illegal littering and dumping	Monthly	Running cost
Soils	Reduced risk of poor quality leachate through clearing of waste from the area	Pos	3	1	1	3	8	3	24	Y	Waste generated on site will be recycled as far as possible and sold/given to interested contractors. Recyclable waste will not be stored on site for excessive periods to reduced risk of environmental contamination. Refuse bins will be placed around site to collect all non-recyclable waste for disposal at a	2	1	1	3	7	2	14	Environmental manager	Inspect area for illegal littering and dumping	Monthly	Running cost

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
											licensed facility.											
Surface water	Reduced risk of poor quality leachate through clearing of waste from the area	Pos	3	2	1	3	9	1	9	Y	Waste generated on site will be recycled as far as possible and sold/given to interested contractors. Recyclable waste will not be stored on site for excessive periods to reduced risk of environmental contamination. Refuse bins will be placed around site to collect all non-recyclable waste for disposal at a licensed facility.	2	2	1	1	6	1	6	Environmental manager	Inspect area for illegal littering and dumping	Monthly	Running cost
Visual Aspect	Improved aesthetics through removal of waste	Pos	3	1	1	3	8	3	24	Y	Waste generated on site will be recycled as far as possible and sold/given to interested contractors. Recyclable waste will not be stored on site for excessive periods to reduced risk of environmental contamination. Refuse bins will be placed around site to collect all non-recyclable waste for disposal at a licensed facility.	2	1	1	3	7	2	14	Environmental manager	Inspect area for illegal littering and dumping	Monthly	Running cost
Wetlands	Reduced risk of poor quality leachate through clearing of waste from the area	Neg	4	2	3	3	12	3	36	Y	Waste generated on site will be recycled as far as possible and sold/given to interested contractors. Recyclable waste will not be stored on site for excessive periods to reduced risk of environmental contamination. Refuse bins will be placed around site to collect all non-recyclable waste for disposal at a licensed facility.	3	2	3	3	11	2	22	Environmental manager	Inspect area for illegal littering and dumping	Monthly	Running cost

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
SUB ACTIVITY 3.2: Re-profiling of all disturbed areas																						
Topography	Re-contouring of area for free surface water drainage	Pos	2	1	3	3	9	4	36	Y	Monitor, especially after first heavy rain falls to ensure adequate surface water drainage.	2	1	3	3	9	4	36	Environmental manager	Inspect area for erosion and pooling.	After rain.	Running cost
Surface water	Free drainage restored to area	pos	3	2	3	3	11	5	55	Y	Monitor area for erosion and pooling and rehabilitate if necessary. Continue with Surface water monitoring.	3	2	3	3	11	5	55	Environmental manager	Inspect area for erosion and pooling. Surface water monitoring.	After rain & monthly	Rehab cost & R 180,000.00
Surface water	Large areas of surface water runoff return to catchment	pos	4	2	3	3	12	5	60	Y	Monitor area for erosion and pooling and rehabilitate if necessary. Continue with Surface water monitoring.	4	2	3	3	12	5	60	Environmental manager	Inspect area for erosion and pooling. Surface water monitoring.	After rain & monthly	Rehab cost & R 180,000.00
Wetlands	Reduced risk of contaminated water entering wetland areas and impairing ecological function.	pos	4	2	3	3	12	4	48	Y	Monitor area for erosion and pooling and rehabilitate if necessary. Continue with Surface water monitoring.	4	2	3	3	12	4	48	Environmental manager	Inspect area for erosion and pooling. Surface water monitoring.	After rain & monthly	Rehab cost & R 180,000.00
SUB ACTIVITY 3.3: Application of subsoils and topsoils																						
Soils	Initial increased potential for loss of soil and soil erosion	Neg	3	2	3	3	11	3	33	Y	Re-vegetate any bare soil immediately.	2	2	3	3	10	2	20	Environmental manager	Inspect area for soil erosion	Monthly	Running cost
Soils	Soils replaced and ameliorated	Pos	3	1	3	3	10	5	50	Y	Ensure soils are replaced to an adequate depth and ensure soil quality is adequate.	3	1	3	3	10	5	50	Environmental manager	Soil survey and soil quality and depth monitoring	Annually	R 45,000.00
Surface water	Potential for silt loading of surrounding surface water bodies	Neg	2	2	3	3	10	2	20	Y	Ensure water management facilities are operating adequately. Clean out silt build up over dry season.	2	2	3	3	10	1	10	Environmental manager	Surface water monitoring & Inspect water management	Monthly & weekly	R 180,000.00 & running costs

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
																				facilities		
Wetlands	Potential for silt loading of surrounding surface water bodies and associated degradation of wetland ecosystems	Neg	4	2	3	3	12	4	48	Y	Monitor area for erosion and pooling and rehabilitate if necessary. Continue with Surface water monitoring.	3	2	3	3	11	3	33	Environmental manager	Inspect area for erosion and pooling. Surface water monitoring.	After rain & monthly	Rehab cost & R 180,000.00
SUB ACTIVITY 3.4: Amelioration of topsoil																						
Flora	Create adequate environment for flora to establish	Pos	4	2	3	3	12	5	60	N		4	2	3	3	12	5	60	Environmental manager			
Soils	Soils replaced and ameliorated	Pos	3	1	3	3	10	5	50	Y	Ensure soils are replaced to an adequate depth and ensure soil quality is adequate.	3	1	3	3	10	5	50	Environmental manager	Soil survey and soil quality and depth monitoring	Annually	R 45,000.00
SUB ACTIVITY 3.5: Erection of contour berms (where necessary)																						
Soils	Potential for loss of soil and soil erosion reduced	Pos	3	2	3	3	11	3	33	Y	Re-vegetate any bare soil immediately.	3	2	3	3	11	3	33	Environmental manager	Inspect area for soil erosion	Monthly	Running cost
Surface water	Surface water runoff drainage controlled and erosion and associated silt loading of water reduced.	Pos	2	2	3	3	10	2	20	Y	Inspect area for erosion and attend to problem areas immediately.	2	2	3	3	10	2	20	Environmental manager	Surface water monitoring	Monthly	R 180,000.00
Wetlands	Reduced risk of silt-loaded water entering wetland areas and impairing ecological function.	pos	4	2	3	3	12	4	48	Y	Inspect area for erosion and attend to problem areas immediately. Continue with Surface water monitoring.	4	2	3	3	12	4	48	Environmental manager	Inspect area for erosion and pooling. Surface water monitoring.	After rain & monthly	Rehab cost & R 180,000.00
SUB ACTIVITY 3.6: Establishment of artificial wetlands (if deemed necessary for water flowing into the natural drainage lines)																						
Surface water	Surface water runoff drainage captured and treated through artificial wetlands before entering	Pos	2	2	3	3	10	2	20	Y	Ensure water stays within artificial wetlands long enough to adequately treat water quality. Continue with surface	2	2	3	3	10	2	20	Environmental manager	Surface water monitoring.	Monthly	R 180,000.00

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
	natural drainage lines and tributaries										water monitoring.											
Wetlands	Reduced risk of silt-loaded/contaminated water entering wetland areas and impairing ecological function. Additional wetland habitat provided for wetland flora and fauna and potential for improved biodiversity	pos	4	2	3	3	12	4	48	Y	Inspect wetlands for vegetation cover and overall biodiversity. Continue with Surface water monitoring.	4	2	3	3	12	4	48	Environmental manager	Surface water monitoring.	Monthly	R 180,000.00
SUB ACTIVITY 3.7: Seeding all rehabilitated areas																						
Fauna	New habitat available to fauna in the area and reduced activity should result in influx of animals to the area	Pos	2	2	3	3	10	2	20	N	Conduct annual surveys to monitor faunal biodiversity.	2	2	3	3	10	2	20	Environmental manager	Monitor any ecologically sensitive species should they be observed on site	As and when required	Running cost
Flora	Area re-vegetated with indigenous plants	Pos	3	1	2	3	9	4	36	Y	Rehabilitate disturbed areas with natural indigenous flora. Monitor for cover abundance.	3	1	2	3	9	4	36	Environmental manager	Floral surveys need to be conducted to monitor cover abundance, plant succession and community structure	Annually	R 80,000.00
Flora	Alien invasive encroachment	Neg	4	2	3	3	12	4	48	Y	Eradicate and control all alien invasive species on site. Rehabilitate and re-vegetate all areas where alien invasive species were removed.	3	2	3	3	11	3	33	Environmental manager	Establish alien invasive monitoring programme	Every 6 months depending on species	Running cost
ACTIVITY 4: continued operation water management facilities																						

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
SUB ACTIVITY 4.1: Operation of berms and trenches																						
Soils	Containment of any potential dirty water	Pos	4	1	1	1	7	5	35	N		4	1	1	1	7	5	35	Environmental manager			
Soils	Potential contamination of soils if dirty water escapes into environment	Neg	3	2	1	3	9	3	27	Y	Monitor for any residual impacts.	4	2	1	3	10	2	20	Environmental manager	Surface water monitoring	Monthly	R 180,000.00
Surface water	Containment of any potential dirty water	Pos	4	2	1	1	8	4	32	N		4	2	1	1	8	4	32	Environmental manager	Surface water monitoring	Monthly	R 180,000.00
Surface water	Potential surface water contamination if leaks escape into the environment	Neg	3	2	1	3	9	2	18	Y	Monitor for any residual impacts.	2	2	1	3	8	1	8	Environmental manager	Surface water monitoring	Monthly	R 180,000.00
Surface water	Potential silt-loading of drainage lines and downstream water bodies	Neg	3	2	1	3	9	2	18	Y	Monitor for any residual impacts.	2	2	1	3	8	1	8	Environmental manager	Surface water monitoring	Monthly	R 180,000.00
Wetlands	Containment of any potential dirty water	pos	4	2	3	3	12	4	48	N		4	2	3	3	12	4	48	Environmental manager	Surface water monitoring.	Monthly	R 180,000.00
Wetlands	Potential surface water contamination if leaks escape into the environment	Neg	4	2	3	3	12	4	48	Y	Monitor for any residual impacts.	4	2	3	3	12	4	48	Environmental manager	Surface water monitoring.	Monthly	R 180,000.00
SUB ACTIVITY 4.2: Operation of PCD																						
Groundwater	Potential infiltration of contaminated water into groundwater table if leaks occur	Neg	4	2	1	3	10	4	40	Y	Ensure water management facilities are operating adequately. Ensure integrity of any lining is not compromised.	4	2	1	3	10	3	30	Environmental manager	Groundwater monitoring. Inspect lining of containment facilities.	Quarterly & annually	R 200,000.00 & part of running cost
Soils	Containment of any potential dirty water	Pos	4	1	1	1	7	5	35	N		4	1	1	1	7	5	35	Environmental manager			

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
Soils	Potential contamination of soils if dirty water escapes into environment	Neg	3	2	1	3	9	3	27	Y	Monitor for any residual impacts.	4	2	1	3	10	2	20	Environmental manager	Surface water monitoring	Monthly	R 180,000.00
Surface water	Containment of any potential dirty water	Pos	4	2	1	1	8	4	32	N		4	2	1	1	8	4	32	Environmental manager	Surface water monitoring	Monthly	R 180,000.00
Surface water	Potential surface water contamination if leaks escape into the environment	Neg	3	2	1	3	9	2	18	Y	Monitor for any residual impacts.	2	2	1	3	8	1	8	Environmental manager	Surface water monitoring	Monthly	R 180,000.00
Surface water	Potential silt-loading of drainage lines and downstream water bodies	Neg	3	2	1	3	9	2	18	Y	Monitor for any residual impacts.	2	2	1	3	8	1	8	Environmental manager	Surface water monitoring	Monthly	R 180,000.00
Wetlands	Containment of any potential dirty water	pos	4	2	3	3	12	4	48	N		4	2	3	3	12	4	48	Environmental manager	Surface water monitoring.	Monthly	R 180,000.00
Wetlands	Potential surface water contamination if leaks escape into the environment	Neg	4	2	3	3	12	4	48	Y	Monitor for any residual impacts.	4	2	3	3	12	4	48	Environmental manager	Surface water monitoring.	Monthly	R 180,000.00
ACTIVITY 5: Continued monitoring (dust, surface water and groundwater)																						
Air quality	Improved response to issues relating to dust generation	Pos	3	1	5	1	10	4	40	Y	Target thresholds as per regulations must be maintained and action plans devised around areas where targets are exceeded	3	1	5	1	10	4	40	Environmental manager	Dust monitoring	Monthly	R 80,000.00
Groundwater	Improved response to issues relating to deterioration of groundwater quality or quantity	Pos	3	2	5	1	11	3	33	Y	Specialists must be consulted if issues with groundwater are observed and qualities do not fall within DWA target qualities or water qualities for livestock watering. Any affected registered water users must be compensated if levels and	2	2	5	1	10	5	50	Environmental manager	Groundwater monitoring	Quarterly	R 200,000.00

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
											quality are impacted by the mining activities.											
Surface water	Improved response to issues relating to deterioration of surface water quality	Pos	2	2	3	1	8	5	40	Y	Specialists must be consulted if issues with surface water are observed and qualities do not fall within DWA target qualities or water qualities for livestock watering. Any affected registered water users must be compensated if levels and quality are impacted by the mining activities.	2	2	3	1	8	5	40	Environmental manager	Surface water monitoring	Monthly	R 180,000.00
ACTIVITY 6: General activities																						
SUB ACTIVITY 6.1: General activities																						
Flora	Alien invasive encroachment	Neg	4	2	3	3	12	4	48	Y	Eradicate and control all alien invasive species on site. Rehabilitate and re-vegetate all areas where alien invasive species were removed.	3	2	3	3	11	3	33	Environmental manager	Establish alien invasive monitoring programme	Every 6 months depending on species	Running cost
Flora	Damage to species in neighbouring areas	Neg	2	1	3	3	9	2	18	Y	Limit activity to area of disturbance and re-vegetate impacted areas as soon as possible.	2	1	3	3	9	1	9	Environmental manager	Inspect area for damage to flora species.	Monthly	Running cost
Fauna	Alienation of animals from the area	Neg	3	2	3	3	11	3	33	Y	Inform staff, contractors and visitors to not harm fauna in the area.	2	2	3	3	10	2	20	Environmental manager	Monitor any ecologically sensitive species should they be observed on site	As and when required	Running cost
Groundwater	Rebound of water levels	Pos	3	3	5	3	14	4	56	N		3	3	5	3	14	4	56	Environmental manager	Groundwater monitoring	Quarterly	R 200,000.00

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
Groundwater	Flow of contaminated groundwater away from mine into neighbouring areas	Neg	5	2	5	5	17	5	85	N		5	2	5	5	17	5	85	Environmental manager	Groundwater monitoring	Quarterly	R 200,000.00
Social	Steady reduction in employment	Neg	5	2	3	3	13	5	65	Y	SLP retrenchment plan and training will be followed. Employ staff at other operations if feasible.	3	2	3	1	9	4	36	Environmental manager	Ensure retrenchment is in line with SLP initiatives	As required	Running cost

Table 73: Closure and post-closure phase activities and aspects which will be impacted on through those activities

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
ACTIVITY 2: Managing and monitoring for all post mining impacts to prevent any further pollution																						
SUB ACTIVITY 2.1: Monitoring and addressing problem areas																						
Air quality	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Environmental manager	Dust monitoring	Monthly	R 80,000.00
Fauna	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Environmental manager	Monitor any ecologically sensitive species should they be observed on site	As and when required	Running cost
Flora	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Environmental manager	Floral surveys need to be	Annually	R 80,000.00

Impacted Aspect	Impact	Positive/ Negative/ Neutral Impact	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE	Mitigation	Mitigation	Affect (severe/ beneficial)	Extent	Duration	Reversibility	CONSEQUENCE	PROBABILITY	SIGNIFICANCE (post mitigation)	Responsible person	Monitoring & inspection	Frequency	Cost / annum
																				conducted to monitor cover abundance, plant succession and community structure		
Groundwater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Environmental manager	Groundwater monitoring	Quarterly	R 200,000.00
Surface water	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Environmental manager	Surface water monitoring	Monthly	R 180,000.00
Topography	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Environmental manager			

8 CUMULATIVE IMPACTS

Generally, as the site is an existing mine, no further major additional cumulative environmental impacts are expected. The overall cumulative impacts of Mooiplaats North Colliery on various environmental aspects are discussed below.

8.1 Topography

The area has had some past mining activities and the topography has been altered by these activities, largely due to the erection of associated co-disposal dumps. The Camden Power Station has also contributed to changes in topography in the area through various infrastructure. The cumulative effect of the stockpiling at the wash plant and the erection of the co-disposal facility at Mooiplaats wash plant will contribute cumulatively to topographical impacts. As the area is relatively hilly, these structures can be constructed to blend in with the surrounding environment. The cumulative impact is therefore of negative, local, definite and of low significance.

8.2 Geology

The removal of the coal reserves results in a reduction of the overall coal resources. The impact is negative, national and definite. The cumulative effect is of moderate to high significance, as coal reserves in South Africa are diminishing.

8.3 Soils and Land Capability

The underground mining will not further impact on the soils or the land capability of the overlying areas and therefore no further cumulative impacts are expected. The existing infrastructure and boxcut area of Mooiplaats Colliery has contributed to a cumulative impact on soil in the area. Many of the activities within the immediate area, however, are restricted to specific footprints due to the nature of the coal seam requiring underground access/mining, leaving surface areas associated with these largely undisturbed. Other activities in the area, including mining, power generation, crop farming and town development have all affected soil and land capability of the area. Soils in the area in general are therefore under pressure and land capability has been affected through many of these developments. The impacts are negative, local, definite and of moderate to low significance.

8.4 Land Use

The underground mining activities will have minimal cumulative impacts on land use as the surface is still available for other activities. The existing infrastructure and boxcut area of Mooiplaats Colliery has contributed to a cumulative impact on land use, altering wilderness, wetland and possibly arable land to mining. Other activities in the area, including mining, power generation, crop farming and town development have all affected land use of the area. Although several activities in the immediate area have altered land use, many are restricted to specific footprints due to the nature of the coal seam requiring underground access/mining, leaving surface areas associated with these largely undisturbed and allowing for alternative land uses on the surface to continue. The impacts are negative, local, definite and of moderate to low significance.

8.5 Surface Water

8.5.1 Surface water quantity

The wash plant area and the underground mining will make use of water contained in the pollution control dam as far as possible. Make up water will be obtained from the environment as per the water use licence application, which is from the old Usutu underground mine for process water and from boreholes for potable use. Surface water quantity impacts are therefore limited to the reduced runoff to the catchment due to the containment of dirty water runoff falling on the mine's dirty water footprint. Other plants, mines, sidings and various other activities in the area will all have dirty footprint areas managed as contained systems, and as the number of these in the area increases the surface water runoff into the affected catchments will decrease, decreasing water quantity to other users. The cumulative effect on surface water quantity will therefore be negative, regional, definite and of moderate to high significance due to the stressed nature of the catchment.

8.5.2 Surface water quality

The wash plant area and the underground mining will impact on surface water quality, but all water within the dirty water footprint will be diverted to and contained in the new pollution control dam. Contamination of water quality in the surrounding areas will therefore be minimal. Many other activities in the area including other mining activities, power generation, town development and agriculture all impact on water quality and therefore any contribution to surface water contamination will result in cumulative impacts of moderate to high significance. The impact is negative, regional, probable and of moderate to high significance, especially due to the stressed nature of the catchment.

8.6 Groundwater

8.6.1 Groundwater quantity

The wash plant area and the underground mining will utilise groundwater as per the IWULA application with use being restricted to the abstraction of water from boreholes for potable use; the dewatering of the Mooiplaats underground mine for safety purposes and the dewatering of the old Usutu underground mine for make-up process water. Groundwater infiltrating the underground workings will be pumped out and diverted to the process flow dam. This will impact on groundwater quantity in the area. Other mining activities in the area contribute to reductions and alteration in groundwater flow and the cumulative impact on groundwater quantity is negative, local, definite and of moderate to high significance.

8.6.2 Groundwater quality

The wash plant area and the underground mining will impact on groundwater quality, as contaminated water may ingress into the groundwater table. The water falling within the dirty footprint will be diverted to the pollution control and process flow dams and the areas are contoured to ensure surface water flow and reduce ingression of contaminated water. Dirty water dams are lined to reduce infiltration of contaminated water to the groundwater environment. The impact is therefore to some extent mitigated. During closure the underground mine will eventually flood as water levels rebound and this could lead to the development of a contamination plume and possible decant points, especially if shafts and exploration boreholes are not properly sealed and rehabilitated. Many other activities in the area including other mining activities, power generation, town development and agriculture will all impact on groundwater quality and therefore any contribution to overall groundwater contamination will result in cumulative impacts that are negative, regional, highly probable and of high significance.

8.7 Air Quality

Many activities in the area including other mining activities, power generation, town development and agriculture contribute to atmospheric pollution in the area. Coal mining contributes predominantly to elevated dust levels with power generation contributing to elevated dust, PM10 and emissions. Dust suppression on site should limit dust generation and keep dust levels to within acceptable limits. Should the threshold and action levels be exceeded then the elevation in dust levels will contribute significantly to elevated dust levels in the area. The impact is negative, local, highly probable to definite if no dust suppression takes place on site, and of moderate to high significance.

8.8 Noise

Many activities in the area including other mining activities, power generation, town development and agriculture contribute to increases in ambient noise levels. Mooiplaats is in close proximity to Camden Power station and therefore is in an area with ambient noise levels already elevated above natural noise levels. The cumulative impact is negative, local, definite and of moderate to low significance.

8.9 Vegetation and Fauna

The grassland Biome is one of the least preserved and most impacted biomes in South Africa. The grassland area coincides with much of the coal fields and prime agricultural land in South Africa and has therefore been highly impacted on by various activities. Many of the wetland systems associated with these areas have also been eradicated or impacted by these activities. The wash plant area and the mine access have in the past impacted on the flora and is encroaching and impacting on wetland areas which harbour protected species. Also, increased traffic in and out of the area and disturbance to the area highly increases the risk of establishment and spread of alien invasive species, which, if unchecked or inadequately controlled, will result in complete alteration of the biodiversity of the area and will provide source populations to surrounding areas. The cumulative impact is therefore negative, site specific, definite and of high significance.

Impacts to flora will result in impacts on the fauna dependent on that flora for food and shelter and therefore the impacts extend to fauna. The cumulative impacts on fauna are negative, local, probable and of moderate significance, however it must be stressed that more sensitive or specialist species will be more affected than less sensitive or generalist species.

8.10 Site of Archaeological and Cultural Interest

No cumulative impacts on sites of archaeological and cultural interest are expected.

8.11 Sensitive landscapes

The grassland area with its many different wetland systems coincides with much of the coal fields and prime agricultural land in South Africa and has therefore been highly impacted on by various activities. Many of the wetland systems associated with these areas have also been eradicated or impacted by these activities. The mine footprint has encroached and impacted on wetland areas which harbour protected species and management measures will need to be proposed to ensure no further deterioration to this wetland system. The cumulative impact is negative, site specific, definite and of high significance.

8.12 Visual aspects

Many activities in the area including other mining activities, power generation, town development and agriculture contribute to the alteration of visual aesthetics of the area. The wash plant and the underground mine access have impacted on the visual aesthetics of the area; however the areas impacted are small and generally not highly visible except to certain residents in the area. The cumulative impact is negative, site specific, definite and of low significance.

8.13 Traffic and Safety

Roads in the area are continuously dealing with increased traffic, and the increased haulage of coal to and from the wash plant has contributed to traffic in the area. The cumulative impact on traffic and safety is therefore negative, local, highly probable and of moderate to high significance, specifically due to the distance the trucks have to travel and their current route which takes them through residential areas.

8.14 Regional Socio- Economic structure

The high unemployment and the high multiplier effect in the region means that the financial input of the mining activities has a huge, positive impact on the socio-economic aspect of the area. The cumulative impact is positive, local to regional, highly probable and of high significance.

9 ENVIRONMENTAL OBJECTIVES

Environmental and social objectives are broad based goals to guide the environmental management plan and ensure mining activities proceed in an environmentally and socially responsible manner. The objectives take into account the various legislation regarding the social and physical environment.

9.1 Environmental objectives and goals

Environmental objectives are to:

- Protect the biophysical environment as far as possible
  - Minimise impacts to the biophysical environment.
  - Ensure relevant legislation in National Environmental Management Act and Conservation of Agricultural Resources Act are applied on site including but not limited to alien invasive management and protection of ecologically sensitive species and environments.
- Protect the water resources in the area
  - Ensure clean and dirty water separation systems are established on site to contain all dirty water and prevent this water from escaping into surrounding water resources.
  - Use water responsibly and recycle water as much as possible.
  - Ensure relevant legislation regarding the National Water Act are applied on site.
- Ensure atmospheric pollution is to a minimum:
  - Manage dust generation
  - Ensure all pollutants are within levels stipulated in the National Air Quality Act
- Ensure an adequate rehabilitation plan is followed to allow for adequate rehabilitation to a prescribed land use, which should be grazing with some arable potential and wetland where relevant.

9.2 Socio-economic objectives and goals

The social objectives are:

- Ensure the targets and objectives set out in the SLP are followed and adhered to, including but not limited to:
  - Employment strategies and opportunities
  - Training in basic literacy.
  - Additional skills training.
  - LED strategies.
  - Retrenchment strategies.

- Provide a safe environment for people to work in and:
  - Ensure safety policies are established on site in line with national policy.
  - Ensure adequate PPE for staff, contractors and visitors to the site.
  - Ensure health and environmental policies are established and in line with national policies.
- Provide a safe environment for people to live in by:
  - Ensuring environmental objectives are followed.
- Provide open and transparent communication opportunity with all I&APs.

9.3 Historical and cultural aspects

- Ensure all archaeological and cultural artefacts/sites are preserved in situ until such time that a specialist advice has been provided.
- Ensure South African Heritage Resources Act (SAHRA) principals are applied with regard to all archaeological and cultural artefacts/sites.
- Ensure any relocation of culturally sensitive sites is done according to SAHRA principals, in a socially sensitive manner and with open and transparent communication with relevant I&APs.

9.4 Closure Objectives and Goals

- Ensure that all infrastructure no longer required by landowner is removed from site.
- Ensure all areas that were disturbed by mining and associated activities are rehabilitated to at least grazing land.
- Ensure adequate soil depth and soil quality is replaced to rehabilitated areas to attain grazing land capability.

10 ENVIRONMENTAL MANAGEMENT PLAN

Table 70, Table 71, Table 72 and Table 73 show the main management and monitoring measures required for each of activities during construction, operation, decommissioning and closure phases respectively. These have been detailed below for each aspect.

10.1 Construction Phase Management plan

The only construction activities (Table 70) to still be undertaken are the construction of proper pollution control dam and associated on site drainage towards these dams. As such these are the only activities considered under the construction phase.

10.1.1 Topography

No mitigation or management measures are proposed for the impacts to topography, but the site manager together with the environmental manager must ensure that all dumps, voids and dams are to the specification of the engineer's designs.

10.1.2 Geology

No significant negative impacts are expected on the geology of the area and no mitigation measures are required.

10.1.3 Soil, Land Capability and Land Use

Management

- All vehicles will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks.
- Truck activity will be limited to the dirty footprint of the existing mine to ensure that any leaks that do occur are managed as part of the enclosed dirty water management system.
- All leaks will be cleaned up immediately using an absorbent material.
- For large spills Hazmat will called in.
- Where required the compacted soils will be disked to an adequate depth and re-vegetated with indigenous plants.
- Any soils which need to be excavated and are clean will be stockpiled or utilised for berm construction and vegetated to reduce erosion.

Monitoring, frequency, estimated costs, responsible person & reporting

- The environmental manager will ensure that the surrounding area is inspected for erosion and soil compaction at least monthly and ensure management measures are applied as soon as possible should issues be observed. This will form part of the mine's running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.

- The site manager or contractor will ensure service plans are maintained by inspecting service books at least every 6 months and noting when next services are due. This will be at the contractor's expense or form part of Mooiplaats running costs.

10.1.4 Surface Water

Management

- Ensure clean and dirty water separation infrastructure is in place prior to commencement of construction activities.
- Compaction of the area during base preparation.
- All vehicles will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks.
- Truck activity will be limited to the dirty footprint of the existing mine to ensure that any leaks that do occur are managed as part of the enclosed dirty water management system.
- All leaks will be cleaned up immediately using an absorbent material.
- For large spills Hazmat will called in.
- A lined PCD needs to be erected on site as a matter of urgency to ensure all contaminated runoff is contained on site. These will be sized to contain at least a 1:50 year 24hr storm event.
- Design and construct all water management facilities as per GN704.
- PCD and other dirty water containment facilities must be lined.
- Sloping of the area as to allow for free run-off towards a pollution control structure or away from the site depending on whether the water is clean or dirty.
- Water is/will be monitored and any observed deterioration caused by the mine attended to immediately with consultation from specialists if necessary.

Monitoring, frequency, estimated costs, responsible person & reporting

- The environmental manager will ensure the surface water monitoring plan is established on site. This will be done monthly and is estimated at around R180,000.00 per annum but will depend on the number of sampling points. Data will be part of the public domain with quarterly quality reports and annual reports along with any additional measures compiled and submitted to the Department of Water Affairs (DWA).
- The site manager will monitor construction activities regarding the PCD at least weekly to ensure these are in accordance with engineering design. This will form part of the mine's running costs.

- The site manager or contractor will ensure service plans are maintained by inspecting service books at least every 6 months and noting when the next services are due. This will be at the contractor's expense or form part of Mooiplaats running costs.
- The site manager will ensure that once the PCD is established and lined that these are functioning properly and ensure that the lining integrity is tested at least annually and repaired if necessary. This will form part of running costs of the colliery. Specialists will be consulted as required and any reports with recommendations by specialists will be kept at the mine offices.

10.1.5 Groundwater

Management

- All vehicles will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks.
- Truck activity will be limited to the dirty footprint of the existing mine to ensure that any leaks that do occur are managed as part of the enclosed dirty water management system.
- All leaks will be cleaned up immediately using an absorbent material.
- For large spills Hazmat will called in.
- PCD and other dirty water containment facilities must be lined.

Monitoring, frequency, estimated costs, responsible person & reporting

- The environmental manager will ensure groundwater quality and levels are assessed thorough a groundwater monitoring plan. This will be done on a quarterly and is estimated at around R200,000.00 per annum but will depend on the number of boreholes needing to be monitored. Data will form part of the public domain with quarterly quality reports and annual reports, along with any additional measures compiled and submitted to DWA.
- The site manager or contractor will ensure service plans are maintained by inspecting service books at least every 6 months and noting when next services are due. This will be at the contractor's expense or form part of mine's running costs.
- The site manager will ensure that once the PCD is established and lined that these are functioning properly and ensure that the lining integrity is tested at least annually and repaired if necessary. This will form part of running costs of the colliery. Specialists will be consulted as required and any reports with recommendations by specialists will be kept at the mine offices.

10.1.6 Flora

Management

- Limit activity to area of disturbance and re-vegetate impacted areas as soon as possible.
- Ensure measures are in place to protect areas where protected species occur as per specialist recommendations, such as berms/trenches between the area of activity and such areas.

Monitoring, frequency, estimated costs, responsible person & reporting

- The environmental manager will ensure surrounding areas are inspected for damage to flora species at least monthly and ensure these are adequately rehabilitated, immediately if observed. This will form part of the mine's running cost. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.

10.1.7 Fauna

Management

- Inform staff, contractors and visitors to not harm fauna in the area.

Monitoring, frequency, estimated costs, responsible person & reporting

- The environmental manager will ensure that any ecologically sensitive species are recorded should they be observed on site. This will be conducted as required and form part of the running costs. Specialists and interest groups could be contacted if any assistance is required relocating species or to assist with conservation. Record of any such species should be maintained and kept at the mine office.

10.1.8 Air quality

Management

- Speed limits will be established on the dirt road to minimise dust generation. All contractors will enforce speed limits.
- Dust suppression by water cart will be undertaken during times of high dust generation in any areas where dust is sourced.
- All vehicles will be regularly serviced to ensure they are in proper working condition and to reduce risk of excessive emissions.

Monitoring, frequency, estimated costs, responsible person & reporting

- The site manager will ensure that speed inspections are conducted sporadically. This will form part of the mine's running costs.
- The environmental manager will ensure dust monitoring is conducted monthly which is estimated at around R80,000.00 per annum. Data will be part of public domain available at the mine and annual reports will be compiled.

- The site manager or contractor will ensure service plans are maintained by inspecting service books at least every 6 months and noting when next services are due. This will be at the contractor’s expense or form part of the mine’s running costs.

10.1.9 Noise

Management

- Vehicles will be regularly serviced to ensure acceptable noise levels are not exceeded.
- Silencers will be utilised where possible.
- Construction activities will be conducted during the day-time hours as far as possible.
- Point sources will be enclosed where possible.
- Screens will be considered if I&AP complaints are received.

Monitoring, frequency, estimated costs, responsible person & reporting

- The site manager or contractor will ensure service plans are maintained by inspecting service books at least every 6 months and noting when next services are due. This will be at the contractor’s expense or form part of Mooiplaats running costs.
- The environmental manager will ensure an ambient environmental noise monitoring programme is established measuring noise at mine boundaries at least quarterly, and if levels are exceeded, at any sensitive receptors beyond the boundary where exceedance was observed. This is estimated at around R90,000.00 per annum but will depend on the number of measurements required.

10.1.10 Visual

No significant negative impacts are expected on the visual aspect of the area and no mitigation measures are required.

10.1.11 Sites of cultural significance

No impacts are expected to such sites and no mitigation measures are required. SAHRA protocols need to be followed should any such sites be discovered during the operations at Mooiplaats.

10.1.12 Sensitive landscapes - wetlands

Management

- PCD need to be erected on site as a matter of urgency to ensure all contaminated runoff is contained on site.
- PCD will be sized to contain at least a 1:50 year 24hr storm event and they must be adequately lined.

- Adequate protection measures must be implemented around wetland areas, as per specialist recommendation, to reduce risk of degradation and deterioration to these systems. These could include a system of berms and trenches between these sites and active mine infrastructure areas.
- Water is/will be monitored and any observed deterioration caused by the mine attended to immediately with consultation from specialists if necessary.

Monitoring, frequency, estimated costs, responsible person & reporting

- The environmental manager will ensure a surface water monitoring plan is established on site. This will be done monthly and is estimated at around R180,000.00 per annum but will depend on the number of sampling points. Data will form part of the public domain with quality reports compiled quarterly and annually, these along with any additional measures will be submitted to DWA.
- The site manager will monitor construction activities regarding the PCD at least weekly to ensure these are in accordance with engineering design. This will form part of the mine's running costs.
- The site manager will ensure that once the PCD is established and lined that these are functioning properly and ensure that the lining integrity is tested at least annually and repaired if necessary. This will form part of running costs of the colliery. Specialists will be consulted as required and any reports with recommendations by specialists will be kept at the mine offices.

10.1.13 Traffic and safety

Management

- All intersections with main tarred roads will be clearly sign-posted.
- Drivers will be enforced to keep to set speed limits.
- Trucks will be in road-worthy condition with reflective strips.
- A fund will be set aside to maintain the serviceability of the road verge where the trucks approach or depart from the main road.

Monitoring, frequency, estimated costs, responsible person & reporting

- The site manager will ensure that the roads and intersections are inspected at least monthly and any issues observed attended to immediately. This will form part of the mine's running cost. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.

10.1.14 Socio-economic

Management

- Labourers/contractors will initially be sought locally and only regionally if skills are not available.

- Employment must be conducted as per SLP.

Monitoring, frequency, estimated costs, responsible person & reporting

- The social manager will ensure that employment is in line with SLP initiatives and as required by the SLP. This will form part of the mine's running costs. Reporting will be conducted as required by the SLP.

10.2 Operational phase Management Plan

The operations phase activities and related impacts and summarised management s are indicated in Table 71. The detailed management plan is given below.

10.2.1 Topography

No mitigation measures can be applied to dumps with regards to impacts on the topography. Environmental and site manager must ensure that all dumps are to the specifications of designs and specialists' recommendations.

Management

- Application of stone dust on pillars to prevent spontaneous combustion.
- Any severe subsidence or sinkholes will be rehabilitated immediately according to acceptable standard practices.

Monitoring, frequency, estimated costs, responsible person & reporting

- The environmental manager will ensure that surface areas overlying underground mining areas are inspected at least monthly for subsidence or sinkholes. This will form part of the colliery's running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.

10.2.2 Geology

No mitigation measures can be applied with regards to impact on geology. The mine manager must ensure that the recommended safety factors are followed to reduce the risk of overlying strata collapsing.

10.2.3 Soil, Land Capability and Land Use

Management

- Topsoil and soil will be stockpiled and maintained within stockpiles for replacement during the rehabilitation process.
- Soil amelioration will be done according to soil analyses after replacement of the topsoil in any rehabilitated areas.
- The soil fertility will be maintained by annual fertilizer applications according to soil analysis.

- The co-disposal dump will be covered with topsoil and re-vegetated with a grass mixture as development of the co-disposal dump proceeds.
- Any new stockpiles will be located outside the 50 meter wetland buffer zone.
- Discard or any coalliferous material will be located outside the 100 m buffer zone or preferably disposed of onto the co-disposal dump (Rehab Green, 2011).
- Existing topsoil and soil stockpiles or berms should by no means be contaminated with coal, discard or overburden material (Rehab Green, 2011).
- All vehicles will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks.
- Wash bays and workshops will have oil traps fitted to capture any hydrocarbon runoff.
- Truck activity will be limited to the dirty footprint of the existing mine to ensure that any leaks that do occur are managed as part of the enclosed dirty water management system.
- All leaks will be cleaned up immediately using an absorbent material.
- For large spills Hazmat will called in.
- Activity will be limited to areas of disturbance. Where required the compacted soils will be disked to an adequate depth and re-vegetated with indigenous plants.
- Any soils which need to be excavated and are clean will be stockpiled or utilised for berm construction and vegetated to reduce erosion.
- Dust management measures will be applied to reduce risk of coal dust impacting on surrounding soils.
- Trucks carrying coal will be fitted with tarpaulins.
- Roads utilised for coal transportation will be cleaned to ensure spilled coal is cleared from the roads.
- Ensure berms/trenches are erected between active areas and wetland areas to contain and divert all dirty water runoff to the dirty water containment facilities, so as to prevent dirty water runoff from contaminating the surrounding soils.
- Installation of energy dissipaters if and when required.
- Clean out silt build up from all dirty water management features annually over the dry season to ensure adequate capacity in these structures for the next rainy season.

- Generators and all hydrocarbons will be stored in concrete bunded areas fitted with taps and oil traps. Bunded areas will be to SABS standards, and bunded area will have adequate capacity to contain leaks / spills.
- Waste generated on site will be recycled as far as possible and sold/given to interested contractors. Recyclable waste will not be stored on site for excessive periods to reduced risk of environmental contamination. Refuse bins will be placed around site to collect all non-recyclable waste for disposal at the licensed municipal waste facility.
- Soil stockpiles will be managed and maintained as per the specifications of the pedologist. They will be well vegetated to reduce risk of erosion.
- Ablution facilities and the sewage treatment plant will be managed by reputable contractors if required and inspected daily for any potential leaks.
- Ensure all pipelines and water containment facilities are adequately sealed to prevent leaks. Record water usage by attaching meters to relevant pumps.

Monitoring, frequency, estimated costs, responsible person & reporting

- The environmental manager will ensure that the surrounding area is inspected for erosion and soil compaction at least monthly and ensure management measures are applied as soon as possible should issues be observed. The roads will also be inspected at least monthly for any spilled coal and this will be cleared immediately. This will form part of the mine’s running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.
- The site manager or contractor will ensure service plans are maintained by inspecting service books at least every 6 months and noting when the next services are due. This will be at the contractor’s expense or form part of mine’s running costs.
- Environmental manager will ensure that dust monitoring is ongoing and conducted monthly, and reports will be compiled annually. This is estimated at around R80,000.00 per annum. Data will form part of public domain and will be available at the mine.
- The environmental manager will be responsible for coordinating weekly inspections of water management features, associated pipelines and containers for leaks, silt build up and capacities. This will form part of the mine’s running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.
- The site manager together with the environmental manager will ensure inspections of bunded areas are conducted weekly and after each rainfall event to ensure taps are closed and bunded areas are not flooded. They will

also ensure the integrity of bunding is tested at least annually. This will form part of the mine's running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.

- The environmental manager will be responsible for inspecting the mine area and surrounding areas for illegal littering and dumping at least monthly and this will be cleared if observed and disposed of as part of the mines waste management plan. This will form part of the mine's running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.
- The environmental manager will inspect soil stockpiles at least monthly for erosion and vegetation cover. This will form part of the mine's running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.
- Ablutions and sewage treatment plant will be inspected weekly for any leaks and attended to immediately if observed. The environmental manager will ensure these inspections are carried out at least weekly. This will form part of the mine's running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.

10.2.4 Surface Water

Management

- Water is/will be monitored and any observed deterioration caused by the mine attended to immediately with consultation from specialists if necessary.
- Adequate buffer zones will be maintained and berms/trenches will be erected around the perimeters of the Erikson dams to ensure any spills or leaks are contained within the dirty footprint area.
- Installation of silt traps at the inflow of all pollution control collection infrastructure. Clean out silt build up annually over the dry season.
- Ensure water management facilities are operating adequately with regard to capacity, silt build up and any potential leaks. Clean out silt build up annually over the dry season and attend to leaks immediately if observed.
- Ensure water management facilities around the co-disposal facility are operating adequately and contain and divert all dirty water runoff to the return water dam (RWD).
- Ensure co-disposal facility is constructed and operated according to design parameters.
- All hydrocarbons will be stored in concrete bunded areas fitted with taps and oil traps. Bunded areas will be to SABS standards, and bunded areas will have adequate capacity to contain leaks.

- Equipment will be regularly serviced to reduce the risk of leaks. Generators will be kept in bunded areas erected as per SABS standards. Any leakages will be reported and treated immediately in a reputable manner.
- All vehicles will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks.
- Truck activity will be limited to the dirty footprint of the existing mine to ensure that any leaks that do occur are managed as part of the enclosed dirty water management system.
- All leaks will be cleaned up immediately using an absorbent material.
- For large spills Hazmat will called in.
- Waste generated on site will be recycled as far as possible and sold/given to interested contractors. Recyclable waste will not be stored on site for excessive periods to reduced risk of environmental contamination. Refuse bins will be placed around site to collect all non-recyclable waste for disposal at the municipality.
- Wash bays and workshops will have oil traps fitted to capture any hydrocarbon runoff.
- Saving water initiatives will be included in environmental awareness training. Utilise water on site responsibly. Ensure all pipelines and water containment facilities are adequately sealed to prevent leaks. Record all water usage on site.
- Soil stockpiles will be managed and maintained as per the specifications of the pedologist. They will be well vegetated to reduce risk of erosion.
- Ablution facilities and sewage treatment plant will be managed by reputable contractors if required and inspected daily for any potential leaks.
- PCD and other dirty water containment facilities must be lined and lining integrity must be undertaken so as to prevent ingression of poor quality water.
- Operate all water management facilities as per GN704.

<u>Monitoring, frequency, estimated costs, responsible person & reporting</u>

- The environmental manager will ensure surface water monitoring is continued on a monthly basis, estimated at around R180,000.00 per annum but will depend on the number of sampling points. Data will form part of the public domain, quality reports will be compiled quarterly and annually these will be submitted along with any additional measures to DWA.
- The environmental manager will be responsible for coordinating weekly inspections of water management features and associated pipelines and containers for leaks, silt build up and capacities. This will form part of the mine's running costs. Any incidences observed and any actions taken will be

recorded in an incident and action report which will form part of the public domain.

- The site manager together with the environmental manager will ensure inspections of bunded areas are conducted weekly and after each rainfall event to ensure taps are closed and bunded areas are not flooded. All oil traps at storage areas and washbays/workshops will also be inspected and hydrocarbons removed if necessary and handled and disposed of as part of the mine's waste management plan. They will also ensure the integrity of bunding is tested at least annually. This will form part of the mine's running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.
- The environmental manager will be responsible for inspecting the mine area and surrounding areas for illegal littering and dumping at least monthly and this will be cleared if observed and disposed of as part of the mines waste management plan. This will form part of the mine's running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.
- The site manager or contractor will ensure service plans are maintained by inspecting service books at least every 6 months and noting when next services are due. This will be at the contractor's expense or form part of Mooiplaats running costs.
- The environmental manager will inspect soil stockpiles at least monthly for erosion and vegetation cover. This will form part of the mine's running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.
- Ablutions and sewage treatment plant will be inspected weekly for any leaks and attended to immediately if observed. The environmental manager will ensure these inspections are carried out at least weekly. This will form part of the mine's running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.
- The site manager will ensure that once the PCD is established and lined that these are functioning properly and ensure that the lining integrity is tested at least annually and repaired if necessary. This will form part of running costs of the colliery. Specialists will be consulted as required and any reports with recommendations by specialists will be kept at the mine offices.

10.2.5 Groundwater

Management

- The application of stone dust on coal pillars for the prevention of spontaneous combustion and weakening of pillars (Geostratum, 2011).

- Maintain prescribed pillar safety factors to ensure that the stability of overlying geological features are not compromised (Geostratum, 2011).
- Mining activities should take place in such a manner, so as to avoid any rock instability below surface water features (Geostratum, 2011).
- No mining will take place below perennial rivers or streams within 100 m (horizontal distance) or within the 1:50 year flood line of the river, whichever is the greatest (Geostratum, 2011).
- Influxes encountered during the intersection of dykes in the underground mine can usually be plugged (grouted), or the influx water can be pumped away and dealt with as part of the mine water balance (Geostratum, 2011).
- MPN must ensure that their pump rate does not exceed the groundwater recharge rate of Usutu. This seems highly unlikely as the pumping rate is less than 5% of the recharge rate (Geostratum, 2011).
- In order to optimize the pumping of mine water (instead of aquifer water), the pumps must be situated at the mining horizon and not above it. It seems as if some aquifer water is currently pumped by MPN along with mine water given the good quality of the pumped water (Geostratum, 2011).
- If the pumps could not be placed at the mining horizon the pumped boreholes must be cased off with solid casing from the top down to the mining horizon (Geostratum, 2011).
- All hydrocarbons will be stored in concrete bunded areas fitted with taps and oil traps. Bunded areas will be to SABS standards, and bunded area will have adequate capacity to contain leaks / spills.
- Equipment will be regularly serviced to reduce risk of leaks. Generators will be kept in bunded areas erected per SABS standards. Any leakages will be reported and treated immediately in a reputable manner.
- All vehicles will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks.
- Truck activity will be limited to the dirty footprint of the existing mine to ensure that any leaks that do occur are managed as part of the enclosed dirty water management system.
- All leaks will be cleaned up immediately using an absorbent material.
- For large spills Hazmat will called in.
- Ensure registered affected water users are compensated in some way, either with alternative water supply or monetary equivalent.
- Ensure water management facilities are operating adequately with regard to capacity, silt build up and any potential leaks. Clean out silt build up annually over the dry season and attend to leaks immediately if observed.

- Ensure water management facilities around the co-disposal facility are operating adequately, divert and contain all dirty water runoff within the RWD. Clean out silt build up annually over the dry season. Ensure co-disposal facility is constructed and operated according to design parameters.
- Berms that divert clean storm water away from the plant areas must be constructed. Storm water within the plant area must be pumped to the pollution control dam (Geostratum, 2011).
- Water pumped from mine workings will be monitored and stored in the lined process water dams (Geostratum, 2011).
- Overburden and coal stockpiles must have drainage diverting berms constructed up gradient in order to prevent clean drainage water for flowing through. Any surface run-off from coal stockpiles must be captured and treated as polluted water. Toe drains at the dirty water dams will intercept most of the seepage originating from the dams (Geostratum, 2011).
- PCD and other dirty water containment facilities must be lined.
- Any ponding noted around the footprint of the mine must be attended to so as to reduce the risk of water ingressing into the water table. All water from the dirty footprint must be diverted to lined dirty water containment facilities.
- Waste generated on site will be recycled as far as possible and sold/given to interested contractors. Recyclable waste will not be stored on site for excessive periods to reduced risk of environmental contamination. Refuse bins will be placed around site to collect all non-recyclable waste for disposal at the licensed municipal waste disposal facility.
- Saving water initiatives will be included in environmental awareness training. Utilise water on site responsibly. Record all water usage on site.
- Ablution facilities and sewage treatment plant will be managed by reputable contractors if required and inspected daily for any potential leaks.

<u>Monitoring, frequency, estimated costs, responsible person & reporting</u>

- The environmental manager will ensure groundwater quality and levels are assessed through a groundwater monitoring plan. This will be done on a quarterly basis and is estimated at around R200,000.00 per annum but will depend on the number of boreholes needing to be monitored. Data will form part of the public domain, with quality reports compiled quarterly and annually. These along with any additional measures will be submitted to DWA.
- An extensive groundwater monitoring system is present at MPN, including the plant area. Any impact on the underlying aquifer will be monitored (Geostratum, 2011).

- Monitoring of fountains and base flow towards streams must be implemented during the operational phase in order to detect any mining related impact (Geostratum, 2011).
- Monitoring of any impact on the Usutu mine due to pumping by MPN must be performed (Geostratum, 2011). Monitoring must include the following:
    - Testing of pumped water;
    - Measuring of Usutu mine water levels, and
    - Testing the Usutu mine water quality at a monitoring borehole (Geostratum, 2011).
- The site manager or contractor will ensure service plans are maintained by inspecting service books at least every 6 months and noting when next services are due. This will be at the contractor's expense or form part of the mine's running costs.
- The site manager together with the environmental manager will ensure that the co-disposal facility is monitored and maintained as per the design specifications at least monthly and more frequently if the disposal rate increases. This will form part of running costs of the colliery. Specialists will be consulted as required and any reports with recommendations by specialists will be kept at the mine offices.
- The environmental manager will be responsible for coordinating weekly inspections of water management features, associated pipelines and containers for leaks, silt build up and capacities. This will form part of the mine's running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.
- The site manager together with the environmental manager will ensure inspections of bunded areas are conducted weekly and after each rainfall event to ensure taps are closed and bunded areas are not flooded. All oil traps at storage areas and washbays/workshops will also be inspected and hydrocarbons removed if necessary and handled and disposed of as part of the mine's waste management plan. They will also ensure the integrity of bunding is tested at least annually. This will form part of the mine's running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.
- The site manager will ensure that all dirty water containment facilities are lined and that these are functioning properly, as well as ensure that the lining integrity is tested at least annually and repaired if necessary. This will form part of running costs of the colliery. Specialists will be consulted as required and any reports with recommendations by specialists will be kept at the mine offices.

- The environmental manager will be responsible for inspecting the mine area and surrounding areas for illegal littering and dumping at least monthly and this will be cleared if observed and disposed of as part of the mines waste management plan. This will form part of the mine's running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.

10.2.6 Flora

Management

- Due to the study site's locality within "Highly Significant Ecosystems", the land use on the remainder of the site as well as surrounding grasslands are to comply with that specified by the MBCP. It is advised that only low intensity grazing be considered as a future land use on such areas (SEF, 2011).
- No further expansion of the mine footprint must occur on site unless appropriate authorisations are received.
- Cooperative conservation arrangements, e.g. conservancies are encouraged in the "Highly Significant Areas" (Ferrar & Lötter, 2007). In order to safe-guard the biodiversity on the study site and its surrounds, as well as to facilitate future monitoring, it is recommended that the Mooiplaats Mine explore the possibility of establishing a conservancy together with surrounding land owners (SEF, 2011).
- Cordon off the main mine infrastructures from the surrounding natural vegetation and wetlands to prevent any disturbances into the surrounding natural grasslands and moist grasslands (SEF, 2011).
- Implement a Plant Rescue and Rehabilitation Plan: Where the plants of conservation concern and protected plants are deemed to be under threat from any activity, the plants will be removed by a suitably qualified specialist and replanted as part of vegetation rehabilitation after the activity (Note, these plants may only be removed with the permission of the local authority) (SEF, 2011).
- An Ecological Management Plan must be compiled by a suitably qualified ecologist and must (SEF, 2011):
  - Ensure the persistence of the plants of conservation concern / declining plants on the study site and along the mine access (operation and after closure) (SEF, 2011);
  - Minimise artificial edge effects (e.g. water runoff from the roads, mining related activities and in the case of unforeseen (emergency) events (SEF, 2011);
  - Include a fire management plan (SEF, 2011); and
  - Result in a report back to the relevant Government Departments during operation and after closure (SEF, 2011).

- Remediate areas of disturbances and use manual labour to remove construction material and rubble from the natural vegetation on the study site (SEF, 2011).
- Rip hardened soil under cemented areas and allow natural re-vegetation, or re-vegetate with grass seeds from the natural grassland. Also, cordon off areas that are under rehabilitation as no-go areas using danger tape and steel droppers. If necessary, these areas will be fenced off to prevent vehicular, pedestrian and livestock access until such time that rehabilitation is found to be successful and the disturbed area covered with perennial growth (at least two years) (SEF, 2011).
- No residue or substance which causes or is likely to cause pollution of a water resource may be placed in the workings of any underground mine (SEF, 2011).
- Formalise access roads and make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas (SEF, 2011).
- Mine workers may not tamper or remove fauna or flora and neither may anyone collect seed from the plants without permission from the local authority (MTPA) (SEF, 2011).
- Do not permit vehicular or pedestrian access into natural areas or into seasonally wet areas during and immediately after rainy periods, until such a time that the soil has dried out (DAWF, 2005) (SEF, 2011).
- Limit activity to area of disturbance and re-vegetate impacted areas as soon as possible.
- Ensure measures are in place to protect areas where protected species occur as per specialist recommendations, such as berms/trenches between the area of activity and such areas.
- An ecologically sound, storm water management plan must be implemented (SEF, 2011).
- Dirty water from the wash bay may not be directed into clean water systems (SEF, 2011).
- Adequate buffer zones will be maintained and berms/trenches will be erected around the perimeters of the dirty water dams to ensure any spills or leaks are contained within the dirty footprint area and diverted to dirty water containment facilities.
- Ensure berms/trenches are erected between any active areas of the mine in close proximity to wetlands to contain all dirty water runoff and divert to PCD. Clean out silt build up annually over the dry season.

- Ensure water management facilities around the co-disposal facility are operating adequately. Ensure berms/trenches are erected between active areas and wetland areas to contain and divert all dirty water runoff to RWD. Clean out silt build up annually over the dry season.
- Compile and implement an alien invasive monitoring plan to prevent the colonisation and spread of alien invasive plant species, in specifically those already identified to occur on the site (SEF, 2011).
- Monitor all sites disturbed in the past for colonisation by exotics or invasive plants and eradicate these. Monitor regularly for any re-sprouting or emerging seedlings (SEF, 2011).
- Follow manufacturer's instruction when using chemical methods, especially in terms of quantities, time of application etc (SEF, 2011).
- Where possible, rather use manual labour to remove these plants, instead of chemicals (SEF, 2011).
- If using chemicals, ensure that only properly trained people handle and make use of chemicals. Do not spray in the proximity of any protected or declining plants species (SEF, 2011).
- Do not spray chemicals on windy days as drift could kill indigenous vegetation (SEF, 2011).
- Rehabilitate all identified areas as soon as practically possible, utilising plant species that naturally occur on the study site (e.g. harvest seeds from surrounding grasses) (SEF, 2011).
- As much of the natural vegetation as possible will be left intact in order to maintain ecological corridors for the movement of faunal species (SEF, 2011).
- Disturbed areas will be re-vegetated as soon as possible using an appropriate rehabilitation plan which incorporates indigenous plant species that naturally occurs on the study site (SEF, 2011).
- The mitigation measures as set out by the wetland assessment report (SEF, 2011) will strictly be adhered to.
- All overburden and soils shall be left in a configuration which is in accordance with accepted conservation practices and which is suitable for the proposed subsequent use of the land (SEF, 2011).
- Ideally, no stockpiling of soils (such as at the borrow pit) will take place at the extraction point: material must be loaded directly from the screens onto trucks and transported to the where it is used (SEF, 2011).
- Runoff from roads must be managed to avoid erosion and pollution problems (SEF, 2011).
- Establish and maintain fire breaks around the mine infrastructure (including bus stop on the side of the mine access road) to prevent veld fires. Burning in

the wrong season could have detrimental effects on these plant species. Like deciduous trees, the energy from bulb leaves are transferred to the bulb during the late autumn and the leaves die back. The energy stored within the bulb during winter is essential for new growth and flowering early in spring when rainfall is still low. Thus, if the leaves are burnt during summer, it could influence the bulbs ability to store energy during winter and subsequently affect new growth in spring and the plants future survival (SEF, 2011).

- A fire management plan to sustain natural grassland on the study site is recommended and will be compiled by a suitable qualified specialist (SEF, 2011).
- Veld fires are essential for grassland maintenance. A lack of fire could lead to moribund grasses, possible bush encroachment and a deterioration of the grassland in general. The most important use of fire for conservation management is to maintain viable populations of all plant and animal species present. Other objectives may include: reduction of fuel load to prevent unmanageable wildfires; control of invasive alien plants; promotion of desirable plants; or safeguarding property and infrastructure (SEF, 2011).
- It is generally accepted that burns should follow a four year cycle. However, it could vary between annual burns to every four years depending on outcomes of a monitoring programme or regular assessments. The burning regime (e.g. frequency, timing or intensity of a fire) will depend on the plant biomass and will dictate whether burning is necessary or not (SEF, 2011).
- The ideal situation is for natural fires to originate at random through ignition caused by lightning strikes. Fires caused by lightning strikes create natural mosaics within grassland resulting in patches of grassland that differs both in height and composition (SEF, 2011).
- Do not leave soil surfaces open to erosion for lengthy time periods (SEF, 2011).
- Surface and groundwater flow systems affected by waste water and storm water must continuously be monitored and natural flow regimes must be restored. Clean and maintain catch basins, drainage ditches, and culverts regularly (SEF, 2011).
- Water that is released back into the environment, must meet the minimum water quality standards (SEF, 2011).

<u>**Monitoring, frequency, estimated costs, responsible person & reporting**</u>

- Regular environmental monitoring and reporting on biodiversity status and/or change of land use to the MTPA (SEF, 2011).
- The environmental manager will ensure surrounding areas are inspected for damage to flora species at least monthly and ensure these are adequately rehabilitated immediately if observed. This will form part of the mine’s running

cost. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.

- Surface and groundwater flow systems affected by waste water and storm water must continuously be monitored and natural flow regimes must be restored (SEF, 2011).
- The environmental manager will ensure berms/trenches are inspected weekly to ensure adequate functioning of these. Erosion must be attended to and adequate vegetation cover must be maintained. This will form part of the mine's running cost. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.
- The environmental manager will be responsible for coordinating weekly inspections of water management features, associated pipelines and containers for leaks, silt build up and capacities. This will form part of the mine's running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.
- The environmental manager will ensure surface water monitoring is continued on a monthly basis, estimated at around R180,000.00 per annum but will depend on the number of sampling points. Data will be part of the public domain, quality reports will be compiled quarterly and annually, these along with any additional measures will be submitted to DWA.
- The environmental manager will ensure that an alien invasive monitoring and management programme is established on site to control and eradicate alien species as soon as possible. The area will be inspected at least every 6 months but this may need to be conducted more frequently depending on specific species which are recorded at site. This will form part of the mine's running costs. All monitoring and eradication conducted must be recorded and kept at the offices and will form part of the public domain.

10.2.7 Fauna

Management

- Inform staff, contractors and visitors to not harm fauna in the area.
- Consider the use of bird flappers on the power lines to reduce risk of birds colliding with power lines, especially if bird mortality is high in areas with power lines or where protected species have settled.
- Remove any snares from the area (SEF, 2011).
- Waste generated on site will be recycled as far as possible and sold/given to interested contractors. Recyclable waste will not be stored on site for excessive periods to reduced risk of environmental contamination. Refuse

bins will be placed around site to collect all non-recyclable waste for disposal at a reputable waste site.

- Ensure directional floodlights are utilised that focus light on the necessary areas and reduce light pollution to surrounding environment.
- Should faunal species of conservation concern (e.g. African Grass Owl owlets) need to be removed from the study area, a faunal capture and relocation plan will be developed and implemented by an accredited specialist (e.g. SACNASP registered) (SEF, 2011).

Monitoring, frequency, estimated costs, responsible person & reporting

- The environmental manager will ensure that any ecologically sensitive species are protected and monitored should they be observed on site. And conduct frequent patrols in order to remove snares. This will be conducted as required and form part of the running costs. Specialists and interest groups could be contacted if any assistance is required relocating species or to assist with conservation. Record of any such species will be maintained and kept at the mine office.
- Environmental manager will periodically inspect power line areas for any significant bird mortalities. If high mortalities are observed or protected bird species are observed to settle in the area, then the use of bird flappers will be considered on the power lines. This will form part of the mine’s running costs.

10.2.8 Air quality

Management

- Speed limits will be established on the dirt road to minimise dust generation. All contractors will enforce speed limits.
- Dust suppression by water cart will be undertaken during times of high dust generation in any areas where dust is sourced.
- All vehicles will be regularly serviced to ensure they are in proper working condition and to reduce risk of excessive emissions.
- Blasting will be underground and will not contribute significantly to dust generation. A water cart will be used to spray relevant areas when dust levels are high.

Monitoring, frequency, estimated costs, responsible person & reporting

- The site manager will ensure that speed inspections are conducted sporadically. This will form part of Mooiplaats Colliery’s running costs.
- The environmental manager will ensure dust monitoring is conducted monthly which is estimated at around R80,000.00 per annum. The levels will be evaluated against threshold limits and action levels. Dust management

measures will need to be revised if either threshold is exceeded. Data will form part of public domain, annual reports will be compiled and these will be kept at the mine offices.

- The site manager or contractor will ensure service plans are maintained by inspecting service books at least every 6 months and noting when next services are due. This will be at the contractor's expense or form part of mine's running costs.

10.2.9 Noise

Management

- Vehicles and equipment will be regularly serviced to ensure acceptable noise levels are not exceeded.
- Silencers will be utilised where possible.
- Point sources will be enclosed where possible.
- Screens will be considered if I&AP complaints are received.

Monitoring, frequency, estimated costs, responsible person & reporting

- The site manager or contractor will ensure service plans are maintained by inspecting service books at least every 6 months and noting when next services are due. This will be at the contractor's expense or form part of Mooiplaats running costs.
- The environmental manager will ensure an ambient environmental noise monitoring programme is established measuring noise at mine boundaries at least quarterly, and if levels are exceeded, at any sensitive receptors beyond the boundary where exceedance was observed. It is estimated at around R90,000.00 per annum but will depend on the number of measurements required.

10.2.10 Visual

Management

- Ensure adequate vegetation cover of berms, soil stockpiles and the co-disposal facility to reduce visual impact.
- Waste generated on site will be recycled as far as possible and sold/given to interested contractors. Recyclable waste will not be stored on site for excessive periods to reduced risk of environmental contamination. Refuse bins will be placed around site to collect all non-recyclable waste for disposal at the municipality.
- Ensure directional floodlights are utilised that focus light on the necessary areas and reduce light pollution to surrounding environment.

Monitoring, frequency, estimated costs, responsible person & reporting

- The environmental manager will be responsible for inspecting the mine area and surrounding areas for illegal littering and dumping at least monthly and this will be cleared if observed and disposed of as part of the mines waste management plan. This will form part of the mine’s running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.
- The environmental manager will inspect all berms, soil stockpiles and the co-disposal at least weekly for vegetation cover. This will form part of the mine’s running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.

10.2.11 Sites of cultural significance

No impacts are expected to such sites and no mitigation measures are required. SAHRA protocols need to be followed should any such sites be discovered during the operations at Mooiplaats.

10.2.12 Sensitive landscapes - wetlands

Management

- Rehabilitation will be required for areas A to M in Figure 29 (SEF, 2011) and the following is proposed:
    - Area A, B, C, D, E, F, L, M & H are all areas which have undergone either soil compaction, loss of topsoil or road construction activities. Basic rehabilitation will include: lifting and removal of all carbonaceous and overburden material, ripping and shaping of affected areas, adding appropriate topsoil including wetland soils and re-vegetation with appropriate species (SEF, 2011);
    - Area G still contains a portion of seepage wetland which is now likely to be hydrologically isolated. The future use of this area should be investigated and a decision made to either conserve this portion in situ or use the hydric soils and hydrophytic vegetation for rehabilitation in other areas (SEF, 2011);
    - Area O is an old access road dissecting the valley bottom wetland which has been constructed from coal discard material. All the material should be lifted, removed and re-vegetated appropriately (SEF, 2011);
    - Area P has been excavated in the past, all the topsoil has been stored next to the excavation which will ease rehabilitation. If the topsoil is not enough to rehabilitate the total affected area, swales should be built as per the existing example (SEF, 2011);
    - Area K consists of an erosion rill which runs along the north-eastern boundary. The erosion process was probably facilitated by a boundary

road which served to increase run-off and now contains several plunge pools. All the gullies and rills should be rehabilitated and several swales should be placed along the length of the boundary (SEF, 2011);

- Area J consist of several erosion gullies which have formed as a result of concentrated run-off from the mining area. This area should be rehabilitated in conjunction with a revamp of the clean and dirty water system (SEF, 2011).

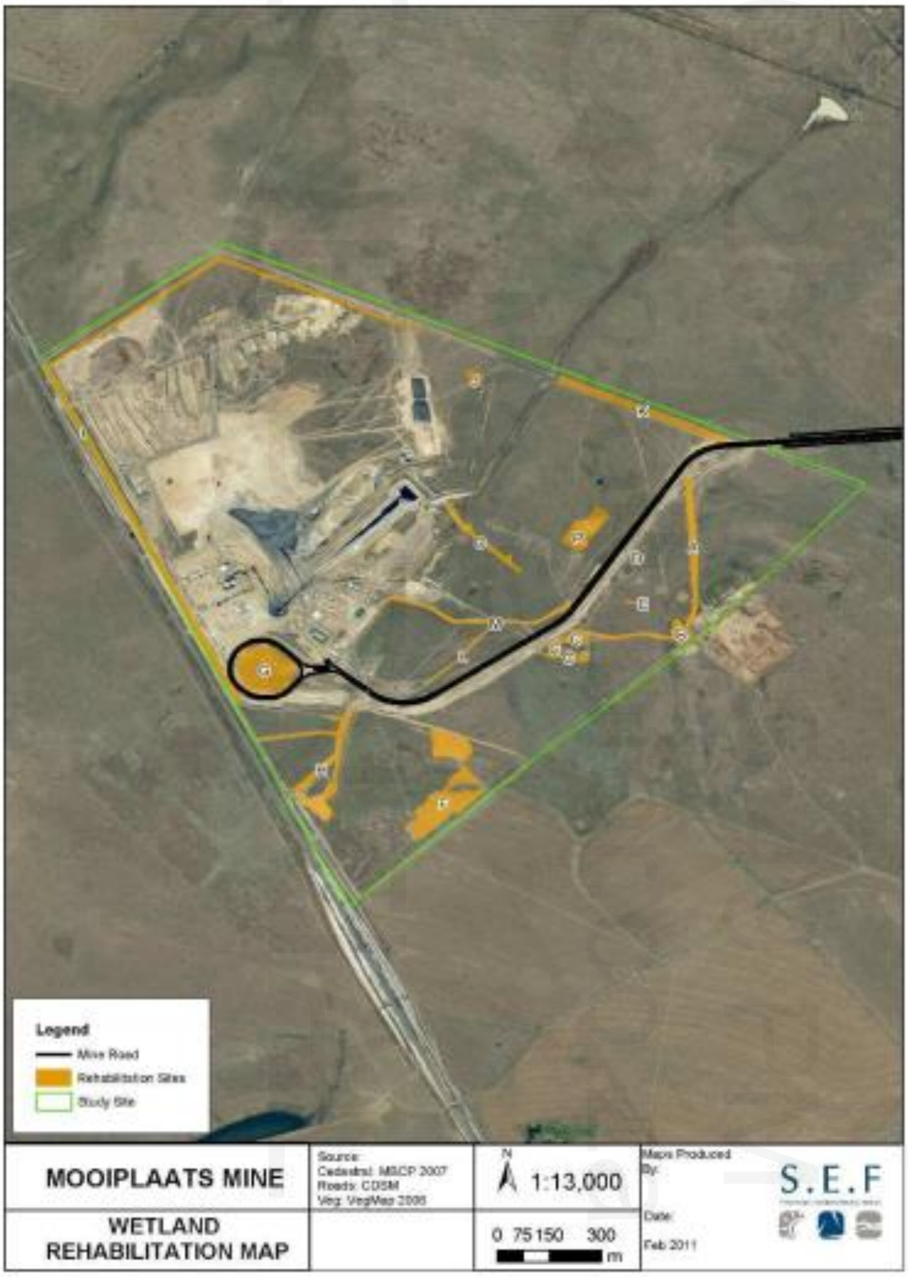

Figure 29: Areas specifically in wetland areas that need special consideration with regards to rehabilitation

- As a result of inadequate clean and dirty water separation infrastructure, a clean and dirty water program must be initiated (SEF, 2011).
- Re-vegetation of disturbed areas must be undertaken with site indigenous species and in accordance with the instructions issued by a wetland specialist and as per the wetland report (**appendix C**) (SEF, 2011):
  - Temporary seeps: *Aristida junciformis; Conyza ulmifolia; Eriocaulon dregei; Fingerhuthia sesleriiformis; Gunnera perpensa; Helichrysum mundii; Imperata cylindrica; Miscanthus capensis; Miscanthus junceus; Paspalum scrobiculatum; Pennisetum macrourum; Pennisetum sphacelatum; Ranunculus meyeri; Ranunculus multifidus and Setaria sphacelata.*
  - Seasonal wetlands: *Andropogon appendiculatus; Arundinella nepalensis; Carex acutiformis; Carex cognata; Cladium mariscus; Cyperus digitatus; Cyperus latifolius; Cyperus longus; Eriocaulon dregei; Fimbristylis complanata; Fimbristylis dichotoma; Fingerhuthia sesleriiformis; Gunnera perpensa; Helichrysum mundii; Isolepis costata; Juncus dregeanus; Juncus exsertus; Juncus oxycarpus; Juncus punctorius; Kniphofia linearifolia; Limosella longiflora; Ludwigia palustris; Paspalum scrobiculatum; Pennisetum macrourum; Pycreus mundii; Pycreus nitidus; Ranunculus meyeri; Ranunculus multifidus; Sacciolepis chevalieri; Schoenoplectus decipiens; Scleria welwitschii; Setaria sphacelata; Xyris capensis; Agrosits lachnanta and Xyris congensis*.
  - Permanent zone: *Arundinella nepalensis; Carex acutiformis; Carex cognata; Cladium mariscus; Cyperus digitatus; Cyperus latifolius; Fimbristylis dichotoma; Gunnera perpensa; Isolepis costata; Juncus dregeanus; Juncus exsertus; Juncus oxycarpus; Juncus punctorius; Kniphofia linearifolia; Limosella longiflora; Ludwigia palustris; Phragmites australis; Leersia hexandra, Typha capensis. Agrosits lachnanta, Pycreus mundii; Pycreus nitidus; Ranunculus meyeri; Ranunculus multifidus; Sacciolepis chevalieri; Schoenoplectus decipiens and Scleria welwitschii.*
- Adequate protection measures must be implemented around wetland areas, as per specialist recommendation, to reduce risk of degradation and deterioration to these systems. These could include a system of berms and trenches between these sites and active mine infrastructure areas.
- Ensure water management facilities around the co-disposal facility are operating adequately and contain all dirty water runoff and divert to the RWD. Clean out silt build up annually over the dry season. Ensure co-disposal facility is constructed and operated according to design parameters.

- Adequate buffer zones will be maintained and berms/trenches will be erected around the perimeters of the dirty water dams to ensure any spills or leaks or contained within the dirty footprint area.
- Water should be monitored and any observed deterioration caused by the mine attended to immediately with consultation from specialists if necessary.
- Ensure water management facilities are operating adequately with regard to capacity, silt build up and any potential leaks. Attend to leaks immediately if observed.
- PCD must be operated to contain at least a 1:50 year 24hr storm event at any time and they must be adequately lined.
- Should it become necessary as a last resort, an off-set approach to the mitigation of significant impacts resulting in wetland loss will be considered and implemented if possible within the same catchment, both from a hydrological as well as a biodiversity perspective in conjunction with on-site mitigation and management (SEF, 2011).
- All hydrocarbons will be stored in concrete bunded areas fitted with taps and oil traps. Bunded areas will be to SABS standards, and bunded area will have adequate capacity to contain leaks.
- Equipment will be regularly serviced to reduce risk of leaks. Generators will be kept in bunded areas erected as per SABS standards. Any leakages will be reported and treated immediately in a reputable manner.
- Waste generated on site will be recycled as far as possible and sold/given to interested contractors. Recyclable waste will not be stored on site for excessive periods to reduced risk of environmental contamination. Refuse bins will be placed around site to collect all non-recyclable waste for disposal at the licensed municipal waste disposal facility.
- All vehicles will be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks.
- Truck activity will be limited to the dirty footprint of the existing mine to ensure that any leaks that do occur are managed as part of the enclosed dirty water management system.
- All leaks will be cleaned up immediately using an absorbent material.
- For large spills Hazmat will called in.
- Wash bays and workshops will have oil traps fitted to capture any hydrocarbon runoff.
- Soil stockpiles will be managed and maintained as per the specifications of the pedologist. They will be well vegetated to reduce risk of erosion.
- Ablution facilities and sewage treatment plant will be managed by reputable contractors if required and inspected daily for any potential leaks.

- PCD and other dirty water containment facilities must be lined and lining integrity must be ensured so as to prevent ingression of poor quality water.
- Saving water initiatives will be included in environmental awareness training. Utilise water on site responsibly. Ensure all pipelines and water containment facilities are adequately sealed to prevent leaks. Record all water usage on site.

<u>Monitoring, frequency, estimated costs, responsible person & reporting</u>

- The environmental manager will ensure surface water monitoring is continued on a monthly basis, estimated at around R180,000.00 per annum but will depend on the number of sampling points. Data will be part of the public domain, with quality reports compiled quarterly and annually, these along with any additional measures compiled will be submitted to DWA.
- An environmental audit of the channelled valley bottom wetlands, seepages and their associated grassland areas contained within the 100m buffer will be conducted at least annually for the duration of the mining activity (SEF, 2011) and focus on:
    - Monitoring of the effectiveness of the rehabilitation program and identifying potential management interventions if needed;
    - Identification of the need for removal of any newly-established specimens of weeds,
    - The evaluation of the effectiveness of the instituted buffer, and
    - The identification of further impacts and the measures required to minimise and mitigate where necessary.
- The environmental manager will be responsible for coordinating weekly inspections of water management features and associated pipelines and containers for leaks, silt build up and capacities. This will form part of the mine’s running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.
- The site manager together with the environmental manager will ensure inspections of bunded areas are conducted weekly and after each rainfall event to ensure taps are closed and bunded areas are not flooded. All oil traps at storage areas and washbays/workshops will also be inspected and hydrocarbons removed if necessary and handled and disposed of as part of the mine’s waste management plan. They will also ensure the integrity of bunding is tested at least annually. This will form part of the mine’s running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.
- The environmental manager will be responsible for inspecting the mine area and surrounding areas for illegal littering and dumping at least monthly and

this will be cleared if observed and disposed of as part of the mines waste management plan. This will form part of the mine's running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.

- The site manager will ensure that once the PCD is established and lined that these are functioning properly and ensure that the lining integrity is tested at least annually and repaired if necessary. This will form part of running costs of the mine. Specialists will be consulted as required and any reports with recommendations by specialists will be kept at the mine offices.
- Ablutions and sewage treatment plant will be inspected weekly for any leaks and attended to immediately if observed. The environmental manager will ensure these inspections are carried out at least weekly. This will form part of the mine's running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.
- The environmental manager will inspect soil stockpiles at least monthly for erosion and vegetation cover. This will form part of the mine's running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.
- The site manager or contractor will ensure service plans are maintained by inspecting service books at least every 6 months and noting when next services are due. This will be at the contractor's expense or form part of the mine's running costs.
- The environmental manager will monitor protected species within wetlands periodically and, should it be absolutely necessary, these will be relocated by specialists. Records will be maintained of any issues, or incidences and actions taken and kept in the offices.

10.2.13 Traffic and safety

<u>Management</u>

- All intersections with main tarred roads will be clearly sign-posted .
- Drivers will be enforced to keep to set speed limits.
- Trucks will be in road-worthy condition with reflective strips.
- A fund will be set aside to maintain the serviceability of the road verge where the trucks approach or depart from the main road.

<u>Monitoring, frequency, estimated costs, responsible person & reporting</u>

- Site manager will ensure that the roads and intersections are inspected at least monthly and any issues observed attended to immediately. This will form part of the mine's running cost. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.

10.2.14 Socio-economic

Management

- Labourers/contractors will initially be sought locally and only regionally if skills are not available and any employment must be conducted as per SLP.
- Ensure baseline photographs are taken of all structures which may be impacted for photographic evidence prior to any blasting. Ensure procedures in place to compensate for damage.
- Ensure all power lines and power generation infrastructure is within specifications. Ensure that all power-related structures are adequately marked with relevant signs and warnings and fenced off with access control.
- Ensure reputable contractors are utilised for management of any facilities on site.
- Ensure all water containment facilities are functioning adequately and no leaks in pipelines. Water will not be released into the surrounding environmental and will be contained on site and recycled.

Monitoring, frequency, estimated costs, responsible person & reporting

- The social manager will ensure that any employment is in line with SLP initiatives and as required by the SLP. This will form part of the mine’s running costs. Reporting will be conducted as required by the SLP.
- The social manager together with the environmental manager will be responsible for inspection of all complaints received regarding any damage to structures and compare against photographic evidence. The social manager will be responsible for ensuring compensation or reparation procedures are implemented if necessary. This will be done on a case to case basis and form part of the mine’s running costs.
- The site manager together with the environmental manager will ensure general inspection of infrastructure associated with power generation such as ensuring fences are not damaged and no illegal connections have been added to lines. This will be done at least every month and will form part of the mine’s running costs.
- The environmental manager will ensure surface water monitoring is continued on a monthly basis, estimated at around R180,000.00 per annum but will depend on the number of sampling points. This will include bacterial monitoring of water from the sewage treatment facility. Data will form part of the public domain, quality reports will be compiled quarterly and annually, these reports along with any additional measures compiled will be submitted to DWA.

10.3 Decommissioning Phase Management Details

The decommissioning phase activities and related impacts and summarised management plans are indicated in Table 72. The detailed management plan is given below.

10.3.1 Topography

No mitigation measures can be applied to dumps with regards to impact on topography. Environmental and site manager must ensure that all dumps are rehabilitated and re-vegetated to the specifications of designs and specialists' recommendations.

Management

- Application of stone dust on pillars to prevent spontaneous combustion.
- Any severe subsidence or sinkholes will be rehabilitated immediately according to acceptable standard practices should these be observed over any surface area where underground mining has taken place.

Monitoring, frequency, estimated costs, responsible person & reporting

- The environmental manager will ensure that surface areas overlying underground mining areas are inspected at least monthly for subsidence or sinkholes. This will form part of the colliery's running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.

10.3.2 Geology

No mitigation measures can be applied with regards to impact on geology. The only impacts that may occur will be through subsidence or sinkholes, however the probability is low due to depth of mining. Impacts must be mitigated as for topography above.

10.3.3 Soil, Land Capability and Land Use

Any activities from occurring during the operation phase that still occur during the decommissioning phase will be managed as per the management plan for operations above.

Management

- Activity will be limited to the area of disturbance.
- Where required the compacted soils will be disked to an adequate depth and re-vegetated with indigenous plants.
- Trucks, machinery and equipment will be regularly serviced to reduce risk of leaks.

- Any leakages or spills will be reported and cleaned up immediately using an absorbent material.
- For large spills Hazmat will called in.
- Re-vegetate any bare soil immediately.
- Monitor for any residual impacts by continuing with surface water monitoring plan.
- Ensure berms/trenches erected between active areas and wetland areas remain in place to contain all dirty water runoff and divert to dirty water containment facilities to prevent dirty water runoff from contaminating surrounding soils.
- Waste generated on site will be recycled as far as possible and sold/given to interested contractors. Recyclable waste will not be stored on site for excessive periods to reduced risk of environmental contamination. Refuse bins will be placed around site to collect all non-recyclable waste for disposal at a reputable facility.
- Contouring of rehabilitated areas in order to control run-off direction, speed and velocity.
- Maintenance and control of vegetation cover over rehabilitated areas.
- Soil will be replaced over rehabilitated areas and treated as per the specifications of the pedologist. They will be well vegetated to reduce risk of erosion. Activities will include (Rehab Green, 2011):
    - A list of structures and their footprint sizes that need to be demolished and rehabilitated. A volume calculation of all existing topsoil stockpiles and a calculation of the topsoil volume required to rehabilitate the listed structures to a depth of at least 300 mm but preferably 500 mm.
    - A proportional allocation of topsoil stockpiles to listed structures to ensure no shortfall of topsoil. This will include a required topsoil thickness calculation per structure.
    - Proper backfill and shaping of areas, where top and subsoil were removed, to a freely drained surface and as close to the original topography as possible is very important. This will re-establish the original surface drainage pattern to some extent and prevent water logged conditions which would probably lead to acidification and salt contamination.
    - The footprint of coal stockpiles or wherever coalliferous material was dumped will be cleaned thoroughly before topsoil is replaced. Contaminated material can be placed on the co-disposal dump.

<u>Monitoring, frequency, estimated costs, responsible person & reporting</u>

- The environmental manager will ensure that the surrounding area is inspected for erosion and soil compaction at least monthly and ensure management measures are applied as soon as possible should issues be observed. This will form part of the mine running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.
- The environmental manager will ensure that the annual soil assessments are conducted as per the pedologist's recommendations and ensure an assessment of soil depth and physical and chemical characteristics and remedial measures recommended by specialist are conducted.
- The site manager or contractor will ensure service plans are maintained by inspecting service books at least every 6 months and noting when next services are due. This will be at the contractor's expense or form part of Mooiplaats running costs.
- The environmental manager will be responsible for coordinating weekly inspections of water management features and associated pipelines and containers for leaks, silt build up and capacities. This will form part of the mine's running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.
- The site manager together with the environmental manager will ensure that soil replacement over rehabilitated areas is conducted as per the pedologist recommendations. This will form part of the mine's running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.
- The environmental manager will be responsible for inspecting the mine area and surrounding areas for illegal littering and dumping at least monthly and this will be cleared if observed and disposed of as part of the mines waste management plan. This will form part of the mine's running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.
- The environmental manager will ensure surface water monitoring is continued on a monthly basis, estimated at around R180,000.00 per annum but will depend on the number of sampling points. Data will form part of the public domain, quality reports will be compiled quarterly and annually, these reports along with any additional measures will be submitted to DWA.

10.3.4 Surface Water

Any activities from the operation phase that still occur during the decommissioning phase will be managed as per the management plan for operations above.

Management

- Water is/will be monitored and any observed deterioration caused by the mine attended to immediately with consultation from specialists if necessary.
- Adequate buffer zones and berms/trenches will be maintained between the mine and wetland areas until such time that the bulk of the decommissioning activities are completed to prevent silt loading of wetland areas.
- Ensure water management facilities are operating adequately until such time that areas managed by these facilities are cleared of potential contaminants and adequately rehabilitated.
- Trucks, machinery and equipment will be regularly serviced to reduce risk of leaks.
- Any leakages or spills will be reported and cleaned up immediately using an absorbent material.
- For large spills Hazmat will called in.
- Monitor for any residual impacts by continuing with surface water monitoring plan.

Monitoring, frequency, estimated costs, responsible person & reporting

- The environmental manager will ensure surface water monitoring is continued on a monthly basis, estimated at around R180,000.00 per annum but will depend on the number of sampling points. Data will form part of the public domain with quality reports compiled quarterly and annually, these reports along with any additional measures compiled will be submitted to DWA.
- The environmental manager will be responsible for continuing coordinating weekly inspections of water management features and associated pipelines and containers for leaks, silt build up and capacities until such time that these get decommissioned. This will form part of the mine’s running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.
- The site manager or contractor will ensure service plans are maintained by inspecting service books at least every 6 months and noting when next services are due. This will be at the contractor’s expense or form part of Mooiplaats running costs.

10.3.5 Groundwater

Any activities from the operation phase that still occur during the decommissioning phase will be managed as per the management plan for operations above.

Management

- Ensure registered affected water users are compensated in some way, either with alternative water supply or monetary equivalent.

- Ensure water management facilities are operating adequately until such time that areas managed by these facilities are cleared of potential contaminants and adequately rehabilitated.
- Trucks, machinery and equipment will be regularly serviced to reduce risk of leaks.
- Any leakages or spills will be reported and cleaned up immediately using an absorbent material.
- For large spills Hazmat will called in.
- Monitor for any residual impacts by continuing with the groundwater monitoring plan.
- Ensure water management facilities around the co-disposal facility are operating adequately and contain and divert all dirty water runoff to the RWD. Ensure co-disposal facility is rehabilitated as per the rehabilitation plan and final dump design.
- Potential mine decant points will be rehabilitated and/or measures will be put in place to ensure that water is abstracted from the shafts or boreholes and treated before decant levels are reached (Geostratum, 2011). Treatment can include adding lime to neutralise water. Other treatment options can be discussed with specialists.
- New external users' boreholes will not be contaminated if they are not drilled close to the underground workings in depth (Geostratum, 2011).
- During the decommissioning phase the co-disposal should be capped with a soil layer. This will significantly minimise the seepage through the dump as well as the oxygen infiltration into the dump. Resultantly, this will significantly decrease the contamination plume development. However, the effectiveness of the mitigation measure must be further investigated through a specialist geochemical and unsaturated flow study (Geostratum, 2011).
- Ensure water from any dirty water dams that remain are sampled to monitored for any residual impacts and that lining of these dams is not compromised.

Monitoring, frequency, estimated costs, responsible person & reporting

- The environmental manager will ensure groundwater quality and levels are assessed through a thorough groundwater monitoring plan. This will be done at least quarterly for quality and annually for levels and is estimated at around R200,000.00 per annum but will depend on the number of boreholes needing to be monitored. Monitoring of boreholes, fountains and baseflow must continue post-closure until a closure certificate for the mine has been obtained (Geostratum, 2011). Data will be part of the public domain with quarterly quality reports and annual reports with any additional measures compiled and submitted to DWA.

- The site manager or contractor will ensure service plans are maintained by inspecting service books at least every 6 months and noting when next services are due. This will be at the contractor's expense or form part of Mooiplaats running costs.
- The site manager will ensure that all dirty water containment facilities are lined that these are functioning properly and ensure that the lining integrity is tested at least annually and repaired if necessary. This will form part of running costs of the colliery. Specialists will be consulted as required and any reports with recommendations by specialists will be kept at the mine offices.

10.3.6 Flora

Any activities from the operation phase that still occur during the decommissioning phase will be managed as per the management plan for operations above.

Management

- Limit activity to area of disturbance and re-vegetate impacted areas as soon as possible.
- Cordon off areas that are under rehabilitation as no-go areas using danger tape and steel droppers. If necessary, these areas will be fenced off to prevent vehicular, pedestrian and livestock access (SEF, 2011).
- Delay the re-introduction of livestock to all rehabilitation areas until an acceptable level of re-vegetation has been reached (SEF, 2011).
- In case of emergencies or unforeseen events (e.g. burst pipeline), the problem must be remediated immediately and any spillage into any watercourses be reported to the Department of Water Affairs. In addition, the soil must be stabilised (import additional topsoil if necessary) and re-vegetated as soon as possible. Re-vegetation will include seeds from the adjacent grassland and any rescued protected plants and/or plants of conservation concern that might have been impacted upon by the emergency / unforeseen event (SEF, 2011).
- Staff / contract workers may not trample natural vegetation (SEF, 2011).
- A fire management plan to sustain natural grassland on the study site is recommended as per the operation phase (SEF, 2011).
- Adequate buffer zones and berms/trenches will be maintained between the mine and wetland areas until such time that the bulk of the decommissioning activities are completed to prevent silt loading of wetland areas.
- Eradicate and control all alien invasive species on site. Rehabilitate and re-vegetate all areas where alien invasive species were removed.
- At mine closure, the land must be cleared of rubbish and all parts of the land shall be left in a condition as close as possible to that prior to use (SEF, 2011).

- Disturbed areas will be re-vegetated as soon as possible using an appropriate rehabilitation plan which incorporates indigenous plant species that naturally occurs on the study site (SEF, 2011).
- Control the type of topsoil material imported to ensure that soil contamination does not occur and bury coarse material incapable of supporting vegetation beneath the finer material (SEF, 2011).
- It is important to ensure that all materials that can pollute water resources are removed prior to rehabilitation. Excess excavation materials must be disposed of in approved areas in order to minimize leaching of hazardous material (SEF, 2011).
- If flooding is used as a method of reducing the potential for acid mine drainage, the entire coal seam must be inundated and reinforcement of key areas of the mine must be undertaken to accommodate water flow in advance of flooding (INAP, 2010) (SEF, 2011).

Monitoring, frequency, estimated costs, responsible person & reporting

- The environmental manager will ensure surrounding areas are inspected for damage to flora species at least monthly and ensure these are adequately rehabilitated immediately if observed. This will form part of the mine's running cost. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.
- The environmental manager will ensure berms/trenches are inspected weekly to ensure adequate functioning of these. Erosion must be attended to and adequate vegetation cover must be maintained. This will form part of the mine's running cost. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.
- The environmental manager will ensure surface water monitoring is continued on a monthly basis, estimated at around R180,000.00 per annum but will depend on the number of sampling points. Data will form part of the public domain, quality reports will be compiled quarterly and annually, these reports along with any additional measures compiled will be submitted to DWA.
- The environmental manager will ensure that an alien invasive monitoring and management programme is established on site to control and eradicate alien species as soon as possible. The area will be inspected at least every 6 months but this may need to be conducted more frequently depending on specific species which are recorded at site. This will form part of the mine's running costs. All monitoring and eradication conducted must be recorded and kept at the offices and will form part of the public domain.

10.3.7 Fauna

Any activities from the operation phase that still occur during the decommissioning phase will be managed as per the management plan for operations above.

Management

- Inform staff, contractors and visitors to not harm fauna in the area.

Monitoring, frequency, estimated costs, responsible person & reporting

- The environmental manager will ensure that any ecologically sensitive species are protected and monitored should they be observed on site. This will be conducted as required and form part of the running costs. Specialists and interest groups could be contacted if any assistance is required relocating species or to assist with conservation. Record of any such species will be maintained and kept at the mine office.

10.3.8 Air quality

Any activities from the operation phase that still occur during the decommissioning phase will be managed as per the management plan for operations above.

Management

- Speed limits will be established on the dirt road to minimise dust generation. All contractors will enforce speed limits.
- Dust suppression by water cart will be undertaken during times of high dust generation in any areas where dust is sourced.
- All vehicles will be regularly serviced to ensure they are in proper working condition and to reduce risk of excessive emissions.

Monitoring, frequency, estimated costs, responsible person & reporting

- The site manager will ensure that speed inspections are conducted sporadically. This will form part of the mine’s running costs.
- The environmental manager will ensure dust monitoring is conducted monthly which is estimated at around R80,000.00 per annum. The levels will be evaluated against threshold limits and action levels. Dust management measures will need to be revised if either threshold is exceeded. Data will form part of public domain available at the mine and annual reports will be compiled.
- The site manager or contractor will ensure service plans are maintained by inspecting service books at least every 6 months and noting when next services are due. This will be at the contractor’s expense or form part of Mooiplaats running costs.

10.3.9 Noise

Any activities from the operation phase that still occur during the decommissioning phase will be managed as per the management plan for operations above.

Management

- Vehicles and equipment will be regularly serviced to ensure acceptable noise levels are not exceeded.
- Silencers will be utilised where possible.
- Decommissioning phase activities will be conducted during the day-time hours as far as possible.
- Point sources will be enclosed where possible.
- Screens will be considered if I&AP complaints are received.

Monitoring, frequency, estimated costs, responsible person & reporting

- The site manager or contractor will ensure service plans are maintained by inspecting service books at least every 6 months and noting when next services are due. This will be at the contractor's expense or form part of Mooiplaats running costs.
- The environmental manager will ensure an ambient environmental noise monitoring programme is continued measuring noise at mine boundaries at least quarterly, and if levels are exceeded, at any sensitive receptors beyond the boundary where exceedance was observed. It is estimated at around R90,000.00 per annum but will depend on the number of measurements required.

10.3.10 Visual

Any activities from the operation phase that still occur during the decommissioning phase will be managed as per the management plan for operations above.

Management

- Ensure adequate vegetation cover of berms, soil stockpiles and the co-disposal facility to reduce visual impact.
- Waste generated on site will be recycled as far as possible and sold/given to interested contractors. Recyclable waste will not be stored on site for excessive periods to reduced risk of environmental contamination. Refuse bins will be placed around site to collect all non-recyclable waste for disposal at the licensed municipal waste disposal facility.

Monitoring, frequency, estimated costs, responsible person & reporting

- The environmental manager will be responsible for inspecting the mine area and surrounding areas for illegal littering and dumping at least monthly and this will be cleared if observed and disposed of as part of the mines waste management plan. This will form part of the mine's running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.

- The environmental manager will inspect all mining areas at least weekly for vegetation cover. This will form part of the mine's running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.

10.3.11 Sites of cultural significance

No impacts are expected to such sites and no mitigation measures are required. SAHRA protocols need to be followed should any such sites be discovered during the operations at Mooiplaats.

10.3.12 Sensitive landscapes – wetlands

Any activities from the operation phase that still occur during the decommissioning phase will be managed as per the management plan for operations above.

Management

- Adequate buffer zones and berms/trenches will be maintained between the mine and wetland areas until such time that the bulk of the decommissioning activities are completed to prevent silt loading of wetland areas.
- Eradicate and control all alien invasive species on site. Rehabilitate and re-vegetate all areas where alien invasive species were removed.
- Ensure water management facilities are operating adequately until such time that areas managed by these facilities are cleared of potential contaminants and adequately rehabilitated.
- Monitor area for erosion and pooling in any rehabilitated areas and re-contour if necessary.
- Trucks, machinery and equipment will be regularly serviced to reduce risk of leaks.
- Any leakages or spills will be reported and cleaned up immediately using an absorbent material.
- For large spills Hazmat will called in.
- Monitor for any residual impacts by continuing with surface water monitoring plan.
- Proper sealing and rehabilitation of shafts and exploration boreholes must be carried out to prevent the establishment of decant points.
- Waste generated on site will be recycled as far as possible and sold/given to interested contractors. Recyclable waste will not be stored on site for excessive periods to reduced risk of environmental contamination. Refuse bins will be placed around site to collect all non-recyclable waste for disposal at a licensed facility.

Monitoring, frequency, estimated costs, responsible person & reporting

- The environmental manager will ensure surface water monitoring is continued on a monthly basis, estimated at around R180,000.00 per annum but will depend on the number of sampling points. Data will form part of the public domain, quality reports will be compiled quarterly and annually, these reports along with any additional measures compiled will be submitted to DWA.
- The environmental manager will be responsible for coordinating weekly inspections of water management features and associated pipelines and containers for leaks, silt build up and capacities. This will form part of the mine's running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.
- The environmental manager will be responsible for inspecting the mine area and surrounding areas for illegal littering and dumping at least monthly and this will be cleared if observed and disposed of as part of the mines waste management plan. This will form part of the mine's running costs. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.

10.3.13 Traffic and safety

Management

- All intersections with main tarred roads will be clearly sign-posted .
- Drivers will be enforced to keep to set speed limits.
- Trucks will be in road-worthy condition with reflective strips.
- A fund will be set aside to maintain the serviceability of the road verge where the trucks approach or depart from the main road.

Monitoring, frequency, estimated costs, responsible person & reporting

- Site manager will ensure that the roads and intersections are inspected at least monthly and any issues observed attended to immediately. This will form part of the mine's running cost. Any incidences observed and any actions taken will be recorded in an incident and action report which will form part of the public domain.

10.3.14 Socio-economic

Management

- SLP retrenchment plan and training will be followed. Employ staff at other operations if feasible.

Monitoring, frequency, estimated costs, responsible person & reporting

- The social manager will ensure that any retrenchment is in line with SLP initiatives. This will form part of the mine's running costs. Reporting will be conducted as required by the SLP.

10.4 Closure and Post closure phases managment details

The closure and post closure phase activities are summarised in Table 73. The activities will be limited to monitoring. Impacts will be negligible as monitoring will assist in identifying issues which will need to be attended to. Closure objectives must be attained through rehabilitation and monitoring should indicate whether these objectives are being attained.

11 MONITORING PROGRAMME AND REPORTING

In accordance with Section 55 of the MPRDA Regulations, CoAL is required to conduct regular monitoring and performance assessments at their operations. The following monitoring programmes are proposed for this site:

11.1 Topography

11.1.1 Monitoring and reporting

- Surface areas where underground mining has occurred need to be inspected at least monthly for subsidence and sinkholes.
- Mining engineers and surveyors will be responsible for ensuring the co-disposal dump design and construction follows specifications and report on all issues to the environmental managers.
- All reports will be filed and kept at the mining offices.
- All incidences and issues will be recorded, as will the actions taken to address issues. These will be filed and kept at the mine offices.

11.1.2 Action required

- Should sinkholes or subsidence be repaired then the materials will be replaced in adequate order, with hard and soft overburden followed by sub-soil and topsoil.
- Co-disposal dump will follow the design specifications and an engineer will be consulted if issues are observed. The discard must be compacted when placed on the dump to reduce risk of spontaneous combustion and infiltration of water.
- Any erosion will also be addressed immediately utilising contour berms, gabion structures if necessary or a specialist will be consulted if necessary. Any eroded soils will be lifted and returned to the affected area.

11.2 Air Quality

11.2.1 Air quality monitoring and reporting

- Dust fallout levels are currently monitored at monthly intervals using dust buckets. Dust monitoring will continue to be conducted on a monthly basis.
- A report on the air quality measurements collected will be compiled annually. These reports will be in the public domain and are subject to review by the authorities.
- PM10 monitoring will be conducted if required as per the air quality act.
- Over and above this, occupational measurements will also need to be conducted as part of Safety, Health and Environment.

- The environmental manager will be responsible for managing the air quality database and implementing actions, should target levels and frequencies be exceeded.
- All incidences and issues will be recorded, as will the actions taken to address issues. These will be filed and kept at the mine offices.
- A specialist will be consulted where necessary.

11.2.2 Action required

Should ambient dust levels exceed recommended standards and frequencies as per the Air Quality Act, then the management plan for dust will be re-evaluated and assessed to improve dust control on site. Actions could include:

- Use of dust binding agents in areas of high dust generation.
- Consideration of sprinkler systems in areas of high dust generation.
- More frequent spraying programme.

11.3 Noise

11.3.1 Ambient noise monitoring and reporting

- Ambient noise will be monitored on a quarterly basis on the mine boundary in at least four compass directions.
- Occupational noise will be monitored on a monthly basis as part of Safety, Health and Environment.
- The environmental manager will be responsible for managing noise level database and implement actions should acceptable noise levels be exceeded.
- All incidences and issues will be recorded, as will the actions taken to address issues. These will be filed and kept at the mine offices.
- Specialists will be consulted where necessary.

11.3.2 Action required

- Should ambient noise levels exceed target levels as described in section 4.10 then:
    - Additional noise measurements will be taken at all sensitive receptors beyond the mine boundary in question, initially those nearest to the mine and working further away until levels are within acceptable levels.
    - Should levels at sensitive receptors still exceed target levels, and it is due to mining activities, then the noise management plan will be re-evaluated to reduce noise at these sensitive receptors to within acceptable limits.
    - Actions can include:

1. Utilisation of sound buffers or screens around noise sources.
2. Enclosing point sources in sound-proof enclosures if possible.
3. Utilising silencers on equipment.

11.4 Surface water monitoring

11.4.1 Water quality monitoring and reporting

- The surface water quality will continue to be monitored on a monthly basis.
- This monitoring programme will include various upstream and downstream monitoring points and various sources on site as proposed by the Hydrological Study (**Appendix D**).
- Quarterly and annual reports will be compiled and submitted to the mine management and will form part of the public domain.
- Reports will be submitted to DWA.
- All samples will be submitted to an accredited laboratory for analysis.
- The following chemical parameters are recommended for the analysis:
    - Total Dissolved Solids / Electrical Conductivity;
    - pH level;
    - Alkalinity;
    - Carbonates;
    - Magnesium;
    - Calcium;
    - Sodium;
    - Potassium;
    - Sulphate;
    - Chloride;
    - Fluoride;
    - Iron;
    - Manganese; and
    - Aluminium.
- Over and above this, water from the sewage treatment facility will also be evaluated for bacteria.
- Water use and consumption on site must be monitored at various strategic locations on site.

11.4.2 General monitoring and reporting

- Continuous monitoring of water consumption at various selected sites.
- All water management facilities will be inspected weekly to ensure there are no leaks which would result in loss of water, and to ensure they are functioning optimally.
- All diversion channels will also be inspected after each rainfall event for silt loading which will be cleared if observed.
- All silt build up in water management facilities / dams will be cleaned out as required but at least once annually during the dry season.
- All water management facilities on site will be inspected after each storm event. Issues that need to be noted include dam capacity, water load, freeboard, erosion and any leaks.
- All dirty water separation and containment facilities will be inspected at least weekly (and after each storm event), to ensure adequate functioning of all systems to prevent leaks into the environment.
- Monthly dust monitoring on site will be ongoing.
- The area will also be inspected monthly for illegal littering and dumping which will be cleared up immediately.
- The diesel storage site will be inspected daily to ensure that the tap from the bunded area is closed and after every rainfall event to empty out water that may have collected in the bunded area. Oil traps will be cleared of hydrocarbon build up.
- The integrity of the concrete of the bunding to the diesel storage area and generators, and the lining of all other waste management facilities and dirty water containment facilities, will be tested at least annually (by a competent person) to ensure optimum functioning.
- All pipelines and associated dirty water channels/compartments will be inspected weekly to ensure no leaks or damage to these.
- Maintenance of vehicles, machinery and equipment will be as per the service plans which will be checked at least every 6 months.
- The environmental manager will be responsible for inspection of sites and keeping records of all monitoring activities.
- All incidences and issues will be recorded, as will the actions taken to address issues. These will be filed and kept at the mine offices.
- Qualified specialists will be hired where required.

11.4.3 Action required

- Should downstream water quality be of significantly lower quality than upstream sources, then:
    - All water management features on site need to be inspected for potential leaks or for erosion, which needs to be repaired immediately.
    - Any issues observed will be reported to the environmental manager and respective site manager.
    - Issues will be addressed immediately.
    - Any large spills/leaks/dam failures will be attended as stated in the emergency response plan.
- Should spikes be observed in water consumption then these will be investigated immediately and sources identified.
- All leaks identified will be repaired immediately.
- Silt build up in water management facilities / dams will be cleared and deposited in soil stockpiles if clean or in residue deposits if dirty.
- All illegally dumped waste will be cleared and disposed of in appropriate waste management stream.
- Water accumulating in bunded areas will be released through oil traps and diverted to dirty water containment facilities as part of the process water circuit.
- Any lining on PCD or bunding which needs to be repaired will be attended to immediately with the assistance of specialists if required.
- Soil and air quality monitoring and action plans will be applied.

11.5 Groundwater

11.5.1 Groundwater quality and quantity monitoring and reporting

- Existing boreholes will be monitored as per the monitoring plan attached (Plan 12). Water level, pH, EC, TDS, Ca, Mg, Na, K, F, T.alk, Cl, SO_4, NO_3, Al, Fe, Mn and an ICP-OES metal scan will be included as part of the quality analysis. This plan is preliminary and changes may be likely after annual review of report and findings.
- The groundwater quality and levels will be monitored on a quarterly basis.
- Hydro-census boreholes will also be monitored for water level and pH, EC, TDS, Ca, Mg, Na, K, F, Talk, Cl, SO4, NO3, Al, Fe, Mn every 6 months.
- Additional monitoring boreholes have and may in future need to be drilled as mining operations progresses and need to be upstream and downstream of high risk areas such as permanent coal stockpile areas, wash plant, co-disposal facility and mining areas. The exact location of these will be

determined by a professional Geohydrologist in conjunction with the mine's environmental manager.

- All monitoring boreholes must be demarcated and protected to prevent damage or tampering.
- All samples will be submitted to an accredited laboratory for analysis.
- Quarterly and annual reports will be compiled and submitted to the mine management and will form part of the public domain.
- Reports will be submitted to DWA.
- The groundwater monitoring programme will be reviewed every 2 years as the groundwater model is updated.
- Water use and water consumption on site will be monitored at various strategic areas on site.

11.5.2 General monitoring and reporting

- Continuous monitoring of water consumption at selected sites to monitor overall water use around the mine.
- All water management facilities will be regularly inspected to ensure there are no leaks which would result in loss of water and that they are functioning optimally.
- All diversion channels will also be inspected for silt loading after rainfall which will be cleared if observed.
- All silt build up in water management facilities / dams will be cleaned out as required but at least once annually during the dry season.
- The pollution control dams will be inspected weekly to ensure no faults in the facility and to ensure they are being operated optimally.
- The area will also be inspected at least monthly for illegal littering and dumping which will be cleared up immediately.
- The diesel storage site and generators will be inspected daily to ensure that the taps from the bunded areas are closed and after every rainfall event to empty out water that may have collected in the bunded area.
- The integrity of the concrete of the bunding, and the lining of all other waste management facilities and dirty water containment facilities, will be tested at least annually to ensure optimum functioning.
- All pipelines and associated dirty water channels/compartments will be inspected weekly to ensure no leaks or damage to these.
- Maintenance of vehicles, machinery and equipment will be as per the service plans which will be checked at least every 6 months.

- A specialist hydrogeologist should save the data in a dedicated database and quarterly and annual reports will be generated. This will assist in building up a reference database for later reference.
- The groundwater flow dynamics will be calibrated every two years with updated monitoring data. This will assist with management and long term risk prediction and management.
- The environmental manager will be responsible for inspection of sites and keeping records of all monitoring activities.
- All incidences and issues will be recorded, as will the actions taken to address issues. These will be filed and kept at the mine offices.

11.5.3 Action required

- Should significant changes in qualities or levels be observed then:
    - All high risk facilities will be inspected to ensure no severe problems occur in these areas which have resulted in poor quality leachate.
    - Any issues observed will be reported to the environmental manager and respective site manager.
    - A geohydrologist will be consulted with regards to any additional mitigation or management activities which can assist in resolving potential pollution, such as cut-off drains.
    - Should substantial decreases in groundwater levels or quality be observed in boreholes utilised by surrounding community then CoAL will need to find solutions in conjunction with affected parties.
    - Issues will be addressed immediately.
- Should spikes be observed in water consumption then these will be investigated immediately and sources identified.
- All leaks identified will be repaired immediately.
- Silt build up in water management facilities / dams will be cleared and deposited in soil stockpiles if clean or in residue deposits if dirty.
- All illegally dumped waste will be cleared and disposed of in appropriate waste management stream.
- Any lining on PCD or bunding which needs to be repaired will be attended to immediately with the assistance of specialists if required.
- Soil and surface water monitoring and action plans will be applied.

11.6 Blast Noise and Vibration Monitoring

11.6.1 Monitoring and reporting

Digital seismographs and digital crack meters will be considered at residences/sensitive receptors which have lodged complaints. These instruments can take <u>continuous</u> readings. The blasting logs will be compared with the data from the seismographs and crack meters, to determine the effects of blasting on the nearby residences and infrastructure.

11.6.2 Action required

CoAL will need to ensure they have adequate photographic evidence of all structures in the vicinity of their mine which records the current status of these structures prior to mining.

CoAL will also need to ensure they have procedures in place to take corrective actions regarding any damage to sensitive receptors/structures done through underground blasting activities on their mine. These could include:

- Direct cash compensation.
- Ensure cost of reparations undertaken are covered.
- Possible replacement of structures if damage is severe.

11.7 Soil and land capability

11.7.1 Monitoring and reporting

- Annual soil assessments will be conducted by specialist pedologists after rehabilitation of the site.
- The soil stockpiles/berms need to be inspected weekly for erosion and to ensure they are adequately vegetated.
- The area will be inspected weekly for any erosion which must be addressed immediately if observed.
- The area will also be inspected monthly for illegal littering and dumping which will be cleared up immediately.
- The diesel storage and generator site will be inspected daily to ensure that the taps from the bunded areas are closed and after every rainfall event to empty out water that may have collected in the bunded area. This water will report to the dirty water circuit via an oil trap.
- The integrity of the concrete of the bunding, and the lining of all other waste management facilities and dirty water containment facilities, will be tested at least annually (by a competent person) to ensure optimum functioning.
- All pipelines and associated dirty water channels/compartments will be inspected weekly to ensure no leaks or damage to these.
- All dirty water separation and containment facilities will be inspected at least weekly (and after each rainfall event), to ensure adequate functioning of all systems to prevent leaks into the environment which will negatively impact on the soils.
- Monthly dust monitoring on site will be ongoing throughout life of operation.

- Maintenance of vehicles, machinery and equipment will be as per the service plans which will be checked at least every 6 months.
- The environmental manager will be responsible for inspection of sites and keeping records of all monitoring activities.
- Qualified specialists will be hired where required.
- All incidences and issues will be recorded, as will the actions taken to address issues. These will be filed and kept at the mine offices.

11.7.2 Action required

- Any recommendations made by specialist pedologist after annual surveys of rehabilitated areas will be carried out as specified.
- Should any activity occur in non-designated areas, the activity in the area will cease immediately and the area rehabilitated appropriately.
- Should any erosion be observed on site, it will be reported to the site manager and environmental manager. The issue will be addressed immediately and consideration given to:
    - Increasing vegetative cover in problem areas through manual seeding/planting.
    - Implementing erosion control measures such as contour berms or gabion baskets.
    - Consulting specialists.
- All illegally dumped waste will be cleared and disposed of in appropriate waste management stream.
- Air quality, surface and groundwater monitoring and action plans will be applied.

11.8 Flora, Fauna and Sensitive Landscapes

11.8.1 Monitoring and reporting

- Construction activities will be monitored at least weekly to ensure development is maintained in relevant areas.
- An alien invasive monitoring, eradication and control programme will be established and the area will be inspected at least every 6 months and more frequently in areas where alien species were observed.
- Protected faunal species observed on site will be reported to the environmental manager and specialists consulted with regards to the relocation of the animals if necessary. If no relocation is required the animals will be monitored.
- An environmental audit of the channelled valley bottom wetlands, seepages and their associated grassland areas contained within the 100m buffer will be

conducted at least annually for the duration of the mining activity (SEF, 2011) and focus on:

  - Monitoring of the effectiveness of the rehabilitation program and identifying potential management interventions if needed;
  - Identification of the need for removal of any newly-established specimens of weeds,
  - The evaluation of the effectiveness of the instituted buffer, and
  - The identification of further impacts and the measures required to minimise and mitigate where necessary.
- Monthly surface water monitoring will continue as stated above under surface water monitoring.
- The environmental manager will be responsible for inspecting and managing the protected flora within wetland areas. Specialists will be consulted regarding relocation of these species if necessary.
- All incidences and issues will be recorded, as will the actions taken to address issues. These will be filed and kept at the mine offices.
- Specialists will be consulted where necessary.

11.8.2 Action required

- Ecologically sensitive species:
  - Animals will only be relocated if they are at risk and then, only with the aid of specialists and with the relevant permits.
  - Protected plants will remain in situ as far as possible. They can only be moved or relocated with relevant permits and with the assistance of specialists.
- Should any erosion be observed on site, it will be reported to the site manager and environmental manager. The issue will be addressed immediately and consideration given to:
  - Increasing vegetative cover in problem areas through manual seeding/planting.
  - Implementing erosion control measures such as contour berms or gabion baskets.
  - Consulting specialists.
- An alien invasive management programme will be implemented for the control and eradication of alien invasive species on site. This plan will give preference to mechanical control methods. Any chemicals utilised must be used responsibly. DWA may need to be contacted and consulted with regards to the use of some chemicals.

- Should wetland and surface water monitoring indicate any deterioration in wetlands as a result of effluent from the colliery then the necessary upgrades of the clean and dirty water management systems will be made.
- Should large erosion gullies be formed through preferential flow paths of clean water diversion, then attenuation of the clean water diversion will need to be investigated and specialist input obtained. Measures could include reducing gradients, establishing erosion control measures such as gabions, or indigenous vegetation for erosion control, or the establishment of a series of artificial wetlands within the clean water diversion flow path.

11.9 Rehabilitated Areas: Soil and Vegetation Monitoring

11.9.1 Monitoring and reporting

- Monitoring of any ecologically sensitive species should they be observed on site will be done as and when required.
- Rehabilitation will be visually inspected at least monthly with regards to vegetation cover abundance.
- The area will be inspected monthly for general erosion and vegetative cover.
- Rehabilitated areas will be monitored for soil quality and depth;
- Floral surveys will be conducted on rehabilitated areas on an annual basis;
- The site will be monitored for alien invasive species at least every 6 months. This will, however, be dependent on the species of alien invasive species on site.

11.9.2 Action required

- Should any erosion be observed on site, it will be reported to the site manager and environmental manager. The issue will be addressed immediately and consideration given to:
  - Increasing vegetative cover in problem areas through manual seeding/planting.
  - Implementing erosion control measures such as contour berms or gabion baskets.
  - Consulting specialists.
- Rehabilitated areas:
  - Should soil depth be inadequate in the rehabilitated areas, then more soil will be brought in and deposited on the site.
  - The area will also be inspected for erosion to determine the reason for soil loss. This will be addressed immediately.
  - All recommendations made by the specialists will be followed.
  - Manual seeding or planting should vegetative cover be inadequate.

- An alien invasive management programme will be implemented for the control and eradication of alien invasive species on site. This plan will give preference to mechanical control methods. Any chemicals utilised must be used responsibly. DWA may need to be contacted and consulted with regards to the use of some chemicals.

11.10 Visual aesthetics

11.10.1 Monitoring and reporting

- The area will be monitored monthly for any illegal dumping and littering which will be cleared up by reputable means if observed on site.
- The dump and berms will be inspected for vegetative cover and erosion.
- The environmental and social managers will be responsible for addressing issues regarding visual aesthetics of the area related to residence in the area.
- All incidences and issues will be recorded, as will the actions taken to address issues. These will be filed and kept at the mine offices.
- Specialists will be consulted where necessary.

11.10.2 Action required

- All illegally dumped waste will be cleared and disposed of in appropriate waste management stream.
- Should any erosion be observed on site, it will be reported to the site manager and environmental manager. The issue will be addressed immediately and consideration given to:
    - Increasing vegetative cover in problem areas through manual seeding/planting.
    - Implementing erosion control measures such as contour berms or gabion baskets.
    - Consulting specialists.
- The co-disposal dump design specifications will be followed and specialists consulted if issues with designs are observed.

11.11 Traffic and Safety

11.11.1 Monitoring and reporting

- The intersection with the main road will be inspected at least monthly for road degradation and spillages.
- Speed limits will be enforced on site.
- All incidences and issues will be recorded, as will the actions taken to address issues. These will be filed and kept at the mine offices.

11.11.2 Action required

- Any degradation to the road will be repaired with consultation of the roads department.
- All spillages will be cleared:
    - o Hydrocarbons will be cleared as per the emergency response plan discussed below.
    - o Coal will be swept, collected and disposed on relevant residue deposit.
- Drivers speeding will be fined and repeated offenders will not be banned from driving on roads on the mine.

11.12 Socio-Economics

11.12.1 Monitoring and reporting

- SLP initiatives and commitments will be monitored by the social/environmental manager.
- Commitments made by the mine to I&APs in the issues register will be followed up on frequently.
- SLP implementation needs to be monitored and audited.
- PPP reports and meeting minutes will be made available to all who attended and copies kept on site. This will include an issues and response register.
- The social/environmental manager will be responsible for keeping all records and following up on commitments made to affected parties.

11.12.2 Action required

- SLP audits will be carried out annually to determine any shortfalls and these will specify targets relevant to specific shortfalls.
- Any commitments made to I&APs will be attended to the relevant I&AP satisfaction as agreed upon between the I&AP and the mine.

11.13 General inspection activities

The Table 74 summarises other monitoring and inspection activities as extracted from the impact assessment tables (Table 70, Table 71, Table 72 and Table 73). The table also summarises some actions to be considered should issues be observed during monitoring and inspection, the responsible person and the estimated annual costs involved with the various monitoring activities.

An incident and action log will be maintained on site which will record date of inspection, any evidence of non-compliance observed with regard to this EMP, all issues observed during inspections or monitoring data, and all remediation actions taken. This log will be part of the public domain and be available to authorities during site visits.

11.14 Performance Assessments

- All information as required by the various Government Departments will be captured and be readily available for submission when required. Therefore all inspections, incidences and remedial actions taken must be recorded and logged and be at the disposal of authorities during site visits.
- A performance assessment will be conducted against this EMP report by an external consultant every two years, throughout the life of mine. This is conducted to assess the adequacy and compliance of the EIA and EMP, and the relevant legislation. Any serious shortfalls will be addressed in an EMP amendment.
- This report will comply with the format as set out in regulation 55 (3) of the MPRDA, and will be submitted to the Department of Mineral Resources (DMR).
- The Quantum of the Financial Provision will be reviewed on an annual basis as part of the performance assessment audit, and submitted to the DMR.

Table 74: Monitoring schedule and actions

Frequency	Monitoring & inspection	Summary of actions to take if issues observed	Responsible person	Cost / annum
CONSTRUCTION PHASE				
Continuous	Monitor water usage	Any large spikes on water use must be followed up and source determined. May indicate leaks on site.	Environmental manager	Running cost
Weekly	Monitor construction activities	Any deviation from plans will be rectified immediately and areas rehabilitated immediately. Specialists will be consulted where needed.	Site manager	Running cost
Monthly	Dust monitoring	See air quality monitoring section above	Environmental manager	R 140,000.00
Monthly	Surface water monitoring	See surface water quality monitoring plan above	Environmental manager	R 180,000.00
Monthly	Inspect area for erosion and soil compaction	Erosion control measures, import soil if necessary and rehabilitate. Rip, disc or scarify depending on extent of compaction and rehabilitate.	Environmental manager	Running cost
Monthly	Inspect intersections and roads	Repair any damages, clear any spills and ensure all road signs are visible to all road users.	Site manager	Running cost

Frequency	Monitoring & inspection	Summary of actions to take if issues observed	Responsible person	Cost / annum
Monthly	Monitor and inspect the PCD	PCD needs to be erected on site as a matter of urgency to ensure all contaminated runoff is contained on site. These will be sized to contain at least a 1:50 year 24hr storm event and they must be adequately lined. Adequate protection measures must be implemented around wetland areas, as per specialist recommendation, to reduce risk of degradation and deterioration to these systems.	Site manager	Running cost
Monthly	Visual assessments of wetland areas	Ensure wetland areas are not impacted and clear of silt build up.	Environmental manager	Running costs
Monthly	Inspect area for damage to flora species.	Seed any areas where vegetation cover is sparse immediately to reduce risk of erosion.	Environmental manager	Running cost
Quarterly	Environmental noise monitoring.	See noise monitoring above.	Site manager	R 90,000.00
Quarterly	Groundwater quality & quantity monitoring.	See groundwater monitoring section above	Environmental manager	R 200,000.00
Every 6 months	Ensure service plans are maintained	Machinery behind on service plans will not be utilised on site until fully serviced.	Site manager	Contractors cost
As required	Monitor any ecologically sensitive species should they be	Should species be in danger from activities on site, then the species will be actively relocated with the aid of specialists.	Environmental manager	Running cost

Frequency	Monitoring & inspection	Summary of actions to take if issues observed	Responsible person	Cost / annum
	observed on site			
As required	Ensure employment is in line with SLP initiatives	SLP must be monitored and annual audits on the SLP conducted to ensure CoAL is in line with commitments set out in the EMP. Issues must be addressed.	Social Manager	Running cost
Sporadically	Speed trapping	Fines will be issued and repeat offenders will not be allowed to drive on site.	Site manager	Running cost
Annually	Test integrity of bunding for diesel storage areas and generators.	A specialist engineer will be contracted to conduct these tests. His/her recommendations will be applied on site as necessary.	Site & Environmental manager	Running cost
Annually	Inspect & test lining of all dirty water containment facilities.	A specialist engineer will be contracted to conduct these tests. His/her recommendations will be applied on site as necessary.	Environmental manager	Running cost
OPERATION PHASE				
Continuous	Monitor water usage	Any large spikes on water use must be followed up and source determined. May indicate leaks on site.	Environmental manager	Running cost
Weekly	Inspect all water management features on site	Any damage must be repaired immediately so that integrity of structures is not compromised. Specialists must be	Environmental manager	Running cost

Frequency	Monitoring & inspection	Summary of actions to take if issues observed	Responsible person	Cost / annum
		consulted if necessary.		
Weekly	Inspect all potable water works and pipelines for leaks	Seal any leaks observed immediately.	Environmental manager	Running cost
Weekly	Inspect all water other pipelines and water containment facilities for leaks	Seal any leaks observed immediately. See emergency response plan for addressing large or hazardous leaks.	Environmental manager	Running cost
Weekly	Inspect bunded areas for generators and hydrocarbon storage to ensure taps & valves are closed and from any leaks	Any open valves will be closed immediately. Any leaks will be cleared and disposed of as part of the hydrocarbon waste stream. Leaky containers will be repaired or replaced. See emergency response plan for addressing large leaks.	Site & Environmental manager	Running cost
Weekly	Inspect containment facilities of hazardous substance storage and check for leaks from any containers	Any leaks will be cleared and disposed of as part of hazardous waste stream. Leaky containers will be repaired or replaced immediately. See emergency response plan for addressing large leaks.	Site & Environmental manager	Running cost
Monthly	Inspect berms/trenches to ensure adequate functioning of these	Adequate buffer zones will be maintained and berms/trenches will be erected around the perimeters of active mine areas and sensitive areas.	Environmental manager	Running cost

Frequency	Monitoring & inspection	Summary of actions to take if issues observed	Responsible person	Cost / annum
Monthly	Inspect area for erosion and soil compaction	Erosion control measures, import soil if necessary and rehabilitate. Rip, disc or scarify depending on extent of compaction and rehabilitate.	Environmental manager	Running cost
Monthly	Inspect underground mining surface area for subsidence and sinkholes	Should subsidence or sinkholes be observed on site, then these areas will be filled with overburden subsoils and topsoil's as necessary and levelled and contoured to original topography of the area. The areas will also be seeded with local indigenous flora.	Mine Manager	Running cost
Monthly	Surface water monitoring	See surface water quality monitoring plan above	Environmental manager	R 180,000.00
Monthly	Monitor water quality from sewage treatment facility including bacteria	See surface water quality monitoring plan above	Environmental manager	R 20,000.00
Monthly	Dust monitoring	See air quality monitoring section above	Environmental manager	R 80,000.00
Monthly	Inspect intersections and roads	Repair any damages, clear any spills and ensure all road signs are visible to all road users.	Site manager	Running cost
Monthly	Inspect roads for coal spillages	Clear all spillages immediately where observed.	Environmental	Running

Frequency	Monitoring & inspection	Summary of actions to take if issues observed	Responsible person	Cost / annum
			manager	cost
Monthly	Inspect power lines and substations and ensure fences are not damaged & no illegal connections have been added to lines	All damaged fences will be repaired immediately. A qualified electrician will be consulted for any potential issues regarding electrical connections and power lines.	Environmental manager	Running cost
Monthly	Visually monitor vegetation cover on soil stockpiles and berms	Seed any areas where vegetation cover is sparse immediately to reduce risk of erosion.	Environmental manager	Running cost
Monthly	Inspect neighbouring areas for damage to flora species.	Seed any areas where vegetation cover is sparse immediately to reduce risk of erosion.	Environmental manager	Running cost
Monthly	Inspect area for illegal littering and dumping	Any illegally dumped waste will be collected and disposed of in the relevant waste stream.	Environmental manager	Running cost
Quarterly	Groundwater quality & quantity monitoring.	See groundwater monitoring section above	Environmental manager	R 200,000.00
Quarterly	Environmental noise monitoring.	See noise monitoring above.	Site manager	R 90,000.00
Every 6 months	Ensure service plans are maintained	Machinery behind on service plans will not be utilised on site until fully serviced.	Site manager	Contractors cost

Frequency	Monitoring & inspection	Summary of actions to take if issues observed	Responsible person	Cost / annum
Monthly	Inspect co-disposal facility development against designs	This will be conducted by the survey department and will require higher frequency as activities progress and higher frequency in active mining areas. Specialist engineers will be consulted if issues in design are observed.	Survey & Environmental manager	Running cost
Every 6 months depending on species	Alien invasive species eradication & control	An alien invasive species management plan will be compiled to eradicate and control alien invasive species on site. This will target species likely to occur in the area and stipulate species specific control measures and frequency of control for each species.	Environmental manager	Running cost
After rainfall	Inspect all bunded areas to ensure areas are not flooded	Any accumulated water within the bunded areas will be released to the process water circuit via an oil trap if there are indications that water has been contaminated by hydrocarbons. The water must not be released into the environment.	Site & Environmental manager	Running cost
Annually: In the dry season	Test integrity of water management structures and clean silt build up	A specialist engineer will be consulted if necessary and his/her recommendations followed. Any accumulated silt build up will be cleared from water management features. If the build up is contaminated then it will be disposed of appropriately.	Environmental manager	Running cost

Frequency	Monitoring & inspection	Summary of actions to take if issues observed	Responsible person	Cost / annum
As required	Monitor any ecologically sensitive species should they be observed on site	Should species be in danger from activities on site, then the species will be actively relocated with the aid of specialists.	Environmental manager	Running cost
As required	Inspect any complaints received regarding property damage from blasting and compare against photographic evidence.	CoAL must establish a complaints and inspections procedure, and a system of compensation for any potential damage from underground blasting activities. This could include direct monetary compensation or ensuring damage is repaired or structures are replaced in the event of serious damage.	Environmental manager	Running costs & dependent on extent of damage.
As required	Ensure employment is in line with SLP initiatives	SLP must be monitored and annual audits on the SLP conducted to ensure CoAL is in line with commitments set out in the EMP. Issues must be addressed.	Social Manager	Running cost
Sporadically	Speed trapping	Fines will be issued and repeat offenders will not be allowed to drive on site.	Site manager	Running cost
Annually	Test integrity of bunding.	A specialist engineer will be contracted to conduct these tests. His/her recommendations will be applied on site as necessary.	Site & Environmental manager	Running cost
Annually	Inspect & test lining of all dirty water containment facilities.	A specialist engineer will be contracted to conduct these tests. His/her recommendations will be applied on site as	Environmental manager	Running cost

Frequency	Monitoring & inspection	Summary of actions to take if issues observed	Responsible person	Cost / annum
		necessary.		
Annually	Test integrity of coal stockpile sacrificial layer	A specialist engineer will be contracted to conduct these tests. His/her recommendations will be applied on site as necessary.	Environmental manager	Running cost
DECOMMISSIONING PHASE				
Continuous	Monitor water usage	Any large spikes on water use must be followed up and source determined. May indicate leaks on site.	Environmental manager	Running cost
Weekly	Inspect all water management features on site	Any damage must be repaired immediately so that integrity of structures is not compromised. Specialists must be consulted if necessary.	Environmental manager	Running cost
Weekly	Inspect all water containment facilities and pipelines for leaks	Seal any leaks observed immediately. See emergency response plan for addressing large or hazardous leaks.	Environmental manager	Running cost
Monthly	Surface water monitoring	See surface water quality monitoring plan above	Environmental manager	R 180,000.00
Monthly	Dust monitoring	See air quality monitoring plan above	Environmental manager	R 80,000.00

Frequency	Monitoring & inspection	Summary of actions to take if issues observed	Responsible person	Cost / annum
Monthly	Inspect area for erosion and soil compaction	Erosion control measures, import soil if necessary and rehabilitate. Rip, disc or scarify depending on extent of compaction and rehabilitate.	Environmental manager	Running cost
Monthly	Inspect intersections and roads	Repair any damages, clear any spills and ensure all road signs are visible to all road users.	Site manager	Running cost
Monthly	Visually monitor vegetation cover in disturbed areas and on all rehabilitated areas	Seed any areas where vegetation cover is sparse immediately to reduce risk of erosion.	Environmental manager	Rehab cost
Monthly	Inspect area for illegal littering and dumping	Any illegally dumped waste will be collected and disposed of in the relevant waste stream.	Environmental manager	Running cost
Quarterly	Groundwater monitoring	See groundwater monitoring section above	Environmental manager	R 200,000.00
Quarterly	Environmental noise monitoring.	See noise monitoring above.	Environmental manager	R 90,000.00
Every 6 months	Ensure service plans are maintained	Machinery behind on service plans will not be utilised on site until fully serviced.	Site manager	Contractors cost
Every 6 months depending on	Alien invasive species	An alien invasive species management plan as	Environmental	R

Frequency	Monitoring & inspection	Summary of actions to take if issues observed	Responsible person	Cost / annum
species	eradication & control	implemented will be followed.	manager	100,000.00
After rainfall	Inspect rehabilitated areas for erosion and pooling	Area will be recontoured to allow for free-drainage of water. Erosion control measures will be established, import soil if necessary and rehabilitate.	Environmental manager	Running cost
As required	Monitor any ecologically sensitive species should they be observed on site	Should species be in danger from activities on site, then the species will be actively relocated with the aid of specialists.	Environmental manager	Running cost
As required	Ensure retrenchment is in line with SLP initiatives	SLP must be monitored and annual audits on the SLP conducted to ensure CoAL is in line with commitments set out in the EMP. Issues must be addressed.	Environmental manager	Running cost
Sporadically	Speed trapping	Fines will be issued and repeat offenders will not be allowed to drive on site.	Site manager	Running cost
Annually	Inspect & test lining of all dirty water containment facilities.	A specialist engineer will be contracted to conduct these tests. His/her recommendations will be applied on site as necessary.	Environmental manager	Running cost
Annually	Floral surveys need to be conducted in rehabilitated areas to monitor cover abundance,	An ecologist will be contracted to conduct these studies annually and his/her recommendations will be applied on site.	Environmental manager	R 80,000.00

Frequency	Monitoring & inspection	Summary of actions to take if issues observed	Responsible person	Cost / annum
	plant succession and community structure			
Annually	Soil survey and soil quality and depth monitoring in rehabilitated areas	A soil and rehabilitation specialist will be contracted to conduct these assessments and his/her recommendations will be applied on site.	Environmental manager	R 45,000.00
CLOSURE AND POST CLOSURE (for a period of 5 Years post closure) PHASES				
Monthly	Dust monitoring	See air quality monitoring plan above	Environmental manager	R 80,000.00
Monthly	Surface water monitoring	See surface water quality monitoring plan above	Environmental manager	R 180,000.00
Quarterly	Groundwater monitoring	See groundwater monitoring section above	Environmental manager	R 200,000.00
Quarterly	Environmental noise monitoring.	See noise monitoring above.	Environmental manager	R 90,000.00
Every 6 months depending on species	Alien invasive species eradication & control	An alien invasive species management plan as implemented will be followed.	Environmental manager	R 100,000.00

Frequency	Monitoring & inspection	Summary of actions to take if issues observed	Responsible person	Cost / annum
As required	Monitor any ecologically sensitive species should they be observed on site	Should species be in danger from activities on site, then the species will be actively relocated with the aid of specialists.	Environmental manager	Running cost
Annually	Floral surveys need to be conducted in rehab areas to monitor cover abundance, plant succession and community structure	An ecologist will be contracted to conduct these studies annually and his/her recommendations will be applied on site.	Environmental manager	R 80,000.00
Annually	Soil survey and soil quality and depth monitoring in rehabilitated areas	A soil and rehabilitation specialist will be contracted to conduct these assessments and his/her recommendations will be applied on site.	Environmental manager	R 45,000.00
At least annually	Topographical surveys	This will be conducted by the survey department. Any areas where topographical changes have occurred will be rehabilitated by filling and depressions with overburden, subsoils and topsoil as required and such areas seeded.	Survey & Environmental manager	Running cost

12 ENVIRONMENTAL AWARENESS PROGRAMME

The purpose of this section is to outline the methodology that will be used to educate the mine's employees and contractors of any environmental risks associated with their work and the manner in which these risks must be dealt with so as to avoid pollution and minimize the degradation of the environment.

Training will also address the specific measures and actions as listed in the EIA and EMP. This Environmental Awareness Plan (EAP) is intended to supplement the Safety, Health and Environmental (SHE) training and awareness requirements.

12.1 Training Needs

A training needs analysis will be performed through all levels of the organization including those within the administration, plant and mining worker sectors. Each of the categories / levels of the organization have different responsibilities and roles, accordingly different knowledge requirements are applicable. These are summarized in Table 75 below.

After the training needs have been identified, it is the responsibility of the SHE Office to ensure that personnel attend the relevant identified training.

12.2 Specialised Skills

The Training Department in conjunction with the SHE Officer are responsible for ensuring job specific training for personnel performing tasks, which can cause significant environmental and social impacts (e.g. receipt of bulk hazardous chemicals/fuel, hazardous materials handling, responding to emergency situations etc.). The Mine Manager with the assistance of the SHE Officer must identify relevant personnel and training courses.

12.3 Review of Training Material

Effectiveness of the environmental management training will be done by the management through task observations and during internal and external audits.

All training material for presentation to personnel and contractors will be reviewed annually to ensure consistency with organizational requirements and best practice guidelines. In addition to this, annual monitoring reports, audit results and all incident reports will be reviewed, any short comings and non-compliancy will be highlighted and management measures incorporated or improved upon within the training material.

12.4 Records

Records from the implementation of this EAP will be kept and controlled in accordance with the SHE Management System Control of Records Procedure, which is required to be implemented so as to provide evidence of conformity and effective operation of the relevant requirements of the SHE management system.

Table 75: Environmental Awareness Plan

OCCUPATION CATEGORY	ENVIRONMENTAL MANAGEMENT RESPONSIBILITY / ROLE:	REQUIRED KNOWLEDGE AND INPUT:	TRAINING REQUIRED:	INTERVAL:
Senior Management including Process Managers and Head of Department	Managing the Social & Environmental Assessment & Management System (SEAMS), and the Safety, Health & Environmental (SHE) Management System	• Understanding the purpose of the SEAMS and SHE Management System • Knowledge of the significant impacts as described in the EIA/EMP during the various phases • Knowledge of the commitments made in the EMP relevant to the various phases • Setting and reviewing the mine's Environmental objectives • Directing the SEAMS and SHE management system, and monitoring their progress	• General in-house, management training	• Once off
		• Accessing the legal register and searching for details • Emergency preparedness and response	• Training on the legal register	• Once off
Environmental Management Representative, SHE Officer & Internal Auditor	Managing the SEAMS and the SHE Management System Monitoring and auditing	• Understanding the purpose of the SEAMS and SHE Management System • Knowledge of the significant impacts as described in the EIA/EMP during the various phases	• General in-house, management training	• Once off

OCCUPATION CATEGORY	ENVIRONMENTAL MANAGEMENT RESPONSIBILITY / ROLE:	REQUIRED KNOWLEDGE AND INPUT:	TRAINING REQUIRED:	INTERVAL:
		• Knowledge of the commitments made in the EMP relevant to the various phases • Directing the SEAMS and SHE management system, and monitoring their progress		
		• Current knowledge of South African regulatory requirements, best practice guidelines and applicable legislation • Emergency preparedness and response	• Training on the legal register	• On going
		• Knowledge in spill management, stockpile management, discard management, water management and waste management • Knowledge of the relevant Operational procedures, Emergency Response Plans and Incident reporting	• Meetings and Talk Topics	• Continuous
		• Knowledge of the SABS standards and other relevant legislation regarding the correct storage of chemicals	• Training on the SABS standards and other legislation	• Annual
		• Knowledge of auditing techniques and report writing	• Auditor training	• Annual

OCCUPATION CATEGORY	ENVIRONMENTAL MANAGEMENT RESPONSIBILITY / ROLE:	REQUIRED KNOWLEDGE AND INPUT:	TRAINING REQUIRED:	INTERVAL:
Section Managers & Section Engineers	Implementation and daily management of the SEAMS and the SHE Management System	• Understanding the purpose of the SEAMS and SHE Management System • Knowledge of the relevant department's significant impacts as described in the EIA/EMP during the construction and operational phases	• General in-house, management training	• Once off
		• Actively implementing actions to achieve SEAMS Management Plans and Environmental Objectives. • Knowledge in stockpile management, discard management, water management and waste management • Knowledge of the relevant Operational procedures, Emergency Response Plans and Incident reporting • Knowledge in the correct storage of chemicals	• Meetings and talk topics	• Continuous
Engineering HOD & General Engineering Supervisor	Implementation and daily management of the SEAMS and the SHE Management System	• Understanding the purpose of the SEAMS and SHE Management System • Knowledge of the relevant department's significant impacts as described in the EIA/EMP during the construction and operational phases • Actively implementing actions to achieve SEAMS	• General in-house, management training	• Once off

OCCUPATION CATEGORY	ENVIRONMENTAL MANAGEMENT RESPONSIBILITY / ROLE:	REQUIRED KNOWLEDGE AND INPUT:	TRAINING REQUIRED:	INTERVAL:
		Management Plans and Environmental Objectives.		
		• Knowledge in spill management and waste management • Knowledge of the relevant Operational procedures, Emergency Response Plans and Incident reporting • Knowledge in the correct storage of chemicals	• Meetings and talk topics	• Continuous
Mine Captain & General Engineering Supervisors	Implementation and daily management of the SEAMS and the SHE Management System	• Understanding the purpose of the SEAMS and SHE Management System • Knowledge of the relevant department's significant impacts as described in the EIA/EMP during the construction and operational phases • Actively implementing actions to achieve SEAMS Management Plans and Environmental Objectives.	• General in-house, management training	• Once off
		• Knowledge in spill management and waste management • Knowledge of the relevant Operational procedures, Emergency Response Plans and Incident reporting • Knowledge in the correct storage and handling of chemicals • Understanding the requirements for not polluting the environment	• Meetings and talk topics	• Continuous

OCCUPATION CATEGORY	ENVIRONMENTAL MANAGEMENT RESPONSIBILITY / ROLE:	REQUIRED KNOWLEDGE AND INPUT:	TRAINING REQUIRED:	INTERVAL:
Supervisors, Shift Boss & Forman	General Environmental Awareness and job specific impacts	• Understanding the purpose of the SEAMS and SHE Management System • Knowledge of the relevant department's significant impacts as described in the EIA/EMP during the construction and operational phases • Knowledge of the relevant Operational procedures, Emergency Response Plans and Incident reporting • Knowledge in spill management and waste management • Understanding the requirements for not polluting the environment	• General in-house, management training	• Once off
Operators, tradespersons & Floor Employees	General Environmental Awareness and job specific impacts	• General Awareness of aim and purpose of the SEAMS and SHE Management System • Understanding the SEAMS Management Plan relevant to their operations • Understanding the requirements for not polluting the environment • General understanding of the relevant Operational procedures, Emergency Response Plans and Incident reporting	• Environmental Awareness Training	• Annual
General Administration	General Environmental Awareness and job	• General Awareness of aim and purpose of the SEAMS and	• Environmental Awareness	• Annual

OCCUPATION CATEGORY	ENVIRONMENTAL MANAGEMENT RESPONSIBILITY / ROLE:	REQUIRED KNOWLEDGE AND INPUT:	TRAINING REQUIRED:	INTERVAL:
Staff	specific impacts	SHE Management System • Understanding the SEAMS Management Plan relevant to their operations • Understanding the requirements for not polluting the environment • General understanding of the relevant Operational procedures, Emergency Response Plans and Incident reporting	Training	
Security	General Environmental Awareness and job specific impacts	• General Awareness of aim and purpose of the SEAMS and SHE Management System • Understanding the requirements for not polluting the environment • General understanding of the relevant Operational procedures, Emergency Response Plans and Incident reporting	• Environmental Awareness Training	• Annual

13 EMERGENCY RESPONSE PLAN

As part of its management tools, a mine should have an Emergency Response Plan. These plans will be disseminated to all employees and contractors in the event of an emergency.

In the case of a medical accident or problem, the mine has first aid kits available at various points and an emergency room. A First Aid officer will be on duty at all times. In the event of an emergency the checklist of emergency response units must be consulted and the relevant units notified.

Communication is vital in an emergency and thus communication devices, such as mobile phones, two-way radios, pagers or telephones, must be placed around the mine.

Should the emergency have the potential to affect the surrounding communities, they will be alerted via alarm signals or contacted in person.

Emergency services will be sourced from the nearest main town, Ermelo wherever possible. Contact details for the emergency services and local authorities are listed below, these will be displayed on site and made available to all employees and contractors.

Fire Brigade:	**017 801 3400**
Police Department:	**10111**
Ambulance:	**017 819 7772/ 017 819 2222**
Hospital:	**017 801 2600**
DWAF:	**012 392 1371**
DME:	**013 656 1448**
DEDET (Previously DALA):	**013 766 4004**

13.1 Environmental emergencies, procedures and remedial action

The following is a list of the most likely potential environmental emergencies:

- Fires;
- A hydrocarbon spill or leak;
- A spill or leak of process water;
- Flooding;
- Explosions;
- Subsidence; and
- Dump Failure.

13.1.1 Fire

Veld fires and fires resulting from other sources must be handled with extreme caution. Fire extinguishers will be placed around the mine.

The following procedures apply to fires:

- In the event of a fire an alarm will be activated to alert all employees and contractors;
- Identify the type of fire and the appropriate extinguishing material. For example water for a grass fire, and mono ammonium phosphate based fire extinguisher for chemical and electrical fires;
- In the event of a small fire the fire extinguishers placed around the mine will be used to contain and extinguish the fire;
- In the event of a large fire, the fire department will be notified and should react timeously;
- All staff will receive training in response to a fire emergency on site;
- A Fire Association will be set up with the mine and surrounding land owners to facilitate communication during fire events and assist in fighting fires, where necessary;
- If possible all surrounding drains, such as storm water drains need to be covered and or protected to prevent any contaminated water from entering the drains;
- In case of a chemical or petroleum fire, run-off from the area will be contained as far as possible using the most appropriate measures e.g. spill absorbent cushions, sand or a physical barrier;
- Contaminated run-off must be diverted into an oil sump, or cleaned up; and
- All fire fighting equipment will be inspected at least monthly to ensure that these are functioning.

13.1.2 Hydrocarbon Spills

Hydrocarbons such as diesel, petrol, and oil which are used as fuel for mine machinery which is kept on site, increases the possibility that spillage may occur. As this is a coal mine there is also the possibility of a coal spillage occurring. In the event of a spillage, procedures must be put into place to ensure that there are minimal impacts to the surrounding environment.

Diesel, engine oil and hydraulic oil are the most likely hydrocarbons identified during impact assessments that can result in an emergency situation.

The following procedure applies to a hydrocarbon spill:

- In the event of a small spillage, the soil will be treated in situ, using Hazmat clean up kits;

- Every precaution will be taken to prevent the spill from entering the surface water environment;
- 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 made available and if required, a specialised clean-up crew will be called in to decontaminate the area. The soil will be removed and treated at a special soil rehabilitation facility;
- Reasonable measures must be taken to stop the spread of hydrocarbons and secure the area to limit access;
- Dispatch necessary services;
- The incident must be reported to the Environmental coordinator immediately;
- The Environmental Coordinator will assess the situation from the information provided, and set up an investigation team or relevant personnel. Included in this team could be the Mine Manager, Chief Safety Officer, the employee who reported the incident and any individual responsible for the incident;
- When investigating the incident, priority must be given to safety;
- Once the situation has been assessed, the Environmental Coordinator must report back to the Mine Manager;
- The Mine Manager and the investigation team must make a decision on what measures can be taken to limit the damage caused by the incident, and if possible any remediation measures that can be taken; and
- The source / reason of the spill or leak will be addressed immediately.

13.1.3 Major Water Leak or Spill

Dam wall failures and burst high-volume dirty water pipelines have been identified as potential emergency situations. The following steps will be followed:

- Turn off all water supply to the dam/pipeline;
- Dispatch necessary emergency services;
- Take all reasonable measures to stop the spread of contaminated water, such as downstream emergency trenches and berms;
- The incident must be reported to the Environmental Coordinator immediately;
- The Environmental Coordinator will assess the situation from the information provided, and set up an investigation team or relevant personnel. Included in this team could be the Mine Manager, Chief Safety Officer, the employee who reported the incident and any individual responsible for the incident;
- When investigating the incident, priority must be given to safety;
- Once the situation has been assessed, the Environmental Officer must report back to the Mine Manager;

- The Mine Manager and the investigating team must take a decision on what measures can be taken to limit the damage caused by the incident, and if possible any remediation measures that can be taken;
- The DWA and DEDET will be notified of the incidence.

13.1.4 Flooding

There is potential for flooding during the rainy season. This could result in a large volume of water flowing downstream or accumulating in a water containment facility and could cause major damage to equipment and endanger the lives of employees on site. Procedures must be put in place to ensure that there is a quick response to flood events and damage is kept to a minimum.

The procedure for flooding is as follows:

DWA's flood warning system will be reviewed annually;

- The use of emergency pumps if the water floods the underground, where it may be exposed to contamination;
- Mine management will be made aware of any such event so they can take appropriate action to ensure production losses are kept to a minimum;
- All dams and water containment facilities will have a 0.8m freeboard and an overflow or outlet to ensure that no damage occurs to the facilities;
- All contaminated water will be contained on site, as far as possible and discharges to the environment will only occur if absolutely necessary in an extreme flood event.

13.1.5 Explosions

Explosions can occur in the plant and workshop areas when working with gas cylinders and chemicals. These could result in large numbers of employees being injured and requiring medical assistance.

The procedure to be followed is:

- Alternative evacuation routes will be devised, should a rock fall occur as a result of the explosion;
- All relevant emergency response units must be notified and hospitals informed of incoming patients.

13.1.6 Surface cracks / subsidence

Should subsidence occur at the underground workings, the following procedure will be followed:

- The Environmental Co-ordinator will be notified immediately;
- The area will be taped off;
- The Environmental Coordinator will assess the situation from the information provided, and set up an investigation team or relevant personnel. Included in

this team could be the Mine Manager, Chief Safety Officer, Mine Engineer and Rock Mechanic Engineer and the employee who reported the incident;

- Depending on the severity of the subsidence, either the cracks will be filled or alternate rehabilitation measures will be proposed by the rock mechanic engineer;
- The DME will be notified of the incident.

13.1.7 Co-disposal dump Failure

Dump failure has been identified as a potential emergency, environmental situation.

The procedure for dump failure is as follows:

- Turn off the slurry pipeline feed;
- Dispatch the necessary emergency services;
- The incident must be reported to the Environmental Coordinator immediately;
- Pollution control measures such as berms will be implemented;
- The Environmental Coordinator will assess the situation from the information provided, and set up an investigation team of relevant personnel. Included in this team could be the Mine Manager, Chief Safety Officer, Mine Engineer and the employee who reported the incident;
- When investigating the incident, priority must be given to safety;
- The co-disposal dump will be repaired according to the original designs and the recommendations of a suitably qualified Engineer;
- A clean up team will be assembled;
- All spills will be lifted and placed back onto the co-disposal facility;
- Once the situation has been assessed, the Environmental Officer must report back to the Mine Manager;
- The DME, DEDET and DWA will be notified of the incident.

14 FINANCIAL PROVISION

An annual calculation of the quantum of pecuniary provision is required by the Department of Minerals and Energy (DME), in terms of Regulation 54 of the Minerals and Petroleum Resources Development Act (28 of 2002). CoAL have submitted these for the last 2 years, the latest of which has been included below (from 2010).

The DME's "Rule-Based" approach must be followed in the determination of the Quantum, for the financial guarantee for submission to DME. The financial provision from the prior year was utilised as a template and additional structures added as necessary, and structures removed from site extracted from the financial provision to ensure an updated financial provision pertinent to the current status of operation.

Mooiplaats Colliery is a coal mine, and as such this mine is categorised as a Class A mine.

The Master rates for the different components were obtained from the DME guideline (2004); these rates were escalated by 42% to account for inflation. Weighting factors were applied based on the nature of the terrain and the proximity to urban areas. The determination of the pecuniary provision for the year 2010 is expanded in the Table 76 below.

The financial provision as calculated for 2010 has decreased compared to the previous year due to:

- The co-disposal dump having a smaller footprint at present than initially proposed; an area of 20 ha versus proposed area of 35 ha.
- Original costing included the tarred road as well as the alternative road past Camden power station. This liability assessment only includes the tarred road as the secondary road falls outside CoAL's area of activity.
- Admin facilities have been reduced and a smaller infrastructure footprint has been utilised for these than initially anticipated.

It should be noted that one of the biggest contributing factors to a high rehabilitation cost for the Office, Workshop and Stores Area, is the fact that all these structures have heavily reinforced foundations.

Table 76: Quantum for financial provision

Template for Level 2: "Rules-base" assessment of the quantum for financial provision							
CALCULATION OF THE QUANTUM							
Mine:	***Coal of Africa Limited - Mooiplaats***	**Location:**	Ermelo				
Evaluators:	CABANGA CONCEPTS, KEN VAN ROOYEN	**Date:**	10-Oct-10				
			A	**B**	**C**	**D**	**E=A*B*C*D**
No.:	**Description:**	**Unit:**	**Quantity**	**Master rate**	**Multiplication factor**	**Weighting factor 1**	**Amount (Rands)**
			Step 4.5	**Step 4.3**	**Step 4.3**	**Step 4.4**	
1	Dismantling of processing plant & related structures (incl. overland	m^3	1166.00	9.684	1.00	1.10	R 12,421.21
2 (A)	Demolition of steel buildings & Structures	m^2	12000.00	134.90	1.00	1.10	R 1,780,680.00
2 (B)	Demolition of reinforced concrete buildings & structures	m^2	3709.00	198.80	1.00	1.10	R 811,084.12
3	Rehabilitation of access roads	m^2	39200.00	24.14	1.00	1.10	R 1,040,916.80
4 (A)	Demolition & rehabilitation of electrified railway lines	m	0.00	234.30	1.00	1.10	R 0.00
4 (B)	Demolition & rehabilitation of non electrified railway lines	m	0.00	127.80	1.00	1.10	R 0.00
5	Demolition of housing &/or administration facilities	m^2	9865.0	269.80	1.00	1.10	R 2,927,734.70
6	Opencast rehabilitation including final voids & ramps	ha	2.559	141432.00	**0.52**	1.10	R 207,012.72
7	Sealing of shafts, adits & inclines	m^3	288.00	72.42	1.00	1.10	R 22,942.66
8 (A)	Rehabilitation of overburden & spoils	ha	4.188	94288.00	1.00	1.10	R 434,324.47
8 (B)	Rehabilitation of processing waste deposits & evaporation ponds (b	ha	0.910	117434.00	1.00	1.10	R 117,551.43
8 (C)	Rehabilitation of processing waste deposits & evaporation ponds (a	ha	22.0000	341084.00	**0.76**	1.10	R 6,273,216.93
9	Rehabilitation of subsided areas	ha	0.00	78952.00	1.00	1.10	R 0.00
10	General surface rehabilitation	ha	43.8465	74692.00	1.00	1.10	R 3,602,481.06
11	River diversions	ha	5.00	74692.00	1.00	1.10	R 410,806.00
12	Fencing	m	3500.00	85.20	1.00	1.10	R 328,020.00
13	Water management	ha	22.0000	28400.00	**0.25**	1.10	R 171,820.00
14	2 to 3 years of maintenance & aftercare	ha	43.8465	9940.00	1.00	1.10	R 479,417.63
15 (A)	Specialist study	SUM	1.00	**0.00**	**1.00**	1.10	R 0.00
15 (B)	Specialist study	SUM	1.00	**0.00**	**1.00**	1.10	R 0.00
						Sub Total 1	
						(Sum of items 1 to 15 Above)	**R 18,620,429.73**
	Inflation from time of release	42%					
				Weighting factor 2 (step 4.4)			
1	Preliminary and General	12.5% of Subtotal 1		Change according to urban, peri-		**1.05**	R 2,443,931.40
2	Administration & supervision costs	6.0% of Subtotal 1					R 1,117,225.78
3	Engineering drawings & specifications	2.0% of Subtotal 1					R 372,408.59
4	Engineering & procurement of specialist work	2.5% of Subtotal 1					R 465,510.74
5	Development of a closure plan						
6	Final groundwater modelling	2.5% of Subtotal 1					R 465,510.74
						Sub Total 3	
		;ubtotal 1 plus sum of management & administrative items, 1 to 6 above)					**R 23,485,016.99**
7	Contingency					VAT (14%)	R 3,287,902.38
				(Subtotal 3 plus VAT)		**GRAND TOTAL**	**R 26,772,919.37**

15 KNOWLEDGE GAPS

All specialist studies are conducted to certain levels of confidence, but in all instances known methodologies have been used and confidence levels are generally high. This means that in most cases the situation described in the pre-mining environment is accurate at high certainty levels, but there exists a low probability that some issues have not been identified during the studies. Such situations cannot be avoided simply due to the nature of field work and have therefore not been further discussed below. Furthermore, statistical analyses and mathematical models are merely tools which assist the researcher in assessing field observations and have innate assumptions which can reduce objectivity of the results obtained. This is not seen as a major flaw but should always be considered when assessing results.

More relevant issues have been highlighted below.

15.1 Soil and land capability

Soil studies are done on a grid basis and soil unit boundaries are inferred from these. The methodologies are accepted, however, and results obtained are generally adequate for effective management of soil units. Finer scale surveys would become too lengthy and costly. It is not strictly a knowledge gap but should be noted as the boundaries are not necessary precise and have an acceptable error margin based on the grid size.

15.2 Groundwater

The results from the Geohydrological Assessment for Mooiplaats North were not yet available at the time of compilation of this EIA/EMP amendment. Information for this report was obtained from the desktop study undertaken for the operation, as well as the Geohydrological Investigation undertaken for the adjacent Mooiplaats South operation.

The final completed Geohydrological Assessment for this operation will be forwarded to DMR as an annexure to this EIA/EMP Report.

15.3 Vegetation and Fauna

Many protected species in grasslands are small, very localised and visible for only a few weeks in the year when they flower and therefore the probabilities of occurrence for these plants can only be assumed and may still be present in the area even if not observed during the site visit. Long term studies would give a better understanding of the nature of the area and give better species richness; however time constraints and cost implications make long-term studies unfeasible.

15.4 Heritage and Archaeological Assessment

No heritage and/or archaeological assessment has been conducted for this operation to date, as this is an underground operation and the disturbed footprint has remained unchanged it is unlikely that any sites will be disturbed. Should any sites be unearthed or identified during the course of the operation SAHRA protocols must be followed and the necessary specialists contracted. A phase 1 heritage and archaeological assessment will be undertaken prior to any new activities occurring on undisturbed land.

16 CONCLUSION

This EIA/EMP Report has been compiled and submitted in response to a directive issued by the DMR in order to bring the existing Mooiplaats North Colliery into compliance with the necessary legislation and best practices.

The only new activities proposed within this amendment for the operation are concerned with the upgrading of the surface water management plan. The construction of these will have an overall positive impact, as it will improve the separation of clean and dirty water on site thereby reducing the potential impacts on nearby water resources.

Environmental studies were conducted and a PPP undertaken to assess the impacts of the operation, these impacts and the proposed mitigation and monitoring measures are included in this report.

The negative impacts from the operations can be mitigated to within acceptable levels. It is essential however, that Mooiplaats Colliery monitors and assesses the potential impacts on a regular basis to ensure compliance with the appropriate legislation, best practice guidelines and standards.

Should these operations take place in accordance with the EMP and supporting documentation Mooiplaats Colliery will achieve the aims of the MPRDA.

17 APPLICANT UNDERTAKING

I, ………………………………………………………………………………., the undersigned and duly authorised thereto by .... ……………………………………. that Mooiplaats Colliery will comply with the provisions of the Minerals and Petroleum Resources Development Act (Act 28 of 2002) and its Regulations as set out in Government Gazette no. 26275 (23 April 2004).

I have studies and understand the contents of this document and duly undertake to adhere to the conditions as set out therein, unless specifically or otherwise agreed to in writing.

Signed at ………………………………….. on this ……day of ……………………20……

____

Name:

Designation:

18 REFERENCES AND SUPPORTING DOCUMENTATION

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