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Exxaro Leeuwpan Coal
EMP Consolidation and OI Expansion Project

Final Environmental Impact Assessment and Environmental Management Programme (EIA/EMP)

in terms of Mineral and Petroleum Resource Development Act, 2002 (Act No. 28 of 2002)

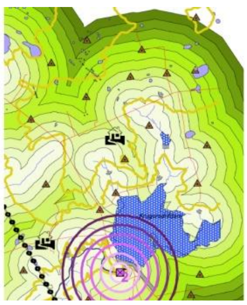
Final for Authority review

Version – 1
April 2015

Exxaro Leeuwpan Coal
GCS Project Number: 11-447
DMR Reference Number: MP 30/5/1/2/2/171 MR
MDEDET Reference Number: 17/2/3N-180

POWERING POSSIBILITY

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	Name	**Signature**	**Date**
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DISCLAIMER

Information contained in this report is based on data/information supplied to GCS Water and Environment (Pty) Ltd (GCS) by the client and other external sources (including previous site investigation data and external specialist studies). It has been assumed that the information provided to GCS is correct and as such the accuracy of the conclusions made are reliant on the accuracy and completeness of the data supplied. No responsibility is accepted by GCS for incomplete or inaccurate data supplied by the client and/or other external sources. Opinions expressed in this report apply to the site conditions and features that existed at the time of the start of the relevant investigations and the production of this report.

EXECUTIVE SUMMARY

Introduction and background

Exxaro Leeuwpan Coal Mine (Leeuwpan) is located between 5km south east of Delmas, in the Victor Khanye Local Municipality. It further falls under the Nkangala District Municipality in the Mpumalanga Province.

The district forms part of the Highveld maize production area of Mpumalanga, and is mainly used as cultivated farm land except for those areas not suitable, which are utilized for grazing.

The mine began as an Iscor Mine in 1991, doing extensive exploration and the first box-cut was opened in 1992. Exxaro Leeuwpan Coal Mine is an operational mine, and became known as Exxaro Leeuwpan Coal Mine in 2007, and operates according to the previous approved Environmental Management Plans (EMP's) that were submitted to the Department of Minerals and Energy (DME), now the Department of Mineral Resources (DMR), thus making Leeuwpan coal Mine a lawful mining operation as stated under the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA).

The purpose of this report is to fulfill the request of the DMR and will entail the consolidation of the current EMP and EMP Addendums into one consolidated Environmental Impact Assessment and Environmental Management Programme (EIA/EMP) in terms of the MPRDA. Leeuwpan will further utilize this opportunity to include a proposed opencast block (referred to as Block OI). The result of this consolidated EIA/EMP will be to have all information in one document for easy reference and effective environmental management.

The DMR previously approved the Block OI mining as an underground operation, however further studies have indicated the increased feasibility for open cast mining methods in this area, due to the shallow coal seams. The surface rights of the property is however not earmarked for opencast mining methods is not owned by ExxaroCoal (Pty) Ltd (Exxaro). Exxaro only owns the Mineral Rights and is currently zoned for agriculture and is used for cultivation. Exxaro Coal (Pty) Ltd is in the process to purchase the properties associated with the proposed new mining area.

Project Description

In terms of Section 102 of the MPRDA Leeuwpan requires authorisation for the proposed activities in the form of an amendment to the existing Environmental Management Programme (EMP), which must be approved by the DMR in Mpumalanga, before construction may begin. The DMR, however, requested Exxaro to consolidate all the previous EMPR's (refer to 1.1.1 to 1.1.6) for the existing operations. The consolidation of EMPR's was requested in addition to the proposed mining of Block OI in order to have one EMP for the entire operations. The MPRDA process will thus address the entire operations as a whole including all activities regarding the proposed Block OI expansion.

Leeuwpan Coal Mine is planning the development of an additional opencast pits (two at Block OI and one at Block OL) which will be located on portions of the farm Moabsvelden and Rietkuil. The mineral rights belong to Exxaro, however the certain portions of these farms are privately owned and utilised for agricultural practices.

The following infrastructure was approved for the previous EMPs under the MPRDA:

- Original EMP:
    - Equipment workshop;
    - Coal mixing bed and off-load facilities;
    - Railroad of ± 3 km for the transport of coal from Leeuwpan Coal Mine;
    - Weighbridge for the road transport;
    - Ablution block and administration offices;
    - A linking road with the R 50 route (between Delmas and Leandra) including security buildings;
    - A linking road with the P 36-2 route between Delmas and Devon;
    - Pit water dam and silt dams;
    - Evaporation ponds;
    - Additional storm water control measures (berms);
    - Electricity supply network (Power lines);
    - Closed water network for process water (Including Pipelines);
    - Potable water supply via pipeline;
    - Sewerage infrastructure;
    - River Diversion (tributary of the Bronkhorstspruit for save continuation of mining); and
    - Mining of mining blocks;
- Addendum 2:
    - New plant (final phase plant);
    - Demolition of old plant; and

  - Opencast block (Block OE);
- Addendum 3:
  - Extension of existing haul roads to Block OM, Block OH as well as Block OFPAD and Block OD;
  - Relocation of the 11 kV powerlines and associated mini substations;
  - Clean and dirty water systems around the mining area of Block OM, Block OH, Block OFPAD and Block OD;
  - Road diversions and associated infrastructure; and
  - Mining of mining blocks;
- Addendum 4:
  - Storage of water in dams and reservoirs
  - Infrastructure in the one in ten year flood line of a river or stream, or within 32 meters of the bank of a river or stream
  - The construction of a road that is wider than 4m
  - Mining of mining blocks
- Addendum 5:
  - Topsoil and overburden stockpiles;
  - ROM stockpile;
  - Storm water diversion channels;
  - Expansion of existing haul roads;
  - Water pollution management system;
  - Water supply system;
  - Ablution facilities;
  - Diesel fuel tank;
  - Workshop;
  - Site offices;
  - Explosives magazine;
  - Haul road and access roads;
  - Portable ablution facilities;
  - Temporary workshop;
  - Portable site office; and
  - Mining of mining blocks;

Exxaro Leeupan Coal Mine currently has approval for any infrastructure under NEMA as mentioned before. The mine do have a Water Use Lices under NWA that were approved in 2011 for water uses associated with Section 21 (a), Section (b), Section 21(c), Section 21(g), Section 21(i) and Section 21(j).

New infrastructure and activities that will be associated with the proposed Block OI expansion, in addition to all approved infrastructure, and that needs to be approved under MPRDA, NEMA and NWA includes the following:

- Two boxcuts for access to opencast pits;
- Explosive magazine;
- Mining of OI (opencast);
- New and extension of haul road from the mine entrance ramp to the tip terrace;
- Tip terrace, crushers, conveyors;
- Screen house;
- Crushing and screening plant (DMS);
- Weirs;
- Plant buildings;
- Stockyard, including stockyard conveyors;
- ROM and product stockpiles;
- Diesel storage of 1000 cubic metres - Fuel Depot;
- Water pipelines (from OI) and pipelines between PCDs;
- Existing return water dams will be put back in use – combined capacity of 80000 Cubic metres;
- Stormwater drains, trenches and cut-off trenches;
- Clean and dirty water systems;
- Evaporation dam, pollution control dam;
- Services including potable water, process water, fire water, electricity reticulation; and
- 11kV bulk electrical supply from Eskom substation.

The expected design life of mine is projected to be 17 years.

The proposed block OI will be situated on the following farm portions:

SG Number	Farm	Portion	Owner detail
T0IR00000000024800002	MOABSVELDEN 248	Portion 02	Exxaro Coal Pty Ltd
T0IR00000000024800003	MOABSVELDEN 248	Portion 03	Exxaro Coal Pty Ltd
T0IR00000000024800010	MOABSVELDEN 248	Portion 10	Exxaro Coal Pty Ltd
T0IR00000000024800016	MOABSVELDEN 248	Portion 16	Exxaro Coal Pty Ltd
T0IR00000000024900001	RIETKUIL 249	Portion 01	Hannes Potgieter Trustfonds
T0IR00000000024900002	RIETKUIL 249	Portion 02	Hannes Potgieter Trustfonds

Environmental Authorization Processes

The environmental processes involved with the project will be undertaken in three (3) parallel processes namely the NEMA EIA process for all the associated listed activities, the MPRDA process to develop a consolidated EIA/EMP, and the NWA process regarding the water uses that will be associated with the proposed development.

The following documents will be submitted to the indicated competent authorities:

- Consolidated EIA/EMP under MPRDA: Department of Mineral Resources (hereinafter referred to as "*DMR*"), in Mpumalanga Province;
- EIA/EMP under NEMA: Mpumalanga Department of Economic Development, Environment and Tourism (hereinafter referred to as "*MDEDET*"); and
- IWULA and Integrated Waste and Water Management Plan (IWWMP) under NWA: Department of Water Affairs (hereinafter referred to as "*DWA*").

Public Participation

The Public Participation Process (PPP) has been initiated as part of the requirements of the NEMA, MPRDA, and NWA. A Background Information Document (BID) was sent to all stakeholders and Interested and Affected Parties (IAPs) on the existing Leeuwpan Coal Mine's database and the identified stakeholders as per the requirements of the NEMA and MPRDA. The database is being updated continuously as new stakeholders and/or IAPs register for the project. Site notices regarding the project background and the assessment process being followed were also put up around the project site.

Advertisements regarding the project background and the assessment process being followed were placed in the following newspapers:

- The Citizen on 9th of November 2012; and
- Streeknuus on 16th of November 2012.

The Draft and Final Scoping reports were submitted for review and the final Scoping report was accepted by MDEDET. An open was held during the review period for the draft Scoping report.

The PPP is a continious process and the next phase of consultation with all stakeholders will commence with the next phase. Advertisements will be placed in the same newspapers to announce the announce the availability of the draft NEMA EIA/EMP document for public review and also the intention to conduct a open day to provide feedback on the findings of specialist studies.

Specialist Studies conducted

Specialist Studies conducted:

The following specialist study was undertaken to record the pre-development baseline of the various environmental parameters:

- Soils, Land Use and Land Capability Assessment;
- Biodiversity Assessment including both Flora and Fauna Assessments;
- Hydrology Assessment,;
- Hydrogeology Assessment;
- Wetlands Assessment;
- Air Quality Assessment;
- Historical Assessment;
- Noise Assessment;
- Blasting Assessment;
- Social Impact Assessment; and
- Traffic Assessment.

Environmental Baseline Description

Geology

The coal reserves located at the Leeuwpan Coal Mine's expansion project area [blocks OL and UI (now OI)] falls within the Witbank Coalfield. The Witbank coalfield's stratigraphy consists of sedimentary rocks of the Karoo Super Group; specifically the Transvaal Group and the lower coal-bearing Ecca Group.

Climate

The climate is generally moderate and dry with harsh winters, coupled with heavy frost. Rainfall is typical of Highveld conditions and occurs mainly during summer.

Average daily maximum temperatures range from 23.7°C in December to 11.3°C in July, with daily minimum ranging from 18.8°C in January to 2.8°C in July.

Witbank normally receives about 625mm of rain per year, with most rainfall occurring during summer. It receives the lowest rainfall (2mm) in July and August, and the highest (117mm) in January.

The local wind field is characterised by: Northerly and north-westerly winds with a strong component from the easterly sector. The north-westerly wind flow increases during day-time conditions with easterly wind flow increasing during the night. Low to moderate wind speeds with an average wind speed of 3.1m/s. Calm conditions occurring approximately 13% of the time.

Soils

Three land types i.e. Ba2, Bb3 and Ea15 are present within the mining right boundaries of Leeuwpan Coal Mine. The soils of the general Delmas area are known to be of the Clovelly and Hutton soil forms and make good agricultural lands. Reviewing soil maps of the area indicated that the following soil forms were present on site before disturbance by mining activities: Hutton, Bainsvlei, Clovelly, Avalon, Glencoe, Sepane, Longlands, Kroonstad, Westleigh, Rensburg, Katspruit and Dresden soil forms. A small section on the far western side of the site contains more structured soils of the Sterkspruit, Bonheim and Estcourt forms. However, only small sections of the original soil profiles are left around the mining areas. The soil profiles on the farm Rietkuil 249 IR are still present and these consist out of Hutton, Bainsvlei, Clovelly, Avalon, Glencoe, Sepane, Longlands, Kroonstad, Westleigh, Rensburg and Katspruit soil forms.

The area has got a high agricultural potential. Land outside areas being actively mined, are used for irrigated crop production, dryland crop production, grazing and farming infrastructure. The rest of the land is used for mining and mining infrastructure.

According to the Department of Agricultural Development, the agricultural land associated with the Delmas area is in the homogeneous farming area of the Magisterial District of Delmas.

Areas not yet disturbed by mining activities have arable and grazing land capability. Some rehabilitated areas may already have wilderness land capability but areas not sufficiently rehabilitated yet and active mining areas have industrial land capability.

Biodiversity

Literature indicated the presence of one regional vegetation unit within the study area, namely the endangered Eastern Highveld Grassland.

The available small-scale datasets (Land Cover 2000, Mpumalanga Conservation Plan) indicated that less than 67% of the study area represents natural vegetation. The species composition and presence of species of concern (Red Data, Protected, Medicinal and Alien invasive) within the remaining untransformed areas were determined during the summer/ wet season survey in October/ November 2012.

From the regional perspective, it is evident that the study area is located in a transformed and fragmented landscape. The area is not considered to be of conservation importance on a provincial scale even though it is located within a nationally threatened ecosystem. However, the remaining natural vegetation, especially terrestrial grassland is important for the mine because it represents source area for future rehabilitation and restoration. The extent and distribution of the remaining terrestrial grassland, especially those located on good agricultural land, were determined during the detail. These areas were also surveyed for the presence of threatened Red Data plants or for their suitability as habitat for threatened plants.

Surface Water

The Leeuwpan Coal Mine study area is located in Water Management Area 4: Olifants and in quaternary catchment area B20A. The Bronkhorstspruit River flows in a south-north direction through the site to eventually end in the Bronkhorstspruit Dam downstream of the site area. Natural water features on site include tributaries of the Bronkhorstspruit River and pans. Artificial water features on site include farm dams, old void areas, Pollution Control Dams (PCD's), rain water in open cast pits and river diversion channels.

There are four main uses of water that have been identified for the subcathment of the Bronkhorstpruit up to the receiving water body, namely the Bronkhorstspruit Dam. The surface water uses include the following;

- Domestic use by formal and informal communities along the affected watercourse;

- Irrigation of crops, especially maize;
- Livestock watering including cattle, sheep and poultry; and
- Aquatic ecosystems including fish, macro and micro-invertebrates.

Very few water bodies in the Delmas area are used for recreational purposes due to their seasonal nature. In most cases, dams are used for fishing.

No direct abstraction of water from the Bronkhorstspruit occurs for commercial irrigation or extensive domestic use. Dams are usually filled with water from the boreholes and this clean water is mainly used for irrigation. Numerous pans occur in the Delmas area, but are not utilized as a source of water for the above mentioned purposes.

Groundwater

There are three aquifer types present in the Leeuwpan Coal Mine area. These aquifers vary with regard to aquifer characteristics and are generally interconnected by fractures:

- The shallow aquifer formed in the weathered zone, often perched on the fresh bedrock;
- The deeper aquifer formed by fracturing of the Karoo sediments and dolerite intrusions; and
- The dolomite & chert rich karst aquifer of the Malmani Subgroup which underlies the Karoo type aquifer.

The coal reserves which are exploited at Leeuwpan Coal Mine are associated with the fractured Karoo aquifer can be classified as a minor (low yielding) aquifer system.

Groundwater is mainly used for domestic supply, small scale irrigation (gardens), livestock watering as well as large scale pivot irrigation of crops. The groundwater quality in the area is generally good.

Seepage through the opencast backfill will become acidic over the long-term. Elevation of TDS and SO4 will occur as a result of pyrite oxidation. In the opencast the SO4 will increase roughly to about 2 500 mg/l over the long term.

It is not foreseen that significant elevation in metals will occur at near-neutral conditions. After acidification non-compliance for Al, Fe and Mn may occur. Cr, Ni and, to a lesser degree, As and V are some of the other trace elements that may be slightly elevated and may reach occasional marginal to non-compliance.

Leeuwpan Coal Mine is an existing operation and as a result there are numerous contaminant sources already present such as the plant area, pollution and return water dams, rehabilitated opencasts and operational opencast.

The majority of privately owned boreholes are associated with the underlying dolomitic aquifer which in unlikely to be impacted by any dewatering activities.

Wetlands

In total the Leeuwpan Coal Mine area classified as wetland covers 1 382ha, which makes up roughly 32.5% of the study area. Approximately 820ha of the site has however already been disturbed by surface mining activities, suggesting that the wetland extent on site was likely significantly more prior to the onset of mining activities.

The National Wetland Inventory (SANBI, 2011) and the Atlas of Freshwater Ecosystem Priority Areas in South Africa (*Nel et al.*, 2011) indicates a number of valley bottom, hillslope seepage and pan wetlands as occurring on site. None of the wetlands are classed as FEPA's (Freshwater Ecosystem Priority Areas), and no FEPA wetlands occur within 3km of the study area boundary.

Air Quality

The Mpumalanga Highveld has frequently been the focus of air pollution studies for two reasons. Firstly, elevated air pollution concentrations have been noted to occur in the region itself. Secondly, various elevated sources of emissions located in this region have been associated with long-range transportation of pollutants and with the potential for impacting on the air quality of adjacent and more distant regions (Piketh, 1994). The Minister of Environmental Affairs and Tourism therefore declared the Highveld Priority Area (HPA) on 23 November 2007 (Highveld Priority Area Air Quality Baseline Assessment, 2010).

Leeuwpan is located in the local municipality of Delmas. According to the HPA Baseline Assessment Delmas is considered a “hotspot” area for PM10 (where ambient air quality is poor and where ambient PM10 generally exceeds air quality standards.

Leeuwpan is located in the Highveld Priority Area (HPA). According to the HPA Baseline Assessment Delmas is considered a “hotspot” area for PM10 (where ambient air quality is poor and where ambient PM10 generally exceeds air quality standards) are indicated. The HPA dispersion modeling results showed that the study site does not fall within an area where more than the allowable 4 exceedances of the PM10 air quality standard were predicted per annum.

<u>Historical</u>

The Mpumalanga Province is a cultural heartland and a tourist’s destination for most of its parts, as it is home to some well-known natural wonders and nature reserves.

The expansion of early farmers who, among other things, cultivated crops, raised livestock, mined ore, and smelted metals occurred in this area between AD 400 and AD 1100. Early Iron Age settlements, homesteads and Bushmen drawings are widespread in Mpumalanga. Large cattle byres with pits are also significant feature to be found in the area.

In the surveyed area seventeen sites of cultural significance have been found. Thirteen of these are grave sites. The others are farm buildings

<u>Noise</u>

The mining at the proposed open cast mine will take place in the vicinity of existing mining operations and busy feeder roads. The people living in the vicinity of these mining activities are already used to the increased noise levels created by the mining activities, hauling vehicles and motor-vehicles. The vegetation such as trees and natural grass will play an important role on how the noise from the opencast activities will be propagated and how the people in the vicinity of the proposed mine will perceive the increased noise levels.

This area where the proposed opencast mine will be situated cannot be classified as a rural type district because of the existing mining activities that allow to classify this area as a Type 2(d) district with higher prevailing ambient noise levels.

The applicable Noise Control Regulations will allow the prevailing ambient noise levels to be exceeded by 7.0dBA before a noise disturbance is created.

The proposed mining activities will create a shift in the near field prevailing ambient noise levels and at times this will create a temporary shift in the far field noise levels. The noise intrusion can however be controlled by means of approved acoustic screening measures, state of the art equipment, proper noise management principles and compliance to the International Finance Corporation's Environmental Health and Safety Guidelines.

Social

When conceptualising a proposal to expand a coal mine, the anticipated social and environmental impacts are generally broad and not limited to one specific area or town. The proposed project falls within the Mpumalanga Province, Victor Khanye Local Municipality (LM), which is part of the Nkangala District Municipality (DM).

In order to assess the potential impact of the proposed project, it is important to consider the particular Province, Distrct Municipality (DM), Local Municipality (LM) as well as the nearby towns in a holistic way.

The population according to the '96 census was 34 894 in Delmas. This increased by 2006 to an estimated 56 208 people, of which women comprised 51.4%. The Victor Khanye LM population in 2010 were composed of mostly Black African persons (69.88%) followed by 8.53% White persons. The number of Black African person has increased by 10.17% since 1995, whereas the number of White persons has decreased by 82.73% since 1995.

The Victor Khanye LM population has a large adolescent population with 26.07% of the population being younger than 15 years of age indicating that they do not form part of the Economically Active Population (EAP) of the area.

The employment status of the population has a variety of important implications. Economically active and employed persons can contribute to the overall welfare of a specific community by paying their taxes, looking after the youth and aged and by stimulating the economy. However, should a community have a large number of economically inactive and / or unemployed persons, the burden on the EAP of that community are amplified.

Even though the working age population for the Victor Khanye LM has increased by 7.58% between 1995 and 2009, the number of employed persons has decreased by 20.53% in the same period. The unemployment rate has fortunately decreased by 17.04% since 1995; however, the labour force participation rate has decreased by 29.48%. According to the South African census "96 the unemployment figure was determined to 20.31%. In 2003, of the 34 894 inhabitants, 37.43% were employed and 42.44% were not working. This included those not looking for work, housewife, students, pensioners/retired persons and disabled persons. By 2006, the number of full time employed people was approximately 13200 from approximately 23000 people. In 2007 the unemployment figure was 27.1%. Of the 36111 inhabitants, 36% was unemployed and 36.26 were economically active.

The wholesale and retail industry is currently creating the most employment opportunities within the Victor Khanye LM (21.45%). The agriculture, forestry and fishing industry has shown a significant decrease since 1995, marking a change of 252.97% for Victor Khanye LM. The major employers in the area include I&J, Voest-Alpine, Meadow foods, the Municipality of Delmas and Delmas Colliery.

Traffic

Traffic counts were carried out during the morning and afternoon peaks hours (6:00 – 9:00 morning and 16:00 – 19:00 afternoon) at the above mentioned intersections. Light vehicles, heavy vehicles (2 - 4 axles) and very heavy vehicle (5 and more axles), were counted at the intersections. The AM and PM Peak hour was determined based on the highest traffic volumes registered during the morning and afternoon period respectively. The AM Peak was found to be from 7:30 to 8:30 and the PM Peak hour was recorded at 16:45 to 17:45.

The R50, R548 and R42 routes are single carriage way (2 lanes, one lane per direction), paved roads with a capacity of ±1500 vehicles/hour/direction.

Environmental Impacts and Mitigation:

The main activities which will create impacts during the different phases of the mine life cycle were assessed during the EIA and mitigation and management measures developed thereto (Refer to Chapter 7 of this document). The main activities are:

Construction

- Land clearing
- Soil stripping and stockpiling
- Infrastructure establishment
- Boxcut establishment (earthworks only)
- Waste handling

Operational

- Opencast mining of existing and new blocks
- Operation of existing and new plants
- Operation and maintenance of linear infrastructure (haul road, powerlines and conveyors)
- Storage of dangerous goods (diesel and explosives)
- Operation and maintenance of dirty water containment dams
- Operation of stockpiles (topsoil, product, including coal mixing bed)
- Maintenance of river diversion

Decommissioning and Closure

- Removal of infrastructure
- Active rehabilitation
- Post closure aftercare and monitoring

Monitoring of Programme

Aspect	Component	Frequency of data collection
Surface water	Surface water quality	Monthly
	Water consumption levels	Daily
Groundwater	Groundwater quality	Quarterly
Biomonitoring	Biological integrity of aquatic habitats	Biannually
Biodiversity monitoring	Red data fauna and flora species Alien invader species	Yearly / biannually
Air quality	Dust fallout	Quarterly
Rehabilitation	Soil	Quarterly

Aspect	Component	Frequency of data collection
	Vegetation (alien invader and vegetation composition, species diversity and cover abundance)	Annually for at least the firts 3 years
	Animal life	Annually
Noise	Noise levels	Monthly
Topography	Surface movement (subsidence)	Quarterly
Integrated Management System	Identification of deviations from standards	Periodically
Performance assessment	Assessment of adequacy of EMP commitments	Biennially

Motivation for the Project

The proposed project will result in the expansion of the life of mine with an additional 18 years. The additional coal resources will supply Eskom with coal for power generation.

The mine has an approved Social and Labour Plan which is set out on injecting capital, skills and services into the district municipality. Should this project be approved, and the life of mine increased, the district municipality will continue to benefit from the mining operations.

However, as with many coal opencast mines', especially in the Mpumalanga Province, there are the unavoidable environmental and social impacts. Should the project be approved the project will necessitate the permanent removal of disturbed wetlands. The project may also have a cumulative impact on water resources in the area and the loss of flora and fauna.

Exxaro is however committed to ensure that all the necessary specialist studies are undertaken to identify the potential impacts and also the significance of these. Based on this detailed management programmes will be established for soil management, ecological management, surface water and wetland management, groundwater management, air quality management, visual and noise management and any other management programme deemed necessary to reduce or eliminate potential negative impacts and enhance the positive impacts associated with the project. Exxaro is committed to investigate options for long term sustainable wetland management programmes and also possibly the potential for establishing off-set areas.

If the ‘No Project’ alternative were implemented, all possible positive impacts resulting from the proposed development would be lost and in terms of the life of mine, closure of the facility will be required within three (3) years. The mine currently employs approximately 500 permanent staff and 400 contractor staff who will be impacted significantly in this event. The overall contribution to the chronic unemployment levels on a national scale, in addition to the required for coal for electricity generation makes the ‘No Project’ option strongly unadvisable. For the above-mentioned reasons, the implementation of the 'No Project' option is not advisable.

CHECKLIST IN TERMS OF REGULATION 50 AND 51 OF GOVERNMENT NOTICE 26275 OF MPRDA

This document has been compiled in terms of Section 39 and of Regulations 50 and 51 of the Mineral and Petroleum Resources Development Act, 2002, (Act No. 28 of 2002). The Department of Mineral Resources (DMR) Environmental Impact Assessment (EIA) and Environmental Management Programme (EMP) template states the following:

"All applicants for mining rights are herewith, in terms of the provisions of Section 29 (a) and in terms of Section 39 (5) of the Mineral and Petroleum Resources Development Act, directed to submit an environmental Impact Assessment, and an Environmental Management Programme strictly in accordance with the subject headings herein, and to compile the content according to all the sub items to the said subject headings referred to in the guideline published on the Departments website, within 30 days of notification by the Regional Manager of the acceptance of such application."

Please note the following:

At the outset it must be stated that there have been substantial amendments to the MPRDA during 2013. However, due to uncertainty on how the new amendments should be implemented, it is assumed that the old MPRDA (before the amendments were promulgated) still functions as guiding mining legislation and the guidelines for the compilation of and Environmental Impact Assessment and Environmental Management Programme, in relation to SAMRAD documents were used as the guiding documentation for this report.

For ease of reference the checklist below has been provided. All subject headings are furthermore included under each chapter of the document.

REGULATION 50 (a).	REPORT REFERENCE
1. Description of the baseline environment	
1.1. Concise description of the environment on site relative to the environment in the surrounding area.	Chapter 4
1.2. Concise description of each of the existing environmental aspects both on the site applied for and in the surrounding area which may require protection or remediation.	Chapter 4
1.3. Concise description of the specific land uses, cultural and heritage aspects and infrastructure on the site and neighbouring properties/farms in respect of which the potential exists for the socio-economic conditions of other parties to be affected by the proposed mining operation.	Chapter 4
1.4. Annotated map showing the spatial locality and aerial extent of all environmental, cultural/heritage, infrastructure and land use features identified on site and on the neighbouring properties and farms.	Figure 1.1; Figure 1.2; Figure 1.4; Figure 2.2; Figure 4.10, Figure 4.11, Figure 4.47; Figure 5.1
1.5. Confirmation that supporting documents in the form of specialist studies are attached as appendices.	Chapter 13
2. The proposed mining operation.	
2.1. The mineral to be mined	Chapter 2
2.2. The mining method to be employed at the level of opencast, underground, stoping, stooping, total extraction, bord and pillar, block caving, shrinking, dredging, pumping, monitoring, etc. and provide a concise description of the intended magnitude thereof, in terms of volumes, depth and aerial extent.	Section 2.3
2.3. List of the main mining actions, activities, or processes, such as, but not limited to, access roads, shafts, pits, workshops and stores, processing plant, residue deposition sites, topsoil storage sites, stockpiles, waste dumps, access roads dams, and any other basic mine design features.	Chapter 2
2.4. Plan showing the location and aerial extent of the aforesaid main mining actions, activities, or processes as required to calculate the financial provision in accordance with the Department's published guideline. (Reg. 51 (b) (v)).	Figure 2.1, Figure 2.2
2.5. Listed activities (in terms of the NEMA EIA regulations) which will be occurring within the proposed project.	Section 1.5.2
2.6. Indication of the phases (construction, operational, decommissioning) and estimated time frames in relation to the implementation of these actions, activities or processes and infrastructure.	Section 6.1 and Section 7
2.7. Confirmation if any other relevant information is attached as appendices.	List of Appendices and Chapter 13
3. The potential impacts	
3.1. List of the potential impacts, on environmental aspects separately in respect of each of the aforesaid main mining actions, activities, processes, and activities listed in the NEMA EIA regulations. (include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department).	Chapter 7

3.2. List of all potential cumulative environmental impacts.	Chapter 7
3.3. State specifically whether or not there is a risk of acid mine drainage or potential groundwater contamination associated with the mineral to be mined. (If such a risk is associated with the mineral to be mined provide a summary of the findings and recommendations of a specialist geo-hydrological report in that regard).	Section 4.7
REGULATION 50 (b)	
4. The alternative land use or developments that may be affected	
4.1. Concise description of the alternative land use of the area in which the mine is proposed to operate.	Chapter 4.3
4.2. List and description of all the main features and infrastructure related to the alternative land uses or developments.	Chapter 3
4.3. Plan showing the location and aerial extent of the aforesaid main features of the alternative land use and infrastructure related to alternative land developments identified during scoping.	**Error! Reference source not found.**
5.The potential impacts of the alternative land use or development	
5.1. List of the potential impacts of each of the aforesaid main features and infrastructure related to the alternative land use or development and related listed activities.	N/A
5.2. Description of all potential cumulative impacts of the main features and infrastructure related to the identified alternative land uses or developments.	N/A
REGULATION 50 (c)	
6. Identification of potential social and cultural impacts.	
6.1. List of potential impacts of the proposed mining operation on the socio- economic conditions of other parties' land use activities. . (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department).	Section 7.2; Section 7.3; Section 7.4
6.2. Description of the cultural aspect that will potentially be affected, and describe the potential impact on such cultural aspect. (In cases where such features are not applicable the applicant must still include the item in the list and describe it as not applicable).	Chapter 7
6.3. Description of heritage features and the potential impact on such heritage feature. (In cases where such features are not applicable the applicant must still include the item in the list and describe it as not applicable).	Chapter 7
6.4. Quantification of the impact on the socio-economic conditions of directly affected persons, as determined by the findings and recommendations of a specialist report in that regard.	Chapter 7
6.4.1. The amount of the quantified potential impact on property or infrastructural assets.	Chapter 7
6.4.2. State the amount of the quantified potential impact on commercial, economic or business activity which will be impacted upon as a result of the mining activity.	Chapter 7
6.4.3. The sum of the amounts, referred to in paragraphs 6.6.1 and 6.6.2 above.	Chapter 7
7. Assessment and evaluation of potential impacts.	

7.1. List of each potential impact identified in paragraphs 3 and 6 above. (Include all the items to be included in the list referred to in the concomitant Chapter of the guideline posted on the official website of the Department).	Chapter 7
7.2.Concomitant impact rating for each potential impact listed in paragraph 7.1 above in terms of its nature, extent, duration, probability and significance.(Provide a definition of the criteria used for each of the variables used for rating potential impacts and ensure that the potential impacts are rated specifically with the assumption that no mitigation measures are applied).	Chapter 7
7.3. Indication of the phases (construction, operational, decommissioning) and estimated time frames in relation to the potential impacts rated.	Chapter 7
REGULATION 50 (d)	
8. Identification of the alternative land uses which will be impacted upon. (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department).	Chapter 3
9. Listed results of a specialist comparative land use assessment. (Refer to the concomitant section of the guideline posted on the official website of the Department and attach the specialist study as an appendix).	Chapter 3
REGULATION 50 (e)	
10.List of all the significant impacts as identified in the assessment conducted in terms of Regulation 50 (c) (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department).	Chapter 7
REGULATION 50 (f)	
11. Identification of interested and affected parties. (Including the community, and list as identified according to the scoping report guideline and identified in the scoping report).	Chapter 5
12. The details of the engagement process. (Including the community, and list as identified according to the scoping report guideline and identified in the scoping report and any further consultation since the compilation of the scoping report).	Chapter 5
13. Details regarding the manner in which the issues raised were addressed. (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department)	Chapter 5
REGULATION 50 (g)	
14. The appropriate mitigatory measures for each significant impact of the proposed mining operation.	
14.1. Adequacy of predictive methods utilised.	Section 12.1
14.2. Adequacy of underlying assumptions.	Section 12.2
14.3. Uncertainties in the information provided.	Section 12.3
REGULATION 50 (h)	
15. Arrangements for monitoring and management of environmental impacts.	
15.1. List of identified impacts which will require monitoring programmes.	Chapter 8
15.2. Functional requirements for the said monitoring programmes.	Chapter 8
15.3. Roles and responsibilities for the execution of the monitoring programmes.	Chapter 8

15.4. Time frames for monitoring and reporting.	Chapter 8
REGULATION 50 (i)	
16. Technical and supporting information. (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department).	List of Appendices and Chapter 13
ENVIRONMENTAL MANAGEMENT PROGRAMME	
REGULATION 51 (a)	
1. Description of environmental objectives and specific goals for mine closure.	
1.1. Environmental aspects that describe the pre-mining environment.	Chapter 4
1.2. Measures required to contain or remedy any causes of pollution or degradation or the migration of pollutants, both for closure of the mine and post-closure.	Chapter 7
2. Description of environmental objectives and specific goals for the management of identified environmental impacts emanating from the proposed mining operation. (As informed by the information provided in the EIA in terms of Regulation 50 (h)).	
2.1. List of identified impacts which will require monitoring programmes.	Chapter 7
2.2. List of the source activities that are the cause of the impacts which require to be managed.	Chapter 4
2.3. Management activities which, where applicable, will be conducted daily, weekly, monthly, quarterly, annually or periodically as the case may be in order to control any action, activity or process which causes pollution or environmental degradation.	Chapter 7
2.4. The roles and responsibilities for the execution of the monitoring and management programmes.	Chapter 8
3. Description of environmental objectives and specific goals for the socio-economic conditions as identified in the social and labour plan. (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department).	Section 6.2
4. Description of environmental objectives and specific goals for historical and cultural aspects.	
4.1. Environmental objectives and goals in respect of historical and cultural aspects identified in specialist studies conducted during the EIA phase.	Section 6.2
REGULATION 51 (b) - Outline of the implementation programme	
5.The appropriate technical and management options chosen for each environmental impact, socio-economic condition and historical and cultural aspect in each phase of the mining operation, as follow	
5.1. Actions, activities or processes, including any NEMA EIA Regulation listed activities, which cause pollution or environmental degradation. (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department).	Chapter 7 & **Error! Reference source not found.**5
5.2. Concomitant list of appropriate technical or management options chosen to modify, remedy, control or stop any action, activity, or process which will cause significant impacts on the environment, socio-economic conditions and historical and cultural aspects as identified. (Attach detail of each technical or management option as appendices).	Chapter 7
6. Action plans to achieve the objectives and specific goals contemplated in Regulation 50 (a).	Chapter 7

17. Time schedules of deadlines for each action to be undertaken to implement each technical or management option chosen. (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department).	Chapter 7
7. Procedures for environmentally related emergencies and remediation (An environmental emergency plan that includes all the items referred to in the concomitant section of the guideline posted on the official website of the Department).	Chapter 9 & Appendix E
8. Planned monitoring and environmental management programme performance assessment.	
8.1. Description of planned monitoring of the aspects of the environment which may be impacted upon. (Include all the items referred to in the concomitant section of the guideline posted on the official website of the Department).	Chapter 8
8.2. Provide a description as to how the implementation of the action plans contemplated in Regulation 51 (b) (ii) as described will be monitored as described in paragraph 6 of the EMP will be monitored.	Chapter 8
8.3. Frequency of proposed reporting for assessment purposes.	Chapter 8
9.Financial provision in relation to the execution of the environmental management programme:-	
9.1. Plan showing the location and aerial extent of the aforesaid main mining actions, activities, or processes anticipated. (Include all the items referred to in the concomitant section of the guideline posted on the official website of the Department)	Figure 2.1 Figure 2.2
9.2. Annual forecasted financial provision calculation (Refer to the concomitant section of the EIA and EMP guideline).	Chapter 10 and Appendix F
9.3. Confirmation of the amount that will be provided should the right be granted.	Chapter 10 and Appendix F
9.4. The method of providing financial provision contemplated in Regulation 53.	Chapter 10 and Appendix F
10. Environmental Awareness Plan (Section 39 (3) (c)) (Include all the items referred to in the concomitant section of the guideline posted on the official website of the Department).	Chapter 9 and Appendix E
11. Attachment of specialist reports, technical and supporting information. (Provide a List)	List of Appendices and Chapter 13
12. SECTION 39 (4) (a) (iii), Capacity to manage and rehabilitate the environment (Include all the items referred to in the concomitant section of the guideline posted on the official website of the Department.	Chapter 10 and Appendix F
13. UNDERTAKING	
13.1. The Environmental Management Programme will, should it comply with the provisions of section 39 (4) (a) of the Act and the right be granted, be approved and become an obligation in terms of the right issued. As part of the proposed Environmental Management Programme, the applicant is required to provide an undertaking that it will be executed as approved and that the provisions of the Act and regulations thereto will be complied with.	Chapter 14

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1 BACKGROUND AND INTRODUCTION

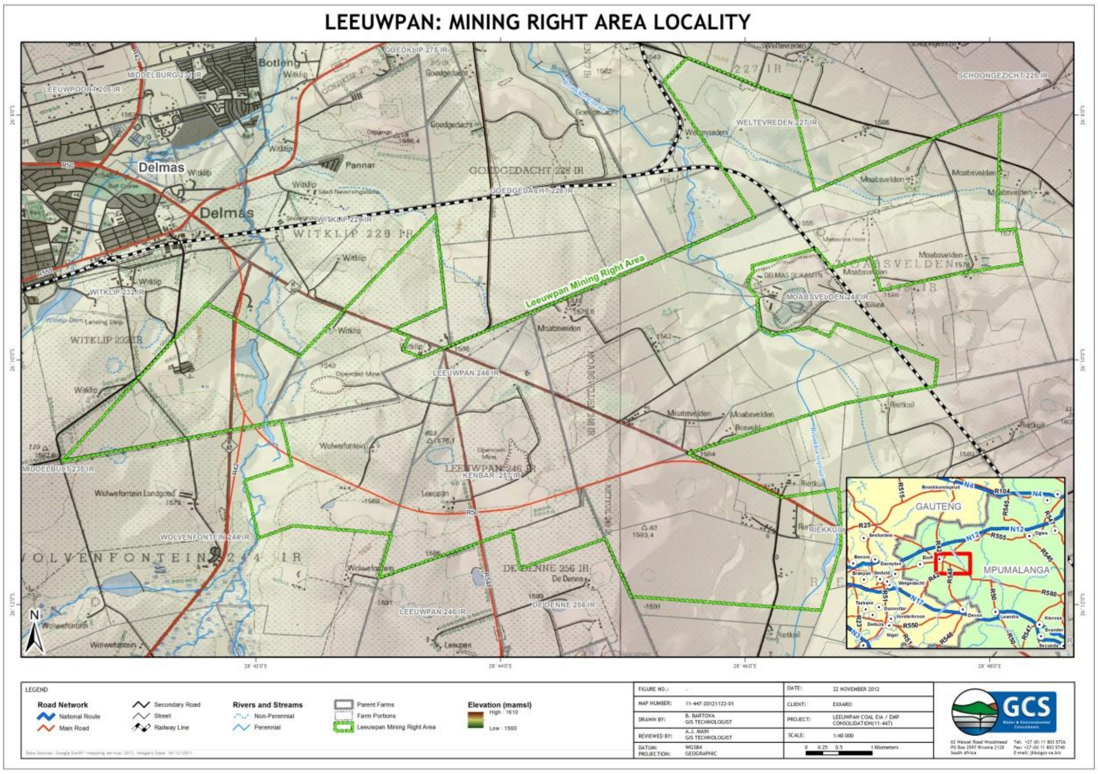
Exxaro Leeuwpan Coal Mine (Leeuwpan Coal Mine) is located between 5km south east of Delmas, in the Victor Khanye Local Municipality. It further falls under the Nkangala District Municipality in the Mpumalanga Province.

The district forms part of the Highveld maize production area of Mpumalanga, and is mainly used as cultivated farm land except for those areas not suitable, which are utilized for grazing.

The Leeuwpan Coal Mine began as an Iscor Mine in 1991, doing extensive exploration and the first box-cut was opened in 1992. Leeuwpan Coal Mine is an operational mine, and became known as Exxaro Leeuwpan Coal Mine in 2007, and operates according to the previous approved Environmental Management Plans (EMP's) that were submitted to the Department of Minerals and Energy (DME), now the Department of Mineral Resources (DMR), thus making Leeuwpan Coal Mine a lawful mining operation as stated under the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA), refer to Figure 1-1.

The purpose of this report is to fulfill the request of the DMR and will entail the consolidation of the current EMP and EMP Addendums into one consolidated Environmental Impact Assessment and Environmental Management Programme (EIA/EMP) in terms of the MPRDA. Leeuwpan Coal Mine will further utilize this opportunity to include a proposed opencast block (referred to as Block OI). The result of this consolidated EIA/EMP will be to have all information in one document for easy reference and effective environmental management.

The DMR previously approved the Block OI mining as an underground operation, however further studies have indicated the increased feasibility for open cast mining methods in this area, due to the shallow coal seams. The surface rights of the property is however not earmarked for opencast mining methods is not owned by Exxaro (Exxaro only owns the Mineral Rights) and is currently zoned for agriculture and is used for cultivation. Exxaro is in the process to purchase the properties associated with the proposed new mining area.



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 1.1 Leeuwpan Locality

1.1 Background to All Leeuwpan EMPs

Refer to Figure 1-2 for reference to different mining sections as discussed in Section 1.1.

1.1.1 Original EIA / EMP

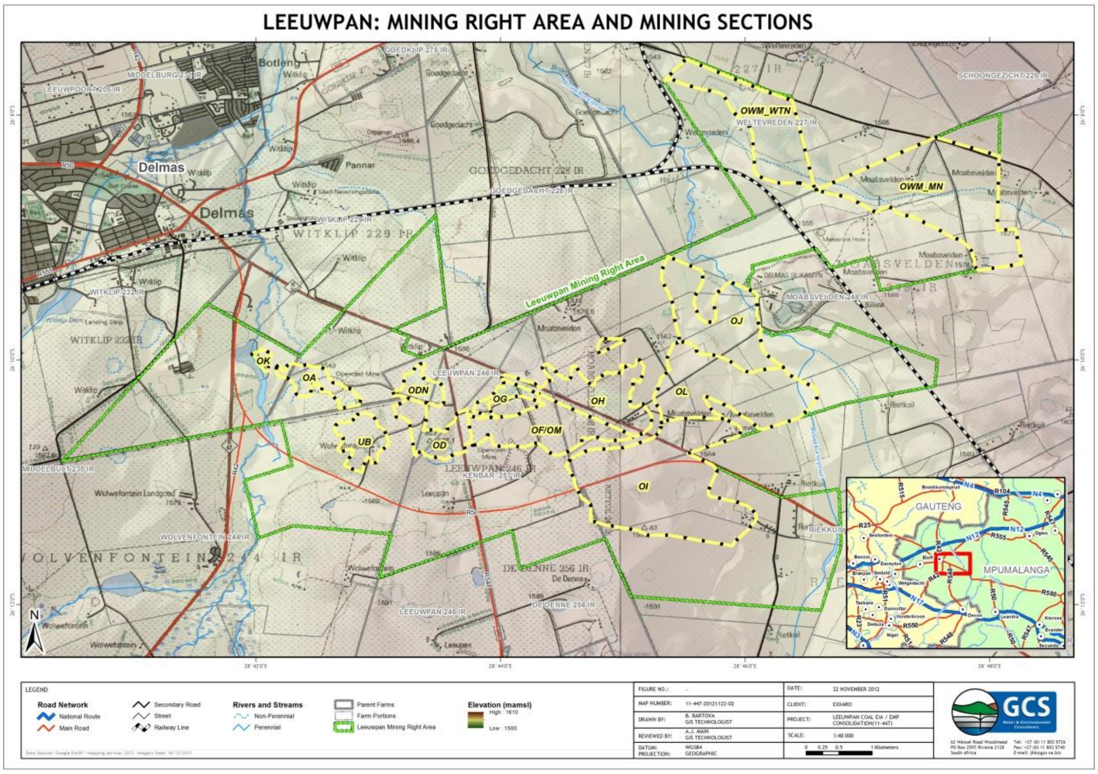
ISCOR, in 1993 conducted the original EMP for the Kenbar and Witklip sections at Leeuwpan. The reserves for the Kenbar and Witklip sections were 15.97Mt Raw Coal Product (RCP) and 5.29Mt RCP respectively.

The top layer material of the Witklip reserve mainly consisted of clay of which a large portion is suitable for the manufacturing of bricks. The stockpiles are still in existence and a portion of the clay is provided to a contractor that produces bricks on the Witklip terrain. The total plastic clay reserve was about 1.6Mt.

The mining method used was opencast mining. The expected life of mine was 10 Years, and if underground mining continues this would add another 9 years to the life of mine. The underground mining method would have involved building chambers supported by pillars to hold the roof and then removing the coal seams.

Two areas, that were suitable options for the mine infrastructure, namely Kenbar and Witklip, were investigated, seeing that Iscor already possessed the surface rights to those areas. The Kenbar terrain was found to be the most suitable.

The original EIA / EMP were approved in 1995.



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 1.2 Leeuwpan Mining Sections

1.1.2 EIA / EMP Update - 1996

As an accompaniment to the mine's application for mining authorisation as required in terms of the Minerals Act, 1991 (Act No 50 of 1991) and as amended by Minerals Amendment Act, 1993 (Act No. 103 of 1993), the original EMPR was updated in May 1996, in the form of Addendum 1.

1.1.3 Addendum 2 - 1998

During 1998 Addendum 1 EMP was still awaiting final approval by authorities. In 1997 Leeuwpan Management proposed mining a small additional area (Block OE) of approximately 3ha, on section 4 of Witklip 229 IR, which was not part of the original EMPR investigation or the updated document (Addendum 1). The investigation concerned the impact of the proposed additional opencast mining area (phase 1) with a coal reserve of approximately 300,000tons. Approximately 4m depth of the overburden constitutes clay suitable for brick manufacture and was being stockpiled as excavation proceeded. This will amount to approximately 2.6Mt of clay to be used by the interested contractor. The Block OE reserves were expected to extend the life of the opencast mining by 3 months.

A number of changes with regards to environmental management, particularly with respect to water management, were investigated and implemented at Leeuwpan Colliery during 1997, these were to be addressed in Addendum 2. A revised water management programme, which includes a proposal to discharge excess water into an unnamed tributary of the Bronkhorstspruit, had also been developed. The available assimilative capacity of the receiving water body warrants a discharge of mine water during high flow periods and provides opportunity for the mine to continue its operation without the terminal expenses of sulphate treatment.

The changes at Leeuwpan during 1998 included:

- The old plant (interim phase plant) were taken apart;
- The new plant (final phase plant) were constructed;
- The new mining area (Block OE) became operational; and
- A comprehensive water monitoring programme was commissioned during 1998.

Addendum 2 was approved in 2003 by the then DME.

1.1.4 Addendum 3 – July 2003

Addendum 3 EMP was compiled for the mining of blocks OD, OFPAD (the road reserve area associated with the provincial R548 road to Devon), OH and OM, of which the Mineral rights were all owned by Kumba Resources. The mining of Block OM, Block OH, Block OFPAD and Block OD involved the extension of existing mining operation at that time. The mining of Block OH would affect Samquarz in terms of mineral rights since they owned the rights to silica in that area.

Two (2) mine plans were investigated during Addendum 3 EMP. **Mine plan 1** would have involved the mining of Block OM, Block OH and Block OD without mining through the provincial R50 and R548 roads. The mining of Block OM would have been a continuation of the current mining of Block OF (in an easterly direction) until the provincial R50 road was reached. In order to facilitate the haulage of coal from the pit to the existing washing plant, a bridge would have been built over the provincial R50 road. A new boxcut would have been constructed on the northern side of the provincial R50 road in order to continue with the mining of Block OH.

In terms of the mining of Block OD, a new boxcut would have been constructed adjacent to the provincial R548 road. The subsequent cuts would have been in a westerly direction and the existing haulage roads used to transport coal from the pit to the existing washing plant.

Mine plan 2 would have involved the mining of Block OM, Block OH, Block OFPAD and Block OD by mining through the provincial R50 and R548 roads. A diversion of the R50 and R548 provincial roads would have been required. The mining of Block OM would be a continuation of the current mining of Block OF (in an easterly direction). The direction of mining would then change to an approximately northeasterly direction as the provincial R50 road and Block OH is mined.

The mining of Block OD would involve the extension of Block OF in a westerly direction, followed by the mining of Block OFPAD and Block OD. The mining of Block OFPAD would involve the mining of the provincial R548 road for which a diversion would be constructed. The subsequent cuts would be in a westerly direction and the existing haulage roads would be used to transport coal from the pit to the existing washing plant.

It was decided to go with mine plan 2. With Mine plan 2, approximately 215 persons would have been employed for a further seven (7) years. Between 300 and 350 persons would then be employed at full production.

It was also indicated that land claims had been lodged against the farms Leeuwpan 246 IR Moabsvelden 248 IR and Wolvenfontein 244 IR. The exact portions of the farms against which the land claims were lodged were however not known at the stage of the Addendum 3 Process.

Addendum 3 was approved in 2007.

1.1.5 Addendum 4 EMP - 2007

The Addendum 4 EMP was compiled for the extension of Block OJ and OL on the Farm Moabsvelden 248 IR. The property is owned by Exxaro Coal. The mine initially proposed to mine the Reserves on the farm Weltevreden, However, the Weltevreden area falls outside of the current mining authorisation area and Leeuwpan had to apply for the mining rights for that area. Due to delays in the mining right application process, the proposed mine plan had been amended to first mine portions of Block OJ and Block OL (Referred to as Phase 1). Mining were proposed to be carried out by opencast method over a period of 18 months and giving rise to a pit of approximately 36.5ha in extent.

The proximity of the Bronkhorstspruit to the operations was of concern and measures were to be taken in order to ensure that the river was protected. No discard material was to be used as backfill in the Phase 1 Pit. In addition, clayey material was to be placed on the downgradient side of the pit to act as a barrier for groundwater seepage towards the pit.

During the application period the mine had 537 employees, of which 203 were contractors and the remaining 334 were permanent staff. Personnel involved in current mining operations at OH, OM and OG were to be utilised on the extension area.

Addendum 4 was approved in 2009.

Listed activities under the National Environmental Management Act (NEMA, No. 107 of 1998) (NEMA) didn’t come into effect before 2006 and therefore didn’t need approval under the NEMA. For Addendums 4 and 5 conducted in 2006 – 2007, mining applications were excluded until further notice from the EIA process legislated under the NEMA. Several activities associated with the mining operations that were proposed in Addendums 4 and 5 have however been listed under the NEMA EIA Regulations (No. R 385, 386 and 387 of 2006). As was agreed then in consultation with Mpumalanga Department of Land Administration (MDALA), since all activities are directly related to mining, it was not be necessary to obtain authorisation in terms of the EIA Regulations.

1.1.6 Addendum 5 - OD, UI and OWM – 2007

In 2006 an EIA / EMP was compiled for Kumba Coal (later Exxaro Resources Limited) for the mining of Block OWM on the farms Weltevreden 227 IR (Portion 7) and Moabsvelden 248 IR (Portions 1, 4, 5 and 6); an extension of the existing Block OD on the farm Wolvenfontein 244 IR (Portion 8); and Block UI to be mined underground on the farm Rietkuil 249 IR (Portions 1 and 2). However, only the part of Block OWM that was to be mined on the farm Moabsvelden 248 IR (Portion 4) formed part of the existing Leeuwpan Coal Mine Mining Rights area. Thus, Leeuwpan submitted applications for a mining authorisation in terms of Section 22 of the MPRDA, to the DME for the remaining farm portions, in October 2004. Subsequently, the DME accepted the application in writing, however, the said letter indicated that the mentioned applications overlapped with other applications lodged prior to the mine’s applications and would therefore be dealt with in accordance with Section 9(1)(b) of the MPRDA, 2002. The DME therefore required the submission of a Scoping Report, an EIA and EMP to be able to assess the project completely.

It was planned that bord-and-pillar underground mining of Block UI would commence during 2011 and continue until 2041. It was also planned that mining of the extension of the existing Block OD at Leeuwpan Coal Mine would commence during 2012 and continue until 2015 using opencast mining. Mining of Block OWM was planned to commence during 2007, also using opencast mining, and would continue until 2031.

The underground mining of Block UI never commenced in 2011 and the mining method for the resource was reconsidered, hence the application to mine the area opencast in future as Block OI.

Addendum 5 was approved in 2010.

1.1.7 Consolidation EMP and OI Expansion Project

In terms of Section 102 of the MPRDA Leeuwpan requires authorisation for the proposed activities in the form of an amendment to the existing Environmental Management Programme (EMP), which must be approved by the DMR in Mpumalanga, before construction may begin. The DMR, however, requested Exxaro to consolidate all the previous EMPR's (refer to 1.1.1 to 1.1.6) for the existing operations. The consolidation of EMPR's was requested in addition to the proposed mining of Block OI in order to have one EMP for the entire operations. The MPRDA process will thus address the entire operations as a whole including all activities regarding the proposed Block OI expansion.

Leeuwpan is planning the development of an additional opencast pit (Block OI) which will be located on portions of the farm Moabsvelden and Rietkuil. The mineral rights belong to Exxaro, however the certain portions of these farms are privately owned and utilised for agricultural practices.

The following infrastructure was approved for the previous EMPs under the MPRDA:

- Original EMP
    - Equipment workshop
    - Coal mixing bed and off-load facilities
    - Railroad of ± 3 km for the transport of coal from Leeuwpan

  - Weighbridge for the road transport
  - Ablution block and administration offices
  - A linking road with the R 50 route (between Delmas and Leandra) including security buildings
  - A linking road with the P 36-2 route between Delmas and Devon
  - Pit water dam and silt dams
  - Evaporation ponds
  - Additional storm water control measures (berms)
  - Electricity supply network
  - Closed water network for process water
  - Potable water supply via pipeline
  - Sewerage infrastructure.
  - River Diversion (tributary of the Bronkhorstspruit for save continuation of mining)
  - Mining of mining blocks
- Addendum 2
  - New plant (final phase plant)
  - Demolition of old plant
  - Opencast block (Block OE)
- Addendum 3
  - Extension of existing haul roads to Block OM, Block OH as well as Block OFPAD and Block OD
  - Relocation of the 11 kV powerlines and associated mini substations
  - Clean and dirty water systems around the mining area of Block OM, Block OH, Block OFPAD and Block OD
  - Road diversions and associated infrastructure
  - Mining of mining blocks
- Addemdum4
  - Storage of water in dams and reservoirs

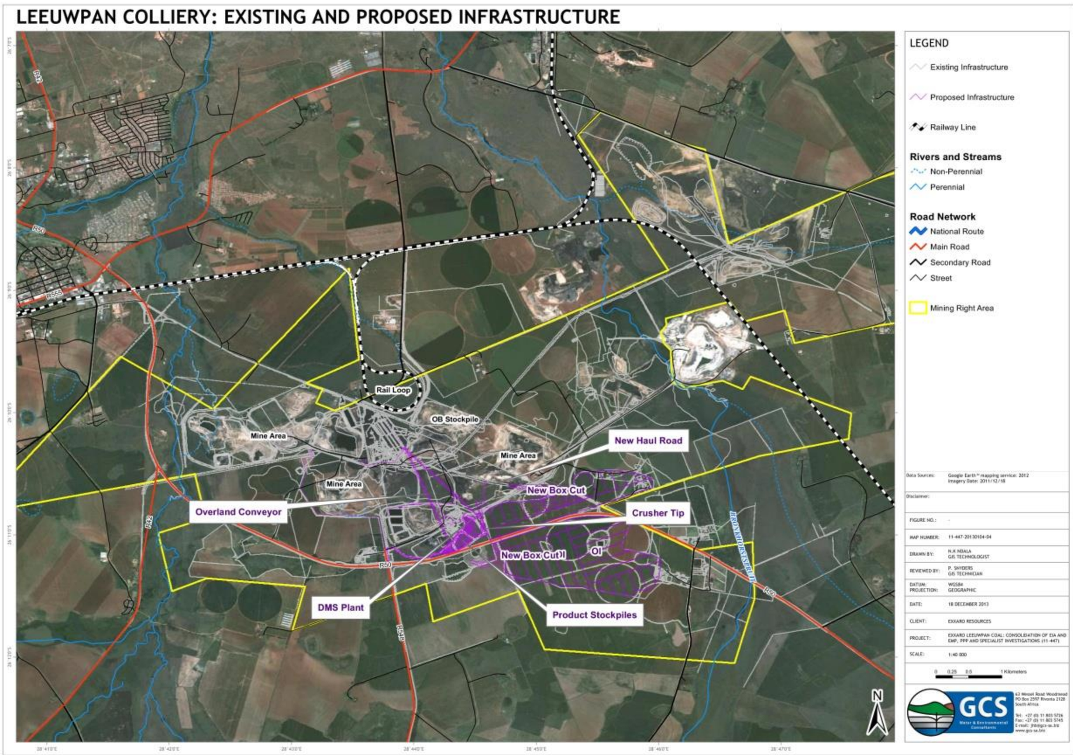
  - Infrastructure in the one in ten year flood line of a river or stream, or within 32 meters of the bank of a river or stream
  - The construction of a road that is wider than 4m
  - Mining of mining blocks
- Addendum5
  - Topsoil and overburden stockpiles
  - ROM stockpile
  - Storm water diversion channels
  - Expansion of existing haul roads
  - Water pollution management system
  - Water supply system
  - Ablution facilities
  - Diesel fuel tank
  - Workshop
  - Site offices
  - Explosives magazine
  - Haul road and access roads
  - Portable ablution facilities
  - Temporary workshop
  - Portable site office
  - Mining of mining blocks

Exxaro Leeupan Coal currently does not have approval for any infrastructure under NEMA as mentioned before. The mine do have a Water Use Lices under NWA that were approved in 2011 for water uses associated with Section 21 (a), Section (b), Section 21(c), Section 21(g), Section 21(i) and Section 21(j).

New infrastructure and activities that will be associated with the proposed Block OI expansion, in addition to all approved infrastructure, and that needs to be approved under MPRDA, NEMA and NWA includes the following:

- Two boxcuts for access to opencast pits
- Explosive magazine
- Mining of OI (opencast)
- New and extension of haul road from the mine entrance ramp to the tip terrace
- Tip terrace, crushers, conveyors
- Screen house
- Crushing and screening plant (DMS)
- Weirs
- Plant buildings
- Stockyard, including stockyard conveyors
- ROM and product stockpiles
- Diesel storage of 1000 cubic metres - Fuel Depot
- Water pipelines (from OI) and pipelines between PCDs
- Existing return water dams will be put back in use – combined capacity of 80000 Cubic metres
- Stormwater drains, trenches and cut-off trenches
- Clean and dirty water systems
- Evaporation dam, pollution control dam
- Services including potable water, process water, fire water, electricity reticulation
- 11kV bulk electrical supply from Eskom substation

The expected design life of mine is projected to be 16 years.



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 1.3 Existing and Proposed Infrastructure and OI Mining Block

1.2 Contact Details

The applicant is Exxaro Leeuwpan Coal. The relevant contact details of the applicant are presented in **Error! Reference source not found.**, and for the Mining Rights Holder in Table 1 .2.

Table 1.1 Name and Address of Mine

Name of Mine	Exxaro Leeuwpan Coal
Telephone	(013) 665 7670
Facsimile	(013) 665 7630
Contact Person	Stephen Badenhorst
Environmental Co-Coordinator	Igna Dougal Environmental Specialist, Mpumalanga Commercial Mines Igna.Dougal@exxaro.com

Table 1.2 Name and Address of Mineral Rights Holder

Name of Mine	Exxaro Leeuwpan Coal
Telephone	(013) 665 7670
Facsimile	(013) 665 7630
Contact Person	Stephen Badenhorst
Environmental Co-Coordinator	Igna Dougal Environmental Specialist, Mpumalanga Commercial Mines Igna.Dougal@exxaro.com

1.3 Description of Land

The Leeuwpan Mining Right Area (MRA) is located approximately 5 km south east of Delmas, in the Victor Khanye Local Municipality. It further falls under the Nkangala District Municipality in the Mpumalanga province. The MRA is adjacent to SamQuarz Silica Mine and Stuart Coal.

The MRA comprises eight (8) farms, namely, Kenbar 257, Leeuwpan 246, Moabsvelden 248, Weltevreden 227, Witklip 229, Witklip 232, Wolvenfontein 244 and Rietkuil 249. Nine mineral resource blocks have been mined or are in the process of being mined. Three Mineral resource blocks, located on Rietkuil 249, Moabsvelden 248 and Wolvenfontein 244, will be or is proposed to be (Rietkuil 249) mined in the future. The property details for the MRA were obtained from the government deeds website (www.deeds.gov.za). The majority of the surface rights are privately owned. Current infrastructure is located on the following farm portions (Table 1.33):

Table 1.3 Farm portions related to existing infrastructure

SG Number	Farm	Portion	Owner detail
T0IR00000000025700000	KENBAR 257	Portion 0	Exxaro Coal Pty Ltd
T0IR00000000024600003	LEEUWPAN 246	Portion 3	Exxaro Coal Pty Ltd
T0IR00000000024800001	MOABSVELDEN 248	Portion 01	Gouws Louis
T0IR00000000024800002	MOABSVELDEN 248	Portion 02	Exxaro Coal Pty Ltd
T0IR00000000024800003	MOABSVELDEN 248	Portion 03	Exxaro Coal Pty Ltd
T0IR00000000024800004	MOABSVELDEN 248	Portion 04	Phillem Beleggings Pty Ltd
T0IR00000000024800005	MOABSVELDEN 248	Portion 05	Exxaro Coal Pty Ltd
T0IR00000000024800006	MOABSVELDEN 248	Portion 06	Exxaro Coal Pty Ltd
T0IR00000000024800010	MOABSVELDEN 248	Portion 10	Exxaro Coal Pty Ltd
T0IR00000000024800012	MOABSVELDEN 248	Portion 12	Exxaro Coal Pty Ltd
T0IR00000000024800013	MOABSVELDEN 248	Portion 13	Exxaro Coal Pty Ltd
T0IR00000000024800016	MOABSVELDEN 248	Portion 16	Exxaro Coal Pty Ltd
T0IR00000000024800027	MOABSVELDEN 248	Portion 27	Transnet Ltd
T0IR00000000024800030	MOABSVELDEN 248	Portion 30	Transnet Ltd
T0IR00000000024800032	MOABSVELDEN 248	Portion 32	Transnet Ltd
T0IR00000000022700007	WELTEVREDEN 227	Portion 07	Exxaro Coal Pty Ltd
T0IR00000000022700037	WELTEVREDEN 227	Portion 37	Transnet Ltd
T0IR00000000022900004	WITKLIP 229	Portion 04	Exxaro Coal Pty Ltd
T0IR00000000022900006	WITKLIP 229	Portion 06	Hendrik Schoeman & Seuns Pty Ltd
T0IR00000000023200113	WITKLIP 232	Portion 113	Eskom Holdings Ltd
T0IR00000000023200016	WITKLIP 232	Portion 16	Hendrik Schoeman & Seuns Pty Ltd
T0IR00000000024400003	WOLVENFONTEIN 244	Portion 03	Endorsement: Exxaro Coal Pty Ltd

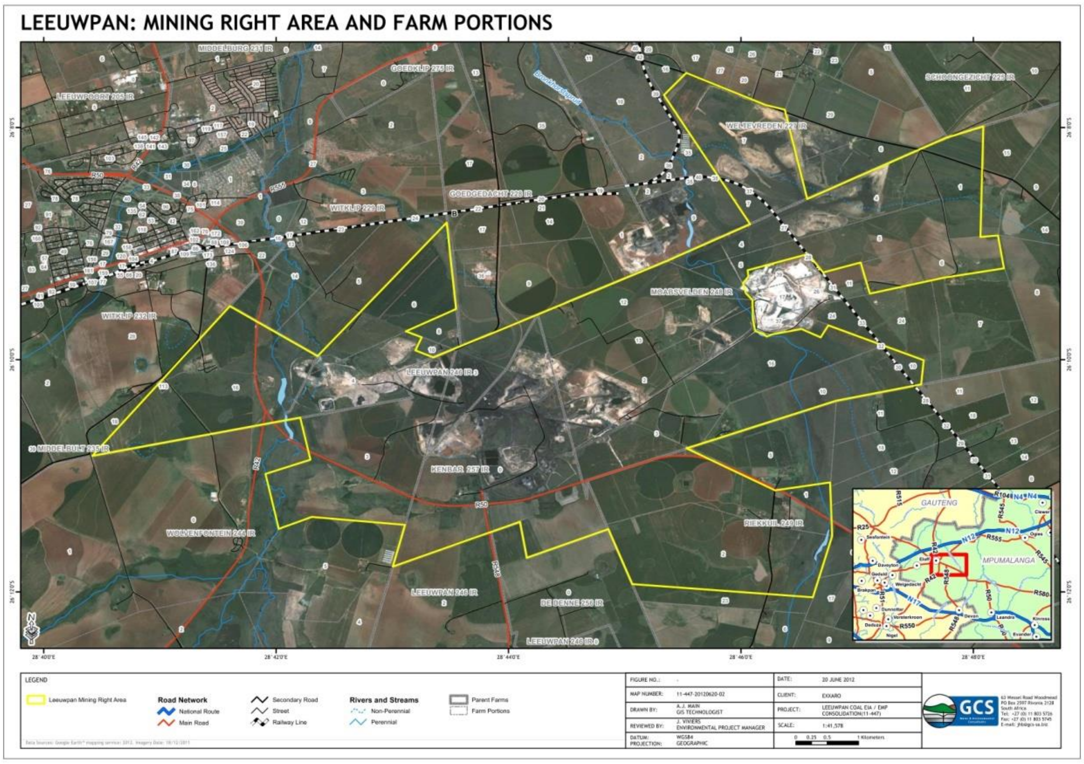
The proposed OI Projects will be situated on the following farm portions (Table 1.34):

Table 1.4 Farm portions associated with the proposed block OI

SG Number	Farm	Portion	Owner detail
T0IR00000000024800002	MOABSVELDEN 248	Portion 02	Exxaro Coal Pty Ltd
T0IR00000000024800003	MOABSVELDEN 248	Portion 03	Exxaro Coal Pty Ltd
T0IR00000000024800010	MOABSVELDEN 248	Portion 10	Exxaro Coal Pty Ltd
T0IR00000000024800016	MOABSVELDEN 248	Portion 16	Exxaro Coal Pty Ltd
T0IR00000000024900001	RIETKUIL 249	Portion 01	Hannes Potgieter Trustfonds
T0IR00000000024900002	RIETKUIL 249	Portion 02	Hannes Potgieter Trustfonds

Please refer to *(not to scale, please refer to Appendix A for a enlarged Map)*

Figure 1.4 for the location of the farm portions as it relates to the Leeuwpan Mining Rights Boundary.



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 1.4 Leeuwpan Location and Farm Portions

1.4 Legislative background

For most of its history, the mining industry in South Africa has not been subjected to comprehensive environmental regulation. However, in recent years, this has changed significantly and the industry is now required to comply with a multifaceted network of mining and environmental legislation. There are no shortages of policy and legal frameworks to ensure "responsible" mining in South Africa. The *Minerals and Mining Policy for South Africa*, 1998 affirmed that the State, as custodian of the nation's natural resources will support mining development while maintaining and enhancing environmental awareness of the mining industry in accordance with national environmental policy, norms and standards. To this end, 10 principles on sustainable mining were adopted. These include the adoption of the precautionary approach as well as the polluter pays principle; assertion that a consistent standard of environmental impact management would be adopted, irrespective of the scale of mining concerned; encouraging the mining industry to reduce problems of pollution by promoting a culture of waste minimisation through re-cycling, and re-use of waste products; and ensuring the effective implementation of environmental management measures and monitoring of occurrences of pollution, amongst others.

For the purposes of this application, authorization in terms of the *National Environmental Management Act*, Act No.107 of 1998 (hereinafter referred to as "*NEMA*"), the *Minerals and Petroleum Resources Development Act*, Act No. 28 of 2002 (hereinafter referred to as the "*MPRDA*"), and the *National Water Act*, Act No. 36 of 1998 (hereinafter referred to as the "*NWA*") is applied for.

1.4.1 The Constitution

The Constitution reigns supreme and the advancement of human rights is one of the foundations of South Africa's democracy. Furthermore, the Bill of Rights plays a central role in the democratic regime because it embodies a set of fundamental values which should be promoted at all times. One of the fundamental values is contained in Section 24 and is, arguably, the cornerstone for environmental governance in South Africa which includes the mining industry. Section 24(a) proclaims the right of everyone ***"to an environment that is not harmful to their health or well-being"***. Mining companies are thus duty-bound to constitutional, legislative, and other measures to prevent pollution and ecological degradation, promote conservation and to develop in a sustainable manner.

Two particular judgments deserve consideration in that they contain a comprehensive analysis of the nature and content of the environmental right within the sustainability context. Firstly, the court in *BP Southern Africa (Pty) Ltd v MEC for Agriculture, Conservation and Land Affairs* 2004 5 SA 124 (WLD) confirmed that environmental interests should be balanced with justifiable economic and social development well beyond the interests of the present living generation. The court justified the latter with Section 24(b), since this Section requires the environment to be protected for the benefit of present and future generations. The court confirmed the importance of sustainable development and predicted that it will ***"…play a major role in determining important environmental disputes in the future"***.

Within this context, the mining industry (and the accompanied social and economic development it should bring with it) is constitutionally bound to uphold the environmental right. The court in *Fuel Retailers Association of Southern Africa v Director General: Environmental Management, Department of Agriculture, Conservation and Environment, Mpumalanga Province* 2007 6 SA 4 (CC) attempted to balance these social, environmental and economic concerns by recognising the importance of economic and social development for the well-being of human beings. However, the court emphasised that development and the environment are inexorably linked and development cannot exist upon a weakening environmental base. Consequently, the promotion of development requires the protection of the environment.

The constitutional environmental right elevates the importance of environmental protection and conservation, and emphasises the significance that South Africans attach to a sound and healthy environment. In addition, the environmental right applies horizontally and this implies that the mining industry has to exercise a duty of care if liability, on the basis of the constitutional environmental right, is to be avoided. The constitutional environmental right is given effect to by means of detailed statutory provisions ranging from framework to sectoral legislation which relate to mining.

1.4.2 Environmental principles

Section 2(1)(c) of NEMA provides that:

"***The principles set out in this section apply throughout the Republic to the actions of all organs of state that may significantly affect the environment and… serve as guidelines by reference to which any organ of state must exercise any function when taking any decision in terms of this Act or any statutory provision concerning the protection of the environment…***"

Any decision taken in respect of the proposed application for environmental authorization should take into account the principles as set out in Section 2 of NEMA. GCS acknowledge that these principles serve as guiding principles because they are binding, enforceable and justiciable. By adhering to these principles, GCS promotes a cautious approach when advising on the activities, processes and daily operations of Leeuwpan's mining operation and advocates compliance with environmental regulatory measures.

The principles contained in Section 2 of NEMA are the corner stone of environmental governance and liability in South Africa and is based on the foundation of sustainable development. These principles all apply directly to mines by virtue of Section 37(1) of the *MPRDA* which provides that regard must be had to the NEMA principles by stipulating that the principles set out in Section 2 of NEMA:

"***a) apply to all prospecting and mining operations, as the case may be, and any matter or activity relating to such operation; and***

b) serve as a guideline for the interpretation, administration and implementation of the environmental requirements of this Act."

Section 37(2) of the MPRDA further provides that:

"***Any prospecting or mining operation <u>must be conducted in accordance with generally accepted principles of sustainable development by integrating social, economic and environmental factors</u> into the planning and <u>implementation of prospecting and mining projects</u> in order to ensure that exploitation of mineral resources serves present and future generations.***"

(own emphasis)

By virtue of Section 37(1) of the MPRDA, these principles apply to the mining sector and therefore the mining industry must adopt a risk-averse and cautious approach; prevent negative impacts or effects of their activities on the health and well-being of people and the environment; and pay for all their pollution since they remain liable for the effects of their policies, projects, programmes, products, processes, services or activities throughout their life cycles. When a competent authority takes a decision in terms of NEMA or any other law concerned with environmental protection, the principles must serve as guidelines. More specifically, the principles should guide the interpretation and implementation of the liability regime of NEMA and any other law concerned with environmental protection including mining related legislation. The following principles are particularly important and are discussed below.

1.4.2.1 Polluter pays principle

The polluter pays principle (PPP) is reflected in the provision that the costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment.

In essence, the PPP means that "***polluters and users of natural resources (should) bear the full environmental and social costs of their activities***". The PPP can also be described as an economic principle that requires the polluter (the mining industry in this instance) to be held liable to compensate or pay for pollution prevention, minimisation and remediation. Therefore, the crux of the principle is to impose economic obligations when environmental damage is caused by a polluter and this is achieved by setting minimum rules on liability for environmental damage.

1.4.2.2 Precautionary principle

The precautionary principle provides guidance during development or when anything occurs which might harm the environment and where there is scientific uncertainty. NEMA stipulates and requires "a risk averse and cautious approach" to be applied and that decision-makers should take "***into account the limits of current knowledge about the consequences of decisions and actions***". This approach is also acknowledged in the *White Paper on a Minerals and Mining Policy for South Africa* in that:

"…***during decision-making a risk averse and cautious approach that recognises the limits of current environmental management expertise will be adopted and where there is uncertainty, action is required to limit the risk.***"

The precautionary principle requires the mining industry to take adequate precautionary measures to safeguard against contamination, pollution or degradation of the environment and where there is uncertainty, the action taken should be to limit the risk to the environment.

1.4.2.3 Preventive principle

The preventive principle is reflected in the concept that the disturbance of ecosystems and loss of biological diversity are to be "…***avoided, or…minimised and remedied***." Furthermore, the principle prescribes that the disturbance of the landscape and the nation's cultural heritage is to be avoided, and where it cannot be altogether avoided, must be minimised and remedied. Any negative impacts on the environment and on people's environmental rights should also be anticipated and prevented, and where they cannot be altogether prevented they should minimised and remedied.

The principle aims to minimise environmental damage by requiring that action be taken at an early stage of the process, and if possible, before such damage actually occurs. Broadly stated, it prohibits any activity which causes or may cause damage to the environment in violation of the duty of care established under environmental law. The preventive principle bestows on the mining industry an obligation to take steps to avoid causing certain types of damage to the environment, including the environment beyond their own territory or property.

1.4.2.4 Cradle-to-grave

A cradle-to-grave stewardship perspective indicates the adoption of a comprehensive ecological view of the impacts of a process on the environment, commencing with research, development and design through the extraction and use of raw materials, production and processing, storage, distribution and use, to the final disposal of the product and the waste generated as a by-product. The integrated consideration of all the environmental impacts forms part of this cycle. The “cradle-to-grave” principle advocates liability as a result of, or caused by, policies, programmes, projects, products, processes, services and activities. Given the general purpose of NEMA, together with the other sustainability principles, this legal liability may include to rectify, remedy or compensate for environmental damage or degradation. The principle also recognises that environmental impacts, pollution or degradation may be associated with the entire life cycle of a mine, that is, from the identification, exploration phase through project planning, implementation, operations and post-operational closure, decommissioning and rehabilitation. Thus, the mining industry will remain liable for the damage or degradation caused by its activities throughout the life cycle of the mining operations until decommissioning and rehabilitation.

1.4.3 The National Environmental Management Act

As stated above, NEMA provides for a comprehensive array of principles which cumulatively aim to create among others, corporate socially responsible behaviour by establishing legal liability for environmental damage as well as damage to human health and well-being. Apart from these principles, NEMA also contains mechanisms, procedures and structures to facilitate pollution prevention, minimisation and remediation.

Chapter 7 of NEMA contains essential provisions dealing with liability for environmental damage in South Africa and two key elements form part thereof; namely: pollution prevention and remediation. A duty of care is contained in Section 28, which encompasses the main liability provision which applies retrospectively and therefore also to historical pollution. Section 28(1) applies to all forms of pollution, including mining pollution, and is formulated generally by providing a duty of care to avoid, minimise and/or remedy pollution or environmental degradation. In terms of this subsection, the duty imposes liability on an almost non-exhaustive category of persons, because it refers to "every person". Section 28(2) goes even further and imposes the duty on a range of people including owners or people in control of land or premises and people who have the right to use the land or premises on which, or in which, an activity or process is, or was, performed or undertaken, or any other situation exists which causes, or is likely to cause, significant pollution or degradation to the environment.

The duty of care imposes strict liability since Section 28(1) requires reasonable persons to take reasonable measures. Subsection (3) provides an indicative range of measures that can be considered as “reasonable measures” and these may include measures to investigate, assess and evaluate the impact on the environment; inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation, contain or prevent the movement of pollutants or the causing of degradation, eliminate any source of the pollution or degradation and remedy the effects of the pollution or degradation. One can identify from the wording an obligation to prevent and minimise pollution or degradation and the list indicates that remediation is clearly part of South African law. Where a mine fails to take reasonable measures to prevent or minimise pollution, it can be directed to do so by the relevant authority and if it does not comply with the directive, measures will be taken by government on its behalf, but at the mine’s expense.

Under Section 34(7), liability is specifically extended to the director of the mining company concerned in his or her personal capacity, in other words, the director is personally liable. Furthermore, Section 43 provides that if directors failed to take all reasonable steps to prevent the offence being committed, and monetary advantage was gained, they may be personally liable for damages or compensation, have to pay a fine, or have to comply with remedial measures determined by the Court, and may even have to pay the State’s investigative costs. The latter was confirmed in *Minister of Water Affairs and Forestry v Stilfontein Gold Mining Co Ltd and Others* 2006 5 SA 333 (W) where the court held, in a telling statement that:

"To permit mining companies and their directors to flout environmental obligations is contrary to the Constitution, the Mineral Petroleum Development Act and to the National Environmental Management Act. Unless courts are prepared to assist the State by providing suitable mechanisms for the enforcement of statutory obligations an impression will be created that mining companies [and their directors] are free to exploit the mineral resources of the country for profit over the lifetime of the mine, thereafter they may simply walk away from their environmental obligations. This simply cannot be permitted in a constitutional democracy which recognises the right of all of its citizens to be protected from the effects of pollution and degradation."

1.4.4 The Mineral and Petroleum Resources Development Act

Section 38 provides a key insight into the MPRDA's environmental liability approach. In terms of this Section, mining companies are required to familiarize themselves of potential environmental impacts; manage any environmental impacts; and rehabilitate the environment in so far as is reasonably possible. Furthermore, Section 38(1)(e) states that such holders, whose mining causes or results in ecological degradation, pollution, or environmental damage that may be harmful to the health or well-being of anyone:

"…***is responsible for any environmental damage, pollution or ecological degradation as a result of his or her operations and which may occur inside and outside the boundaries of the area to which such right, permit or permission relates***."

These holders will "…***remain responsible for any environmental liability, pollution or ecological degradation and the management thereof until a closure certificate has been issued***". Similar to NEMA, the MPRDA specifically extends the widely-framed liability of mines to the director of the mining company concerned in his or her personal capacity, by stating in Section 38(2) the following:

"...***the directors of a company or members of a close corporation are jointly and severally liable; for any unacceptable negative impact on the environment, including damage, degradation or pollution; advertently or inadvertently caused by the company or close corporation which they represent or represented***."

In general, this provides for a comprehensive liability net which must also be considered in light of NEMA's provisions. According to Section 39, a mine must indicate how it will contain or remedy the cause of pollution or degradation and migration of pollutants and comply with any prescribed waste standards or management practice. Granting of permission to mine or prospect, among others, is conditional on an environmental management programme and plan being submitted and accepted by the relevant government authority. Section 43 is one of the most important provisions as it deals with the responsibility for any environmental liability, pollution or ecological degradation until the issue of the closure certificate. It is important to note that environmental liability will not necessarily cease or fall away by the issuing of a closure certificate. In addition to the broader liability provisions above, Section 45 provides that the relevant authority may direct a mine to undertake remedial measures where:

"...***any prospecting, mining, reconnaissance or production operations cause or results in ecological degradation, pollution or environmental damage which may be harmful to the health or well-being of anyone and requires urgent remedial measures***."

Where the mine fails to take these measures, the relevant authority will act on its behalf and then recover costs incurred from the mine. If the mine fails to compensate the authority, the latter is empowered to seize and sell the mine's property to recover the costs. The mine will thus remain financially liable for the rehabilitation, even if it chooses to ignore the government directive.

1.4.5 The National Water Act

One of the main and ever-continuing concerns in South Africa is the sustainability of water management, and the costs associated with the prevention and remediation of pollution in a country with an average rainfall far below international standards. The NWA is one of the government's answers to some of these challenges and functions as sectoral legislation within the framework of NEMA.

Section 19 of the NWA mirrors the provision of Section 28 of NEMA and addresses the prevention and remediation of the effects of pollution. The NWA provides a wide duty of care in that:

"(1) an owner of land, a person in control of land or a person who occupies or uses the land on which-

(a) any activity or process is or was performed or undertaken; or

(b) any other situation exists, which causes, has caused or is likely to cause pollution of a water resource must take all reasonable measures to prevent any such pollution from occurring, continuing or recurring."

The words "likely to cause pollution" broadens the scope of the duty, which enables an activity, or situation that is land-based, to trigger the application of the duty. The "reasonable measures" are not prescribed, but may include measures intended to:

"***cease, modify or control any act or process causing the pollution; comply with any prescribed waste standard or management practice; contain or prevent the movement of pollutants; eliminate any source of pollution; remedy the effects of pollution; and remedy the effects of any disturbance to the bed and banks of a watercourse."***

The NWA, furthermore, provides for water use authorisations which a mine will have to apply for, before commencing with its primary activity of mining. Various conditions may be attached to these licenses and a breach thereof will result in criminal and civil liability. The conditions attached to water use authorisations will function alongside the additional protective measures, duty of care and statutory liability provisions provided by the NWA and other legislation to regulate a whole array of water issues.

The detrimental impact of mining on water resources is further regulated by the NWA in a comprehensive set of regulations titled: "Regulations on the Use of Water for Mining and Related Activities Aimed at the Protection of Water Resources". In terms of these regulations:

"No person in control of a mine or [mining] activity may place or dispose of any residue or substance which causes or is likely to cause pollution of a water resource, in the workings of any underground or opencast mine excavation, prospecting diggings, pit or any other excavation."

Regulation 7 provides for a whole array of provisions which specifically aim to protect water resources from mining. These provisions state that every person in control of a mine or mining activity must take all reasonable measures to, inter alia: prevent water containing waste or any substance which causes or is likely to cause pollution from entering any water resource; design, modify, locate, construct and maintain all water systems including residue deposits, to prevent the pollution of any water resource through the operation or use thereof; cause effective measures to be taken to minimise the flow of any surface water or floodwater into mine workings, opencast workings, other workings or subterranean caverns; prevent the erosion or leaching of materials from any residue deposit or stockpile from any area; and ensure that water used in any process at a mine or activity is recycled as far as practicable. These provisions specifically relate to the protection of water resources and they clearly set out further additional liabilities for mines as far as their water resource protection activities are concerned.

1.5 Environmental process

The environmental processes involved with the project will be undertaken in three (3) parallel processes namely the NEMA process for all the associated listed activities, the MPRDA process to develop a consolidated EIA/EMP for the DMR, and the NWA process regarding the water uses that will be associated with the proposed development.

The following documents will be submitted to the indicated competent authorities:

- Consolidated EIA/EMP under MPRDA: Department of Mineral Resources (hereinafter referred to as “*DMR*”), in Mpumalanga;
- EIA/EMP under NEMA: Mpumalanga Department of Economic Development, Environment and Tourism (hereinafter referred to as “*MDEDET*”); and
- IWULA and Integrated Waste and Water Management Plan (IWWMP) under NWA: Department of Water Affairs (hereinafter referred to as “*DWA*”).

The various environmental authorisation processes being followed for this project are described in the sections which follow hereunder.

1.5.1 The process in terms of MPRDA

Mines and mining related activities are regulated by the MPRDA, therefore in terms of Section 102 of the MPRDA, Leeuwpan requires authorisation for the proposed activities in the form of an amendment to the existing Environmental Management Programme (EMP), which must be approved by the DMR in Mpumalanga, before construction may begin.

The DMR has however, requested the consolidation of all the previous EMPR's in addition to the proposed mining of Block OI in order to have one document for the entire mine. The MPRDA process will thus address the project as a whole including all activities regarding the new block OI mine.

The application to amend the EMP requires the compilation and submission of a Scoping Report, and thereafter an EIA report and EMP. This report has been compiled in compliance with Regulation 51 of GN R527, dated 23 April 2004 (published in terms of Section 107(1) of the MPRDA) (hereinafter referred to as the "*MPRDA Regulations*") as well as the Guidelines, and takes into consideration all aspects included in these documents.

The EIA/EMP will contain the following:

- An assessment of the environment likely to be affected by the proposed operations;
- An assessment of the nature, extent, duration, probability and significance of the identified potential environmental, social and cultural impacts of the proposed operation, including cumulative impacts;
- A comparative assessment of the potential operation, as well as a comparison of other potential land uses for those sites;
- Identification of appropriate mitigatory measures for each significant potential impact of the proposed operation;
- Description of the stakeholder engagement process undertaken during the course of the assessment, issues that were raised and questions asked by I&APs and authorities, and how these issues and questions were addressed;
- Identification of gaps in knowledge, report on the adequacy of predictive methods, underlying assumptions and uncertainties encountered in compiling the required information;

- Description of the arrangements for monitoring and management of environmental impacts;
- A description of the environmental objectives and specific goals for the management of the identified environmental and socio-economic impacts during all phases of the development(construction, operation, decommissioning and post-closure);
- A description of the appropriate technical and management options chosen for each environmental, socio-economic, cultural and historical impact for all project phases;
- Action plans to achieve the specific goals set out, as well as timeframes for the implementation of mitigatory measures;
- Procedures for environmental related emergencies and remediation;
- Planned monitoring and environmental management programme performance assessment;
- An environmental awareness plan; and
- An undertaking by the applicant to comply with the provisions of the MPRDA and regulations thereto.

1.5.2 The process in terms of NEMA

Section 24(1) of NEMA requires that the potential consequences of or impacts on the environment of listed activities must be considered, investigated, assessed and reported on to the competent authority. Where environmental impact assessment has been identified as the instrument to be utilised in achieving the aforementioned, an application for environmental authorisation needs to be obtained. The identified activities are listed under GN R544, R545, R546 and R547 of the NEMA Regulations respectively.

The listed activities (Table 1.5) which are triggered by the proposed mining operation are contained in Listing Notice 1 (GN R544) and Listing Notice 2 (GN R545). Activities contained in Listing Notice 1 require a Basic Assessment (BA) process to be followed whilst activities in Listing Notice 2 require a Scoping and EIR (S&EIR) process to be followed. For the purposes of Leeuwpan, all items listed under Listing Notice 1 will be addressed in the required EIA process applicable to Listing Notice 2 activities. MDEDET is regarded as the competent authority in terms of NEMA and as such a consolidated EIA report will be developed for Leeuwpan and submitted to MDEDET for assessment and authorisation in addition to the MPRDA report.

Table 1.5 Listed activities in terms of NEMA

Number and date of the relevant notice	Activity number	Listed activity	Activity description
GN R 544 in GG 33306 of 18 June 2010	9	The construction of facilities or infrastructure exceeding 1000m in length for the bulk transport of water, sewage or storm water – (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more, excluding where: (a) such facilities or infrastructure are for bulk transport of water, sewage or storm water or storm water drainage inside a road reserve; or (b) where such construction will occur within urban areas but further than 32 metres from a watercourse, measured from the edge of the watercourse.	• Water pipelines (from OI) • Stormwater Drains • Trenches and Cut-off trenches • Clean and Dirty water systems • Pipelines between PCDs
GN R 544 in GG 33306 of 18 June 2010	11	The construction of: (i) canals; (ii) channels; (iii) bridges; (iv) dams; (v) weirs; (vi) bulk storm water outlet structures; (vii) marinas; (viii) jetties exceeding 50 square metres in size; (ix) slipways exceeding 50 square metres in size; (x) buildings exceeding 50 square metres in size; or (xi) infrastructure or structures covering 50 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.	• Crushing and Screening plant • Weirs • Stormwater structures close to watercourse • Plant buildings
GN R 544 in GG 33306 of 18 June 2010	12	The construction of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50000 cubic metres or more, unless such storage falls within the ambit of activity 19 of Notice 545 of 2010.	• Pollution control dams • Silt dams • Evaporation dams • Return water dams

Number and date of the relevant notice	Activity number	Listed activity	Activity description
GN R 544 in GG 33306 of 18 June 2010	13	The construction of facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic metres.	Explosive Magazines renewal
GN R 544 in GG 33306 of 18 June 2010	18	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock from- (i) a watercourse; (ii) the sea; (iii) the seashore; (iv) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater, but excluding where such infilling, depositing, dredging, excavation, removal or moving- (i) is for maintenance purposes undertaken in accordance with a management plan agreed to by the relevant environmental authority; or (ii) occurs behind the development setback line.	Mining of OI
GN R 544 in GG 33306 of 18 June 2010	22	The construction of a road, outside urban areas - (i) With a reserve wider then 13,5 meters or, (ii) Where no reserve exists where the road is wider than 8 metres, or (iii) For which an environmental authorization was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Notice 545 of 2010.	• Haul roads (From OI to existing roads) • Access roads
GN R 544 in GG 33306 of 18 June 2010	24	The transformation of land bigger than 1000 square metres in size, to residential, retail, commercial, industrial or institutional use, where, at the time of the coming into effect of this Schedule such land was zoned open space, conservation or had an equivalent zoning.	Rezoning of Block OI to industrial will be undertaken.

Number and date of the relevant notice	Activity number	Listed activity	Activity description
GN R 544 in GG 33306 of 18 June 2010	28	The expansion of existing facilities for any process or activity where such expansion will result in the need for a new, or amendment tor, an existing permit or license in terms of national or provincial legislation governing the release of emission or pollution, excluding where the facility process or activity s included in the list of wate management activities published in terms of section 19 of the NEMWA.	• Backfilling • Slimes disposal
GN R 544 in GG 33306 of 18 June 2010	37	The expansion of facilities or infrastructure for the bulk transportation of water, sewage or storm water where: (a) the facility or infrastructure is expanded by more than 1000 metres in length; or (b) where the throughput capacity of the facility or infrastructure will be increased by 10% or more– excluding where such expansion: (i) relates to transportation of water, sewage or storm water within a road reserve; or (ii) where such expansion will occur within urban areas but further than 32 metres from a watercourse, measured from the edge of the watercourse.	Expansion of water structures.
GN R 544 in GG 33306 of 18 June 2010	41	The expansion of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, where the combined capacity will be increased by 50000 cubic metres or more.	Existing return water dams will be put back in use – combined capacity of 80000 Cubic metres.
GN R 544 in GG 33306 of 18 June 2010	47	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre - (i) where the existing reserve is wider than 13,5 meters; or (ii) where no reserve exists, where the existing road is wider than 8 metres, excluding widening or lengthening occurring inside urban areas.	Haul road expansion.
GN R 545 in GG 33306 of 18 June 2010	3	The construction of facilities or infrastructure for the storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.	Diesel Storage of 1000 cubic metres - Fuel Depot.

Number and date of the relevant notice	Activity number	Listed activity	Activity description
GN R 545 in GG 33306 of 18 June 2010	5	The construction of facilities or infrastructure for any process or activity which requires a permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent and which is not identified in Notice 544 of 2010 or included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act 59 of 2008) in which case that Act will apply.	• NEM:WA activities dependant (waste license) • Slimes disposal
GN R 545 in GG 33306 of 18 June 2010	15	Physical alteration of undeveloped vacant or derelict land for residential retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20ha or more, except where such physical alteration takes place for: Linear development activities; or Agriculture or afforrestation where activity 16 in this Schedule will apply.	• Mining OI • RoM and coal stockpiles • JIG and DMS plant and associated infrastructure
GN R 545 in GG 33306 of 18 June 2010	20	Any activity which requires a mining right or renewal thereof as contemplated in section 22 and 24 respectively of the Mineral and Petroleum Resources Development Act, 200 (Act 28 of 20902). [Date of commencement of Activity 20: to be proclaimed]	This activity will come into force 18 months after 7 June 2013 as per Promulgation Notice 14 of GG 36512, 31 May 2013.

1.5.3 The process in terms of NWA

In addition to the NEMA and MPRDA authorisations, activities which have the potential to impact on a water resource require a water use licence (WUL) issued by the DWA, under the NWA. Section 21 of the NWA identifies certain water uses which have to be authorised. A Water Use Licence Application (WULA) and an accompanying Integrated Waste Water Management Plan (IWWMP) must be submitted to the DWA for the following:

- 21(a): Taking water from a water resource;
- 21 (b): Storing water;
- 21 (c): Impeding or diverting the flow of water in a watercourse;
- 21(g): Disposing of waste in a manner which may detrimentally impact on a water resource;
- 21 (i): Altering the beds, banks, course or characteristics of a watercourse; and
- 21(j): Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.

The IWWMP is used as a management tool by Leeuwpan to manage water emanating from their operations, using best practices in the interest of protecting the water resources which may be affected.

A WUL may be issued for a maximum period of 40 years with a specified review period. The WUL also prescribes a set of conditions to protect water resources, and gauge the impact of the water use. These have to be strictly adhered to for as long as the water use continues. This may extend beyond the life of the mining operation, as Leeuwpan will be responsible for impacts caused by the mining operations after decommissioning and closure.

Furthermore, Section 27 of the NWA specifies that the following factors, regarding water use authorization, must be taken into consideration:

- the efficient and beneficial use of water in the public interest;
- the socio-economic impact of the decision whether or not to issue a license;
- alignment with the catchment management strategy;
- the impact of the water use and possible resource directed measures; and

- investments made by the applicant in respect of the water use in question.

Section 27 considerations will be included in the WULA and IWWMP. This will assist Leeuwpan in ensuring that the water uses applied for, are undertaken in a manner that does not negatively impact on the public, water resources, or downstream water users or compromise any of the country's international obligations with regards to shared water resources.

1.6 Environmental Assessment Practitioner

In terms of Section 17 of the NEMA, the applicant has to appoint Environmental Assessment Practitioners (EAPs) before applying for an environmental authorisation of any activity listed in terms of GN 544 and 545. For this purpose Exxaro Leeuwpan Coal has appointed GCS Water and Environment (Pty) Ltd t/a GCS (Pty) Ltd to undertake the necessary environmental assessments and to ensure that all legislative requirements are adhered to as part of the environmental authorisation processes.

GCS (Pty) Ltd (GCS) provides a professional, independent consulting service in the fields of water, environmental, engineering and earth sciences. The GCS team consists of highly trained staff that has extensive experience in the fields of hydrogeology, hydrology, earth sciences, engineering geology, engineering and environmental sciences.

GCS have considerable experience in Southern Africa and undertake investigations for environmental assessments. The environmental scientists carry out all aspects of environmental assessments and management programmes.

GCS was founded in 1987 and the broad GCS client base ranges from individuals, engineers, municipalities and mines, to Independent States and Governments. GCS is an independent practice, which is wholly owned by the partners of the company.

GCS is an independent environmental consulting firm and has undertaken the Environmental Impact Assessment (EIA)/Environmental Management Programme (EMP) Report development. GCS is also responsible for the Public Participation Process (PPP) pertaining to the proposed operation.

The EAP is independent and has no vested interest in the outcome of the environmental authorization applications.

Refer to Table 1.6 for the EAPs involved and Appendix B for GCS Profile.

Table 1.6: EAP Details

Name of EAP	Position	Qualification	Experience
Tanja Bekker	Technical and Quality Control	MSc. (Environmental Management). PrSciNat Registered EAPSA Certified	12 years
Jaco Viviers	Environmental Project Manager	BSc (Hons) Geography and Environmental Management	8 years
Riana Panaino	Environmental Consultant	B. Sc (Hons) Biodiversity and Conservation	5 years

1.7 Report Structure

This report has been compiled in compliance with the requirements of regulation 50 and 51 of the MPRDA Regulations, Government Notice R527, dated 23 April 2004

Chapter 1:

- This chapter provides a background to the project and the applicant; a description of the applicable rights; a list of the applicable legislation reviewed during the compilation of this report, as well as a description of all the applicable environmental authorization application processes being undertaken with respect to the proposed mine.

Chapter 2:

- This chapter provides a description of the existing and proposed mining operations, mining method, required services, access routes, transport routes and surface infrastructure.

Chapter 3:

- This chapter provides a description of the project alternatives considered and a motivation for why the preferred alternative was selected.

Chapter 4:

- This chapter of the report provides a description of the baseline biophysical and socio-economic conditions of the project area. The information in this chapter has been obtained from the specialist studies undertaken as well as various desktop sources.

Chapter 5:

- This chapter describes the stakeholder consultation process undertaken as well as the issues which were identified during the process. Further public consultation which is required as part of the NEMA and NWA applications is also described. The proof of public consultation is attached as part of report.

Chapter 6:

- This chapter outlines the environmental management objectives and goals for the mine.

Chapter 7:

- This chapter contains the following:
    - The construction, operational and decommissioning activities will impact on the biophysical and socio-economic environment;
    - A description of the environmental impact assessment methodology, impact assessment criteria and rankings;
    - The rating of the significance of the impacts posed by the proposed activities;
    - The management and mitigation measures, action plans, timeframes and costs with respect to avoiding and managing environmental and socio-economic impacts, as well as the associated costs.

Chapter 8:

- This chapter outlines the monitoring and auditing programmes which have been recommended by the relevant specialists. It includes objectives of each proposed monitoring programme, the location of monitoring points, the procedures to be followed when undertaking monitoring; the frequency of monitoring required; criteria to assess environmental performance, as well as the recommendations for internal and external (independent) auditing to be undertaken.

Chapter 9:

- This chapter sets out procedures to be followed during and after various types of incidents and accidents. It also sets out the procedure for inducting employees and informing all mine employees and contractors of the various risks which may results from the various activities on site and all required management and mitigation measures which are in place and that must be complied with in order to avoid environmental pollution and degradation.

Chapter 10:

- The chapter provides the financial provision required for the project.

Chapter 11:

- This chapter outlines the environmental rehabilitation to be undertaken following environmental disturbances caused by the proposed activities associated with the proposed mine.

Chapter 12:

- This chapter outlines the assumptions made during the specialist studies and environmental impact assessment, the adequacy of underlying assumptions, the uncertainties in the information provided, as well as recommendations to improve the accuracy of the information used to compile this report and the relevant appendices.

Chapter 13:

- List of specialist reports which are appended to this document.

Chapter 14:

- This chapter is the undertaking that the EMP will be executed as approved and that the provisions of the Act and regulations thereto will be complied with.

Chapter 15:

- This chapter is the conclusion to the report which summarises the results of the studies and contains the recommendations of the EAP.

Chapter 16:

List of references used to compile this report.

2 PROJECT DESCRIPTION

This chapter describes the proposed surface infrastructure, mining infrastructure, mining method, etc., thereby fulfilling the requirements as per Regulation 50 (a) of the MPRDA Regulation R527 and the EMP Template.

REGULATION 50 (a):

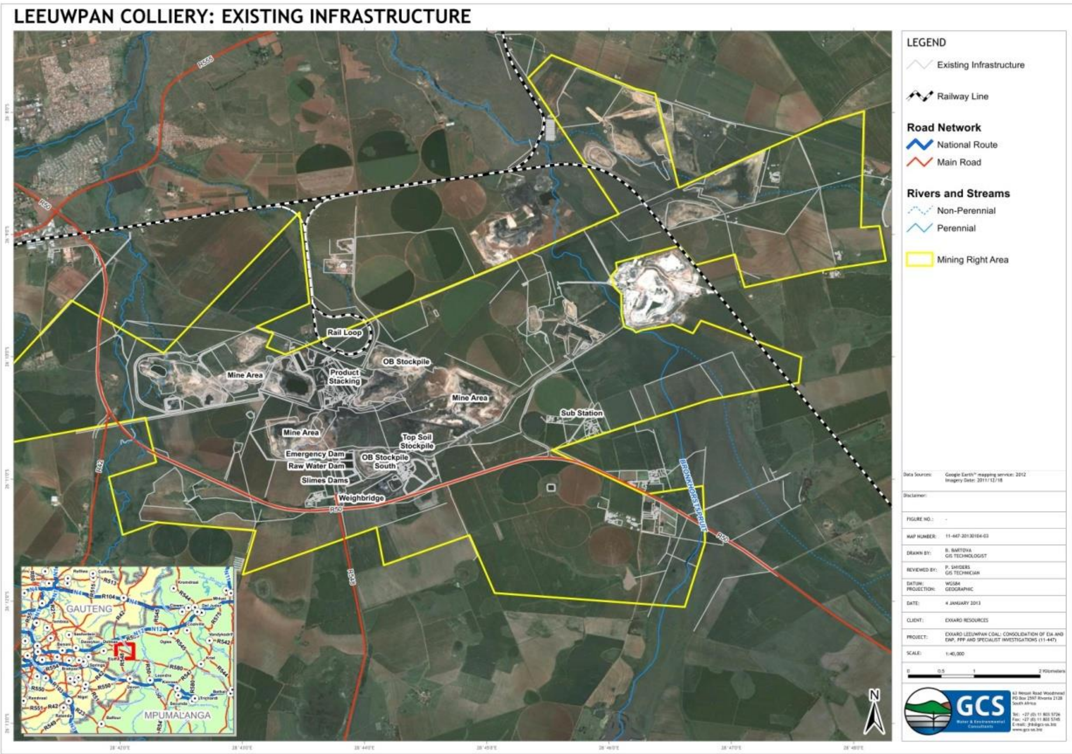
- *(Section 1 – 2): The proposed mining operation*
  - *(Section 1 – 2.1): The mineral to be mined;*
  - *(Section 1 – 2.2): The mining method to be employed at the level of opencast, underground, stoping, stooping, total extraction, bord and pillar, block caving, shrinking, dredging, pumping, monitoring, etc. and provide a concise description of the intended magnitude thereof, in terms of volumes, depth and aerial extent;*
  - *(Section 1 – 2.3): List of the main mining actions, activities, or processes, such as, but not limited to, access roads, shafts, pits, workshops and stores, processing plant, residue deposition sites, topsoil storage sites, stockpiles, waste dumps, access roads dams, and any other basic mine design features;*
  - *(Section 1 – 2.4): Plan showing the location and aerial extent of the aforesaid main mining actions, activities, or processes as required to calculate the financial provision in accordance with the Department's published guideline. (Reg. 51 (b) (v));*
  - *(Section 1 – 2.5):Listed activities (in terms of the NEMA EIA regulations) which will be occurring within the proposed project (Refer to section 1.5.2);*
  - *(Section 1 – 2.6): Indication of the phases (construction, operational, decommissioning) and estimated time frames in relation to the implementation of these actions, activities or processes and infrastructure; and*
  - *(Section 1 – 2.7): Confirmation if any other relevant information is attached as appendices.*

The information contained in this chapter has been obtained from the draft Pre-Feasibility Study (PFS) and the Mining Works Programme (MWP) submitted to DMR in 2013.

2.1 Approved Infrastructure

Infrastructure approved under the MPRDA at Leeuwpan Coal are detailed below for each of the mining areas discussed in the project background, each table will indicate what infrastructure still exists and what has been removed. Figure 2.1 shows the existing infrastructure of Leeuwpan Coal Mine.

Listed activities under the National Environmental Management Act (Act No. 107 of 1998) (NEMA) didn't come into effect before 2006 and therefore didn't need approval under the NEMA. For Addendums 4 and 5 conducted in 2006 – 2007, mining applications were excluded until further notice from the EIA process legislated under the NEMA. Several activities associated with the mining operations that were proposed in Addendums 4 and 5 have however been listed under the NEMA EIA Regulations (No. GNR 385, 386 and 387 of 2006). As was agreed then in consultation with Mpumalanga Department of Land Administration (MDALA), since all activities are directly related to mining, it was not be necessary to obtain authorisation in terms of the EIA Regulations.



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 2.1 Existing infrastructure at Leeuwpan Coal Mine

2.1.1.1 Kenbar and Witklip

Table 2.1 indicates infrastructure and facilities approved under the MPRDA associated with the original EMP for Kenbar and Witklip.

Table 2.1 Kenbar / Witklip approved infrastructure from Original EMP

Activity / structure	Still existing
Discharge silo and conveyor band across the Delmas – Leandra road	No
Equipment workshop	Yes
Coal mixing bed and off-load facilities	Yes
Railroad of ± 3 km for the transport of coal from Leeuwpan	Yes
Weighbridge for the road transport	Yes
Ablution block and administration offices	Yes
A linking road with the R 50 route (between Delmas and Leandra) including security buildings	No
A linking road with the P 36-2 route between Delmas and Devon	No
Pit water dam and silt dams	No
Evaporation ponds	Yes
Additional storm water control measures (berms)	Yes
Electricity supply network	Yes
Closed water network for process water	Yes
Potable water supply via pipeline	Yes
Sewerage infrastructure	Yes
River diversion	Yes
Mining of Kenbar and Witklip sections	Yes – not operational

2.1.1.2 Block OE

A number of changes with regards to environmental management, particularly with respect to water management, came about at Leeuwpan Coal Mine during 1997. Approved activities and infrastructure under the MPRDA are indicated in Table 2.2.

Table 2.2 Block OE Activity / Infrastructure approved under the MPRDA

Activity / structure	Still existing
Discharge of excess water into an unnamed tributary of the Bronkhorstspruit	No
Demolition of old plant (interim phase plant)	No
New plant (final phase plant)	Yes
Opencast block (Block OE)	Yes – not operational
River diversion	Yes

2.1.1.3 Blocks OD, OFPAD, OH and OM

The mining of Block OM, Block OH, Block OFPAD and Block OD involved the extension of existing mining operation and Table 2.3 indicates the activities / infrastructure approved under the MPRDA that were added during the process.

Table 2.3 OM, OH, OFPAD and OD approved Infrastructure / Activities under the MPRDA

Activity / structure	Still existing
Extension of existing haul roads to Block OM, Block OH as well as Block OFPAD and Block OD	Yes
Relocation of the 11 kV powerlines and associated mini substations	Yes
Clean and dirty water systems around the mining area of Block OM, Block OH, Block OFPAD and Block OD	Yes
Road diversions and associated infrastructure	Yes
Mining activities	Yes

2.1.1.4 Block OJ and OL

The Addendum 4 EMP was compiled for the extension of Block OJ and OL on the Farm Moabsvelden 248 IR. Infrastructure and activities that was approved under the MPRDA in the proposed extension are shown in Table 2.4. As mentioned previously it was agreed in consultation with Mpumalanga Department of Land Administration (MDALA), since all activities are directly related to mining, that it was not be necessary to obtain authorisation in terms of the EIA Regulations.

Table 2.4 OJ, OL Extension Infrastructure / Activity approved under the MPRDA

Activity / structure	Still existing
Infrastructure in the one in ten year flood line of a river or stream, or within 32 meters of the bank of a river or stream	Yes
The construction of a road that is wider than 4m	Yes
Development activity, including associated structure or infrastructure.	Yes
Mining of mining blocks	Yes

2.1.1.5 OD, UI and OWM

In 2006 an EIA/EMP was compiled for Kumba Coal for the mining of an extension of the existing Block OD on the farm Wolvenfontein 244 IR; and Block UI to be mined underground on the farm Rietkuil 249 IR.

Block UI was however never mined and thus no infrastructure was put in place for that section. Table 2.5 shows the infrastructure and activities approved under the MPRDA for the OD mining area.

As mentioned previously it was agreed in consultation with Mpumalanga Department of Land Administration (MDALA), since all activities are directly related to mining, that it was not be necessary to obtain authorisation in terms of the EIA Regulations.

Table 2.5 OD Infrastucture / Activities

Activity / structure	Still existing
Topsoil and overburden stockpiles	Yes
RoM stockpile	Yes
Storm water diversion channels	Yes
Expansion of existing haul roads	Yes
Pollution water management system	Yes
Water supply system	Yes
Ablution facilities	Yes
Diesel fuel tank	Yes
Workshop	Yes
Site offices	Yes
Explosives magazine	Yes
Mining of OD	Yes

In 2006 an EIA/EMP was also compiled for the mining of Block OWM on the farms Weltevreden 227 IR and Moabsvelden 248 IR. Table 2.6 shows the approved infrastructure (under the MPRDA) associated with the proposed mining of Block OWM.

Table 2.6 OWM Infrastructure / Activities

Activity / structure	Still existing
Topsoil and overburden stockpiles	Yes
ROM stockpile	Yes
Water pollution management system	Yes
Storm water diversion measures, including the proposed stream alteration	Yes
Water supply system	Yes
Haul road and access roads	Yes
Portable ablution facilities	Yes
Diesel fuel tank	Yes
Temporary workshop	Yes
Portable site office	Yes
Explosives magazine	Yes
Mining of OWM	Yes

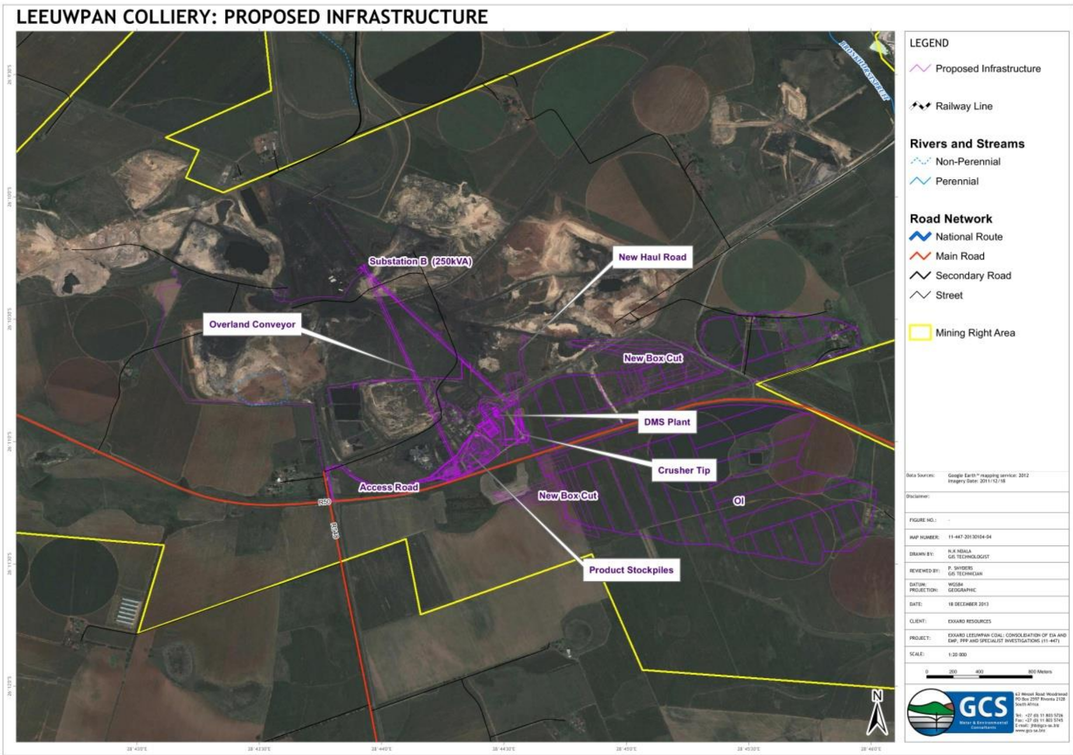
2.2 Proposed project infrastructure and activities

Leeuwpan Coal Mine is planning the development of an additional opencast block (Block OI) which will be located on portions of the farm Moabsvelden 248 IR and Rietkuil IR. The mineral rights belong to Exxaro, however the certain portions of these farms are privately owned and utilised for agricultural practices.

Infrastructure that will be associated with the proposed Block OI development will be:

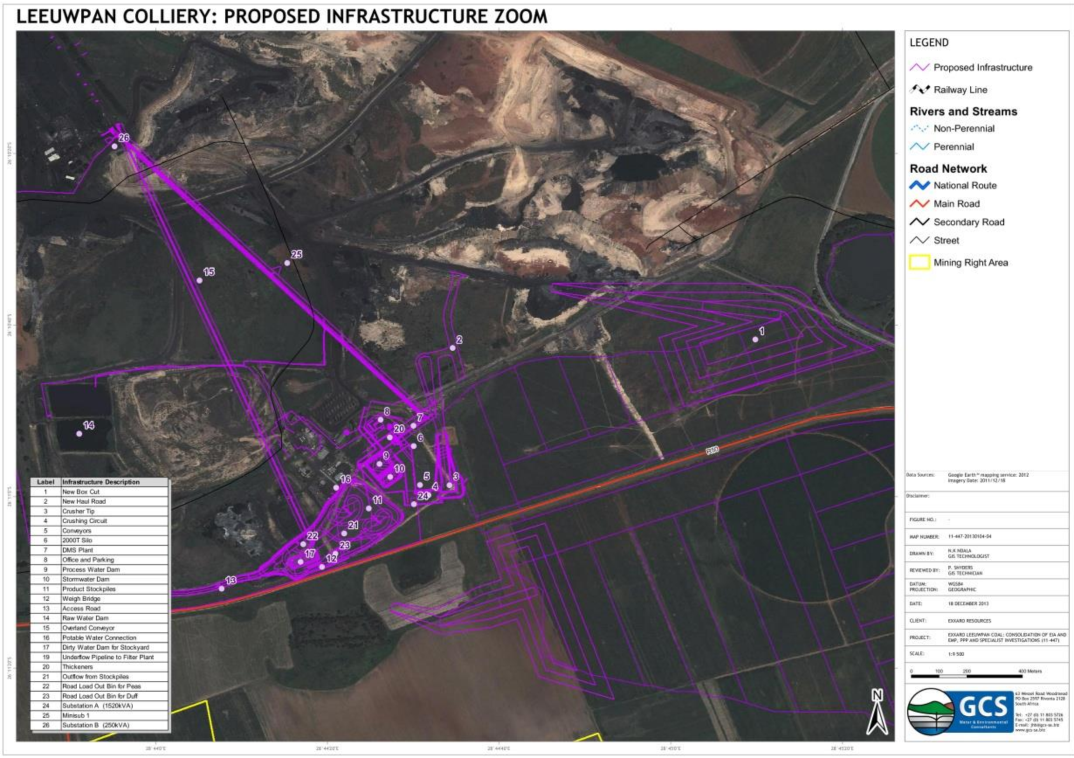
- Two boxcuts for access to opencast pits;
- Explosive magazine;
- Mining of OI (opencast);
- New and extension of haul road from the mine entrance ramp to the tip terrace;
- Tip terrace, crushers, conveyors
- Screen house;
- Crushing and screening plant (DMS);
- Weirs;
- Plant buildings;
- Stockyard, including stockyard conveyors;
- ROM and product stockpiles;
- Diesel storage of 1000 cubic metres - Fuel Depot.
- Water pipelines (from OI) and pipelines between PCDs;
- Existing return water dams will be put back in use – combined capacity of 80000 Cubic metres;
- Stormwater drains, trenches and cut-off trenches;
- Clean and dirty water systems;
- Evaporation dam, pollution control dam;
- Services including potable water, process water, fire water, electricity reticulation; and
- 11kV bulk electrical supply from Eskom substation.

Figure 2.2a and b shows the proposed infrastructure associated with the Block OI project.



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 2.2 Proposed infrastructure associated with the Blocks OI and OL project



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 2.3 Proposed infrastructure (Zoomed) associated with the Block OI and OL project

2.3 Mining Method

2.3.1 Opencast

2.3.1.1 Previously approved

Opencast mining started on the farm Witklip in 1994, and stopped in 2005. Remaining reserves being mined are Blocks OWM, OG, OH and OJ. UI (now OI) and OL were planned to be mined previously. The mine works at UI was put on hold for further exploration and mine simulation, and was subsequently decided to convert to opencast mining. OL will be mined in 2020.

2.3.1.2 Proposed

Leeuwpan Coal Mine is evaluating the potential open cast mining of the coal reserves on the farms Rietkuil 249 IR and Moabsvelden 248 IR (Block OI) within its mining right area. The purpose of the proposed open cast development will be to expand the current mining operations. The reserves will be mined using the drilling, blasting, loading and hauling with truck and shovel, excavator and fleets methods.

The proposed mining operations will extend the Life of Mine (LOM) for Leeuwpan with 16 years up to 2029 (Refer to Figure 2.3). The LOM for the OI reserve will be up to approximately 2023 (Refer to Table 2.7).

Table 2.7 Production Schedule for OI Reserve

Description	Unit	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
OVB soft	*ton*	4 767 331	3 297 880	2 479 518	4 348 253	4 549 360	4 858 764	5 414 488	5 925 512	6 762 044	2 140 790
OVB hard	*ton*	35 540 451	28 633 755	22 208 151	30 343 637	33 728 839	35 116 666	36 739 643	38 170 310	40 000 000	13 875 743
ROM bolaag	*ton*	2 374 314	2 002 385	1 942 599	2 486 338	2 942 759	3 037 096	3 245 921	3 026 812	2 687 491	1 194 090
ROM Onderlaag	*ton*	2 250 425	2 314 018	2 363 580	2 335 037	2 400 000	2 400 000	2 400 000	2 267 717	1 982 027	1 249 113

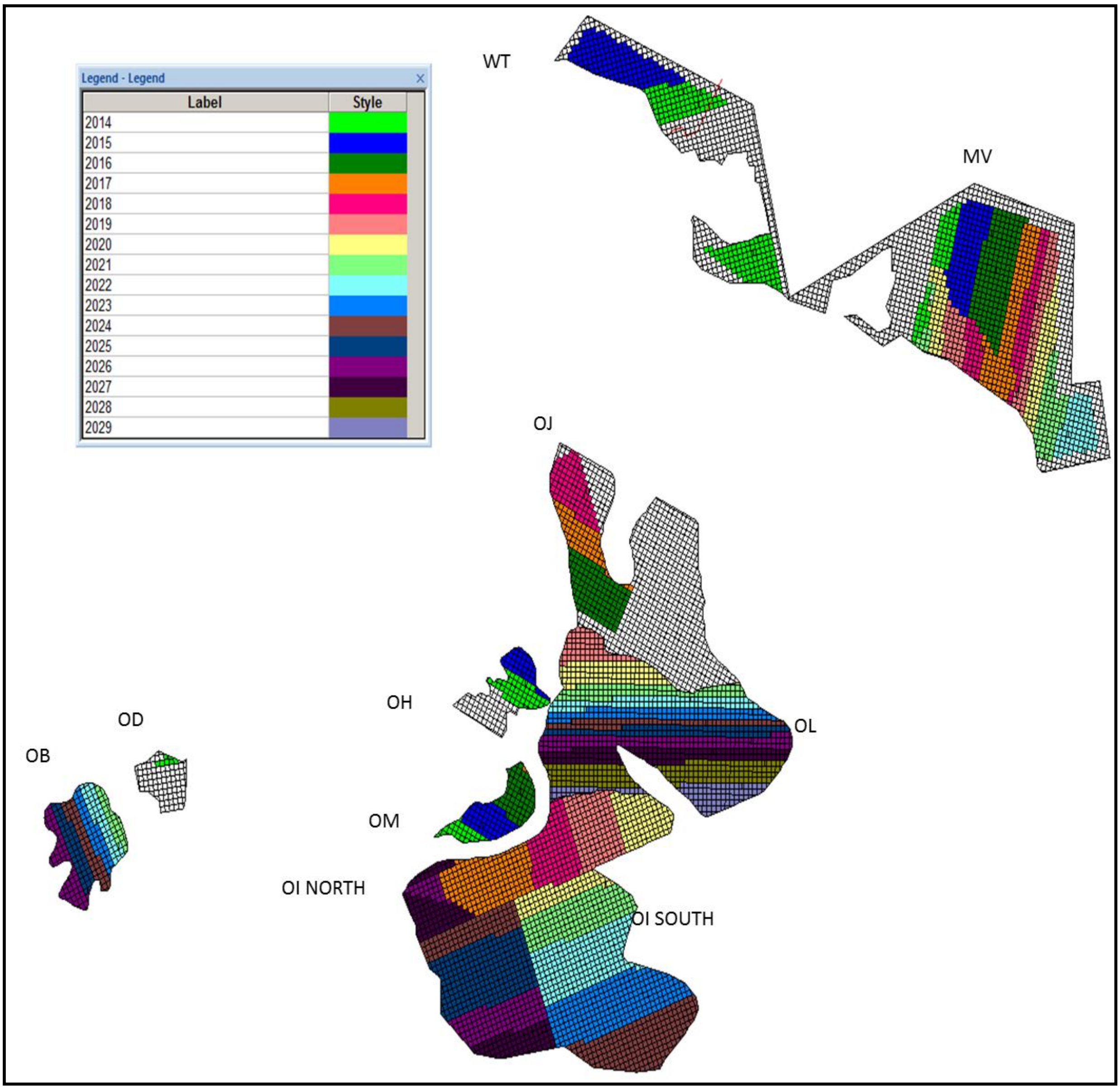


Figure 2.4 Leeuwpan Coal Mine proposed mining Schedule

2.4 Roads, Railway Lines and Power Lines

2.4.1 Previously approved

- Roads:
  - New haul roads were constructed for the Kenbar Witklip sections;
  - Existing haul roads were extended to Blocks OM, OH, OFPAD and OD;
  - New roads were constructed to Blocks OJ and OL; and
  - Haul roads and access roads were constructed for block OWM.
- Railway Lines:
  - Leeuwpan Coal Mine has a private siding where rapid loading of train trucks including Jumbo trucks can be done. The siding links up with the Hawerklip line, 3 km east of Delmas. At the end of this siding is a 500 m loop where train trucks are loaded and turned around.
- Power Lines
  - Electricity is supplied directly to the mine by Eskom be means of a sub-station at Witklip which is linked to the nearby Eskom power line;
  - Locally the electricity is distributed by overhead powerlines; and
  - As the open pit areas progresses, the power lines and the mini substations are relocated in line with the path of the open pit operations.

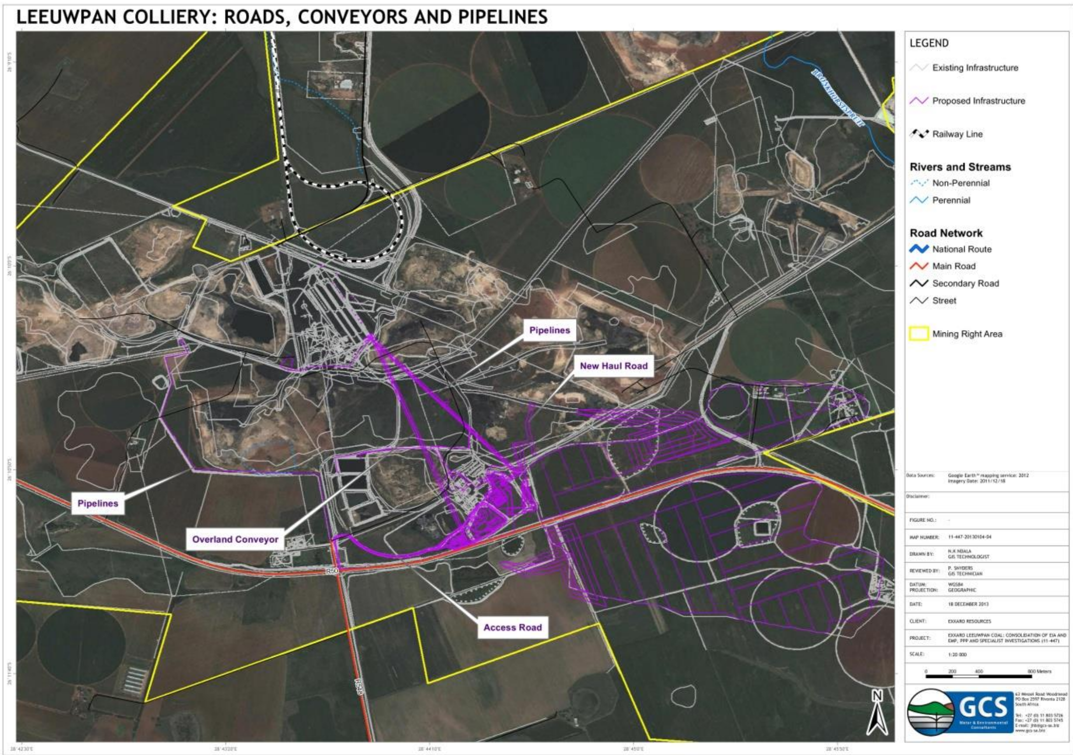
2.4.2 Proposed

For the purposes of the proposed new OI and OL opencast operation the following additional infrastructure will be required:

- Roads
  - An additional Haul road and extensions to current haul roads will be constructed for the transport of coal from block OI to the new plant (crushing and screening) area via the tipper terrace, and the transportation system will also include various conveyor systems within and from the crushing and screening area to the new plant and the stockyard (product stacking) area for OI;
  - Haul roads were designed to accommodate CAT 777 mining trucks, with minimum clearances under conveyors at conveyor over haul road crossings to allow for these trucks transported on low beds;

- Access roads with 7.5m width (duel traffic flow) can accommodate any road legal transport effectively and safely. Haul roads with 23 m width for duel traffic flow were designed;
- Maintenance roads are allowed for next to the new overland conveyor, in order to provide easy access to the conveyor for maintenance or any other event that require access to a specific point next to the conveyor; and
- All gravel roads will have a gravel wearing course as a final layer. This provides a durable and easily maintained surface with expected low maintenance.

- Conveyors
  - The geometric design (horizontal) for the overland conveyor was chosen to limit interferences with existing infrastructure and to limit transfer points. The proposed route need to cross existing haul roads on 2 positions, but no transfer points is required with a single conveyor from the product bin to the screenhouse;
  - The screenhouse was positioned outside the current OG pit footprint. The OG pit is currently being backfilled and there is a high risk of settlement should any infrastructure be constructed on backfilled material;
  - The overland conveyor needs to be constructed over the current OG pit. The mine indicated that this pit will be backfilled prior to the construction of the overland conveyor; and
  - Conveyor lighting was based on the requirement for a minimum maintained luminance level of 50 Lux on conveyor walkways and 10 Lux for conveyors without walkways, with emergency lighting for at least 30 min after power failure.
- Power Lines
  - The current bulk power supply of 11kV will be extended to take the expansion of the mine to OI section and the additional plant into consideration.



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 2.5 Proposed Hauls roads, powerlines and pipelines

2.5 Buildings, workshops, offices

2.5.1 Previously approved buildings, workshops and offices

A workshop of 300m^2 was constructed for the first mining operations and was equipped with a 20t overhead hoist. A service station and wash area was established in front of the workshop. Offices and ablution facilities for staff was erected on one side of the workshop.

2.5.2 Proposed buildings, workshops and offices

Buildings comprising plant offices and a substation will be constructed for the new DMS plant areas. The offices and boardroom next to new Plant control room will be an estimated 40m^2 for a small boardroom, 4 offices, and ablution facilities for male and female personnel as well as a small kitchenette. Parking area will also be constructed.

2.6 Housing and Transport

No housing and recreational or other facilities are planned. Workers are responsible for their own housing. Each worker is also responsible for his/her own transport between home and work.

2.6.1 Previously approved transport of coal

The coal from existing pits is transported mainly by truck to the existing Final Phase Coal Processing Plant. From the plant it is transported via conveyors to the siding. The final coal product is transported by means of railroad to the different work centers or via road transport to other markets. Road transport is handled by means of a weighbridge.

2.6.2 Proposed transport of coal

The coal from the proposed pit will be transported by truck and conveyor to the new plant. The final coal product is transported by means of existing railroad to the different work centers or via road transport to other markets. The size of the current road stockpile area need to be increased should the market need more road dispatches. Current new boiler markets will make use of the road facilities as not all the customer has access to rail off-loading facilities.

2.7 Pollution Control Dams, Settling Dams, Slurry Dams, Evaporation Dams

2.7.1 Previously approved

The prevention of water pollution at Leeuwpan Coal Mine was managed by way of a closed water circuit. Mine water was pumped from the open pits to evaporation dams. Plant water was first pumped to slurry dams where settling of coal fines occur and was then re-used in the coal washing process. Water was pumped back to the plant from the evaporation dams for re-use.

Storm water canals were built around the evaporation dams in order to prevent clean storm water from entering the dirty water area.

The polluted water from the existing coal refinement plant was separated in a condenser and pumped back to the plant. The slimes from the condenser were pumped to the settling dams, from where the run-off was pumped back to the plant.

The settling dams consisted of three separate dams. The settling dams were used on a rotational basis and the dried silt was reclaimed with the aid of mechanical equipment, and sold or returned to the pit. The mine stopped using these pits in 2003.

The Witklip Pit Water Settling/Evaporation Dam (PCD) (140 000m^3) operated as an industrial water storage dam and was supplied by a series of boreholes. Water from this dam was pumped to the raw water settling dam. When necessary, water from the emergency overflow dam can be pumped to this dam for storage. The dam had been upgraded to include an HDPE liner.

The Raw Water Settling Dam also acted as an industrial water storage dam. Surplus water from the Raw Water Settling Dam overflows to the Emergency Overflow Dam. These dams are unlined.

The Stockpile Settling Dams captured runoff from the stockpile and the main processing plant areas.

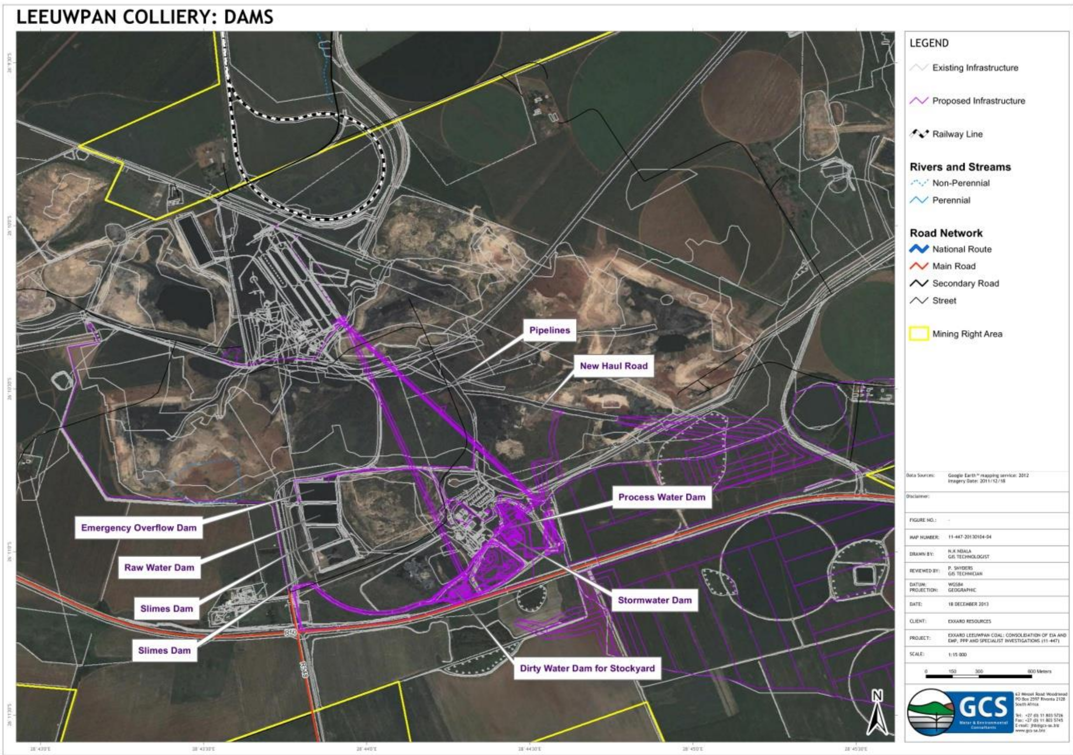
The Slurry Dams, which contain coal fines were discontinued and being allowed to dry. The mine planned to sell the material.

A filter press was commissioned in 2003 to dewater the slimes at the main plant area. This advanced technology allows the mine to re-use process water very efficiently.

2.7.2 Proposed

The decommissioned settling dams / slimes disposal dams will be recommisioned for the OI project. The dams are being cleared of all additional material and lined.

A new process water dam, stormwater dam and evaporation dam will be constructed at the DMR Plant and Crushing and Screening Facility. Water will be pumped back to the plant from the evaporation dam for re-use. All dams will be HDPE lined.



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 2.6 Proposed process water, evaporation and stormwater dams

2.8 Crushing and Processing plant

2.8.1 Previously approved

Originally the coal distribution construction consisted of a crusher plant and a washer to refine the coal by means of a wet process. Final Phase Coal Processing Plant was used for washing and sorting. The Interim Phase processing plant had been dismantled and removed from the site. The final phase processing plant consisted of a Beneficiation Plant and a Jig Plant.

Existing beneficiation plant

The Beneficiation Plant consisted of a Crushing and Washing Plant. A volume of 638 520m^3 per year of process water, consisting of groundwater ingress into the pits and make-up water from boreholes, is used at the Beneficiation Plant.

The rate of process water use is 85m^3/h. Process water is used on a continuous basis and is proportional to the amount of coal that is being washed per day. No significant daily fluctuations exist in the use of water on the mine. The Beneficiation Plant operates 24 hours a day for 313 days per year.

Existing Jig Plant

In 2005, Leeuwpan Coal Mine commissioned a new Jig Plant within the existing Plant infrastructure area of the mine. The Jig Plant is a refinement of the existing coal beneficiation process to improve the recovery percentage from ROM tons. It was estimated that the product tons would be increased from 140,000 to 164,000 tons per month with the discard decreasing from 110,000 tons to 86,000 tons. This calculates to an improvement from 56% to 65.6% recovery.

Any contaminated water generated by the Jig Plant is managed in the existing dirty water system as part of the existing water distribution network. The Jig Plant requires an additional raw water make-up requirement of approximately 45m^3/h. As the product is increased while the ROM remains the same, more contaminated water is released in a non-polluting way. Furthermore, the operation of the Jig Plant results in the generation of less discard which in turn results in less contaminated water being discharged back to the Open Pits as moisture in discard.

2.8.2 Proposed new Beneficiation Plant for OI

A crushing and processing plant will be constructed for Block OI; product from the pit will be transported by loading and hauling with truck and shovel, excavator and fleets to the crusher where the crushed product will be transported via the conveyor system to the processing plant to be processed.

The plant will typically consist of the following processing areas:

- ROM tip, 2 Stage Crushing and Screening;
- Single wash dense medium plant (Low Gravity/Coarse DMS);
- Fines DMS plant;
- Thickening;
- Material handling; and
- Services i.e. flocculant plant, magnetite make-up etc.

Refer to Figure 2.6 for Beneficiation Plant flow diagram.

The Crushing and Screening plant will beneficiate ore from the Leeuwpan Coal Mine Block OI top coal reserve. The ROM will be crushed down to -50mm through primary and secondary crushing. Crushed ROM will be fed to the beneficiation plant. The coarse plant feed coal (-50+1mm) will be washed through a single wash DMC and crushed to produce a -30mm domestic product. The -1mm will also be beneficiated in a fines beneficiation plant, also to produce a domestic product. The base case fines beneficiation plant shall be fine coal DMS. Prior to the fines beneficiation, the -150µm slimes will be removed via a desliming cyclone.

Dewatering of the coarse discard and product will be achieved using centrifuges whilst the fine beneficiation discard and product will be dewatered using cyclones and screens or fine coal centrifuges. The -150µm slimes will report to the thickener for ultrafine fine coal and water recovery. The thickener underflow (-150µm coal) will be processed through the existing Leeuwpan Coal Mine filters. Filtrate will report to the thickener for water recovery and recycling. Filter cake disposed together with the plant discard.

Plant discard will be conveyed to the discard bin whilst the product reports to the product buffer bin. From the product bin the coal is conveyed to the product wet screening plant. The product will be screened into the peas and duff size fractions and conveyed to the existing Leeuwpan Coal Mine stockpile facility. The DMS plant will also consist of a magnetite and flocculant make-up systems.

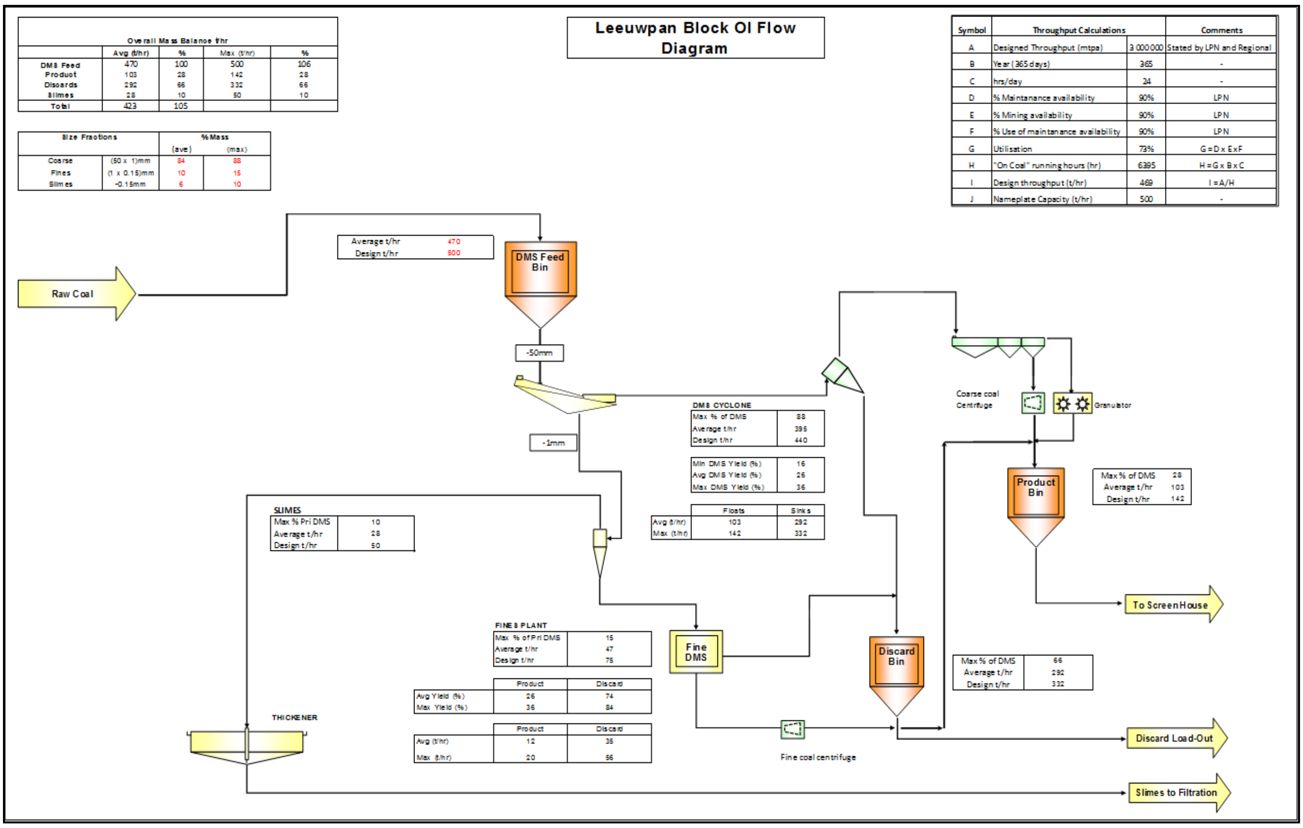


Figure 2.7 Beneficiation Plant flow diagram (See Appendix A for A3)

2.9 Solid Waste (Domestic, Industrial, Mine and Hazardous)

2.9.1 Domestic Waste

2.9.1.1 Previously approved

Domestic waste generated on-site is disposed of into allocated and marked waste bins / containers. Domestic waste is then collected and disposed of in a steel skip at the workshop located within the Leeuwpan Coal Mine boundary area; the contents of the steel skip are emptied into 210l drums located at the old farm shed within the existing mining boundary area. The old farm shed consists of a cement slab covered from the rain. The drums located at the old farm shed are collected and delivered by Archer Mining, using a mining vehicle, to the Delmas Municipal Dump for disposal. The Delmas Municipal Dump holds a Permit from the DWA to receive general solid household waste. No domestic waste is dumped in any unauthorised landfill site / waste site or dumped in a pit.

2.9.2 Mine Waste

2.9.2.1 Previously approved

Originally the mine residue consisting of carbon-carrying shales, plant residue and fine coal recovered from the slimes dams, was compacted and introduced to the mined-out pits below the groundwater table. It was then covered with a clay layer and topsoil so that it would be suitable for agricultural purposes at a later stage.

No mine residue disposal sites were constructed for Block OM, Block OH, Block OFPAD or Block OD. Discard material was placed back into the open pits.

For Blocks OJ and OL (Phase 1) the topsoil was stripped and used in rehabilitation operations. The initial box cut material was also used for the development of the stormwater management berms. Backfilling at Phase 1 Pit took place 45 m from the working face. Due to the risk of pollution to the Bronkhorst River, no discard was backfilled into the Phase 1 Pit.

For block OWM and OD carbonaceous residue material from the existing Process Plant(s), stockpiled topcoal and slurry cakes from the existing filter press, as well as overburden is disposed of back into the proposed pit as part of the mining rehabilitation process.

2.9.2.2 Proposed

Backfilling will take place for the proposed Block OI project as with all other sections on the mine and there will be no discard dumps. Topsoil and overburden will be stockpiled for rehabilitation purposes. Once steady state of production is achieved, discard material and the overburden for OI will be backfilled into the OI pit concurrently throughout the operations of OI.

2.9.3 Hazardous Waste

2.9.3.1 Previously approved

All hazardous waste (excluding mine waste) is stored in accordance with the minimum requirements for the handling, classification and disposal of hazardous waste – including appropriate roofing, fencing, locking (preventing unauthorised access), labelling, waterproof hard standing, protection from storm water ingress (bunding, etc.), drainage and collection system for spills and general protection from potential environmental pollution.

Any hazardous waste is disposed of in clearly marked containers, which are then be sent to the mine workshop hazardous waste storage area, located within the existing mine boundary area, and removed by a contractor to a licensed waste disposal site.

2.9.3.2 Proposed

The already existing hazardous waste storage facility permit that of Leeuwpan Coal Mine will be renewed for the extension of the life of mine and to incorporate the OI Expansion.

2.10 Diesel Storage

2.10.1 Previously approved

Diesel is currently stored on site in a capacity tank of approximately 108m^3.

2.10.2 Proposed

The aboveground Diesel Storage Facility will be increased to 1000m^3 to accommodate for additional diesel to be stored. Refer to Figure 2.7

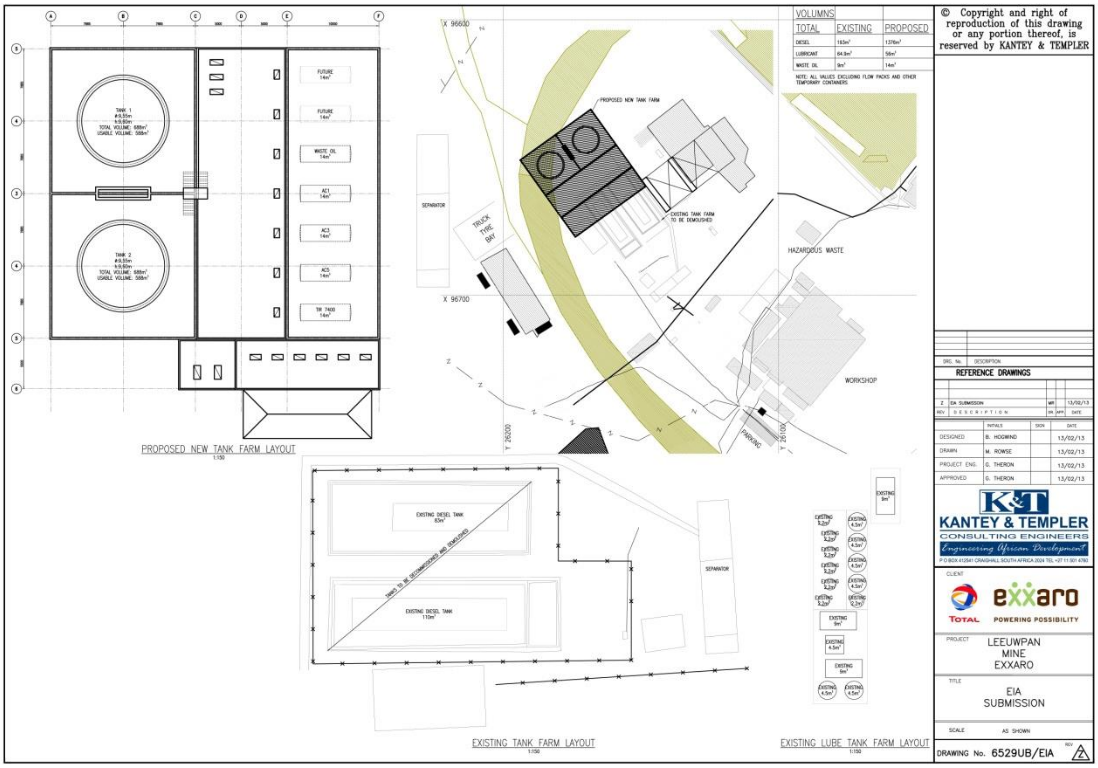


Figure 2.8 New Diesel Storage Facility and Fuel Bay

2.11 Clean and Dirty Water Processes

2.11.1 Clean and Dirty Water Separation Infrastructure

2.11.1.1 Previously approved

Clean and Dirty water separation berms and channels were constructed for all the existing mining areas.

2.11.1.2 Proposed

Clean and Dirty water separation berms and channels will be constructed for the new proposed block OI pit and associated infrastructure.

Storm water dams were allowed for at the plant terrace and the new coal stockyard. These dams will be HDPE lined and was sized to contain a 1:50 year storm event. It only receives storm water run-off water from the new plant terrace and stockyard terrace respectively. The purpose of these dams is to provide a surge capacity and to contain the 1:50 year storm event as per the GN 704 regulations. The dams should be pumped away to existing process water dams in time to contain the next rain event without spilling and cause contamination to the surrounding areas.

2.12 Storm Water Management Measures

Government Notice No. 704, published in terms of the National Water Act (Act No. 36 of 1998) requires the following, which will be adhered to:

- All clean water systems must be designed and operated in such a manner that they are at all times capable of handling the 1:50 year flood event on top of their mean operation level without spilling;
- Any water arising from an area, which causes, has caused or is likely to cause pollution of a water resource, including polluted storm water, must be contained within a dirty water system. In order to reduce the volume of polluted water, contaminated areas should be minimised. While clean water should be diverted to natural water courses, polluted water should be re-used wherever possible, thereby reducing the use of clean water; and
- Design, construct, maintain and operate any dam or tailings facility that forms part of a dirty water system to have a minimum freeboard of 0.8m above full supply level.

2.12.1 Previously approved

Storm water cut-off trenches had been constructed around all areas where affected mine water occurs or where water might become affected. This was done to prevent clean water from mixing with affected water. All storm water that falls within this area had been channelled to the evaporation dams from where it will be either evaporated or re-used.

2.12.2 Proposed

A storm water management plan were compiled for the new block OI (refer to Figure 2.8) and the existing storm water management plan were reviewed and updated to take the entire mine complex into consideration. The complete storm water management plan can be reviewed in Section 4.5 and the Hydrology study in Appendix C-3.

(not to scale, please refer to Appendix A for a enlarged Map)

Figure 2.9 SWMP for OI Section

2.13 Potable Water Supply

2.13.1 Previously approved

Drinking water is supplied from separate boreholes, which are used only for drinking water. Studies had shown that this water is suitable for human consumption and no further water treatment was necessary.

Potable water for domestic purposes is stored in a holding tank referred to as the Office potable water reservoir. This reservoir provides drinking water at the existing offices, ablution facilities, laboratory and workshop. The Office potable water storage reservoir has a capacity of approximately 253 m^3.

2.13.2 Proposed

The expected potable water demand for the new infrastructure is shown in Table 2.8.

Table 2.8 Expected Potable Water Demand for OI

Description	Usage/day	Total
24 people per day, total for all shifts combined	150 liter / person / day	3,600 liter / day
Dust suppression (primary crusher)		24,660 liter / day
Dust suppression (secondary crushing)		16,440 liter / day
Total		**44,700 liter/day**

There is a 250mm existing pipeline in close proximity of the new DMS plant and allowance was made for a connection point from this existing pipeline to a new proposed storage facility on the plant terrace and next to the new plant. The norm is to provide at least 24 hours, preferably 48 hours storage for potable water and therefore 2x 5000 liter poly tanks (Jo-Jo tanks) was allowed for at the offices. For the dust suppression, less storage was allowed for.

No allowance was made for elevated storage and it is planned to construct the new storage tanks on ground level with a small booster pump to provide pressure to the potable water network. This system also provides water to the dust suppression tanks situated between the primary and secondary crushers. Due to the water quality requirements for the mist sprayers at the crushers, it is not recommended to use process water for this.

2.14 Process Water Supply

2.14.1 Previously approved

The only process where water is used for industrial purposes is at the existing coal beneficiation plant. The plant consists of a crushing and a washing plant. Process water is supplied from a closed system, which includes the plant, slimes dams and pit dams. Water replenishment comes from the pits, but if this is insufficient, make-up water from six boreholes is also used.

Water is used on a constant basis and is proportional to the amount of coal that is being washed per day. No significant daily fluctuations exist in the use of water on the mine. The beneficiation plant operates 24 hours a day for 313 days per year.

2.14.2 Proposed

Process water will be supplied from a closed system, which includes the new plant, re-commisioned slimes dams and new evaporation dams. Water replenishment comes from the pit areas as per the current water supply process.

2.15 River Diversions

2.15.1 Previously approved

A section of the Bronkhorstspruit on the farm Kenbar 257 IR was diverted to keep water out of the open pit. A section of a tributary to the Bronkhorstspruit on the farm Witklip 229 IR was also diverted to prevent water from flowing into the open pit. The necessary permits were obtained in accordance with Article 20 of the Water Act, 1956, (Permit nr B 187\1\220\6).

In order to prevent the tributary of the Bronkhorstspruit from flowing into the Block OWM pit, the construction of a river diversion was also deemed necessary. The EIA for the river diversion was submitted in November 2009. A Water Use Licence in terms of Chapter 4 of the National Water Act, 1998 (Act No. 36 of 1998) was obtained in April 2011 (Ref: 16/2/7/B100/C27).

No additional river diversions will be required for the OI Block extension.

2.16 Project Planning and Associated Activities

2.16.1 Construction Phase

During the construction phase, the following activities could impact on the bio-physical environment and the cultural/social setting:

- Stripping of vegetation;
- Stripping of topsoil and subsoil as the construction activities start on site;
- Oil and fuel spills;
- Soil compaction;

- Dust dispersion from construction vehicles, infrastructure construction and boxcut construction activities;
- Noise generated by construction activities;
- Blasting;
- Establishment of new infrastructure;
- Temporary workers disrupting communities; and
- Increased traffic.

2.16.2 Operational Phase

During the operational phase, the following activities could impact on the bio-physical environment and the cultural/social setting:

- Removal of coal resources;
- Topographic alteration;
- Oil and fuel spills;
- Possible compaction of soils;
- Opencast Mining Activities;
- Plant Operation;
- Change of land use;
- Establishment of waste facilities;
- Dust dispersion from vehicles and workings;
- Noise generated by earthmoving equipment and workings;
- Blasting;
- Temporary workers disrupting communities;
- Increased traffic;
- Stockpiling of RoM and overburden;
- Transport of coal product via road and conveyor systems;
- Erosion of soil stockpiles and berms by wind and water; and
- Ancillary activities (workshops, offices, etc).

2.16.3 Decommissioning and Closure Phase

When the decision is taken to decommission the mine, the following objectives and proposed actions for the decommissioning and closure phase of the mine could be considered depending on the outcomes of the EIA and draft EMP:

- Prevention of Acid Mine Drainage;
- Demolition of structures not to be used in the future;
- Ripping of all compacted areas, which will be followed with amelioration and vegetation;
- Ensure that all remaining dumps, piles and slopes are sufficiently shaped to blend in with the surrounding infrastructure;
- Amelioration and vegetation of all disturbed areas;
- Maintenance of all re-vegetated areas up until such areas initiate succession and create a sustainable cover;
- Monitoring of key environmental variables (i.e. soils, vegetation, groundwater and surface water) in order to demonstrate stability of rehabilitated areas;
- Weed management after closure, limited to areas disturbed by mining or included in the mining area; and

Monitoring will be undertaken for a specific period after closure or up until such time that all areas create a sustainable cover and ecosystem and a closure certificate is obtained.

3 PROJECT ALTERNATIVES

This section describes the project alternatives which have been considered, including alternative land uses, thereby fulfilling the requirements as per Regulation Section 50 (b) of the MPRDA Regulation R527 and the DMR EMP Template.

REGULATION 50 (b)

- *(Section 1 - 4): The alternative land use or developments that may be affected.*
  - *(Section 1- 4.1): Concise description of the alternative land use of the area in which the mine is proposed to operate.*
  - *(Section 1 - 4.2): List and description of all the main features and infrastructure related to the alternative land uses or developments.*
  - *(Section 1 - 4.3): Plan showing the location and aerial extent of the aforesaid main features of the alternative land use and infrastructure related to alternative land developments identified during scoping.*

3.1 Mining Method Alternatives for Opencast Pit Development

The alternatives that were considered are based on years of experience by the Leeuwpan mining engineers. The options included opencast mining (truck and shovel), conventional underground bord-and-pillar mining, conventional underground bord-and pillar mining followed by limited pillar extraction, conventional underground bord-and pillar mining followed by total pillar extraction, underground high extraction methods (e.g. stooping or longwall mining), and the no project option.

The mining of the Block OI coal reserve using conventional bord-and-pillar mining methods would minimise the geological impacts, since less geological layers would be destroyed by the mining technique. However this method was not chosen due to the shallow coal layers and most of the coal would be lost as this cannot be safely mined due to the levels at which the coal lies, as well as geological intrusions in the coal necessitating accurate, specific mining of the areas

The conventional underground bord-and-pillar mining followed by limited pillar extraction and the conventional underground bord-and-pillar mining followed by total pillar extraction were also considered for mining at Block OI. Should these methods be implemented, negative impacts on the geological strata overlying the coal layer might occur due to subsidence. Furthermore, the roof conditions due to the shallowness of the coal seam will lead to unsafe mining conditions and since the proposed underground mining operation at Block OI will make use of only an incline shaft, unstable roof conditions can result in a serious safety risk for mine workers. The roof conditions due to the shallowness of the coal layer can possibly lead to secondary impacts on other environmental aspects, such as potential surface crack formation due to roof collapse, and the subsequent infiltration of excessive surface water to the groundwater aquifers.

The option of opencast mining by means of Truck and Shovel mining was chosen as the most economically viable option and thus the mining method that will be used for coal extraction at the proposedLeeuwpan Coal Mine's Block OI and OL project site.

3.2 Alternative Mine Scheduling

Possible alternatives in terms of the mine plan at Block OI include the exclusion of coal reserves under sensitive landscapes (such as pans and wetlands), the inclusion of coal reserves under sensitive landscapes (such as pans and wetlands) option.

Should the coal reserves under sensitive landscapes be excluded, block OI wil be divided into three separate pits, each pit needing a separate boxcut, and sterilizing roughly 74.4% of the coal resource. This is not an economically viable option.

The option to include coal reserves under sensitive landscapes and farm dams is considered to be the most economical viable option due to the high revenue value of the coal at the proposed Block OI. The sensitive landscapes in the area is also highly disturbed due to agricultural activities in the past that has had a cumulative effect over a long period of time on the importance and natural workings of the sensitive wetlands. Mining in the area will result in removal of the already altered sensitive landscapes.

Leeuwpan Coal Mine takes cognizance of the importance DWA places on wetlands and the protection of these ecosystems and will therefore commit to undertaking in depth studies as part of the updating of the approved Integrated Water Use Lisence (IWUL) which will include investigating options in terms of a wetland rehabilitation programme, onsite wetland rehabilitation intervention to compenaset for loss of wetland functionality and/or an offset plan which will be presented to the DWA.

3.3 Alternative Mine Infrastructure

3.3.1 Transportation of coal

The alternatives that were considered in terms of the transportation of coal include the (1) use of haul trucks to transport coal from the proposed opencast area to the New Process Plant – Crushing and Screening area at Leeuwpan Coal Mine via existing haul roads on-site, t (2) the use of haul trucks to transport coal from the proposed Opencast area to the New Process Plant – Crushing and Screening area at Leeuwpan Coal via a newly constructed haul road, (3) the use of a conveyor belt system to transport coal to the New Process Plant – Product Stacking area from the Crushing and Screening area, and (4) the use of haul trucks to transport coal to the New Process Plant – Product Stacking area from the Crushing and Screening area.

The alternative of utilising haul trucks to transport coal from the opencast area to the New Process Plant area at Leeuwpan Coal Mine via existing haul roads onsite is a viable alternative if the existing roads within the mining area are upgraded to a haul road with the capacity to safely carry 100t payload trucks. Constructing a new road will economically be less viable.

The use of a conveyor belt system to transport coal to the New Process Plant area was chosen as a feasible alternative as this is a proven reliable method of coal transportation and will be constructed within the mining boundary of Leeuwpan Coal Mine. In addition to this, this option will also reduce the need for additional mining vehicles on roads.

3.3.2 Process Plant

Possible alternatives in terms of the process plant include the (1) use of the existing Process Plant area at Leeuwpan Coal Mine for the beneficiation of the RoM coal, (2) the alteration of, or addition to, the existing Process Plants within the existing Process Plant area, (3) the construction of a new Process Plant for the beneficiation of the ROM coal and the (4) 'No Project' option.

Since the mining of the proposed Block OI coal reserve is necessary to ensure the continuation of the existing Leeuwpan Coal Mine and the mining activities at Block OI will increase the amount of coal going through the existing Process Plant (Block OI operations will happen in conjunction with continued mining operations at other mining blocks), it was decided to construct a new Process Plant for the beneficiation of the ROM coal as the current facilities do not have the capacity to handle the increased amount of ROM and is dedicated to Eskom products from pits that will still be actively mined after the opening of block OI, which will mean effectively that product will not be delivered on time,.

The alternative to use the existing Process Plant area at Leeuwpan Coal Mine for the beneficiation of the RoM coal was not considered to be the most viable option. As mentioned previously, the mining activities at Block OI will increase the amount of coal going through the existing Process Plant and therefore the existing Process Plant within the existing mining boundary area will need to be altered or a new Process Plant built. Due to limited land space the current plant cannot be upgraded to accommodate for the increase in coal and as such not a viable option.

It was noted that the areas allocated for the plant and associated infrastructure does not allow enough space to have all the material handling equipment in a linear (preferred) configuration and alternative positions were investigated.

The open area directly north of the mine access was investigated as an alternative. During the investigation Leeuwpan Coal Mine confirmed that this area is in fact an old backfilled pit (OM) and therefor all the infrastructure will be constructed on a previously mined and backfilled area. The risk of constructing on a backfilled area of this depth and on unknown backfill material was deemed to be unacceptably high and therefor this option was not developed further on instruction of the mine.

No other alternative positions were identified as the following limitations or restrictions apply:

- The Block OI reserve is located directly to the east. Any positions east of the proposed area will sterilize a portion of the Block OI reserve.
- The R50 provincial road is located directly to the south. There is also a grave site between the R50 and the proposed area. The distance from the proposed stockyard and existing railway loading station will also increase should the proposed site be moved to the south; and
- Alternative positions to the west are limited by the existing Leeuwpan Coal Mine's infrastructure (workshops, diesel depot and changehouse). It will also increase the haul distance from the Block OI reserve.

The chosen option for the locality of the new processing plant were directly adjacent to the Block OI resource directly next the the current dams on site. The position will result in the shortest hauling distance for ROM to the Crushers and the closest positions to the dams. The area will not be utilized for mining and as such were the best available option.

By 2019 when Block OL will be mined the infrastructure in place at that stage will be sufficient for processing of the coal for Block OL.

3.3.3 Discard Material Disposal

Possible alternatives in terms of the discard material disposal include on-surface disposal at the existing Leeuwpan Coal Mine, on-surface disposal facility at the proposed Block OI project site, and backfilling into existing Open Pit areas at Leeuwpan Coal Mine.

The disposal of discard on surface at the existing Leeuwpan Coal Mine and at the proposed Block OI project site, will result in increased areas of surface disturbance, and resulting impacts on the environment. The alternative of disposal of discard on-site was thus not considered viable.

Backfilling of discard material into the Open Pit areas at Leeuwpan Coal Mine, as well as backfilling into the Block OI area was decided to be the preferred method of disposal of mine residue and is the current approved method at Leeuwpan Coal Mine.

3.3.4 Land Use / Development Alternatives

Possible land use alternatives at the Block OI project sites include mining, use for grazing potential, use for crop production, conservation and ecotourism, making land available for residential development, making land available for small industries and combination of some of the abovementioned land use alternatives.

Since the area surrounding the mine is predominantly agricultural land, a large area is already assigned to crop production and after mining at the proposed Block OI has ceased, the area will be rehabilitated to grazing land with agricultural potential.

An Economic study is proposed to determine the economic value of agriculture on the land compared to the value if the mining of block OI should go ahead.

The proposed Block OI project site is not located near any tourist routes or destinations. In addition, many other mines are situated close to the proposed Block OI project site which already contributes to the surrounding area not being considered for ecotourism.

Wetlands (including pans) do, however, occur within the proposed Block OI mining area and thus the use of land for conservation purposes thus needed to be investigated. The land use alternative of conservation and ecotourism was not found to be viable due to the disturbed nature of the wetlands and close proximity to other mining areas and their cumulative impact on the area. However, should this project prove viable, detailed studies in terms of wetland rehabilitation intervention to address loss of wetland functionality programmes and/or offsets must be investigated. The mine owns the mineral rights over the properties applied for for opencast mining and would like to utilize this economically feasible opportunity to optimally mine these resources.

3.4 No-Go Option

The proposed project will result in the expansion of the life of mine with an additional 18 years. The additional coal resources will supply Eskom with coal for power generation.

The mine has an approved Social and Labour Plan which is set out on injecting capital, skills and services into the district municipality. Should this project be approved, and the life of mine increased, the district municipality will continue to benefit from the mining operations.

However, as with many coal opencast mines', especially in the Mpumalanga Province, there are the unavoidable environmental and social impacts. Should the project be approved the project will necessitate the permanent removal of disturbed wetlands. The project may also have a cumulative impact on water resources in the area and the loss of flora and fauna (within limited remaining areas covered with natural vegetation).

Leeuwpan Coal Mine is however committed to ensure that all the necessary specialist studies are undertaken to identify the potential impacts and also the significance of these. Based on this detailed management programmes will be established for soil management, ecological management, surface water and wetland management, groundwater management, air quality management, visual and noise management and any other management programme deemed necessary to reduce or eliminate potential negative impacts and enhance the positive impacts associated with the project. Exxaro is committed to investigate options for long term sustainable wetland management programmes and also possibly the potential for establishing onsite wetland rehabilitation intervention to address the anticipated loss of wetland functionaility or wetland off-set areas (as a last resort to compensate for wetland loss) off-set areas.

If the 'No Project' alternative were implemented, all possible positive impacts resulting from the proposed development would be lost and in terms of the life of mine, closure of the facility will be required within three (3) years. The mine currently employs approximately 500 permanent staff and 400 contractor staff who will be impacted significantly in this event. The overall contribution to the chronic unemployment levels on a national scale, in addition to the required for coal for electricity generation makes the 'No Project' option strongly unadvisable. For the above-mentioned reasons, the implementation of the 'No Project' option is not advisable.

4 ENVIRONMENTAL DESCRIPTION

The chapter describes the existing status of the receiving environment which will be impact on by the proposed mining activities and associated infrastructure development. As required by the EIA and EMP Template, the following information is included under this chapter:

REGULATION 50 (a):

- *(Section 1): Description of the baseline environment:*
    - *(Section 1.1): Concise description of the environment on site relative to the environment in the surrounding area;*
    - *(Section 1.2): Concise description of each of the existing environmental aspects both on the site applied for and in the surrounding area which may require protection or remediation;*
    - *(Section 1.3): Concise description of the specific land uses, cultural and heritage aspects and infrastructure on the site and neighbouring properties/farms in respect of which the potential exists for the socio-economic conditions of other parties to be affected by the proposed mining operation;*
    - *(Section 1.4): Annotated map showing the spatial locality and aerial extent of all environmental, cultural/heritage, infrastructure and land use features identified on site and on the neighbouring properties and farms; and*
    - *(Section 1.5): Confirmation that supporting documents in the form of specialist studies are attached as appendices.*

REGULATION 50 (d):

- *(Section 1 – 8): Identification of the alternative land uses which will be impacted upon. (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department)*
- *(Section 1 – 9): Listed results of a specialist comparative land use assessment. (Refer to the concomitant section of the guideline posted on the official website of the Department and attach the specialist study as an appendix).*

For all the current and previous workings specialist studies were also undertaken and the results of the studies were consolidated with the results from the proposed Block OI project. The consolidation of the studies will provide a holistic view of Leeuwpan as a whole.

Please note: Due to infrastructural changes several of the specialist studies are in the process to be updated and completed to take all the related changes into consideration with regards to their environmental impacts on the area. The studies which should be read as draft will be indicated as such.

4.1 Geology

The coal reserves located at the Leeuwpan Coal Mine expansion project area [blocks OL and UI (now OI)] falls within the Witbank Coalfield. The Witbank coalfield's stratigraphy consists of sedimentary rocks of the Karoo Super Group; specifically the Transvaal Group and the lower coal-bearing Ecca Group. The geology map can be seen in Figure 4.1.

The OI and OWM mining block are similar in geology to that of the Witklip and Kenbar Sections of the existing Leeuwpan Coal Mine. The new mining area is thus underlain by a sedimentary rock succession of the Vryheid Formation, Ecca Group (Karoo sediments underlain by Transvaal sediments). The Karoo sediments are developed in the southeastern portion of the existing Leeuwpan Coal Mine area. The general characteristics are as follows:

- Karoo sediments have been deposited - Highly variable in thickness, varying from 0 to 60m; attributed to the uneven palaeofloor on which the Karoo sediments have been deposited
- The top portion of the Karoo sediments consists of highly weathered Ecca material. Weathering extends into the coal seam. This weathering is the result of water and oxygen movement through the Ecca sediments during infiltration of rainwater, and
- Underlying this highly weathered horizon is a thick accumulation of coal as well as some development of carbonaceous shale. The coal and shale vary in thickness between 0 - 30m.

The coal seams in the Vryheid Formation lie conformably on the Dwyka formation. Erosion has removed the uppermost parts of the Vryheid formation. The thin layer of Dwyka tillite underlying the karoosediments is characterized by its pebbly nature in a medium to fine matrix. The colour of the matrix is usually dark grayish-brow, the latter indicating a high clay content.

The dolomitic sequence underlies the Karoo sediments. The characteristics of the dolomitic sequence are as follows:

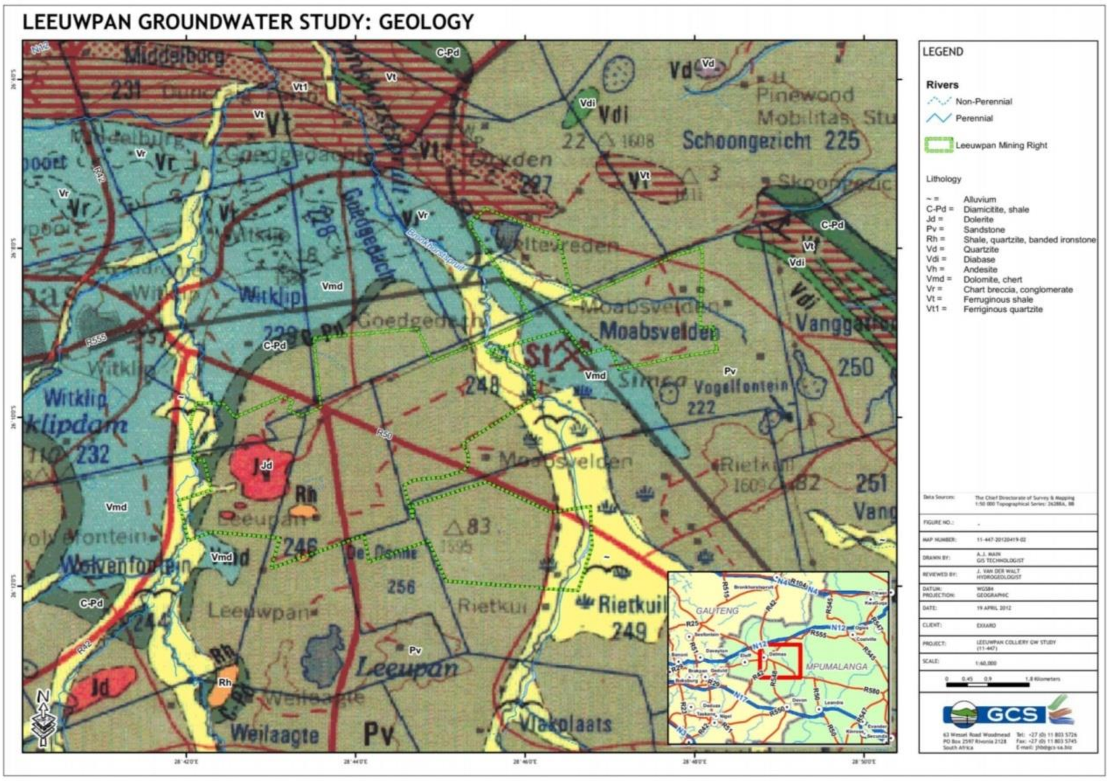
- The top of the dolomitic sequence is marked by a sporadic accumulation of chert pebbles that may, in places, be well cemented by calcareous material. In other areas, the chert appears to be vuggy, with the result that groundwater can be transmitted with ease along this horizon. This layer represents an erosion landscape that originated after the deposition of the dolomites and before that of the Dwyka tillite; and
- Underneath the pebbly chert layer lies proper dolomite of unknown thickness. The Stratigrafic relationship between the chert and the dolomite is unclear.

The Delmas coal field is situated on the western border of the Witbank coal field. Three coal seams have been identified, namely the upper, middle and lower seams. The top seam corresponds with the No. 2 seam of the Witbank coal field, the bottom seam corresponds with the No. 4 seam.

The lower seam consists of massive dull coal with scatteredbands of lustrious coal. The division between the lower and the middle seam is generally shale (0.4m to 1.4m thick). In the central part of Witklip section of the existing Leeuwpan coal Mines mining area, a coal succession in a through-like structure is evident. This reaches a maximum thickness of 18m.

The upper seam (only at the Kenbar Section of the existing Leeuwpan coal Mine's Operations) is on average 5m thick and consists mainly of dull and lustrous coal with alternating shale bands of which the uppermost 0.5 to 0.8m consists mainly of chert fragments, with a shale rich matrix. The base of the coal is very uneven, possibly as a result of sinkholes in the dolomite, before and after coal deposition. At the Kenbar Section of the existing Leeuwpan Coal Mine, the coal is overlain by clayey and sandy sedments approximately 2m thick. At the Witklip Section of the Existing Leeuwpan, the capping is on average 10m thick and consists, for the most part clay.

Dolerite intrusions in the form of dykes and sills are widespread in both the Karoo Supergroup as well as the Malmani Subgroup, and are often found in the Leeuwpan Coal Mine area. A dolerite sill or dyke is known to sub-outcrop immediately to the south of the existing Leeuwpan Coal Mine's operations area (Block OD EMPR, 2007).



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 4.1 Geology of Leeuwpan Coal Mine area

4.2 Climate

The climate of Leeuwpan Mine is classified as a temperate climate (dry winters, warm summers), with most rainfall occurring during summer. It receives the lowest rainfall (almost nothing) in July and the highest in January.

The climate is generally moderate and dry with harsh winters, coupled with heavy frost. Rainfall is typical of Highveld conditions and occurs mainly during summer.

4.2.1 Temperatures

The annual maximum, minimum and mean temperatures for Witbank are given as 33°C, -0.8°C and 16°C respectively, which are in agreement with the MM5 modelled data for the study site. Average daily maximum temperatures range from 27°C in December to 17°C in June, and daily minima from 16°C in December to 5°C in July.

Long-term monthly average maximum, mean and minimum temperatures for the nearest major town of Witbank are shown in Table 4.1, and long-term monthly daily maximum and minimum temperatures in Table 4.2.

Table 4.1: Long-term minimum, maximum and mean temperatures (°C) for Witbank

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Maximum	29	28	27	26	23	24	23	24	29	33	31	31
Minimum	15	13	9	5	2	-0.8	5	0.1	4	9	8	11
Mean	20	20	17	16	12	11	14	12	17	20	19	21

Table 4.2: Long-term daily minimum and maximum temperatures (°C) for Witbank

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Maximum	25	27	27	25	21	17	19	19	24	26	25	27
Minimum	15	16	14	12	8	6	5	6	10	13	15	16

Annual mean temperature for the site may be calculated as 15.1°C. Average daily maximum temperatures range from 23.7°C in December to 11.3°C in July, with daily minima ranging from 18.8°C in January to 2.8°C in July.

4.2.2 Rainfall

Witbank normally receives about 625mm of rain per year, with most rainfall occurring during summer. It receives the lowest rainfall (2mm) in July and August, and the highest (117mm) in January.

The rainfall station used to describe rainfall conditions on site was the South African Weather Service (SAWS) Delmas rain station (477309). The station has a Mean Annual Precipitation (MAP) of 681mm. The station has rain data from 1907 to 1999. A summary of the total annual rainfall over the entire record period is shown in Figure 4.2. and 4.3

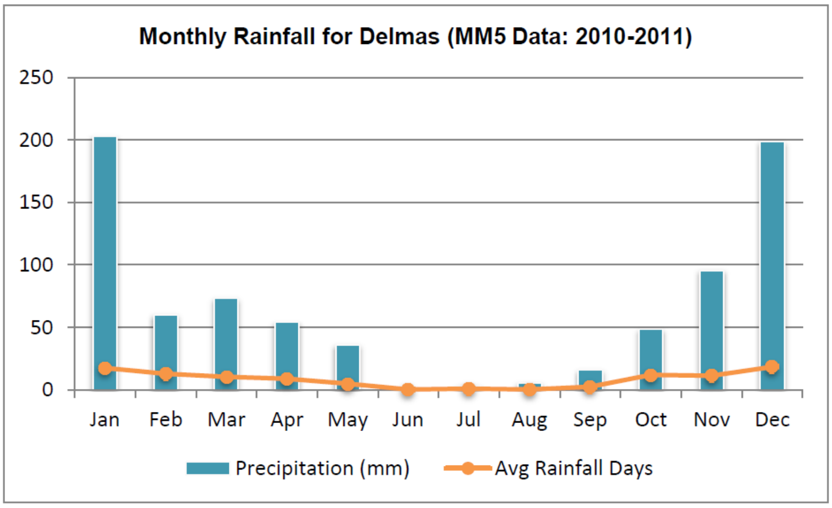


Figure 4.2 Average monthly rainfall and rainfall days for the site (2010-2011)

Witbank normally receives about 625 mm of rain per year, with most rainfall occurring during summer. It receives the lowest rainfall (2 mm) in July and August, and the highest (117 mm) in January.

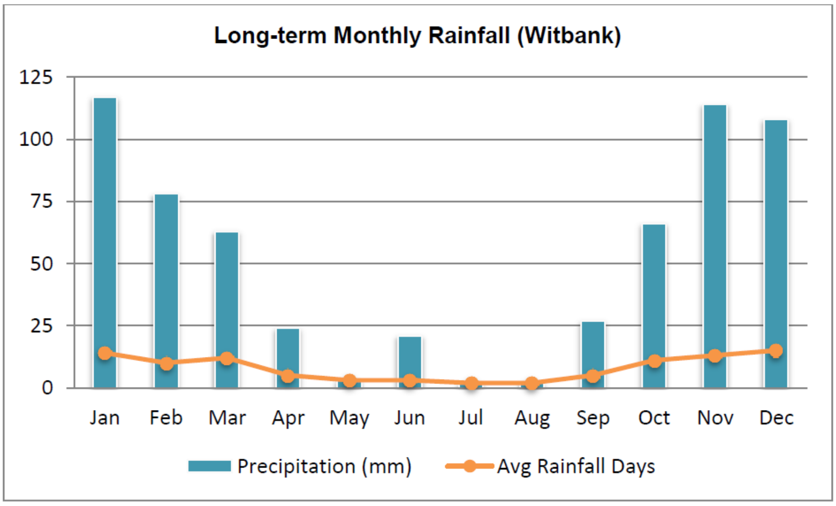


Figure 4.3: Long-term average monthly rainfall for Witbank

A comparison between the two rainfall graphs shows a similar rainfall trend; a higher average annual rainfall is evident in the Delmas graph however, and notably higher rainfall is predicted for the Delmas site during the months of January and December.

4.2.3 Evaporation

The Mean Annual Evaporation (MAE) of the area is 1 677 mm. The estimated total monthly evaporation for the area is described by data obtained from the WR2005 database and can be seen in Figure 4.4:

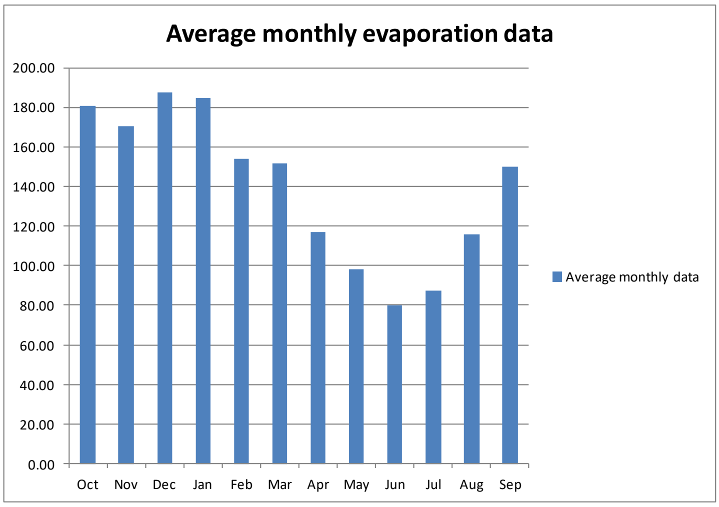


Figure 4.4 Evaporation data (WR2005)

4.2.4 Wind direction

Wind roses comprise 16 spokes, which represent the directions from which winds blew during a specific period. The colours used in the wind roses below, reflect the different categories of wind speeds; the red area, for example, representing winds in excess of 5 m/s. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories. The frequency with which calms occurred, i.e. periods during which the wind speed was below 1 m/s are also indicated.

The dominant wind is from the northwest to northern sector, with a strong component from the easterly sector. The wind field is characterised by dominant northerly and easterly winds. Calm conditions prevailed 13.12% during the 2010-2011 period with a period average wind speed of 3.1 m/s. Wind speeds exceeding 5 m/s occurred with a frequency of 13%. The north-westerly wind flow increases during day-time conditions with easterly wind flow increasing during the night.

A distinct shift in the prevailing wind field between seasons was noted. During spring months, the strongest winds were from the northerly direction. Summer and autumn months were characterised by a higher frequency in moderate winds with a wind flow field similar to that of the period windrose. Winter months were found to be dominated by strong winds from the southeasterly and southerly sectors, with a small component from the northwest (Refer to Figure 4.5 and Figure 4.6).

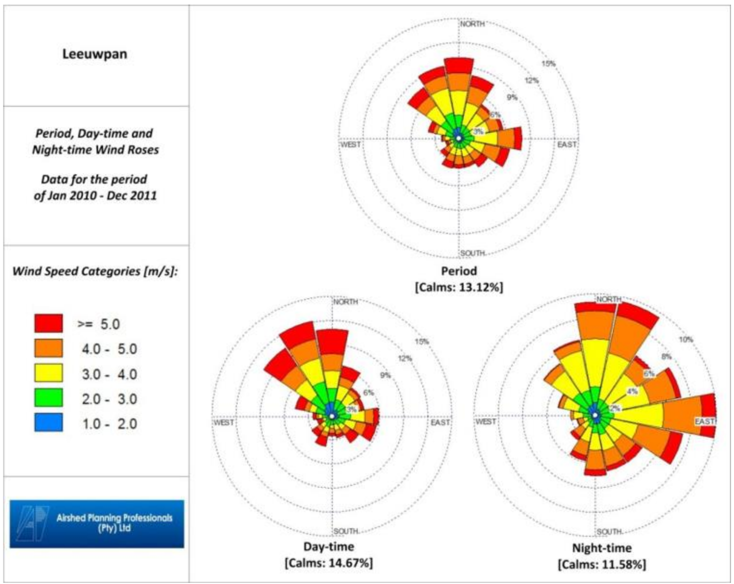


Figure 4.5: Period and diurnal wind roses

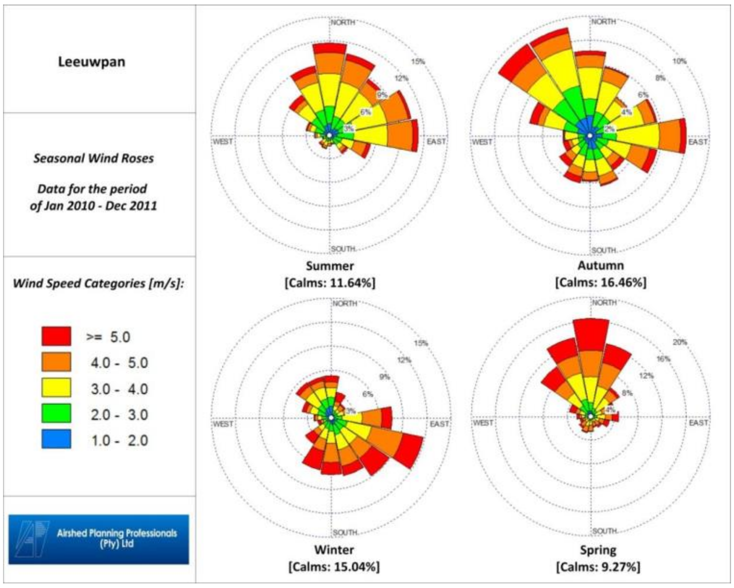


Figure 4.6: Seasonal wind roses

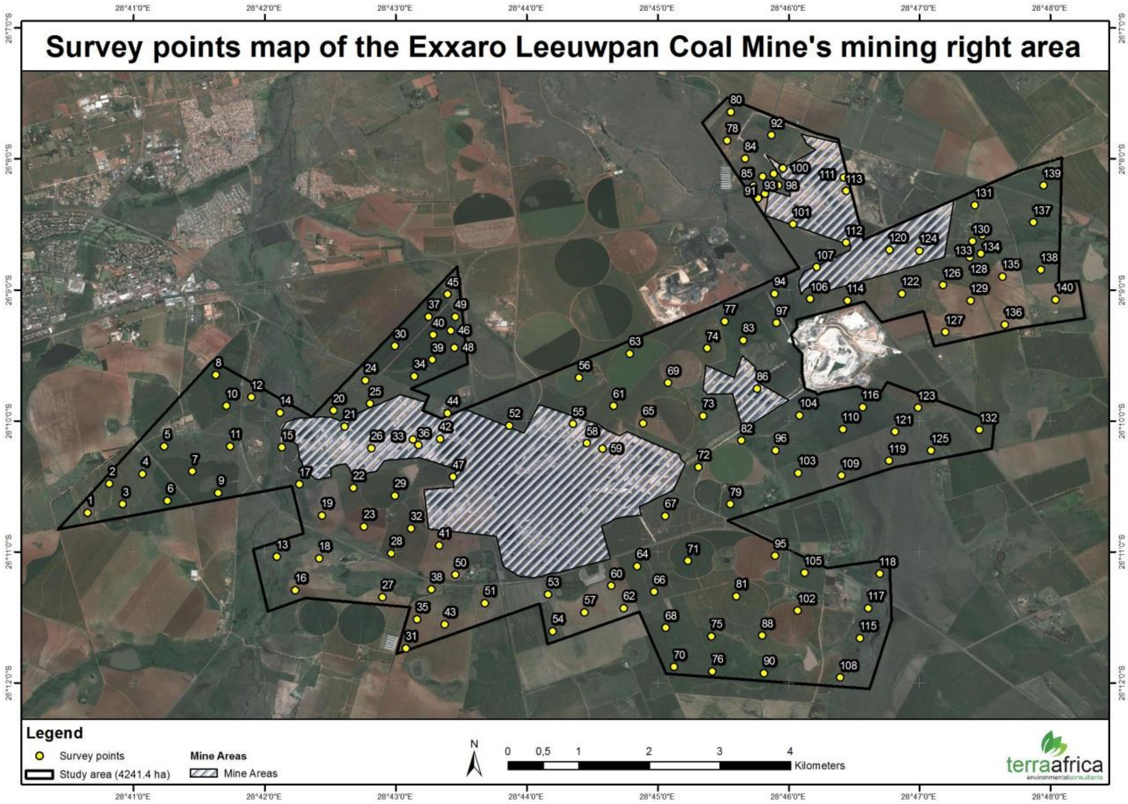
4.3 Soils, Land use and Land Capability

The information contained in this section of the report was obtained from the Detailed Soil and Land Use Assessment conducted by TerraAfrica, attached herewith as Appendix C-1.

4.3.1 Soil Survey

A systematic soil survey was undertaken with sampling points between 100 and 150m apart in most areas and survey points in mining areas were only observed where access was possible (Refer to Figure 4.7). A total of 140 survey points were observed. The soils are described using the S.A. Soil Classification Taxonomic System (Soil Classification Working Group, 1991) published as memoirs on the Agricultural Natural Resources of South Africa No.15.

Soils are grouped into classes with relatively similar soil characteristics. Thirty soil samples were collected at the proposed new Leeuwpan Coal Mine Block OI and OL study site, stored in perforated soil sampling plastic bags and sent to SGS for analyses. Samples were analysed for pH, phosphorus content (topsoil samples only), macro nutrients (calcium, magnesium, and potassium) and electrical conductivity.



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 4.7: Soil Survey Locations

4.3.2 Land Types

The entire mining right area of Leeuwpan Coal Mine initially consisted of a combination of three (3)different land types before any mining activities started (the survey was conducted by the ARC before any mining took place). These land types are Ea15 (145 ha), Bb3 (2542 ha) and Ba2 (830 ha).

4.3.2.1 Land Type Ba2

This land type is underlain by shale and sandstone of the Ecca Group, Karoo Sequence as well dolerite, granite and gneiss.

The soil forms found in this land type are a combination of deep Huttons soil forms (between 900mm and 1200mm) and deep (800 – 1000mm) yellow-brown apedal soils of the Glencoe and Avalon forms. Kroonstad, Wasbank and Westleigh forms also occur in this land type but in much smaller areas. The topography is flat to slightly undulating and slopes can range between 0% and 6%.

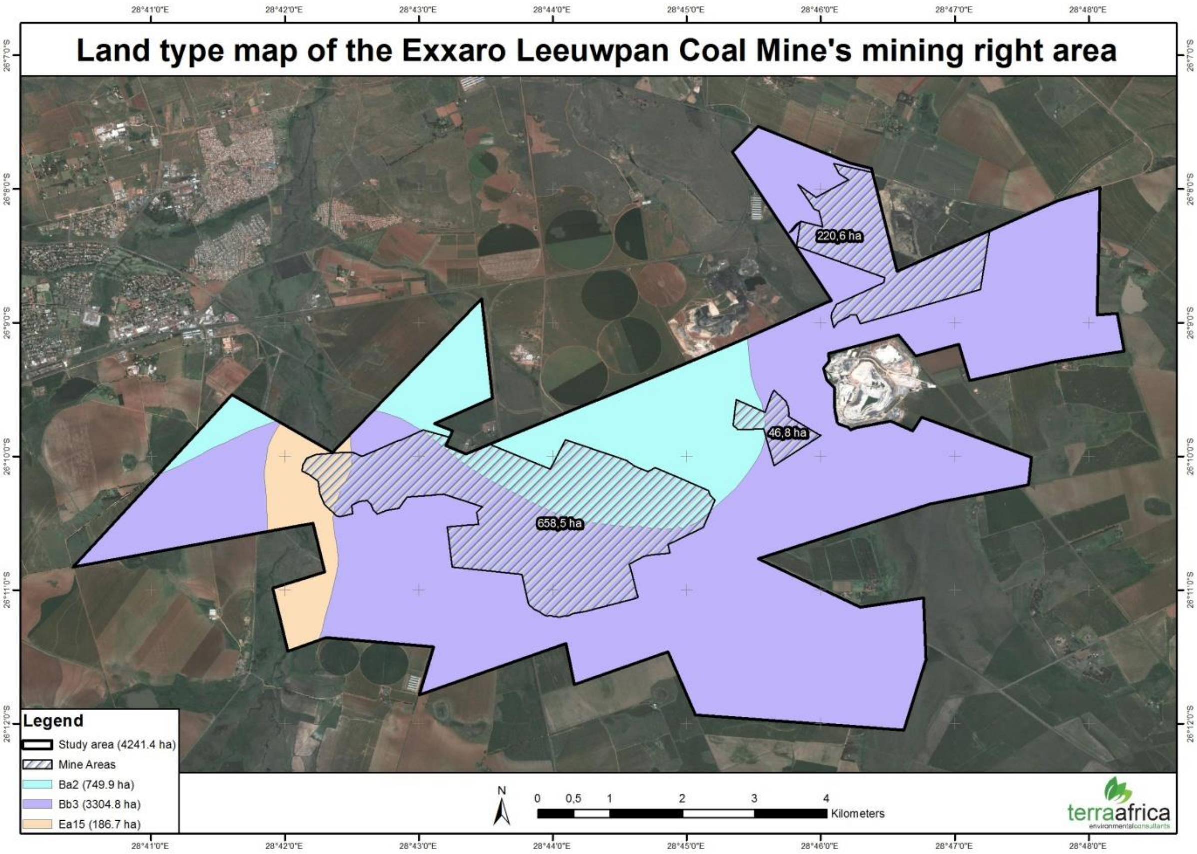
4.3.2.2 Land Type Bb3

Soils in this land type is underlain by a combination of shale, sandstone, clay, conglomerate, limestone and marl of the Ecca Group; shale and tillite of the Dwyka Formation, Karoo Sequence; dolerite; occasional Ventersdorp lava, Witwatersrand quartzite and slate; dolomite. This forms the parent material to a mixture of deep to medium deep sandy clay-loam soil of the Avalon, Glencoe, Wasbank and Westleigh forms. A smaller group of more strongly structured clay-loam soils of the Swartland, Rensburg and Arcadia forms are also found in this land type.

4.3.2.3 Land Type Ea15

This land type occurs on flat to slightly undulating plains (slope range between 0% and 1%) and consists of medium to strongly structured soils with vertic (Arcadia and Rensburg forms) or melanic A-horizons (Bonheim, Inhoek and Willowbrook forms). These soil forms have clay-loam texture with clay content ranging between 25% and 70%. The geology underlying this land type consists of alluvium, dolerite, sandstone and shale of the Ecca Group, Karoo Sequence.

Refer to Figure 4.8 for the different land types identified and assessed.



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 4.8: Land Type Map

4.3.3 Soil properties

The current soil forms as well as disturbed profiles could be classified into sixteen mapping units. Areas currently being actively mined or not remediated successfully yet has been classified as mine areas while a small section where stripping and stockpiling activities have resulted in red soil overlying a vertic

A-horizon has been classified as the Witbank form. Mine areas form the largest portion of the entire Leeuwpan Coal Mine's mining right area (925.9ha or 21.8%) while productive soil profiles not disturbed by mining activities are dominated by soil forms with either a yellow-brown or red apedal horizon. Approximately 873ha or 20.6% of land consist of hydromorphic soil forms with wetland land capability.

4.3.3.1 Yellow-brown apedal soils (Soil Units AY1, AY2 and AY3)

This unit consist of soil forms with a yellow-brown apedal horizon and soil forms identified within this unit include soil of the Clovelly, Avalon and Glencoe forms with soil depth ranging from 40 to 130cm. All these soils are well-drained with sandy loam to sandy clay loam texture. The limiting material in profile depth is soft plinthite, hard plinthite or unconsolidated material. These soils have arable land capability and are suitable for crop production purposes.

The Clovelly soil profiles identified in this soil groups have sandy-loam orthic A horizons overlying well-drained yellow-brown apedal B1 horizons also with sandy-loam texture. The yellow-brown apedal horizon is underlain by unspecified material where limited pedogenesis has taken place. The depth of these profiles ranged between 75 and 150cm. The Avalon soil form is underlain by a soft plinthic B horizon instead of unspecified material and the soft plinthic B horizon can result in temporary water saturation of soil profiles due to clay accumulation in this horizon.

The Glencoe soil form is underlain by a hard plinthic B horizon which does not hold water as in the case of the Avalon but has physical restrictions to cultivation.

4.3.3.2 Red apedal soils (Soil Units AR1, AR2, AR3 and AR4)

The soil profiles identified in this soil groups have sandy-loam orthic A horizons overlying well-drained red apedal B1 horizons also with sandy-loam texture and includes soil of the Hutton, Bainsvlei and Lichtenburg forms.

The range of red colors of the apedal B1-horizon is a key identification tool in differentiating between a red apedal and yellow-brown apedal and is defined by the Soil Classification Working Group Book, 1991. Some of the defining red soil colors identified on the sites are bleached (10R 6/4 and 10R6/6), while some are bright red (2.5YR 4/8). The red apedal horizon is underlain by unspecified material where limited pedogenesis has taken place in the case of the Hutton soil form. In case of the Bainsvlei form, the soil is underlain by a soft plinthic B-horizon.

4.3.3.3 Lithic soils (Soil Units R1 and R2)

This soil unit consist of mainly shallow rocky soils of the Mispah and Glenrosa forms. The Mispah form consists of a shallow orthic A horizon (10 to 25cm) underlain by hard rock or parent material.

Mispah and Glenrosa soil form and rocky outcrops can be categorised in the international classification group of lithic soil forms because it is relatively young, developing soil profiles. In lithic soil forms the solum is dominated by rock or saprolite (weathered rock). These soils have sandy-clay-loam texture and are no deeper than 50cm.

The orthic A-horizon of the lithic soil group is unsuitable for annual cropping or forage plants (poor rooting medium since the low total available moisture causes the soil to be drought prone). These topsoils are not ideal for rehabilitation purposes for they are too shallow and/or too rocky to strip. Topsoil stripping and stockpiling of the ‘shallow’ soils should only be attempted where the surface is not too rocky.

4.3.3.4 Soil Unit E

Soil Unit E on the soil map represent soil of the Longlands, Dresden and Wasbank soil forms ranging from 80 to 100cm occur in this unit. These soils are moderately deep, bleached, structureless, poorly-drained and of sand to sandy loam texture. Concretions occur abundantly in the matrix of lower horizons. Distinct signs of wetness and water logging are found in the lower horizons.

The Longlands soil form consists of an orthic A-horizon overlying an E-horizon which overlies a soft plinthic horizon with the orthic horizon between 10 and 20cm deep. Both the bleached colours of the E-horizon and the soft plinthic sub-surface horizon indicate periods of intermittent wetness. The A-horizon is slightly darker in colour which indicates accumulation of some organic material. This soil form is associated with seasonal wetlands and the soil form has wetland land capability. The Dresden soil form consists of a shallow sandy-loam orthic A-horizon overlying a hard plinthic B horizon with hard plinthic outcrops visible on the surface in a few places.

4.3.3.5 Hydromorphic soil (Soil Unit W)

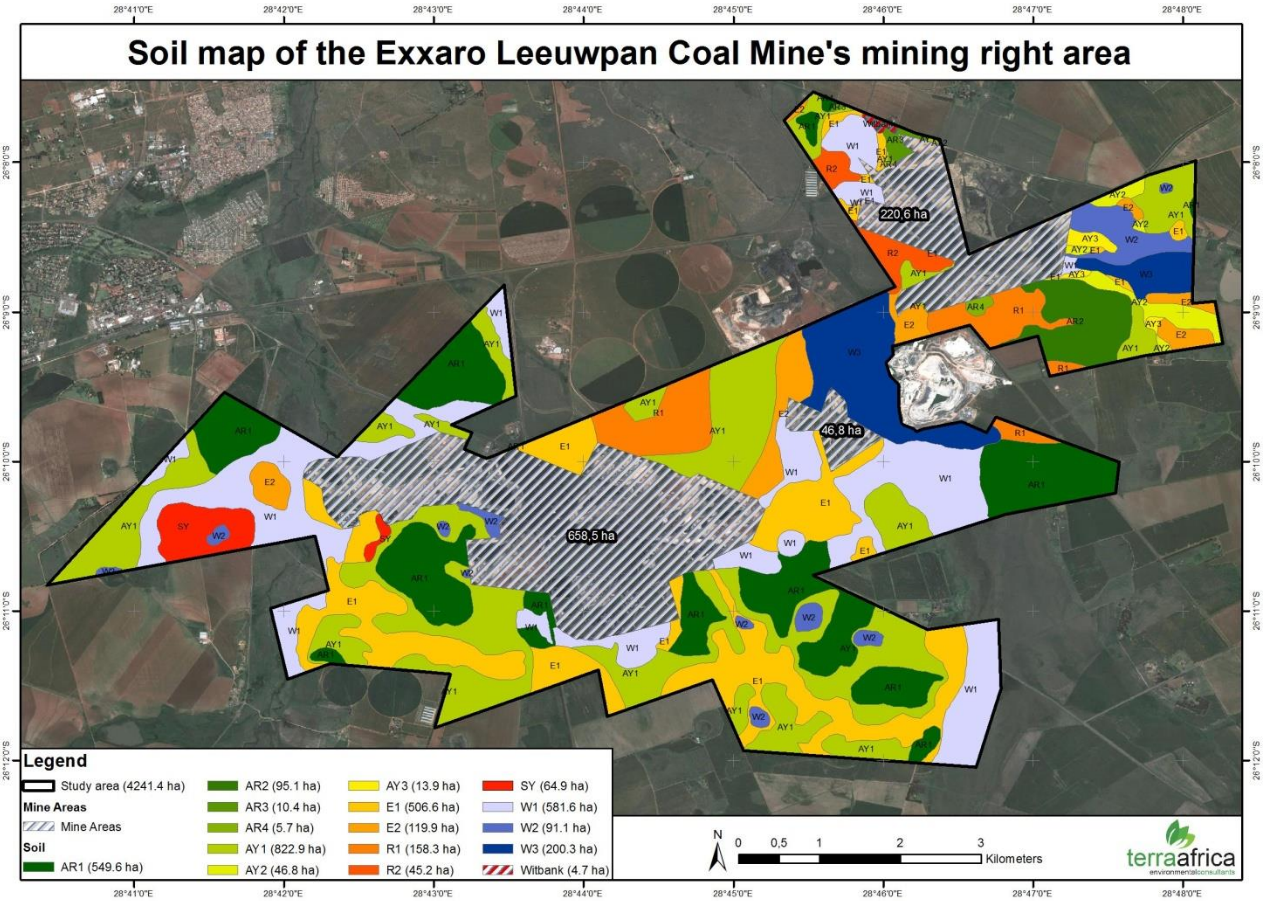
Soil Unit W consist of soil forms with hydromorphic properties associated with wetlands both seasonal and permanent. Soil forms in this unit are Kroonstad, Katspruit, Rensburg and Wasbank soil forms ranging in soil depth between 30 and 60cm. These soils are shallow, bleached, structureless to structured, poorly-drained and of sand to sand-clay texture. Concretions and mottles occur abundantly in the grey matrix of lower horizons. Distinct signs of wetness and water logging are found in the lower horizons.

The Katspruit soil form comprises of an orthic A-horizon overlying a G-horizon with the orthic horizon between 15 and 30cm deep and the G-horizon thicker than 100cm. The orthic A horizon shows significant accumulation of organic material. The G-horizon has developed during long periods of water saturation that gave rise to gleying with the reduction of ferric oxides and hydrated oxides. The G-horizon is dominated by grey, low chroma colours with marked clay illuviation. The Katspruit soil form has wetland land capability. The Kroonstad soil form comprises an orthic A-horizon overlying an E-horizon on a G-horizon.

4.3.3.6 Anthropogenic soil (Soil Unit Witbank)

This unit includes soils that has been affected by human disturbance that the natural horizon development has been disturbed and where pedogenesis has not yet resulted in profile development. This soil form is usually associated with excavations and mining areas. The properties of the soil form are affected strongly by the nature of the material or the human activity that placed it. They are more likely to be contaminated than soils from other groups. The area where this soil form has been identified is characterised by a vertic horizon that is now covered with a red apedal soil layer.

Refer to Figure 4.9 for Soil Forms identified and to Table 4.3 for soil forms and the land capabilities identified for Leeuwpan.



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 4.9: Soil Map of the soil forms recorded within the mining right area of Leeuwpan Coal Mine's mining right area

Table 4.3: Summary of soil forms and land capabilities identified for the Leeuwpan Coal Mine study area

SUMMARY OF SOIL FORMS AND ASSOCIATED LAND CAPABILES IDENTIFIED FOR THE LEEUWIPAN STUDY AREA				
Map Code	**Area (ha)**	**% of study area (%)**	**Average soil depth (cm)**	**Land capability class**
AY1	822.9	19.4	100 - 150 cm	Arable
AY2	46.8	1.1	40 – 70 cm	Arable
AY3	13.9	0.3	20 – 40 cm	Arable
AR1	549.6	13.0	100 - 150 cm	Arable
AR2	95.1	2.2	70 - 100 cm	Arable
AR3	10.4	0.2	40 – 70 cm	Arable
AR4	5.7	0.1	20 – 40 cm	Arable
SY	64.9	1.5	70 - 100 cm	Arable
E1	506.6	11.9	70 - 100 cm	Grazing
E2	119.9	2.8	20 – 40	Grazing
R1	158.3	3.7	20 – 40 cm	Grazing
R2	45.2	1.1	0 – 10 cm	Grazing
W1	581.6	13.7	50 – 70 cm	Wetland
W2	91.1	2.1	30 - 50 cm	Wetland
W3	200.3	4.7	0 - 30 cm	Wetland
Mine Areas	925.9	21.8	N/A	Active Mining
Witbank	4.7	0.1	N/A	Industrial/wilderness
Totals	**4242.9**	**100.0**		

4.3.4 Soil Chemical Characteristics and Soil Fertility

The purpose of establishing baseline chemical composition of soil on a site before mining or construction commences, is to determine whether there is any deterioration in soil fertility and what the nutrient status of the soil is associated with the natural vegetation. Should the chemical content of the soil be drastically different once mine rehabilitation commences, the chemical composition might have to be amended by the addition of fertilizers or organic matter.

Soil pH is an indicator of soil acidity and basicity. Most soils have a pH in the range of 4 to 10. The pH of a particular soil, such as 5 or 8, reflects a certain chemical and mineralogical environment in that soil, and thus the pH is of great importance to plant roots and microbial activity. For these reasons soil pH is one of the most important factors affecting soil fertility. Descriptive terms commonly associated with certain ranges in soil pH are presented in Table 4.4.

Table 4.4: Terminology Associated with pH

pH Range	Terminology
<4,5	Extremely acid
4,5 – 5,0	Very strongly acid
5,1 – 5,5	Strongly acid
5,6 – 6,0	Medium acid
6,1 – 6,5	Slightly acid
6,6 – 7,3	Neutral
7,4 – 7,8	Mildly alkaline
7,9 – 8,4	Moderately alkaline
8,5 – 9,0	Strongly alkaline
>9,0	Very strongly alkaline

Soil fertility describes the potential of land for successful crop production. Soil fertility can usually be improved by the addition of chemical fertilizers. However, with sharp increases in the price of these fertilizers and the negative environmental impact that these chemicals have on groundwater and surface water runoff quality it is becoming increasingly important to manage the inherent soil fertility correctly. This fertility is the combined result of the cation exchange capacity (CEC) of the soil, as well as the exchangeable bases namely Ca (calcium), Mg (magnesium), K (potassium) and Na (sodium).

Soil was chemically analysed at a soil laboratory and was found to have pH levels ranging between 4.2 and 5.6. This is considered to extremely acid to very strongly acid and may be a result of the combined crop production practices and high rainfall. These crop fields will need regular applications of agricultural lime to manage the pH levels.

Phosphorus content of topsoil samples is sufficient for crop production purposes and these levels indicate that phosphate levels are amended by application of phosphate containing fertilizer. The subsoil phosphate levels are 5 mg/kg which is normal for South African subsoil conditions. Calcium, magnesium and potassium levels are neither deficient nor toxic and the cations are well balanced for crop production purposes. Sodium levels are sufficiently low thus eliminating the potential for sodic soils. Samples have organic carbon content of 0.32% and 0.84% which is average for South African soils under intensive crop production.

4.3.5 Land use

The current land use of the proposed Leeuwpan Coal Mine Block OI and OL study area consists of mainly of crop production and cattle farming. Due to large resources of underground water available for irrigation and the high crop production potential of soils in the area, land with arable crop production are used mostly for irrigated crop production under centre pivot irrigation and some fields for dryland crop production. Areas not suitable for cultivation due to restricted soil depth and conditions of temporary water saturation are used for cattle farming and the average grazing capacity for the area is 5 ha/LSU (large stock unit). Areas where wetlands occur are also being used for grazing purposes resulting in disturbance of wetland vegetation.

The farm Rietkuil is still operating as an independent farming unit with production of maize, sunflowers and soya beans as well as cattle and sheep farming.

Surrounding land use to the proposed site includes irrigated (approximately 295.3ha) and dryland (approximately 1241.9ha) crop production as well as cattle farming (estimated grazing area of 1740.7ha). The town of Delmas is in close proximity to the study site and the larger region is dominated by a mix of land uses including increasing mining activities, crop production and town development. Refer to Figure 4.10 for Land Use map.

(not to scale, please refer to Appendix A for a enlarged Map)

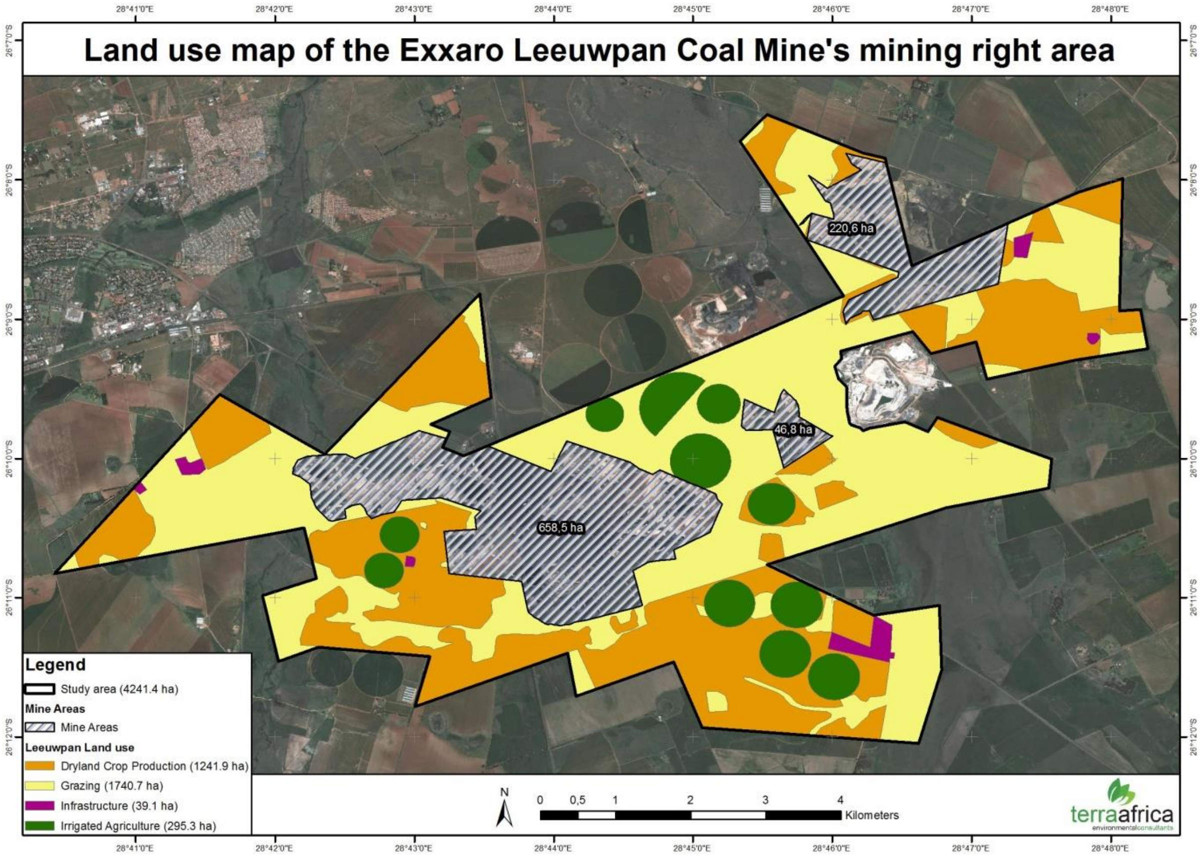


Figure 4.10: Land Use Map of Leeuwpan Coal Mine's mining right area

4.3.6 Land capability

Land capability classes were determined using the guidelines outlined in Section 7 of The Chamber of Mines Handbook of Guidelines for Environmental Protection (Volume 3, 1981). The Chamber of Mines pre-mining land capability system was utilised, given that this is the dominant capability class classification system utilized in the mining and industrial fields.

The land capability was derived by evaluating and categorizing soil properties such as effective soil depth, mechanical limitation, internal drainage, soil texture, soil structure, erosion susceptibility and slope percentage.

The largest portion of land has arable land capability (1609.3ha or 37.9% of the total area) consisting of deep to medium deep sandy clay-loam and clay-loam soils. These areas are well-suited to both dryland and irrigated crop production activities. Refer to Figure 4.11 for Land Capability Map.

(not to scale, please refer to Appendix A for a enlarged Map)

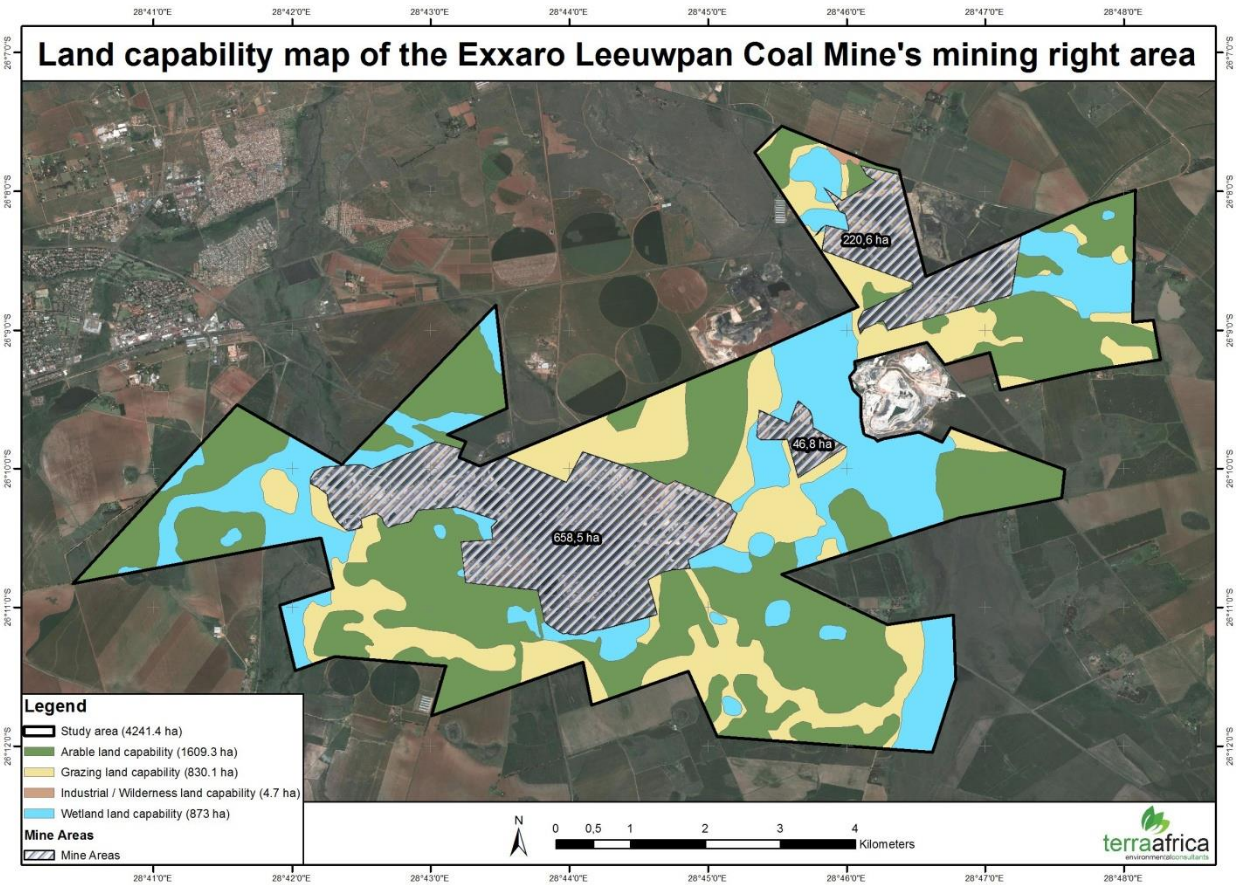


Figure 4.11: Land Capability Map of Leeuwpan Coal Mine's mining right area

A total area of 830.1ha (or 19.6% of the total mining right area) has grazing land capability on shallower soils with a tendency to get water saturated during the rainy season. Soil with wetland land capability has been identified on 873ha (20.6% of the entire study site) of soil with hydromorphic soil and these are directly associated with permanent and seasonal wetlands identified on site by the wetland specialist.

The area where soil profiles show significant anthropogenic activities (the Witbank soil form) has industrial or wilderness land capability (4.7ha or 0.11% of the study area). The areas where mining activities are currently active and land has not been rehabilitated can technically be classified as having wilderness land capability but as the land is still targeted for rehabilitation which will change the land capability, this is excluded from the areas of wilderness land capability.

4.4 Biodiversity - Flora

The Biodiversity studies were undertaken by EkoInfo during wet and dry season periods, with consideration of all past studies also undertaken for Leeuwpan. The Biodiversity assessment is attached hereto as Appendix C-2.

4.4.1 Regional Ecosystem Diversity

The literature review indicated the presence of one regional vegetation unit within the study area, namely the endangered Eastern Highveld Grassland (Mapping unit Gm12; Mucina & Rutherford; 2006)

The available small-scale datasets (Land Cover 2000, Mpumalanga Conservation Plan) indicated that less than 67% of the study area represents natural vegetation. The species composition and presence of species of concern (Red Data, Protected, Medicinal and Alien invasive species) within the remaining untransformed areas was determined during the summer/ wet season survey in October/ November 2012.

From the regional perspective, it is evident that the study area is located in a transformed and fragmented landscape. The area is not considered to be of conservation importance on a provincial scale even though it is located within a nationally threatened ecosystem. However, the remaining natural vegetation, especially terrestrial grassland is important for the mine because it represents source area for future rehabilitation and restoration.

4.4.2 Local Ecosystem Diversity

A total of 76 plots were target, but only 38 plots were effectively sampled due to the targeted areas being transformed by either agriculture or mining. The floristic composition of the 38 sampled plots was used in a TWINSPAN analysis.

Therefore the following four vegetation communities were identified, mapped (See Figure 4-13) and described:

1. Sourveld climax grassland associated with large boulders on crests with very coarse textured soils;
2. Climax grassland close to the crests on very shallow, well-drained, coarse textured soils;
3. Temporary and seasonally coarse textured, moist grassland on midslopes and footslopes; and

4. Seasonally and permanently fine textured, wet grassland on footslopes and valley bottoms.

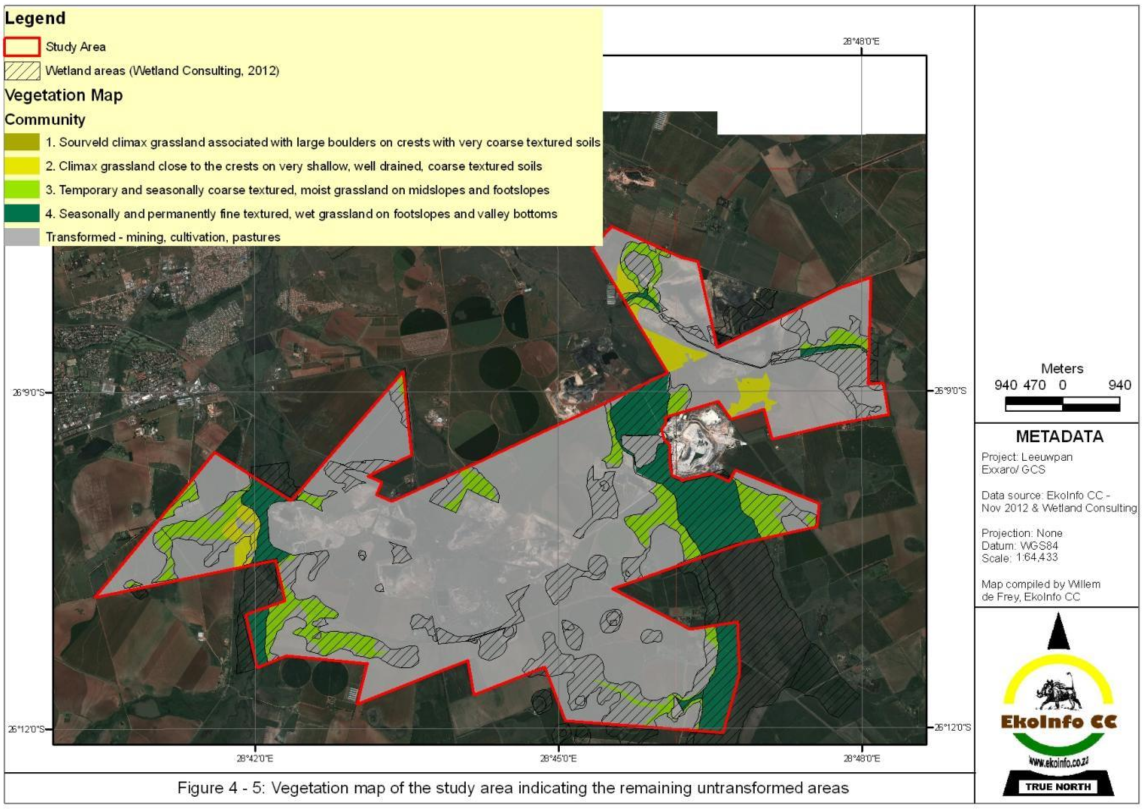


Figure 4 - 5: Vegetation map of the study area indicating the remaining untransformed areas

(not to scale, please refer to Appendix A for a enlarged Map)

Figure 4.12: Vegetation Map of the Leeuwpan Coal Mine's mining right area

4.4.2.1 Community 1: Sourveld climax grassland associated with large boulders on crests with very coarse textured soils

Phytosocological name: *Aristida junciformis - Themeda triandra* bushclumps on crests associated with large boulders and very coarse textured soils.

This community is associated with the higher lying areas (crests, upper midslopes), where the geology outcrops as large boulders and rocks, in slightly steeper environments, with very shallow soils (average 200 mm). There are shrubs present within this community with and average cover of 13%, the average maximum height of the herbaceous layer is 55 cm. This community has a very limited distribution of less than a hectare or less than 1% of the study area.

Figure 4.13: Community One

The following species had been recorded within this community:

Grasses: *Aristida junciformis subsp. junciformis, Brachiaria nigropedata, Brachiaria serrata, Cynodon dactylon, Cyperus rupestris var. rupestris, Eragrostis capensis, Eragrostis curvula, Eragrostis plana, Harpochloa falx, Hyparrhenia hirta, Kyllinga alba, Melinis repens subsp. repens, Microchloa caffra, Panicum natalense, Setaria incrassata, Themeda triandra, Tristachya leucothrix*

Forbs: *Acrotome hispida, Anthericum fasciculatum, Asclepias fruticosa, Aster harveyanus, Becium obovatum subsp. obovatum var. obovatum, Berkheya insignis, Bidens formosa, Bidens pilosa, Cheilanthes viridis var. viridis, Cleome monophylla, Commelina africana var. africana, Cyanotis speciosa, Dianthus mooiensis subsp. mooiensis var. mooiensis, Felicia muricata subsp. muricata, Gerbera piloselloides, Helichrysum callicomum, Helichrysum rugulosum, Indigofera comosa, Ipomoea bathycolpos, Ipomoea ommanneyi, Justicia anagalloides, Leonotis ocymifolia var. schinzii, Nemesia fruticans, Oldenlandia herbacea var. herbacea, Plectranthus madagascariensis var. madagascariensis, Rhynchosia caribaea, Selaginella dregei, Senecio consanguineus, Solanum panduriforme, Tagetes minuta, Ursinia nana subsp. nana, Vernonia galpinii*

Woody species: *Cryptolepis oblongifolia, Diospyros lycioides subsp. lycioides, Pavetta gardeniifolia var. gardeniifolia, Stoebe vulgaris*

This isolated community of terrestrial vegetation, provides habitat diversity with the presence of a woody layer. It was not ploughed for the obvious reason of being to rocky. Due to its position in the landscape on the crests and upper midslopes, it represents also the sourveld because of the coarse soil texture associated with it. The coarse texture allows for good infiltration and the removal of nutrients from the soil. Therefore under natural conditions it would be expected that this community will be less utilised by livestock, whether domestic or game, but due to the high level of transformation in the study area and the landscape, limited natural grassland is available to herbivores and therefore this area experience also grazing pressure.

4.4.2.2 Community 2: Climax grassland close to the crests on very shallow, well drained, coarse textured soils

Phytosocological name: *Vernonia oligocephala - Themeda triandra* climax grassland associated with well drained, coarse textured, shallow soils.

This community is associated with the midslopes between the crests and valley bottoms surface rock is present mainly in the form of gravel and various size stones, the soils are shallow (average 521 mm). There are shrubs present within this community but there average cover is less than 10% and the average maximum height of the herbaceous layer is 63 cm. This community also has a limited distribution at 104 ha or 2% of the study area.

Figure 4.14: Community Two

The following species had been recorded within this community:

<u>Grasses:</u> *Bewsia biflora, Brachiaria serrata, Bulbostylis burchellii, Ctenium concinnum, Cynodon dactylon, Cyperus obtusiflorus var. obtusiflorus, Cyperus rupestris var. rupestris, Digitaria tricholaenoides, Diheteropogon amplectens var. amplectens, Elionurus muticus, Eragrostis capensis, Eragrostis chloromelas, Eragrostis curvula, Eragrostis racemosa, Harpochloa falx, Helictotrichon turgidulum, Heteropogon contortus, Hyparrhenia hirta, Juncus lomatophyllus, Koeleria capensis, Kyllinga alba, Melinis repens subsp. repens, Microchloa caffra, Miscanthus junceus, Scirpus burkei, Scirpus ficinioides, Setaria sphacelata var. sphacelata, Themeda triandra, Tristachya leucothrix, Urelytrum agropyroides.*

<u>Forbs:</u> *Acrotome hispida, Ajuga ophrydis, Anthericum fasciculatum, Asclepias brevipes, Asclepias stellifera, Becium obovatum subsp. obovatum var. obovatum, Berkheya carlinopsis subsp. magalismontana, Berkheya insignis, Berkheya radula, Chaetacanthus costatus, Chamaecrista mimosoides, Chironia purpurascens subsp. purpurascens, Cleome maculata, Cleome monophylla, Commelina africana var. africana, Crabbea acaulis, Crassula capitella subsp. capitella, Crepis hypochaeridea, Crinum graminicola, Cyanotis speciosa, Dianthus mooiensis subsp. mooiensis var. mooiensis, Dicoma anomala subsp. anomala, Dipcadi marlothii, Elephantorrhiza elephantina, Eriosema salignum, Eucomis autumnalis subsp.*

autumnalis, Euphorbia striata var. striata, Felicia muricata subsp. muricata, Gazania krebsiana subsp. krebsiana, Gerbera ambigua, Gnidia caffra, Gnidia capitata, Haplocarpha lyrata, Helichrysum aureonitens, Helichrysum callicomum, Helichrysum coriaceum, Helichrysum melanacme, Helichrysum nudifolium var. nudifolium, Helichrysum rugulosum, Hermannia depressa, Hirpicium armerioides, Hypoxis argentea var. argentea, Hypoxis hemerocallidea, Hypoxis obtusa, Hypoxis rigidula var. rigidula, Indigofera cryptantha var. cryptantha, Indigofera dimidiata, Ipomoea bathycolpos, Ipomoea bolusiana, Ipomoea ommanneyi, Justicia anagalloides, Kohautia amatymbica, Ledebouria cooperi, Ledebouria ovatifolia, Lotononis listii, Monopsis decipiens, Nidorella anomala, Nidorella hottentotica, Oenothera tetraptera, Pearsonia sessilifolia subsp. sessilifolia, Pentanisia prunelloides subsp. prunelloides, Pollichia campestris, Polygala amatymbica, Psammotropha myriantha, Richardia brasiliensis, Rorippa nudiuscula, Rumex acetosella subsp. angiocarpus, Scabiosa columbaria, Senecio coronatus, Senecio erubescens var. erubescens, Senecio othonniflorus, Senecio polyodon var. polyodon, Senecio venosus, Solanum elaeagnifolium, Tephrosia capensis var. capensis, Tephrosia elongata var. elongata, Thesium utile, Ursinia nana subsp. nana, Verbena bonariensis, Vernonia oligocephala, Vigna vexillata var. vexillata, Wahlenbergia virgata, Zornia linearis,

Woody species: *Elephantorrhiza elephantina, Erythrina zeyheri, Stoebe vulgaris, Ziziphus zeyheriana,*

A relatively large pacth/ stand of this community is present within the current mining area towards the north-northeast. This is an important community in that it contains species which are remants/ representatives of the terrestrial communities lost to cultivation on the deeper soils. Therefore the conservation of this community should be a priority, as it provides the opportunity to re-introduce species into the rehabilitated or abandoned cultivated land.

4.4.2.3 Community 3: Temporary and seasonally coarse textured, moist grassland on midslopes and footslopes

Phytosocological name: *Nidorella anomala - Eragrostis curvula* tall temporary or seasonally moist grassland associated coarse textured soils on midslopes.

This community is associated with the lower midslopes and footslopes, no surface rock is present and the soils are deep (average 976 mm). It has a finer soil texture in the A-horizon than the previous communities at an estimated average of 17%. There is limited to none woody species present in this community and the average maximum height of the herbaceous layer is 88 cm. This community covers approximately 356 ha or 8% of the study area.

Figure 4.15: Community 3

The following species had been recorded within this community:

Grasses: *Aristida junciformis subsp. junciformis, Bothriochloa insculpta, Cynodon dactylon, Cyperus denudatus var. denudatus, Digitaria argyrograpta, Eleocharis acutangula, Eragrostis capensis, Eragrostis chloromelas, Eragrostis curvula, Eragrostis plana, Eragrostis racemosa, Fimbristylis complanata, Harpochloa falx, Helictotrichon turgidulum, Hyparrhenia hirta, Imperata cylindrica, Juncus lomatophyllus, Kyllinga alba, Leersia hexandra, Miscanthus junceus, Paspalum urvillei, Pycreus nitidus, Schoenoplectus paludicola, Scirpus ficinioides, Setaria incrassata, Stiburus alopecuroides, Themeda triandra, Typha capensis*

Forbs: *Anthericum fasciculatum, Berkheya radula, Berula erecta subsp. erecta, Bidens formosa, Buchnera longespicata, Centella asiatica, Chironia purpurascens subsp. purpurascens, Cirsium vulgare, Commelina africana var. africana, Cordylogyne globosa, Crinum bulbispermum, Denekia capensis, Dipcadi viride, Euphorbia striata var. striata, Gerbera ambigua, Haplocarpha lyrata, Helichrysum aureonitens, Helichrysum coriaceum, Helichrysum nudifolium var. nudifolium, Helichrysum rugulosum, Hypericum lalandii, Lactuca serriola, Lobelia angolensis, Mimulus gracilis, Monopsis decipiens, Nemesia fruticans, Nidorella anomala, Oxalis obliquifolia, Persicaria lapathifolia, Pseudognaphalium luteo-album, Ranunculus meyeri, Rorippa nudiuscula, Rumex crispus, Rumex lanceolatus, Senecio consanguineus, Senecio erubescens var. erubescens, Senecio inornatus, Senecio polyodon var. polyodon, Sonchus asper subsp. asper, Tagetes minuta, Tephrosia capensis var. capensis, Verbena bonariensis, Verbena brasiliensis, Vernonia hirsuta*

Woody species: *Stoebe vulgaris*

This community is associated with those areas on the midslopes and footslopes where water tends to move laterally through the soil, as indicated by its occurrence on mainly E-horizons in the sub soil. In many places this community was ploughed. Wetland Consulting’s wetland assessment supports this statement. Therefore although mining as the potential to currently impact on this community it is clear that agriculture specifically cultivation has had an impact on this community historically. This community is also transitional between the highlying sourveld areas and the lowlying sweetveld associated with finer soil textures, resulting in its exploitation by livestock, whether domestic or game. The high constancy (presence) of the grass species Eragrostis curvula highlights the fact that this community is often used for pasture.

4.4.2.4 Community 4: Seasonally and permanently fine textured, wet grassland on footslopes and valley bottoms

Phytosocological name: *Falckia oblonga - Eragrostis plana* seasonally or permanently wet grassland associaed with fine textured soils in valleybottom wetlands.

This community is associated with the lowlying areas in the landscape, specifically the valley bottoms, no surface rock is present and the soils are very deep (average 1115 mm). It has the finest soil texture in the A-horizon of all the communities at an estimated average of 37%. There is limited to none woody species present in this community and the average maximum height of the herbaceous layer is 63 cm. This community covers approximately 381 ha or 9% of the study area.

Figure 4.16: Community Four

The following species had been recorded within this community:

<u>Grasses:</u> *Agrostis eriantha var. eriantha, Aristida junciformis subsp. junciformis, Cynodon dactylon, Cyperus denudatus var. denudatus, Cyperus esculentus var. esculentus, Cyperus sphaerospermus, Eleocharis acutangula, Eragrostis chloromelas, Eragrostis curvula, Eragrostis inamoena, Eragrostis plana, Harpochloa falx, Hyparrhenia hirta, Juncus lomatophyllus, Kyllinga alba, Miscanthus junceus, Paspalum dilatatum, Pennisetum thunbergii, Pycreus nitidus, Schoenoplectus paludicola, Scirpus burkei, Scirpus ficinioides, Setaria incrassata, Setaria pallide-fusca, Themeda triandra, Typha capensis*

Forbs: *Anthericum fasciculatum, Arctotis arctotoides, Asclepias brevipes, Asclepias fruticosa, Asclepias stellifera, Berkheya carlinopsis subsp. magalismontana, Berkheya radula, Bidens formosa, Boophone disticha, Buchnera longespicata, Capsella bursa-pastoris, Centella asiatica, Cirsium vulgare, Conyza podocephala, Cordylogyne globosa, Crepis hypochaeridea, Crinum bulbispermum, Denekia capensis, Dimorphotheca caulescens, Dipcadi viride, Euphorbia striata var. striata, Falkia oblonga, Felicia muricata subsp. muricata, Gazania krebsiana subsp. krebsiana, Gnidia gymnostachya, Gynandriris simulans, Haplocarpha lyrata, Helichrysum aureonitens, Helichrysum rugulosum,*

Hermannia coccocarpa, Hermannia erodioides, Hibiscus trionum, Hypoxis acuminata, Hypoxis hemerocallidea, Indigofera dimidiata, Ipomoea transvaalensis, Jamesbrittenia aurantiaca, Ledebouria cooperi, Ledebouria graminifolia, Lotononis listii, Mimulus gracilis, Nidorella anomala, Oenothera rosea, Oenothera tetraptera, Plantago longissima, Pseudognaphalium luteo-album, Ranunculus meyeri, Ranunculus multifidus, Rorippa nudiuscula, Rumex crispus, Rumex lanceolatus, Salvia runcinata, Scabiosa columbaria, Senecio consanguineus, Senecio erubescens var. erubescens, Senecio inaequidens, Senecio inornatus, Senecio polyodon var. polyodon, Sonchus asper subsp. asper, Sphenostylis angustifolia, Tagetes minuta, Trachyandra asperata var. asperata, Trachyandra erythrorrhiza, Verbena bonariensis, Vernonia oligocephala, Xanthium spinosum, Zornia linearis

Woody species: *Erythrina zeyheri*

This community represents the typical wetland areas which are inundated or saturated with water throughout the year. It was not ploughed because of its high clay content (Vertic and Melanic topsoils) and the probability that it becomes annually flooded. This community is mainly used for grazing and therefore tends to be exploited. The strong presence of the grass *Eragrostis plana* supports this statement.

Refer to the detailed wetland report with regards to wetland types, PES, EIS and functionality.

4.4.3 Species Richness

During the study 207 species were recorded, representing the alpha-diversity or overall species richness. These 207 species represents 47 plant families of which almost 50% belong to the families: Asteraceae, Poaceae and Fabaceae. The 207 species belong to 144 genera of which the following 42 genera contains 50% of the species: *Acrotome, Agrostis, Ajuga, Anthericum, Arctotis, Aristida, Asclepias, Aster, Becium, Berkheya, Berula, Bewsia, Bidens, Boophone, Brachiaria, Cleome, Crinum, Cyperus, Digitaria, Dipcadi, Eragrostis, Gerbera, Gnidia, Helichrysum, Hermannia, Hypoxis, Indigofera, Ipomoea, Ledebouria, Nidorella, Oenothera, Paspalum, Ranunculus, Rumex, Scirpus, Senecio, Setaria, Solanum, Tephrosia, Trachyandra, Verbena, Vernonia.*

Therefore it should be evident that as a minimum during rehabilitation/ restoration of the grassland areas, species from more than one family should be introduced and preferably the *Asteraceae* and *Fabaceae*.

Between the plant communities, the community with the most species for its surface area or extent (and therefore the most diverse community) is community one (Table 4-13). It is evident that the terrestrial communities are the most diverse with regards to floristic diversity, while the wetland associated communities (Community 3 and 4) have a lower diversity due to the more extreme habitat in which the grow which varies between wilting point/ field capacity to saturated or inundated. These results further highlight the significance of conserving the remaining terrestrial grassland within the landscape with regards to vegetation.

4.4.3.1 Red Data plants

None of the 112 threatened (Vulnerable, Endangered, Critical Endangered) Red Data listed species for Mpumalanga Province was recorded within the study area. However communities one and two is the most likely communities in which these threatened Red Data plants could occur or establish. These two communities represent shallow rocky areas with coarse textured soils.

4.4.3.2 Protected plants – National and provincial

Only three provincially protected plants were recorded within the study area, namely: *Crinum bulbispermum, Crinum graminicola, Eucomis autumnalis*. It should be noted that all of the species in these genera are protected in terms of the Mpumalanga Nature Conservation Act (Act No 10 of 1998). No nationally protected plant in terms of the National Environmental: Biodiversity Act (Act No 10 of 2004) was recorded within the study area.

4.4.3.3 Medicinal plants

Ten species with medicinal properties were recorded (Van Wyk, Van Oudtshoorn & Gericke 2000), namely: *Berula erecta, Centella asiatica, Elephantorrhiza elephantina, Eucomis autumnalis, Hypoxis hemerocallidea, Pentanisia prunelloides, Rumex lanceolatus, Scabiosa columbaria, Typha capensis, Vernonia oligocephala*. The majority of them were recorded in communities two and four.

4.4.3.4 Alien invasive species

Three declared Category 1, 2 & 3 invasive species in terms of the Conservation of Agricultural Resources Act, 1989 (Act No. 43 of 1983) (CARA), were recorded within the study area, across three of the four communities: *Cirsium vulgare, Solanum elaeagnifolium, Xanthium spinosum*.

All of these species are Declared Category 1 invaders and therefore has to be controlled. Additional Declared Category 1,2,3 invasive species noted within the study area but not recorded within the survey plots, were *Eucalyptus* species (Bluegums), *Acacia mearnsii* (Wattles) and *Pinus* species (Pine), *Cactaceae* (Opuntia species). These species occur either in well defined stands (forestry plots) or in close proximity to homesteads and other human infrastructure (roads, dams). It should be noted that alien invasive species should be controlled and eradicated in terms of both the CARA and the NEMBA.

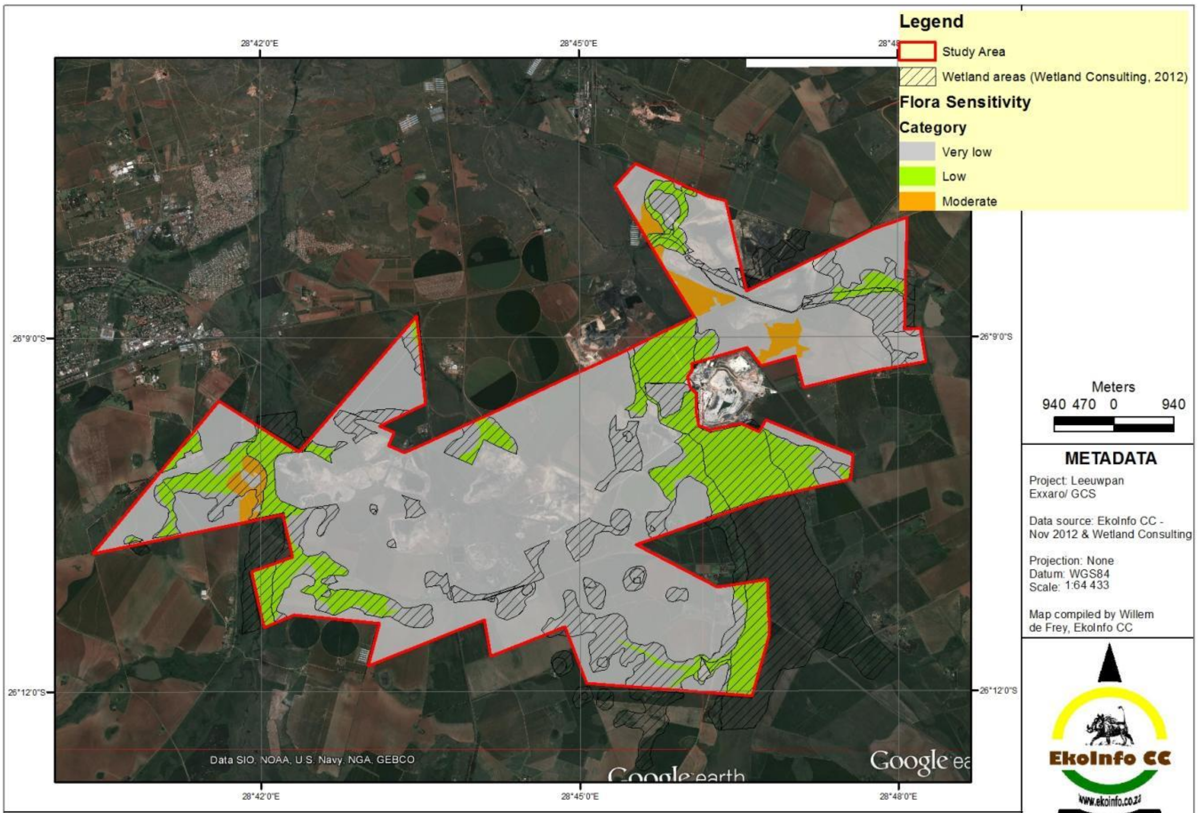


Figure 4 - 6: Flora sensitivity map

(not to scale, please refer to Appendix A for a enlarged Map)

Figure 4.17: Flora Sensitivity Map of the Leeuwpan Coal Mine's mining right area

4.5 Biodiversity - Fauna

The Biodiversity studies were undertaken by EkoInfo during wet and dry season periods, with consideration of all past studies also undertaken for Leeuwpan Coal Mine. The Biodiversity assessment is attached hereto as Appendix C-2.

4.5.1 Avifauna

Preliminary richness statistics

According to the previous South African Bird Atlas Project (Harrison *et al.*, 1997), an average of 196 bird species have been recorded in the region based on two quarter degree grid cells that are sympatric to the study site (2628BA = 191 spp. and 2628BB = 201 spp.). This equates to 21% of the approximate 951 species listed for the southern African sub-region[1].

[1] A geographical area south of the Cunene and Zambezi Rivers (includes Namibia, Botswana, Zimbabwe, southern Mozambique, South Africa, Swaziland and Lesotho).

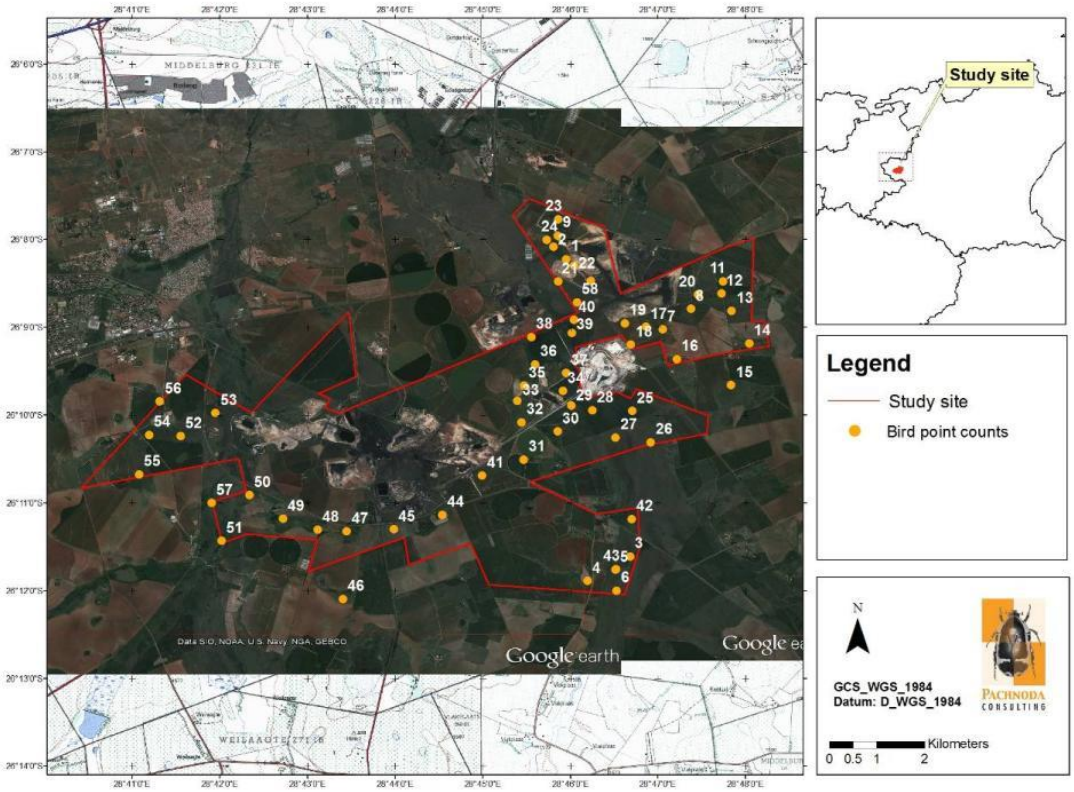
However, the SABAP2 database suggests that the study area is more likely to sustain an average 121 species[2] (www.sabap2.adu.org.za). On a national scale, the bird richness on the study site is predicted to be moderate-high. Refer to Appendic C-2 for full list of threatened and near threatened bird species.

According to a recent site visit, the study site is represented by two distinct avifaunal assemblages consisting of (1) a community confined to the wetland features and (2) a community restricted to the grassland units. The former is dominated by the Red-knobbed Coot (*Fulica cristata*), Egyptian Goose (*Alopochen aegyptiaca*), Yellow-billed Egret (*Egretta intermedia*) and Blacksmith Lapwing (*Vanellus armatus*), and the latter by the African Pipit (*Anthus cinnamomeus*), Cape Longclaw (*Macronyx capensis*), Levaillant's Cisticola (*C. tinniens*) and Ploceid weavers (weavers and bishops). **Error! Reference source not found.** p rovides an overview of threatened and near-threatened bird species recorded in the study area[3], as well as those previously recorded in area based on their known distribution range and the presence of suitable habitat. A total of 18 species could occur on the study site.

Orientation site visit

A total of 83 bird species were recorded during an orientation site visit, which include the vulnerable Southern Bald Ibis (*Geronticus calvus*), African Marsh Harrier (*Circus ranivorus*) and Secretarybird (*Sagittarius serpentarius*). It is worth mentioning that 41 % of the observed species is represented by obligate and facultative aquatic species, thereby emphasising the contribution of the wetland features towards local bird diversity.

[2] According to five pentad grid localities (range = 98 - 137 species).
[3] The study region has reference to an area that is larger than the study site itself. It incorporates external habitat types that are bordering the study site. Many bird species, especially large terrestrial species exhibit large home ranges and will move over large distances in search of food or mating partners. Therefore, the area of occupancy of some species is determined by changing environmental conditions.



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 4.18: Avifauna count locations within the mining right area of Leeuwpan Coal Mine

4.5.1.1 African Marsh Harrier (Circus ranivorus) – "Nationally Vulnerable"

The African Marsh Harrier requires extensive permanent wetlands with reed beds to satisfy its breeding requirements, but will often utilise smaller wetlands while foraging (Barnes, 2000). At present, it is considerably localised and the South African population displays a highly fragmented distribution range. The breeding success of this species is highly dependent on the spatial scale of wetland systems, and is seldom successful if suitable breeding habitat is less than 100 ha in extent (Tarboton & Allen, 1984). In addition, it prefers to nest in dense reed beds placed over water.

The study site provides suitable breeding and foraging habitat for C. ranivorus to occur. Despite being recorded over agricultural land, the extensive wet grassland units, especially areas dominated by Carex and Typha capensis, provide suitable breeding and roosting habitat.

4.5.1.2 Black-winged Pratincole (Glareola nordmanni) – "Globally Near-threatened"

The Black-winged Pratincole is a non-breeding Palaearctic migrant to southern Africa, in particular to the Grassland Biome. It is a species synonymous with agricultural landscapes, especially areas subjected to ploughing and tilling. Within South Africa, it is highly nomadic with erratic influxes observed during certain years, probably in response to rainfall. It is gregarious and occurs almost invariably in small to sometimes very large flocks (c. 250 000 – 800 000 individuals) (BirdLife International, 2012a). In South Africa it is mainly threatened by locust control measures and grassland degradation.

Small flocks (of up to 40 individuals) were recorded from the study area (Rietkuil; per obs.) and from nearby areas (Vangatfontein; pers. obs.). However, their occurrence on the study site is considered a consequence of the agricultural activities observed from the region. None of the observed individuals was observed roosting on the study site and they are considered passing birds en route to suitable feeding ground (e.g. areas subjected to harvesting). The wet and moist grassland units along the Bronkhorstspruit floodplain provide access to drinking water for foraging flocks.

4.5.1.3 Southern Bald Ibis (Geronticus calvus) – "Globally Vulnerable"

The Southern Bald Ibis is endemic to the north-eastern parts of South Africa, Lesotho and western Swaziland, with the core of its distribution located in the north-eastern Free State, the Mpumalanga escarpment and the KwaZulu-Natal Drakensberg (BirdLife International, 2012b). It is currently listed as "Vulnerable" due to its small global population size, which is believed to be declining owing to habitat transformation and degradation. The global population is approximately 8 000 – 10 000 individuals (Barnes, 2000) with an estimated 1 500 breeding pairs in South Africa (BirdLife International, 2012b).

The Mpumalanga and Limpopo population stands at approximately 2 250 individuals (Allen, 1985). It is threatened by human interference at breeding localities and habitat loss due to afforestation, opencast mining activities and agricultural intensification (BirdLife International, 2012b). It prefers to breed on vertical cliffs, while high-altitude grassland, especially when recently burned, is its preferred foraging habitat. It also utilises cultivated land, pastures and tilled land during foraging bouts (pers. obs.). It will also attempt to breed on the vertical sides of old opencast void systems (e.g. near the Kriel Onverwacht mine and on Ikwezi-Doornkop mine near Newcastle).

G. calvus is regarded as regular winter visitor to the primary (climax) sourveld grassland units (on the site). Nevertheless, the vertical cliffs of a small sinkhole on the western section of the study site provides potential breeding habitat.

4.5.1.4 Melodious Lark (Mirafra cheniana) – "Globally Near-threatened"

M. cheniana is an endemic species to southern Africa and listed as “Near-threatened” owing to rapid population declines caused by habitat alteration (BirdLife International, 2012c). It prefers fairly short grassland (<50 cm) with a low basal cover and was previously thought to occur almost exclusively in grassland dominated by dry Themeda triandra (Harrison et al., 1997). However, recent observations showed that this species has a high preference for open grassland on sandy, siliceous soils dominated by sour, wiry grasses such as Loudetia simplex, Tristachya rehmannii, Trachypogon spicatus and Diheteropogon amplectens. It will even colonise tall secondary Hyparrhenia hirta grassland provided that patches of short open grassland persist (pers. obs.). Although not observed during the survey period, a number of displaying males were confirmed from primary sourveld grassland bordering a closed depression during a previous assessment. The primary grassland units on the study site are likely to support a localised breeding population.

4.5.1.5 Yellow-billed Stork (Mycteria ibis) – “Nationally Near-threatened”

The Yellow-billed Stork (Mycteria ibis) was observed during a previous survey from a “blind” channel along an unnamed tributary of the Bronkhorstspruit floodplain (Rietkuil; pers. obs.).

It is considered as an irregular (non-breeding) visitor to the study site although influxes are sometimes common when favourable conditions prevail (during sudden flood events following preceding rains).

4.5.1.6 Maccoa Duck (Oxyura maccoa) - “Globally Near-threatened”

O. maccoa was recently classified by the IUCN as “near-threatened” owing to its small population size (it is endemic to sub-Saharan Africa) and ongoing declines resulting from a number of unrelated threats (BirdLife International, 2012d). Main threats include water pollution and habitat alteration. It feeds almost exclusively on benthic invertebrates, which makes it susceptible to bio-accumulation of pollutants.

South Africa supports the largest population with approximately 4 500 – 5 500 individuals (BirdLife International, 2012d). Unfortunately, only 20 % of the South African population occurs in protected areas, making this species extremely vulnerable to further habitat alteration. They are entirely aquatic and dependant on permanent wetlands with high concentrations of benthic invertebrates (Colahan, 2005).

Small rafts comprising of 1-4 individuals were observed on the open water habitat and impoundments that are associated with wet grassland on the central section of the study site. The nearby pans and areas of suitable habitat that were identified on the study site are regarded as important post-breeding habitat for this species in the region.

4.5.1.7 Greater Flamingo (Phoenicopterus ruber) & Lesser Flamingo (P. minor) - "Nationally & Globally Near-threatened"

Both P. ruber and P. minor are highly nomadic and thus unpredictable in their occurrence. However, they prefer to congregate on large shallow impoundments and lakes, especially alkaline pans with pH values as much as 10.5 that hold high densities of brine shrimps, diatoms and cyanobacteria (del Hoyo et. al, 1992; Simmons, 2005a; Simmons, 2005b).

However, the dominance of each species is determined by the densities of their respective prey preference. Based on differences in mandible morphologies, the Greater Flamingo with its shallow-keeled bill prefers to feed on Artemia (brine shrimps), chironomids, copepods, diatoms, the chrysalis of Ephydra flies and certain snails (Cerithidea & Cerithium).

On the other hand, the Lesser Flamingo with its deep-keeled bill prefers small algae, benthic diatoms and blue-green algae of the genus Spirulina. Both species do not breed in the Mpumalanga Province, and it seems that most of the wetlands in the province are unsuitable and does not meet their breeding demands.

Both species have been observed from the large endorheic pan south of the study site (approximately 1.6 km south of the site) (pers.obs), while P. ruber was also observed from an artificial impoundment on the study site. In addition, the presence of these species is also highlighted by reporting rates obtained from the area during the SABAP1 (P. ruber = 12% & P. minor = 6%) and recent SABAP2 (P. ruber = 22%) periods. Therefore, the large pans and dams in the study region qualify as important foraging habitat for flamingos.

4.5.1.8 Secretarybird (Sagittarius serpentarius) – "Globally Vulnerable"

This species was recently upgraded from "Least Concern" to "Vulnerable" since recent evidence suggests that it has experienced rapid declines across its entire range due to habitat loss, anthropogenic disturbances and intensive grazing (BirdLife International, 2012e). Secretarybirds are widespread in Africa south of the Sahara, but have declined over most of their geographic distribution range. Based on reporting rates, they appear to be more common in large conservation and rural areas, and this explains why reporting rates are relatively low (or even absent) on areas that are not statutorily conserved. Secretarybirds prefer open areas, in particular open savanna and grassland, but tend to avoid areas of dense bush or very rocky areas.

It could occur on the footprint site and is regarded as a regular foraging visitor, although reporting rates for the area (based on SABAP1) suggest that it occurs at low densities. Its habitat on the footprint site is threatened by the current grazing regime (transforming grassland to karroid shrub), while disturbances caused by human activities on the site will deter this species from utilising the grasslands on the eastern part of the footprint site.

It was confirmed from fragmented primary grassland south of the study site and is regarded as an irregular to uncommon foraging visitor on the primary and grazed grassland units. The reason for its presence on the study site is probably a function of habitat loss that occurred elsewhere in the region and seasonality.

Many terrestrial bird species show widespread declines in numbers, primarily due to large-scale loss of habitat, especially the loss of large patches of grassland. It is postulated that this steady decline of suitable habitat has "forced" this species to utilise other "sub-optimal" areas, many being closely associated with human settlements, where it is often confronted or threatened by human activities.

4.5.1.9 African Grass-owl (Tyto capensis) – "Nationally Vulnerable"

The African Grass-owl is categorised as "Vulnerable" in the Red Data book of Birds (Barnes, 2000) of which the southern African population is less than 5 000 individuals. It is a secretive and strictly nocturnal species that is seldom seen unless flushed from its daytime roosting site or nest (Kemp, 2005).

It is often possible that the Marsh Owl (Asio capensis) could be mistaken for a Grass-owl since both species share the same type of habitat. Grass-owls are more often outnumbered (10:1) by Marsh Owls, and it is not unlikely that some observers could confuse the two species with each other (Tarboton et al., 1987). In addition, both species have similarly structured roosting sites, thereby complicating identification. Grass-owls and Marsh Owls will often use the same habitat to breed, although the former always utilise dry or damp areas and not areas that are placed over water (Tarboton, 2001). In addition, Grass-owls always construct a "tunnel system" within rank grass that differs from Marsh Owl nests.

The occurrence of African Grass-owls depends on four important factors and includes the following (partly defined by Ansara, 2004 and adapted from Van Rooyen, 2009):

- The graminoid layer should be dense enough for individuals to roost and breed while protecting them from potential predators. Grass-owls prefer the densest vegetation for breeding and roosting;
- The height (or structure) of the grassy layer should exceed 750 mm in length to facilitate the construction of their diagnostic system of tunnels (nests). If < 750 mm, the grassy layer should be densely intertwined by members of the Cyperaceae;
- Typical roosting and breeding habitat must not be regularly burned or grazed, and should preferably be left unburned or grazed for at least two years at a time to allow the grass to recover; and
- Suitable foraging habitat (e.g. open grassland and fallow land) should be accessible and preferably located in close proximity to roosting and foraging habitat.

Based on the above, it is clear that African Grass-owls are entirely dependent on the availability of rank, moist grassland, especially along permanent or seasonal vleis (Barnes, 2000) where they show a high preference for dense, tall patches of grassland dominated by Imperata cylindrica, Arundinella nepalensis, Hyparrhenia spp. or Carex spp. These conditions are normally associated with relatively pristine and well-managed grassland conditions. It typically nests within a system of constructed tunnels, which are situated on the ground in patches of tall dense grassland that have remained unburned and were left ungrazed for several years (Tarboton, 2001). Breeding normally corresponds to the late summer season when maximum grass cover is available (Steyn, 1982).

However, recently Grass-owls were also found roosting and breeding within wetland systems made-up by dense matted sedge pertaining to the Cyperaceae intertwined with moist grasses (pers. obs.).

Foraging activity is mainly confined to taller grasslands rather than short or grazed grasslands (Kemp & Calburn, 1987), although it is known to hunt over fallow land (Tarboton et al., 1987) and other drier habitat types, or may even become nomadic during sub-optimal conditions (which may be the case when typical habitat was burned). It is therefore subject to local movements in response to prey fluctuations and habitat availability (especially during fires) (Kemp, 2005). Agricultural transformation of key habitat and frequent burning of prime habitat are major threats, especially when rank grassland is converted to short grassland or cultivated areas (Barnes, 2000). Uncontrolled burning, especially in the late summer (March-April), has severely affected the breeding success of Grass-owls (Vernon, 1972; Tarboton & Erasmus, 1998).

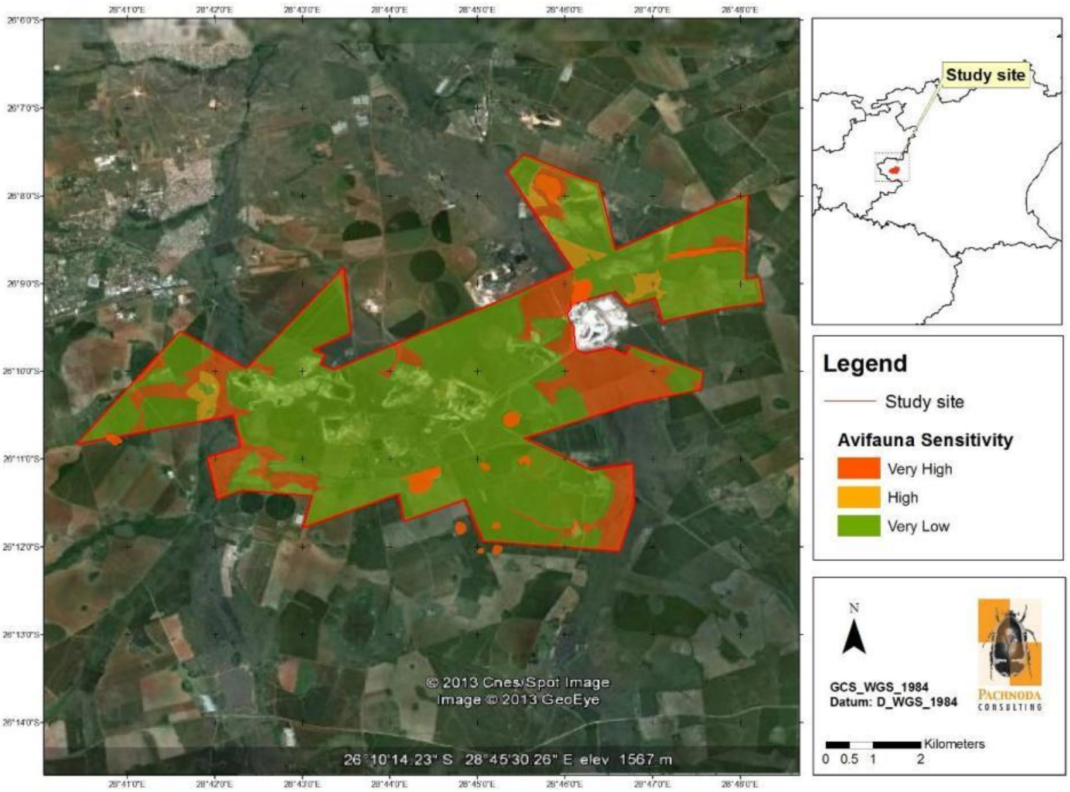
The presence of dense, tall Imperata cylindrica grassland and Carex-dominated valley bottom wetland features on the study site provide optimal breeding and roosting habitat for the African Grass-owl. Three independent observations of this species were confirmed in or adjacent to the study site consisting of one breeding pair, one killed by vehicle traffic at night and another breeding pair confirmed during a previous survey (pers. obs.).

4.5.2 Invertebrates

The unchannelled valley bottom wetlands and hillslope seeps provide suitable habitat for the vulnerable Marsh Sylph (*Metisella meninx*) butterfly. *M. meninx* is an obligate wetland species and depends on the occurrence of *Leersia hexandra* (Rice Grass), its host plant, to sustain a viable population. The latter was found growing extensively, almost forming uniform stands, in many of the wetlands features. *M meninx* occupies wetlands in open grassland at altitudes of 1 400 to 1 700 m, often corresponding to the upper catchment regions of rivers and streams. The adults are on the wing from November to March (Henning *et al*., 2009).

Potential Ecological Importance of the area includes the following:

1. A part of the study site coincides with the floodplain of the Bronkhorstspruit and an unnamed tributary (western part of the study site). These areas experience inundation on a seasonal basis, forming extensive shallow palustrine conditions which are often used as focal congregational habitat for waterfowl and wader species.
2. The pans on the study site, including those adjacent to the study site, are all spatially interlinked with each other, and offer ephemeral foraging habitat for a variety of migratory and sedentary waterbird species. These are the only habitat to be utilised by the Yellow-billed Egret (*Egretta intermedia*).
3. The moist grassland series along the hillslope seeps and some of the pans sustain remnant patches of *Imperata cylindrica*. These provide optimal roosting and breeding habitat for the threatened African Grass-owl (*Tyto capensis*). This species has been confirmed breeding on the southern part of the study site (2009, pers. obs.).
4. The grassland patches on the eastern section of the study site, in particular those with primary compositions, have the intrinsic potential to provide habitat for threatened and conservation important bird species, especially when burned (Southern Bald Ibis *Geronticus calvus* and Secretarybird *Sagittarius serpentarius*).
5. The rocky grasslands on the eastern part of the study site show high spatial heterogeneities contributing to a myriad of microhabitat types and niche space. These areas could support a high species richness of epigaeic invertebrate taxa and provide refugia for important invertebrate guilds (e.g. pollinators).



(not to scale, please refer to Appendix A for a enlarged Map)

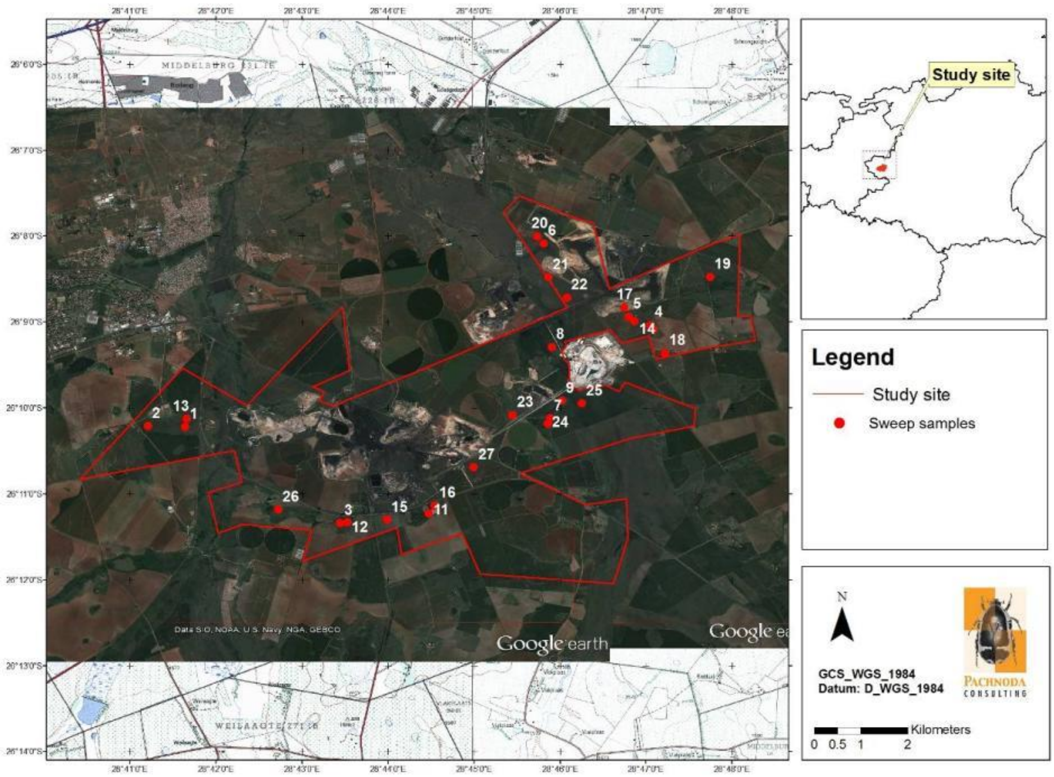
Figure 4.19: Avifauna Sensitivity Map within the mining right area of Leeuwpan Coal Mine

Butterflies were collected by means of active pursuit methods along random transect walks using a standard sweepnet. In addition, the occurrence of the vulnerable *Metisella meninx* (Marsh Sylph) butterfly was verified in areas with a high prevalence of *Leersia hexandra* grass.

The presence of scorpion taxa was verified by means of hand searching and rock lifting.

The objective of quantitative surveys is to evaluate the arthropod and Coleopteran diversity by comparing major habitat types (primary, secondary and rocky grassland) with each other.

Sweepnetting was used to collect invertebrates from above-ground foliage pertaining to grassland seres. A total of 27 sweep samples **Error! Reference source not found.**were taken w hereby the grassy layer was brushed back and forth to dislodge invertebrates up to a height of 1 m above the ground. Each sweep sample consisted of a linear transect of 100 sweeps each.

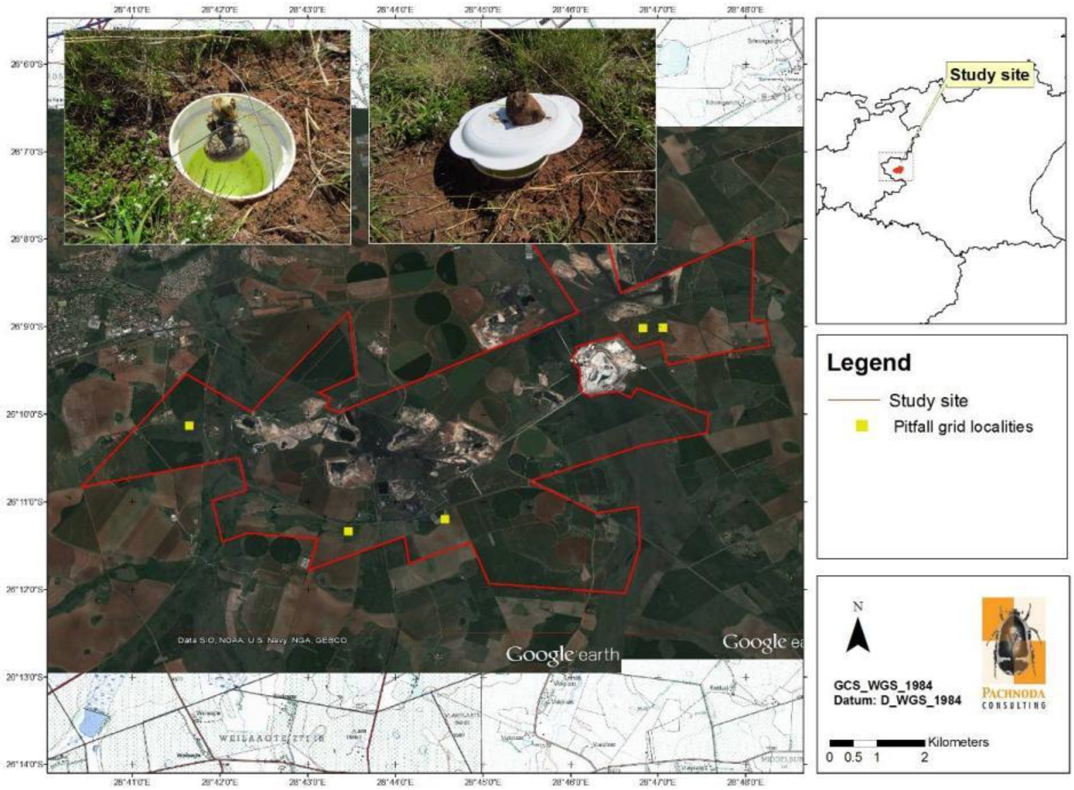


(not to scale, please refer to Appendix A for a enlarged Map)

Figure 4.20: Sweep Netting Sample Locations within the mining right area of Leeuwpan Coal Mine

A total of 5 pitfall trap stations were positioned within three major habitat types (primary, secondary and rocky grassland), consisting of 10 buckets (2L) each. The buckets were dug into the soil with the opening level with the soil surface and were baited with cattle dung. Each trap was filled with preservative (ethyl-α-glycol) and left *in situ* for three weeks before removal.

Order-level and beetle family-level diversities were calculated using the Shannon-Weaver index (H') (in Zilihona & Nummelin, 2001) and rarefaction, while Bray-Curtis similarity coefficients were used to compare arthropod and beetle abundance distributions between the different habitat types. A cluster analysis based on Bray-Curtis similarity coefficients (Clarke & Warwick, 1994) will estimate the similarity of the taxa involved between the different habitat types.



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 4.21: Pitfall Grid Locations within the mining right area of Leeuwpan Coal Mine

4.5.2.1 Butterflies

A total of 17 butterfly species were recorded on the study site during a site survey conducted on 12 - 15 November 2012. Results showed that the butterfly richness on the study site was low as evidenced by the large surface area of transformed habitat (agricultural land).

Table 4.5: Confirmed Invertebrates

Family	Subfamily	Genus & species	Common Name	Distribution
Hesperiidae	Pyrginae	*Spialia asterodia*	Star Sandman	Common
Lycaenidae	Lycaeninae	*Eicochrysops messapus*	Cupreous Blue	Widespread & common
Lycaenidae	Lycaeninae	*Cupidopsis cissus cissus*	Common Meadow Blue	Common
Lycaenidae	Lycaeninae	*Lampides boeticus*	Long-tailed Blue	Widespread & common
Lycaenidae	Lycaeninae	*Leptotes pirithous pirithous*	Common Blue	Widespread & common

Family	Subfamily	Genus & species	Common Name	Distribution
Lycaenidae	Lycaeninae	*Zizeeria knysna*	Sooty Blue	Widespread & common
Lycaenidae	Lycaeninae	*Zizula hylax*	Gaika Blue	Widespread & common
Nymphalidae	Danainae	*Danaus chrysippus aegyptius*	African Monarch	Widespread & common
Nymphalidae	Heliconiinae	*Hyalites rahira rahira*	Marsh Acraea	Common but restricted to wetlands
Nymphalidae	Nymphalinae	*Junonia hierta cebrene*	Yellow Pansy	Widespread & common
Nymphalidae	Nymphalinae	*Junonia orithya madagascariensis*	Eyed Pansy	Widespread & common
Nymphalidae	Nymphalinae	*Vanessa cardui*	Painted Lady	Widespread & common
Papilionidae	Papilioninae	*Papilio demodocus demodocus*	Citrus Swallowtail	Widespread & common
Pieridae	Coliadinae	*Catopsillia florella*	African Migrant	Widespread & common
Pieridae	Coliadinae	*Eurema brigitta brigitta*	Broad-bordered grass yellow	Widespread & common
Pieridae	Pierinae	*Belenois aurota aurota*	Brown-veined White	Widespread & very common
Pieridae	Pierinae	*Pontia helice helice*	Meadow White	Widespread & very common

4.5.2.2 Scorpions

Two scorpion species were located on the study site:

- Uroplectes triangulifer – widespread on chert-rich dolomite grassland (rocky primary sourveld grassland); and
- Uroplectes sp. nr. U. formosus Group – a localised and undescribed species found in grassland on vertic soils with scattered rock. This species appears to be restricted to the Mpumalanga Highveld (Mr Ian Engelbrecht – invertebrate specialist at GDARD, pers. comm.).

4.5.2.3 Mygalomorphid spiders (baboon spiders)

The only species of mygalomorphae recorded on the study site was the Brachionopus cf. pretoriae (Pretoria lesser baboon spider). This species is small-bodied and was only located in the chert-rich dolomite grassland (rocky primary sourveld grassland) where it occurs in silk-lined burrow underneath rocks.

4.5.2.4 Epigeal invertebrates

A total of 826 arthropod specimens belonging to 85 different taxa, 12 orders (including classes) and 12 beetle families (including 18 dung beetle species) were collected from the pitfall traps. Hierarchical agglomerative clustering showed that the sourveld community were significantly different from the moist and secondary grassland communities. The different grassland types share about the same number of arthropods. However, the highest diversity of arthropod taxa was recorded in the sourveld. The secondary grasslands showed lower overall diversities and were composed of fewer taxa. However, the moist grassland units supported higher numbers of beetle (Coleoptera) families and arthropod Orders (83%).

The Diplopoda (millipedes) was the most prominent arthropod group on the study site. The Coleoptera (beetles) was prominent on the moist grassland units, while the Orthoptera (grasshoppers), Chilopoda (centipedes) and Arachnida (spider related taxa) were dominant on the sourveld units. The Diplopoda was prominent on the secondary grasslands. The Mantodea (mantids) and Hemiptera (bugs) were only recorded from the sourveld units and were rare in the other grassland units. Nevertheless, invertebrate groups with a preference for moisture, such as the Isopoda (wood lice), were absent from the other habitat types.

4.5.3 Herpetofauna

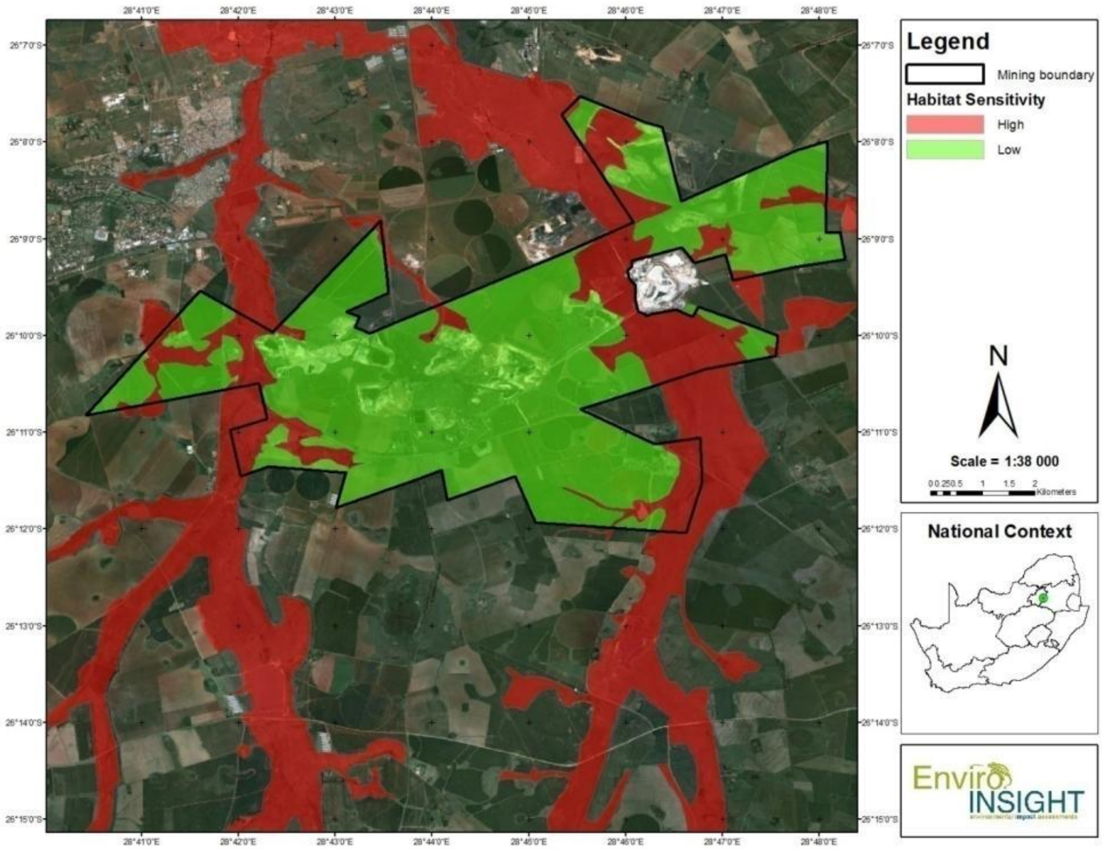
Summer and Winter Site visits were undertaken. A winter site visit was performed on 18 and 19 July 2012. An attempt was made to visit all habitats represented on the mine site as well as those surrounding the mine site. This was achieved by driving a vehicle and periodically stopping to take georeferenced photographs and make habitat specific notes. No active sampling or trapping was performed during the winter site visit.

A summer survey was performed between 12-17 November 2012 and an additional field survey day was required on 22 November 2012. During this survey all possible methods (described below) were employed to detect herpetofauna on the site. An attempt was made to cover the entire mining area as well as several key areas of importance outside of the mining boundary in order to gain a comprehensive understanding of the study site regarding herpetofauna.

4.5.3.1 Funnel Traps

Funnel trap drift fence arrays were placed in two of the remaining natural areas where herpetofauna diversity was expected to be greatest. These sites where selected through ground-truthing inspection at the initiation of the summer survey. Pitfall traps are very effective in trapping small reptiles, particularly lizards, small snakes and amphibians (Corn & Bury 1990; Branch 1998; Crosswhite *et al.* 1999). The efficacy of pitfall trap arrays is increased by the addition of funnel traps along the drift fences (e.g. Masterson *et al.* 2009). The funnel-trap drift fence (Figure 6-1), designed by L. Verburgt) allow for the placement of traps where it is not possible to sink a 25 litre bucket (e.g. rocky or boggy ground) and provide greater trapping success (L. Verburgt, pers obs). Traps were inspected daily in the morning and all captured specimens were photographed and released unharmed away from the traps, to reduce the chances of recapture.

As expected no reptiles were observed during the site visits. Only a single amphibian (*Amietia angolensis*) was heard calling intermittently at an artificial dam.



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 4.22: Herpetofauna Sensitivity Assessment within the mining right area of Leeuwpan Coal Mine

A prediction of the winter survey was that any significant herpetofauna populations were expected to be confined to the drainage lines or the few rocky outcrops in the area. This prediction was verified for reptiles as no reptiles were encountered outside of these areas. This can be explained by the observation of the connected untransformed areas. The only natural areas left in the regional landscape are those that cannot be ploughed for agricultural crops or cattle fodder (pastures). Both the rocky ridges and the wet vertic soils of the drainage lines do not allow for ploughing and hence these areas provide the only habitat available for reptiles.

Some species, such as snakes that feed on rodents may utilize the adjacent agricultural fields for hunting purposes but will almost certainly require the natural areas for refuge and breeding. The connected nature of these natural areas allows for migration of species between different habitats and promotes gene flow, which is crucial to the long term survival of populations fragmented by mining and agricultural developments. For example, all of the vegetation types present in the region, each of which may possess certain critical micro-habitat features for a particular species, are connected through these corridors of untransformed habitat.

It is therefore crucial for the long term conservation of the regional herpetofauna that the proposed mining activities take this into account and make all attempts to promote the continued existence of these natural areas in the region.

Figure 4.23: Amphibians observed

From right to left in descending order: *Xenopus laevis; Amietia angolensis; Strongylopus fasciatus; Tomopterna cryptotis; Cacosternum boettgeri; Amietophrynus gutturalis; Amietophrynus rangeri*.

Figure 4.24: Reptiles observed

From Right to Left Descending: *Lamprophis aurora; Boaedon capensis; Lycodonomorphus rufulus; Psammophylax rhombeatus; Hemachatus haemachatus; Rhinotyphlops lalandei; Nucras lalandii; Trachylepis capensis; Trachylepis punctatissima; Pachydactylus affinis*.

4.5.4 Mammals

This section represents the overall results from the literature and desktop review as well as detail level assessments conducted during July (dry season) and November (Wet Season).

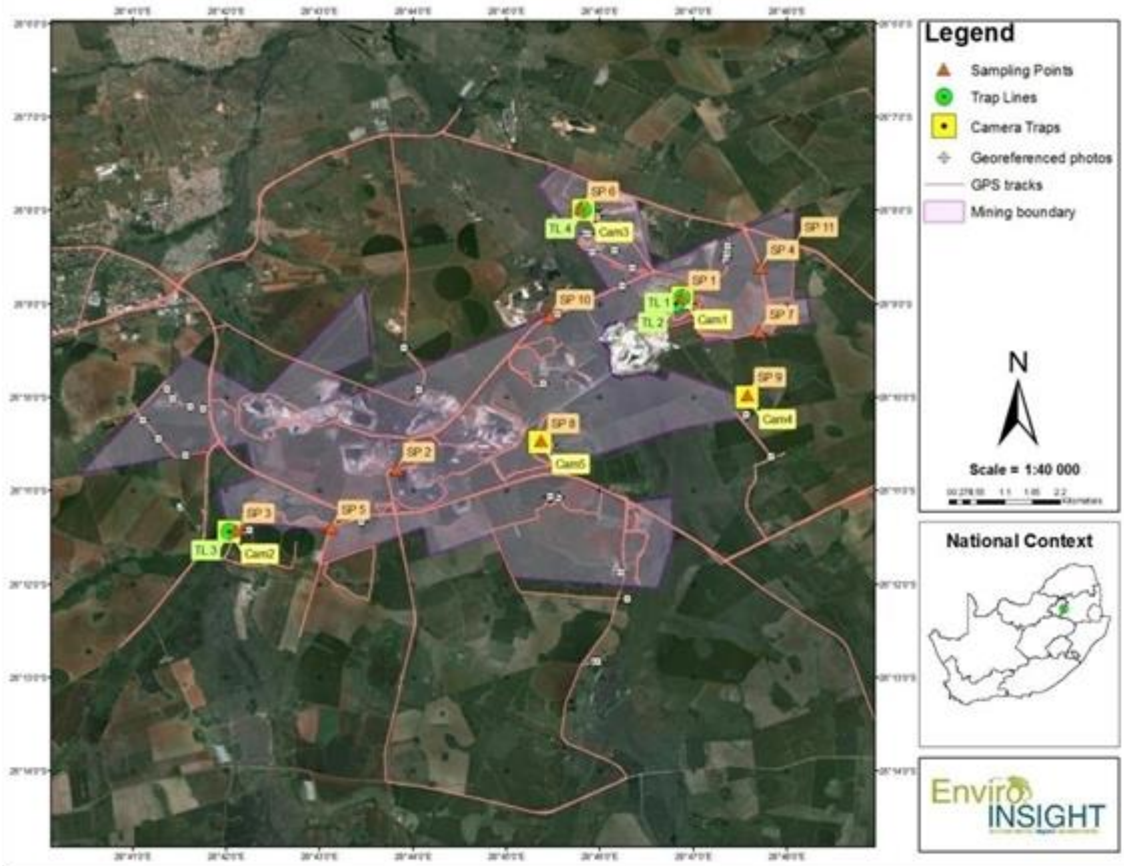


Figure 4.25: Camera and Sherman Trap locations for Mammal study within the mining right area of Leeuwpan Coal Mine

Sampling points: For each habitat, comprehensive sampling was carried out in order to ascertain any correlations between species diversity, species composition and the prevailing habitat types. The results of the habitat analysis feed directly into the sensitivity map for the study site. A sampling point usually encompasses a stringent search for all signs of mammals (utilising all of the above method techniques if required) in the immediate area (up to an including 1 km sq).

Habitat assessment: Habitat assessment was based on a simple structural classification of the vegetation within the study site, using both field analysis and cross referencing with the vegetation specialist. Subsequently, a number of factors are then combined to provide a basic sensitivity rating to be used in mapping.

In total, 16 mammal species were recorded during the two survey periods. The complete list of mammals is shown in **Table 4.6**. This represents strong preliminary evidence as to a significant mammal assemblage populating the study site. Due to the complexity and diversity of body sizes, ecology and movements of mammalian fauna, as well as the strong variation in sampling techniques used for each group, it is imperative that various aspects of the data be discussed in extended detail.

Table 4.6 List of mammal species acquired during the dry-season study

BIOLOGICAL NAME	ENGLISH NAME	EWT 2004 STATUS	TOPS	METHOD OF ACQUISITION	NOTES	LOCAL SENSITIVITY	REGIONAL SENSITIVITY	SEASON
Atilax paludinosus	Water Mongoose	Least Concern	Nil	Camera trap	Common wetland resident	Low	Low	Both
Aonyx capensis	African Clawless Otter	Least Concern	Yes	Camera trap	Common wetland resident	Low	Low	Both
Canis mesomelas	Black-backed Jackal	Least Concern	Nil	Sighting	Common resident	Low	Low	Both
Crocidura cyaena	Red-grey Musk Shrew	Data Deficient	Nil	Sherman trap	Common wetland resident	Moderate	Low	Summer
Cryptomys hottentotus	Common Mole-rat	Least Concern	Nil	Spoor	Common resident	Moderate	Low	Both
Cynictis penicillata	Yellow Mongoose	Least Concern	Nil	Sighting	Common resident	Low	Low	Both
Dasymys incomtus	Water Rat	Near Threatened	Nil	Scat analysis	Wetland resident	Moderate	Moderate	Summer
Felis lybica	African Wildcat	Least Concern	Nil	Night survey	Scarce resident	Moderate	Moderate	Both
Galerella sanguinea	Slender Mongoose	Least Concern	Nil	Sighting	Common resident	Low	Low	Both
Genetta genetta	Small-spotted Genet	Least Concern	Nil	Night survey	Common resident	Low	Low	Both
Hystrix africaeaustralis	Porcupine	Least Concern	Nil	Spoor (Quills)	Common resident	Low	Low	Both
Leptailurus serval	Serval	Near Threatened	Nil	Camera trap	Resident	Moderate	Moderate	Both
Lepus saxatilis	Scrub Hare	Least Concern	Nil	Night survey	Common resident	Low	Low	Both
Mastomys natalensis	Multimammate Mouse	Least Concern	Nil	Sherman trap	Common resident	Low	Low	Summer
Micalamys namaquensis	Rock-mouse	Least Concern	Nil	Sherman trap	Common ridge resident	Low	Low	Summer
Myosorex varius	Forest Shrew	Least Concern	Nil	Sherman trap	Common wetland resident	Moderate	Low	Summer
Mellivora capensis	Honey Badger	Near Threatened	Nil	Spoor	Common resident	Low	Low	Both
Otomys irroratus	Vlei rat	Least Concern	Nil	Scat analysis	Common resident	Low	Low	Both
Pedetes capensis	Springhare	Least Concern	Nil	Night survey	Common resident	Moderate	Low	Both
Phacochoerus africanus	Warthog	Least Concern	Nil	Spoor	Common resident	Low	Low	Winter
Potamochoerus larvatus	Bushpig	Least Concern	Nil	Spoor	Common resident	Low	Low	Summer
Raphiceros campestris	Steenbok	Least Concern	Nil	Sighting	Common resident	Low	Low	Summer
Rhabdomys pumilio	Striped Mouse	Least Concern	Nil	Sherman trap	Common resident	Low	Low	Summer
Sylvicapra grimmia	Common Duiker	Least Concern	Nil	Night survey	Common resident	Low	Low	Both
Tatera brantsii	Highveld Gerbil	Least Concern	Nil	Sherman trap	Common resident	Low	Low	Summer
Tatera leucogaster	Bushveld Gerbil	Data Deficient	Nil	Sherman trap	Common resident	Low	Low	Summer
Total Number of Species	26	3 (RD)	1					

Species of conservation concern

Two red-data species were located on the study site, which represent species of conservation concern. These species are discussed below.

Serval: This species is listed as Near Threatened in South Africa. A serval was photographed very near to the drainage line, which is expected as the species forages on rodents which are often associated with wetland/drainage areas. The summer survey may reveal more about the prevailing serval population on site, as they may be transitory or indeed resident. Previous studies from the authour has shown the servals frequently make use of ridges, eucalyptus and wattle stands for refugia, emerging to forage along drainage areas, pans, wetlands and open grassland.

Honey Badger: This species is listed as Near Threatened in South Africa. Honey badger tracks were periodically encountered on road networks in the study area. The low frequency of tracks as well as the lack of camera trap evidence suggests that this species may only use the study area as a migratory pathway between home ranges, rather than as a permanent core area, supporting viable populations. However, the summer study will provide more evidence as to the population status of not only honey badger, but other mesopredators found in the region.

Water Rat: This species is listed as Near Threatened in South Africa. Water rat jawbones were found in an analysed owl pellet found next to the wetlands within the mine concession (Trapline 3). The low frequency of occurrence as suggests that this species may be of lower densities or distribution. However, trap shyness may also be a factor in the sample frequency of this species. The sensitivity of this species is directly proportional to the impacts on its wetland habitat.

Data-Deficient Species: There are a number of listed Data-Deficient species that were sampled on the site that are listed under the 2004 EWT red-list. This list is currently under review and the relevant species need no special attention as they are not considered to be under threat. The species are

- Forest shrew (Myosorex varius);
- Single-striped mouse (Lemiscomys rosalia);
- Bushveld gerbil (Tatera leucogaster); and
- Red-grey musk shrew (Crocidura cyaena).

Table 4.7: Species records (implying distribution) per sampling point in the study area.

SPECIES	SP1	SP2	SP3	SP4	SP5	SP6	SP7	SP8	SP9	SP10	SP11
Water Mongoose		X	X			X	X	X		X	
African Clawless Otter			X					X			X
Black-backed Jackal	X		X	X		X			X		X
Red-grey Musk Shrew			X			X					
Common Mole-rat	X		X	X		X	X		X		
Yellow Mongoose	X	X	X	X	X	X	X		X	X	
Water Rat						X					X

SPECIES	SP1	SP2	SP3	SP4	SP5	SP6	SP7	SP8	SP9	SP10	SP11
African Wildcat			X			X					
Slender Mongoose	X	X	X		X	X			X		X
Small-spotted Genet			X	X		X		X			
Porcupine	X		X	X		X		X	X		
Serval	X		X			X		X			X
Scrub Hare	X		X	X		X	X		X		
Multimammate Mouse	X		X			X			X		
Rock-mouse	X					X			X		
Forest Shrew			X								
Honey Badger	X		X			X					X
Vlei rat			X			X		X			X
Springhare	X		X			X					
Warthog			X								
Bush pig									X		X
Steenbok			X			X		X			
Striped Mouse	X					X		X			
Common Duiker	X		X		X		X	X			X
Highveld Gerbil	X			X				X			X
Bushveld Gerbil			X			X					
TOTAL	14	3	21	7	3	20	5	10	9	2	10

4.5.5 Total Ecological Sensitivity

It is evident from the biodiversity assessment that the majority of natural vegetation remaining in the study area is wetland related, with the exception of small patches of terrestrial grassland in areas associated with shallow soils and rockiness. All of the remaining natural vegetation is of high ecological sensitivity and therefore of high conservation priority (Figure 27). These areas have a high conservation status mainly due to the following factors:

- These remaining natural vegetation areas represent habitat for various faunal species present within the area;
- These areas represent elements or taxa that is coherent in driving ecosystem services (e.g. invertebrate pollinators);

- These areas, especially those sections associated with exoheric wetland systems (drainage systems/ water courses) are crucial for maintaining connectivity between meta-populations (be it fauna or flora) within a highly fragmented landscape.
- These areas represent the basis of the trophic food web for higher faunal species, especially larger vertebrates.

Therefore it is of critical importance that no further infringements be allowed within these remaining natural areas and where mining or cultivation activities have come to an end, and that emphasis should be placed on improving the connectivity between these areas through effective rehabilitation and restoration. Professionally registered ecologists with expertise in botany and zoology should assist with the planning and design of connectivity zones.

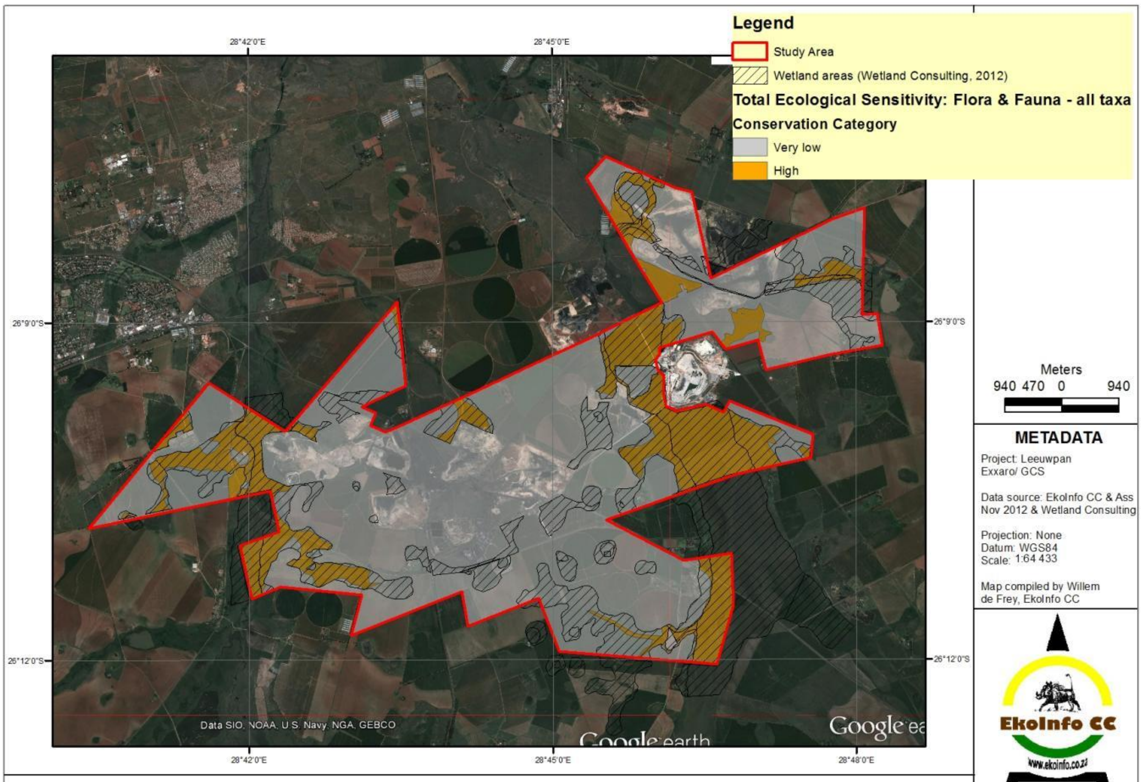


Figure 8 - 1: Total ecological sensitivity map of the Leeuwpan Colliery study area

(not to scale, please refer to Appendix A for a enlarged Map)

Figure 4.26: Total Ecological Sensitivity within the mining right area of Leeuwpan Coal Mine

4.6 Surface water

The information contained in this section of the report was obtained from the draft Hydrology Assessment conducted by GCS (Pty) Ltd, attached herewith as Appendix C-3.

Please note: Due to infrastructural changes this specialist study is in the process to be updated and completed to take all the related changes into consideration with regards to their environmental impacts on the area.

The study area is located in Water Management Area 4: Olifants and in quaternary catchment area B20A. The Bronkhorstspruit River flows in a south-north direction through the site to eventually end in the Bronkhorstspruit Dam downstream of the site area. Natural water features on site include tributaries of the Bronkhorstspruit River and pans. Artificial water features on site include farm dams, old void areas, Pollution Control Dams (PCD's), rain water in open cast pits and river diversion channels.

The watercourse on the newly proposed area that is indicated on the 1:50 000 topographical map was not flowing and did not seem to have a defined flowpath.

4.6.1 Surface water use

There are four (4) main uses of water that have been identified for the subcatchment of the Bronkhorstspruit up to the receiving water body, namely the Bronkhorstspruit Dam. The surface water uses include the following;

- Domestic use by formal and informal communities along the affected watercourse,
- Irrigation of crops, especially maize,
- Livestock watering including cattle, sheep and poultry and
- Aquatic ecosystems including fish, macro and micro-invertebrates.

Very few water bodies in the Delmas area are used for recreational purposes due to their seasonal nature. In most cases, dams are used for fishing.

No direct abstraction of water from the Bronkhorstspruit occurs for commercial irrigation or extensive domestic use. Dams are usually filled with water from the boreholes and this clean water is mainly used for irrigation. Numerous pans occur in the Delmas area, but are not utilized as a source of water for the above mentioned purposes.

4.6.2 Surface water quantity

4.6.2.1 Catchment delineation

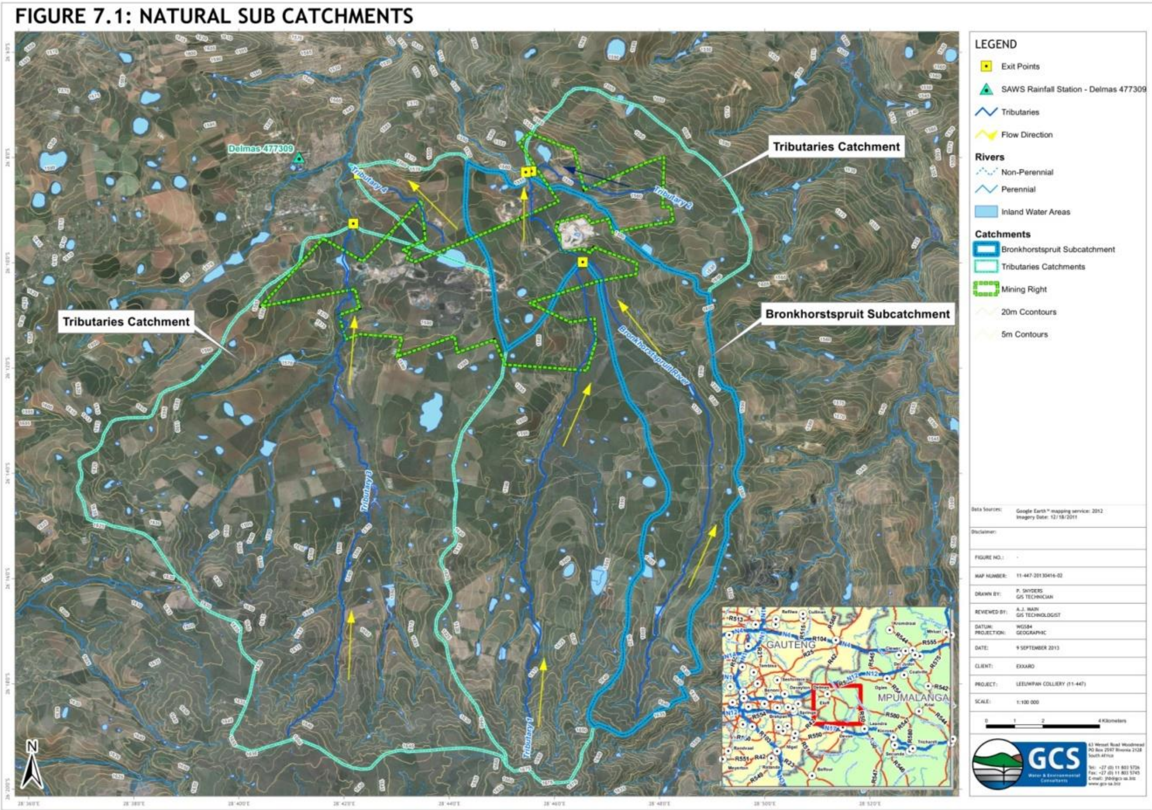
Kenbar and Witklip are situated in the Bronkhorstspruit's catchment area. The Bronkhorstspruit originates from a series of fountains in the dolomitic rocks south of Witklip. This source area is marshy and characterized by vleis. The Bronkhorstspruit flows past Witklip for approximately 20km before being joined by the Koffiespruit. Thereafter, it flows for another 5 km until reaching the Bronkhorstspruit Dam. Water in this dam is used for domestic, recreational and irrigation purposes.

The Wilge River flows to the east of the Bronkhorstspruit in a northerly direction towards the Premier Mine Dam. The overflow of the Bronkhorstspruit also flows into the Premier mine. The overflow of the Premier Mine Dam then flows as the Wilge River to the Loskop Dam.

The project area consists of a main natural catchment that was divided into five sub catchments (natural). Table 4.8 below shows a summary of the catchment area sizes.

Table 4.8: Summary of catchment sizes

Sub-catchment	River (catchment)	Area	Area	Area
		(m2)	*(km2)*	*(Ha)*
Natural (original) conditions				
Bronkhorstspruit sub catchment	Bronkhorstspruit	57 930 000.00	57.93	5 793.00
Sub catchment 1	Tributary 1	82 490 000.00	82.49	8 249.00
Sub catchment 2	Tributary 2	29 110 000.00	29.11	2 911.00
Sub catchment 3	Tributary 3	156 790 000.00	156.79	15 679.00
Sub catchment 4	Tributary 4	8 960 000.00	8.96	896.00



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 4.27: Sub-catchments

4.6.3 Mean Annual Runoff (MAR)

WR2005 quaternary runoff data was downscaled in order to obtain representative site runoff. Table 4.9 below summarises the MAR contribution of each natural sub catchment.

Table 4.9: Summary of MAR over catchments

Catchment	Actual MAR (Mm^3)
Leeuwpan site boundary	1.35
Bronkhorstspruit sub catchment	2.22
Sub catchment 1	3.16
Sub catchment 2	1.12
Sub catchment 3	6.01
Sub catchment 4	0.34

4.6.4 Normal Dry Weather Flow (NDWF)

Normal Dry Weather Flow is the flow that can be seen 70% of the time within a flow time series of a specific catchment. This flow is also reduced and calculated from the WR2005 runoff record in terms of probability of exceedence. Table 4.10 below summarises the NDWF that can be expected over each sub catchment.

Table 4.10: Summary of NDWF over catchments

Sub-catchment	Actual NDWF (Mm^3)
Leeuwpan site boundary	0.55
Bronkhorstspruit sub catchment	0.62
Sub catchment 1	0.88
Sub catchment 2	0.31
Sub catchment 3	1.68
Sub catchment 4	0.09

4.6.5 Flood lines

Streams occur on 4 areas of the project boundary area as follows:

- Tributary of the Bronkhorstspruit River - West (Witklip area);
- Bronkhorstspruit River - East (Weltevreden and Mohabsvelden area);
- Bronkhorstspruit River – East (Delmas Silica Mine and Pits OJ and OL); and
- Bronkhorstspruit River - South (new proposed pit mining area).

Flood line analyses on the Bronkhorstspruit River – East (Weltevreden and Mohabsvelden area) have been conducted prior to this study. The following paragraph summirises the report that was reviewed on the flood line analyses that were done:

- Kumba Resources – Leeuwpan Coal Mine – Proposed Stream Alterations at Weltevreden Section – April 2004 (Inprocon Consultants). The main findings of the study are summarised below;
    - Catchment area surface area size is approximately 24 km^2;
    - The 1085 slope is at 0.7%;
    - No defined watercourse (channel) is present and mostly sheet flow occurs;
    - The soils are highly permeable;
    - MAP of 698 mm;
    - Point rainfall intensity of 106.3 mm was adopted for a 24 hour 1:100 year storm event;

- A peak flow of 197 m^3/s for a 24 hour 1:100 year event was estimated;
- Normal flow depths were calculated at three (3) chainages in the valley;
- An average roughness coefficient of 50 mm was assumed;
- The hydraulic flow condition will be supercritical;
- Flow velocities of between 2 and 2.5 m/s are anticipated;
- Expected flow depth near the exit of the watershed will be 1.3 m and declines to roughly 0.7 m downstream of the farm dam; and
- No figures, plans, or maps of the flood lines are available.

Flood line analyses on the Bronkhorstspruit River – East (Delmas Silica Mine and Pits OJ and OL) have been conducted prior to this study. The following paragraph summarizes the report that was reviewed on the flood line analyses that was done:

- Preliminary Design Report for Stormwater Diversion Channels and Berms at Leeuwpan mine for Phase 1 at Blocks OJ and OL – February 2007 (Leon van Biljon and Charles Linstrom). The main findings of the study are summarized below;
  - This report found that two dams are located within the study area; a small dam embankment that will be completely breached and a larger, irrigation dam;
  - The report was intended to survey methods of breaching the dam wall and construct hydraulic models to determine final 1:50 and 1:100 year flood lines;
  - Design considerations included separating clean and dirty water, reducing the existing floodplain by breaching the existing embankment and determining 1:100 and 1:50 year flood lines after breaching the dam wall, as well as impacts on neighbours;
  - Catchment area surface area sise is 1.744 km^2;
  - Catchment slope is 1.2%;
  - Catchment response time is 2.36 hours;
  - Soil is permeable, veld and in good conditions 100% (60);
  - Peak flow for a 1:50 year event is 4.0 m^3/s;
  - Peak flow for a 1:100 year event is 4.9 m^3/s;
  - Cross sections of the study area were extracted from the DTM and water levels were calculated with the steady state analyses option of HEC-RAS;
  - 2 scenarios were modeled, with and without the dam wall;
  - The following graph illustrates the results of the investigation on a longitudinal profile of the 1:100 year flood event;

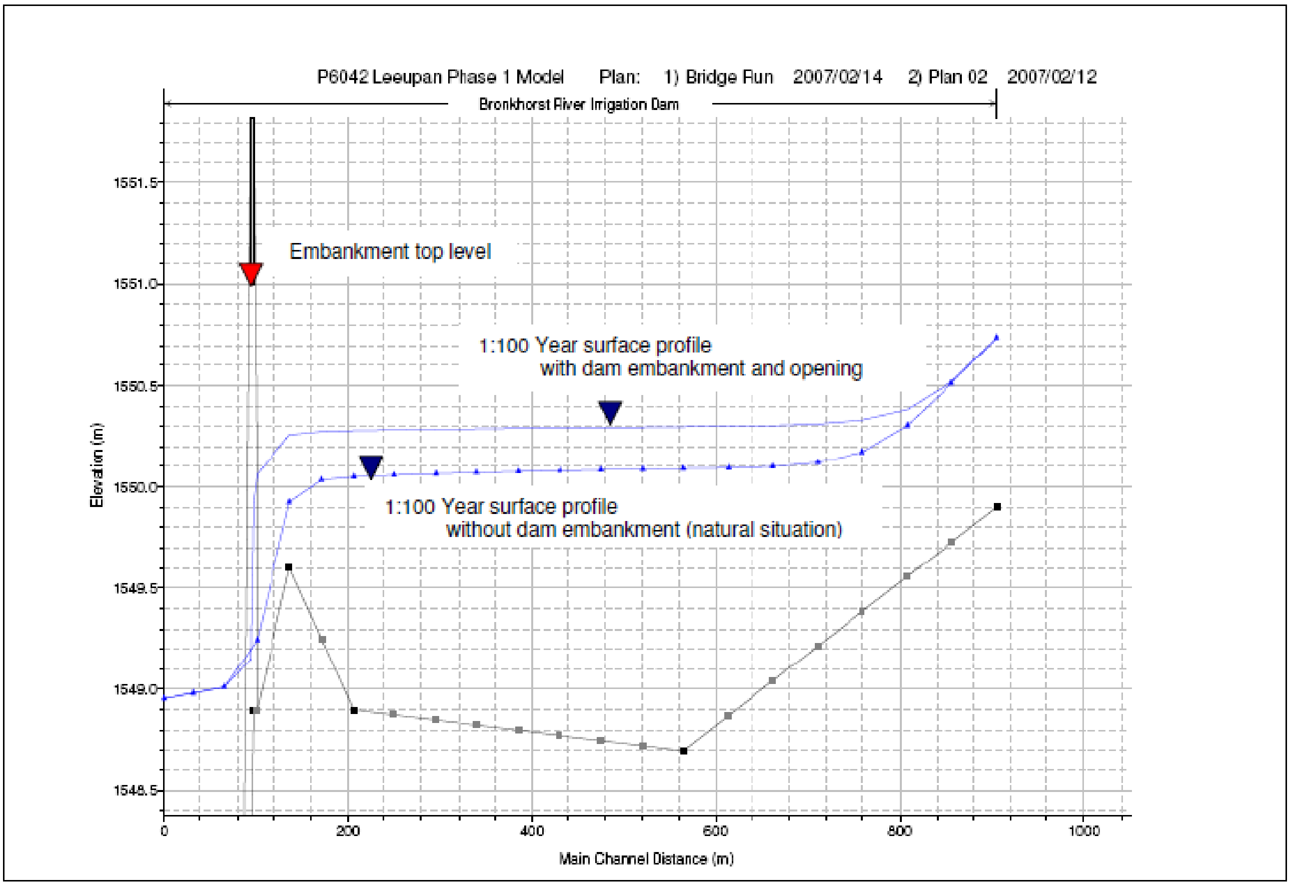


Figure 4.28 Longitudinal profile of the 1:100 year flood

- It is evident from the figure above that the breached embankment has a backwater effect on the water surface profile;
- The water surface profile is increased with approximately 250 mm compared to the natural flow situation;
- It was decided that the existing irrigation dam wall should act as a hydraulic control;
- It was found that flood lines upstream of the irrigation dam are affected by the earth fill embankment of the irrigation dam, creating a significant backwater effect;
- It was calculated that the earth embankment be overtopped by almost 1 m during the 1:100 year flood event;
- It was decided that backwater levels should not be more than 0.6 m above the nominal full supply level of the dam, that the flow velocity be less than 4 m/s and the ratio of the design flow to natural flow velocity not exceed 1.67;
- The following conclusions were drawn:
  - It was found that a nominal breach of the wall that resulted in design flow velocities of 4 m/sec would not reduce the 1:100 year flood line significantly;

- The breach, located above the old river channel should be 65 m wide; and
- A 500 mm by 10 m lined channel be provided at the old river channel to prevent scour;

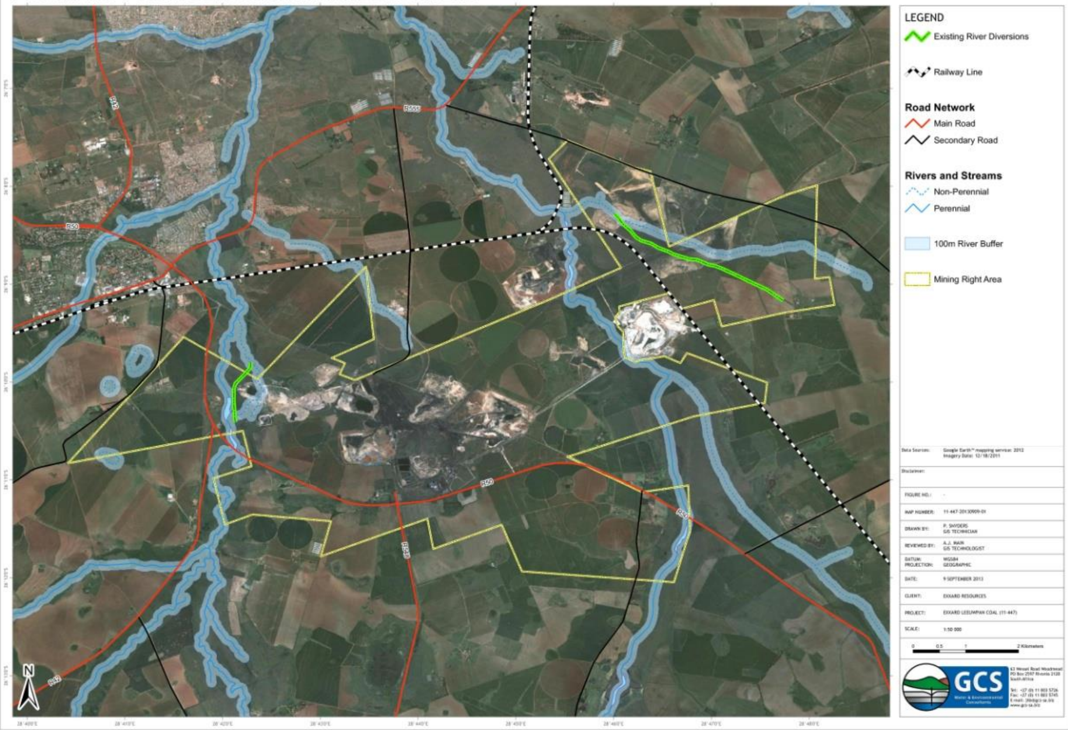
o No figures, plans, or maps of the flood lines are available.

No information was reviewed on the Tributary of the Bronkhorstspruit River – West (Witklip area). A diversion channel is present at this area which changes the flood line dynamics of the natural river. It is assumed that the original flood lines as well as post development of the diversion channel flood lines were assessed previously. It is further assumed that this assessment of the flood lines and consequent design of the diversion channel are in accordance to legislation.

Analyses on the Bronkhorstspruit River – South (new proposed pit mining area) indicate that the proposed mining area is far away from the stream (approximately 1km) and that there is no immediate or significant risk or associated potential negative impact on the watercourse. Conclusions from these analyses show that the 100m buffer area is thus in accordance with legislation.

The following map shows the 100m buffer areas around all streams.

FIGURE 7.2 : 100M BUFFER AREAS AROUND RIVERS



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 4.29: 100m Buffer Area around rivers

4.6.5.1 Surface water quality

Both the Wilge River and the Bronkhorstspruit are relatively unpolluted, but nuisance macrophytes do occur. The Total dissolved salts concentrations and sodium absorption ratios of the water in the Wilge river catchment are usually higher during winter than in the summer rainy season. This is due to seasonality and by the fact that water regulating structures reduce the stream flow downstream. Restrictions are imposed on the construction of dams in order to limit this effect.

The catchment can be considered to be sensitive as the Wilge River has a marked positive effect on the Olifants River water quality before it reaches the Loskop dam. Without the alkaline contribution from the Wilge River, serious water quality problems may be expected in the Loskop Dam, where metal concentrations hinge on a fine margin as a result of acid mine drainage in the catchment.

Most of the monitored points showed no significant impact from mining activities with the exclusion of the Weltevreden Spruit and the River diversion. At the Weltevreden Spruit in general, the variable concentration was higher at the downstream locality than at the upstream locality. Water from the downstream location at the River diversion showed a higher SO_4 dominance compared to the upstream location.

The chemical composition of most of the monitored points remained stable throughout the monitoring period except for the two points described above (Weltevreden Spruit and River diversion).

The average water quality at all of the monitored points can be described as neutral and non-saline.

The following graph illustrates the temporal trends observed in the water quality composition (ph, EC, and SO_4 concentrations) of the Bronkhorst Spruit up and down stream monitoring localities.

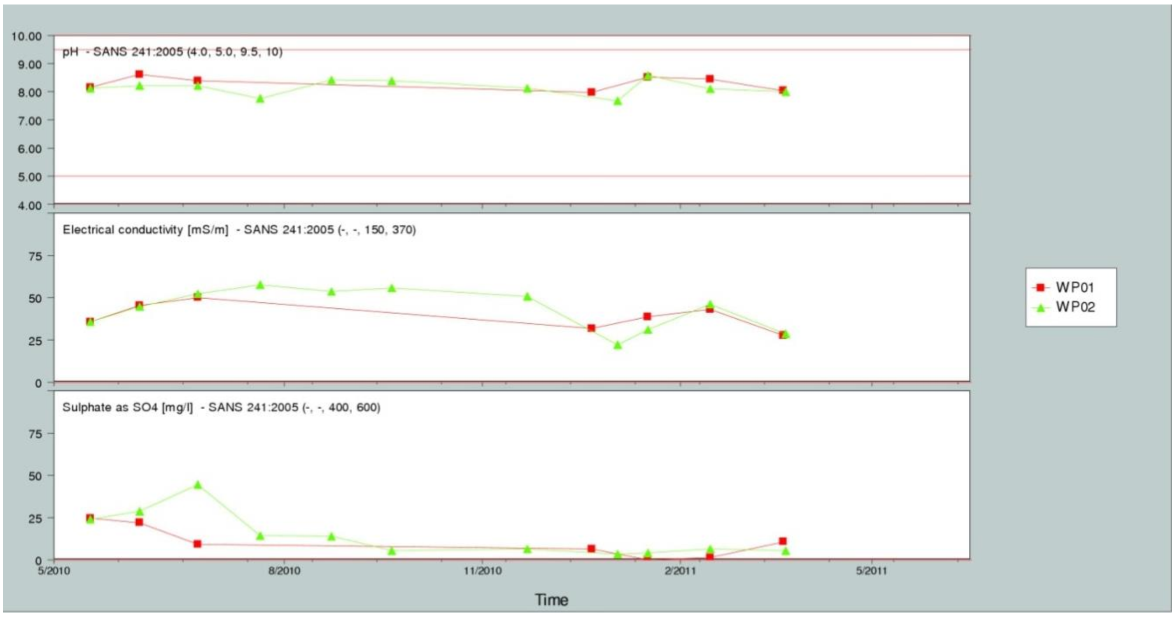


Figure 4.30 Bronkhorst Spruit water quality trends

4.6.5.2 Mine surface water

Most of the monitored points remained stable throughout the monitoring period except for the Sewage Plant and Workshop area. The average water quality of all the monitored points can be described as neutral. Most points can also be described as saline and hard with the exception of the 2 points above being described as non-saline.

The following graph illustrates the temporal trends observed in the water quality composition (ph, EC, and SO_4 concentrations) of the Witklip Area.

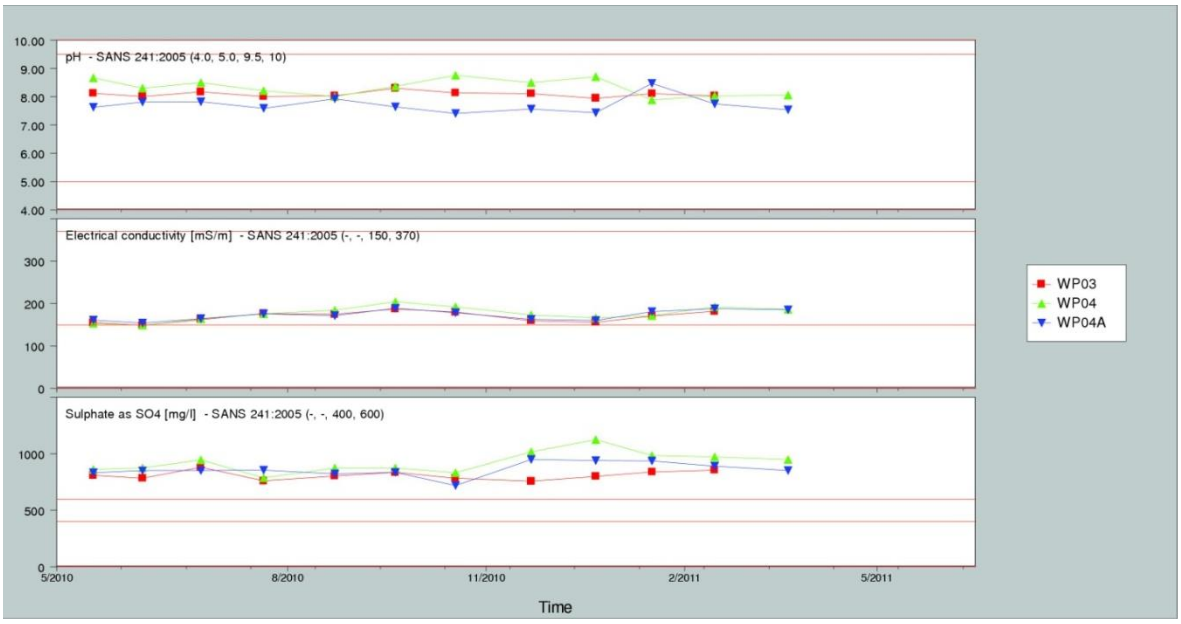


Figure 4.31 Witklip Area water quality trends

4.6.5.3 Drinking water

Ideal water quality (class 0) could be obtained at all of the monitored points for the majority of the monitoring period. Only 3 samples showed inconsistencies as follows;

- Good water quality (class 01) at LWDT during September 2010 as a result of raised Mn levels;
- Marginal water quality (class 02) at LWDP in April 2011 as a result of the high level of E. coli and total coliforms detected; and
- Poor water quality (class 03) at LWDO during July 2010 as a result of the very high level of total coliforms detected.

4.7 Groundwater

The information contained in this section of the report was obtained from the Groundwater Assessment conducted by GCS, attached herewith as Appendix C-4.

4.7.1 Aquifer Description

The new mining area is underlain by a sedimentary rock succession of the Vryheid Formation of the Ecca Group which forms part of the Karoo Supergroup. The sedimentary phases of the Karoo succession originated with the onset of the Dwyka Formation tillite and fluvio-glacial sediments on the glacial weathered palaeotopography of the pre-Karoo succession. There is a presence of reported dolerite dykes, faults and fractures within the strata of the study area.

It is likely that the following three aquifers exist within the proposed mining area. These aquifers vary with regard to aquifer characteristics and are generally interconnected by fractures and faults:

- A shallow aquifer formed in the weathered zone, perched on the fresh bedrock;
- A deeper aquifer formed by fracturing of the Karoo sediments and dolerite intrusions; and
- A Dolomite & Chert rich aquifer of the Malmani Subgroup.

Unconsolidated colluviums and weathered sediments overlie the consolidated formations and dolerite intrusions. The depth of the weathering range between 5 to 12 mbgl in the study area and experiences relatively high recharge from rainfall (3%) (Hodgson *et. al.*, 2007). The water level of this perched aquifer is shallow and may daylight as springs occasionally when intersected by barriers such as topography, dykes and basement highs in valleys and topographic lows/depressions (Hodgson *et. al.*, 2007). This aquifer is low yielding (50 - 500l/h) due to the thickness. As a result, groundwater is not abstracted from this aquifer. This aquifer is important as it often acts as a pathway for contaminants migrating from surface activities to surface water bodies such as rivers.

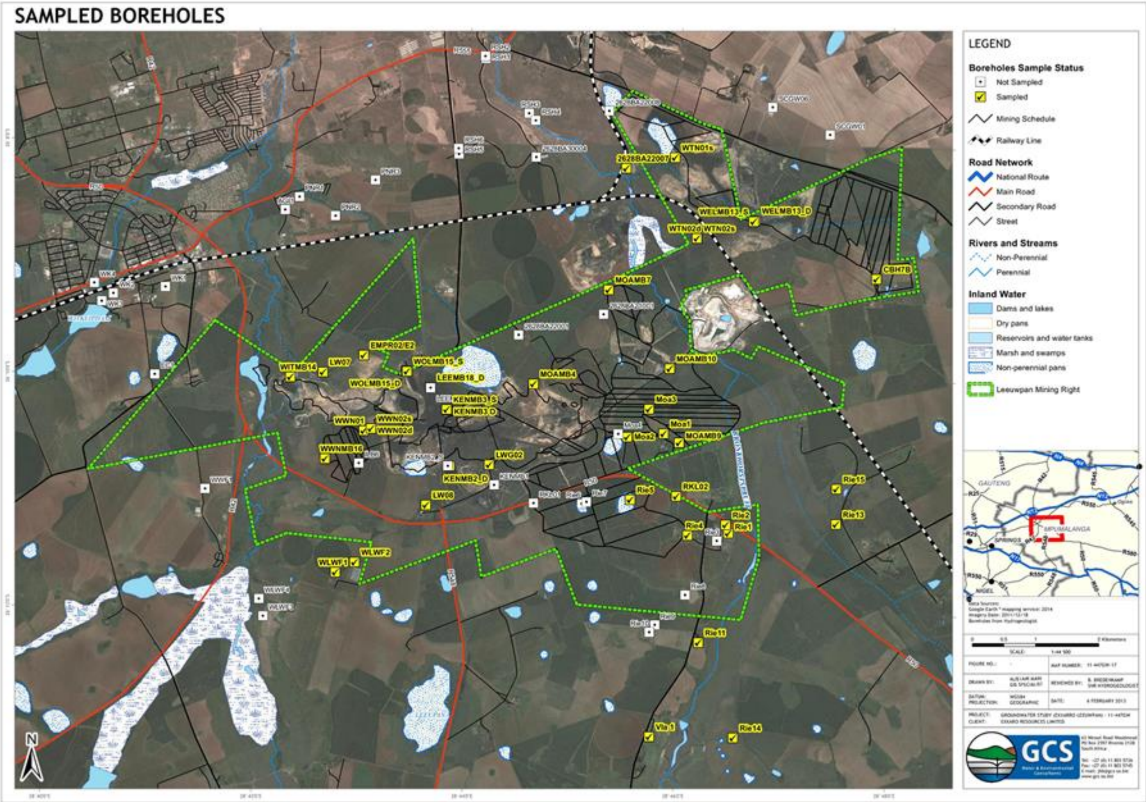
Most of the groundwater flow will be along the fractures, cracks and joints that occur in the rock. These conductive zones effectively interconnect the strata of the Karoo sediments, both vertically and horizontally into a highly heterogeneous and anisotropic unit. The fractured Karoo aquifer can be classified as the secondary source aquifer in this instance. It is generally considered low yielding (Parsons, 1995) and display characteristics of the intergranular and fractured regime, which indicate groundwater storage and flow occurs mainly within the fractures of the rock. This aquifer is reported to be approximately 40m thick. From previous investigation in similar geological units the saturated hydraulic conductivity of the Ecca Group was found to vary between 1x 10-1 and 1 x 10-3m/day.

The Malmani Subgroup forms the main aquifer, and consists mainly of alternating layers of chert free dolomite and chert rich dolomite. (Visser, 1989). Overlying this is the Vryheid Formation of thick sandstone and gritstone alternated by sandy shale and coal beds. The Dwyka Formation separates the dolomitic aquifer from the Vryheid Formation. It consists of gravely diamictite with minor varved shale and mudstone that is less permeable than both the Vryheid Formation and the Malmani dolomite. The Dwyka is normally considered as an aquiclude. An effective depth of 300m has been accepted as the maximum depth to which significant dissolution of the dolomite has been taking place. A hydraulic conductivity that varies between 10 to 100m/day is considered representative of the Malmani dolomite.

4.7.2 Ground water quality

A total of 41 groundwater samples were assessed, taken from the hydrocensus and mine monitoring boreholes (existing and newly drilled). The analytical results were compared to the Department of Water Affairs' South African Water Quality Guidelines for Domestic Use Target Values (DWA SAWQTV) and South Africa National Standard (SANS 241-1:2011)

Drinking Water Standard in order to evaluate the groundwater quality. The average background groundwater quality was also included in the analytical result tables for comparative purposes. The analytical results can be seen in Table 4.11. The baseline groundwater characteristics were presented with a Piper- and Stiff diagrams for the analytical results of groundwater collected from hydrocensus and monitoring boreholes.



(Figure not to scale- refer to Appendix A for enlarged map)

Figure 4-32 Sampled Boreholes

4.7.3 Hydrocensus Water Quality Results (2012)

A total of 16 water samples were collected during the GCS hydrocensus investigation in 2012. The water samples obtained mainly represented samples from production boreholes which are mainly used for domestic water supply or livestock watering. The hydrocensus groundwater quality results are outlined in **Table 4.11**. The following observations were made from the results:

- Rie1 and Rie2 only exceeded the SANS 241 Drinking water limits for nitrates (NO_3);
- Rie5 has exceeded the SANS 241 Drinking water limits for manganese (Mn) and iron (Fe); and

- The remainder of the boreholes and their constituents remained compliant with the relevant standard limits for drinking water.

Table 4.11: Hydrochemistry Results - 2012

Parameter (mg/l)	SAWQG Domestic Use Target Values	SANS 241-1: 2011 Drinking Water Standard	Background groundwater quality	Moa1	Moa2	Moa3	Vla1	Rie1	Rie2	Rie4	Rie5	Rie11	Rie13	Rie14	Rie15	2628BA22007	CBH7B	WLWF2	WLWF1
pH at 25ºC	6-9	5-9.7	7.6	7.7	7.9	7.9	7.5	7.3	7.7	7.4	6.8	8	7.6	8.2	8	7.67	7.33	7.43	7.5
Conductivity mS/m @ 25˚C	<70	<170	39	83.9	47.7	47.6	37	77.9	63	28	56.4	39.8	51.7	52.4	44.1	47.9	22.35	23.91	27.68
Total Dissolved Solids	<450	<1200	239	580	310	288	256	606	396	216	358	250	310	314	274	257	107	112	143
Calcium, Ca	<32	NS	28	79	39	37	42	63	51	21	53	27	23	16	13	46.26	16.77	19.25	26.68
Magnesium, Mg	<30	NS	15	44	17	20	10	36	23	10	26	9	12	9	9	26.66	7.35	12.78	16.09
Sodium, Na	<100	<200	23	29	26	26	10	13	31	13	26	38	59	74	66	9.92	13.25	9.22	9.7
Potassium, K	<50	NS	5	4.8	9.7	6.5	9.9	8.3	5.2	8.7	6.8	6.5	3.9	3.9	2.3	3.32	2.39	2.4	2.67
Total Hardness as CaCO3	NS	NS	130	328	167	175	146	305	222	94	239	104	107	77	69	225	72	101	133
Bicarbonate, HCO_3	NS	NS	160	293	244	219	200	122	210	122	341	215	205	224	219	132.9	67.3	97.4	119.3
Carbonate, CO_3	NS	NS	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chloride, Cl	<100	<300	25	35	30	40	13	95	57	15	18	23	59	57	32	15.76	17.97	5.82	8.37
Sulphate, SO_4	<200	<500	18	187	15	35	<5	9	19	<5	<5	9	25	13	19	73.82	8.09	<0.13	3.68
Nitrate, NO_3	<26.6	<48.7	4	3.1	11	1	19	146	66	26	0.8	8.4	2.7	1.1	0.9	0.947	0.06	3.55	4
Fluoride, F	1	1.5	0.3	0.2	0.2	0.3	<0.2	<0.2	0.2	0.2	0.2	0.3	0.6	1.1	0.7	<0.183	0.292	<0.183	0.217
Aluminium, Al	<0.15	NS	0.1	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	0.12	<0.100	<0.100	<0.100	<0.100	<0.100	<0.006	<0.006	<0.006	<0.006
Manganese, Mn	<0.05	0.5	0.2	<0.025	<0.025	0.052	<0.025	<0.025	<0.025	<0.025	14	0.076	<0.025	<0.025	0.032	<0.001	<0.001	<0.001	<0.001
Iron, Fe	<0.1	2	0.2	0.092	0.03	0.052	0.046	<0.025	<0.025	0.414	14	0.095	0.095	<0.025	0.113	<0.006	<0.006	<0.006	<0.006
Zinc, Zn	<3	5	0.1	0.755	0.043	<0.025	0.33	0.028	<0.025	0.034	0.025	0.055	0.286	<0.025	<0.025	<0.004	<0.004	<0.004	<0.004
Lead, Pb	<0.01	0.01	BDL	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.006	0.001	<0.001	<0.001
Copper, Cu	<1.0	2	BDL	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.001	<0.001	<0.001	<0.001
Cobalt, Co	NS	<0.5	BDL	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.002	<0.002	<0.002	<0.002
Exceeding least stringent limit																			
Exceeding most stringent limit																			

As indicated in the Piper plot (Figure **4-33**), most of the water samples that were analysed plot within the middle section of diamond field, which indicate water with a calcium-magnesium-bicarbonate nature, which is indicative of an aquifer of dolomitic nature.

Figure 4-34 presents a compilation of stiff diagrams for the hydrocensus boreholes and correlates with the results from the piper diagram in Figure **4-33**.

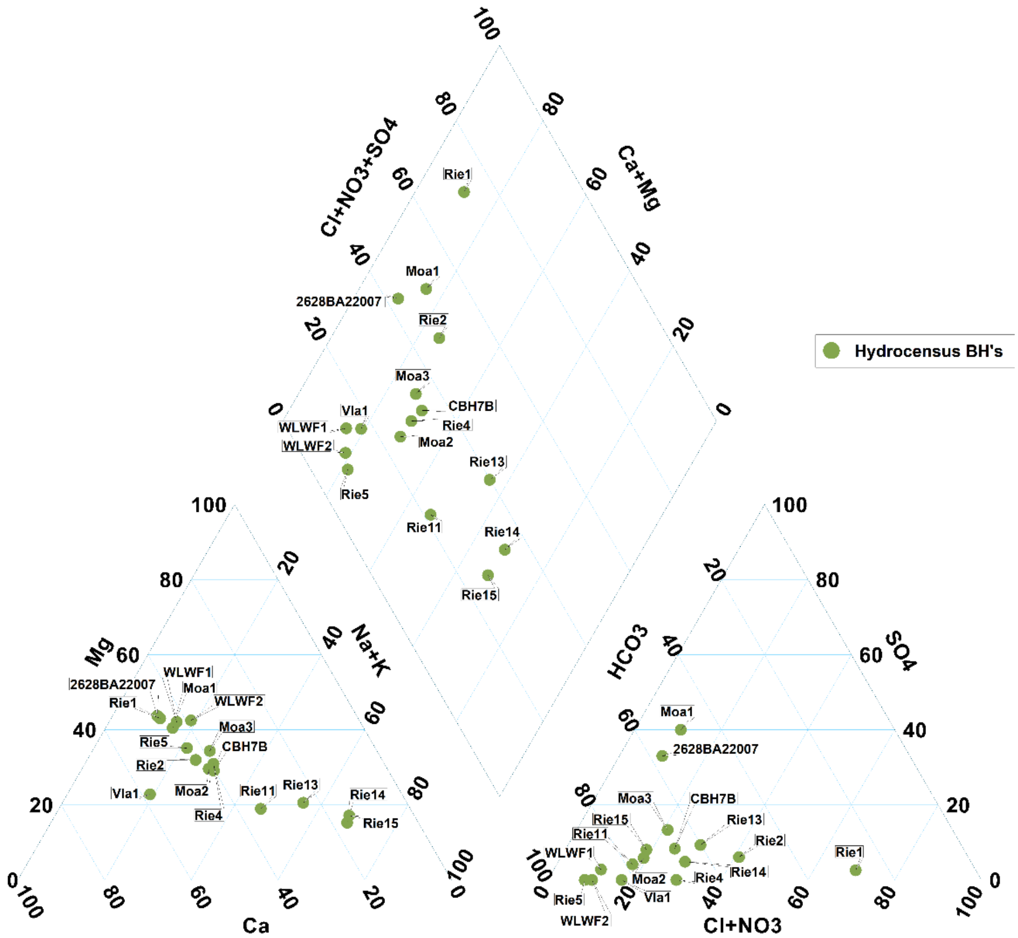


Figure 4-33: Hydrocensus Piper Plot

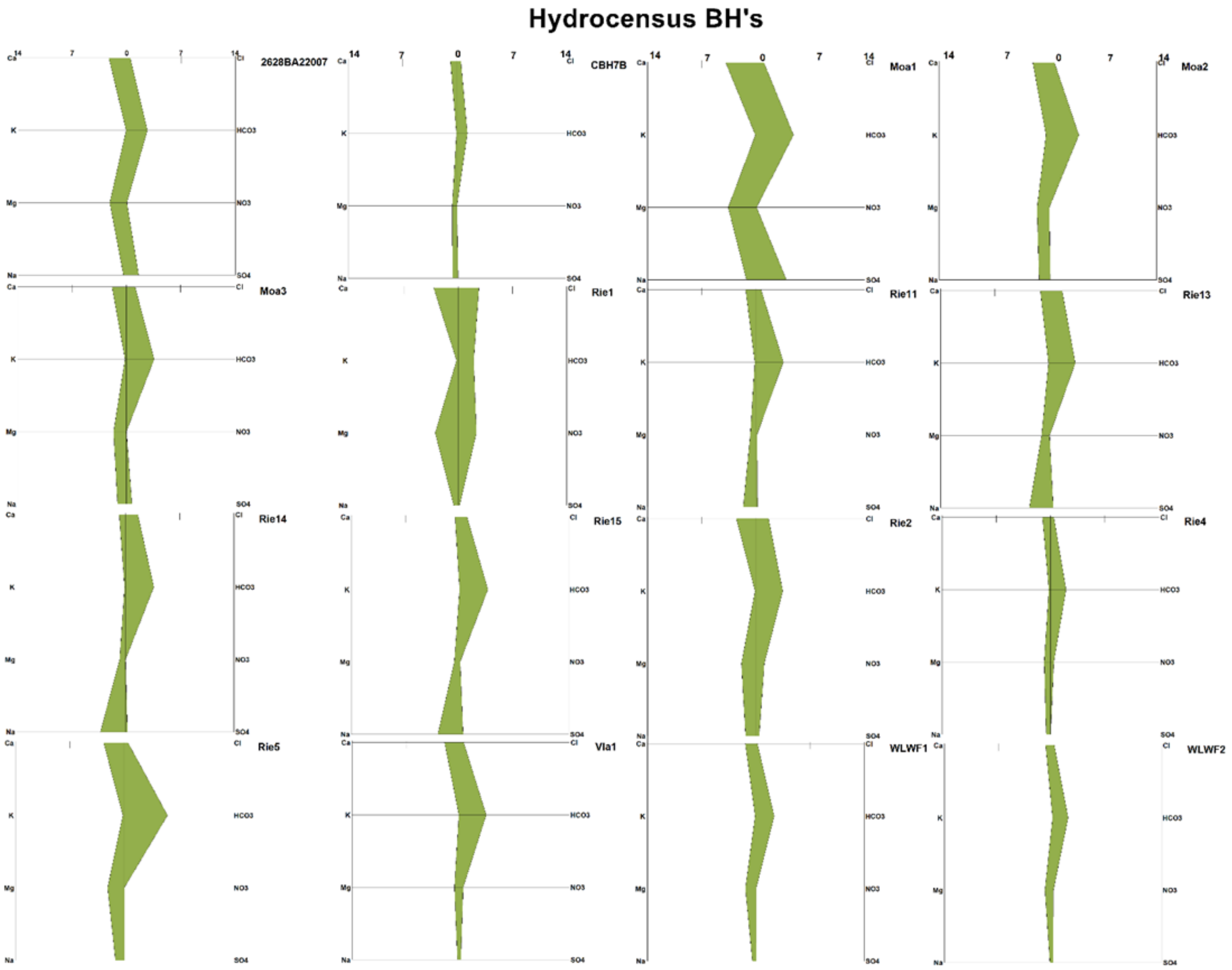


Figure 4-34: Stiff Diagrams for the Hydrocensus Boreholes (also refer to specialist study)

According to the Piper plot below (Figure 4-35), a number of monitoring points plot within the sulphate dominant field (Ca, Mg – SO4), which suggests mining related impacts (WWN02d, WWN02s; WTN02s; and WWN01).

The remainder of the existing monitoring boreholes plot towards the middle section of the plot, which is indicative of calcium-magnesium-bicarbonate nature.

Figure 4-36 presents a compilation of the stiff diagrams for the various existing monitoring boreholes and results correlated well with the results of the piper plot in Figure 4-35.

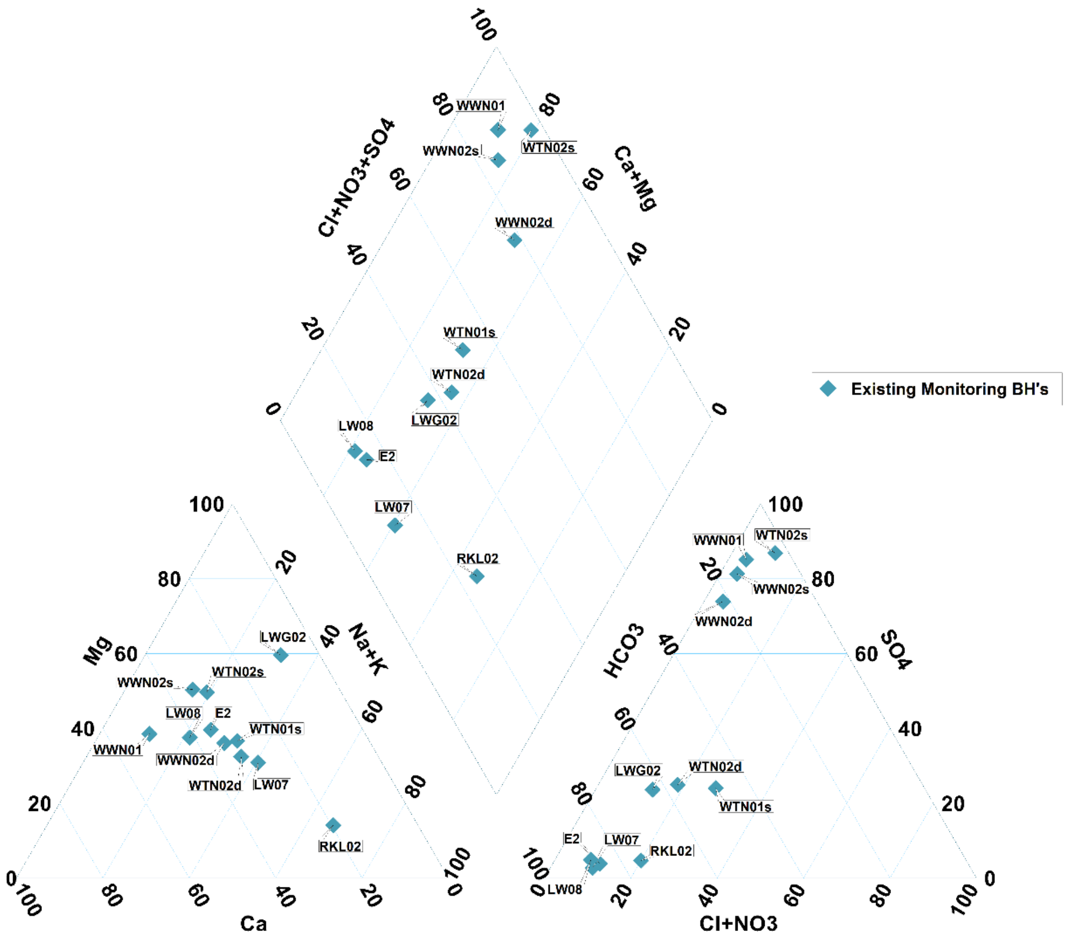


Figure 4-35: Existing Monitoring Boreholes Piper Plot

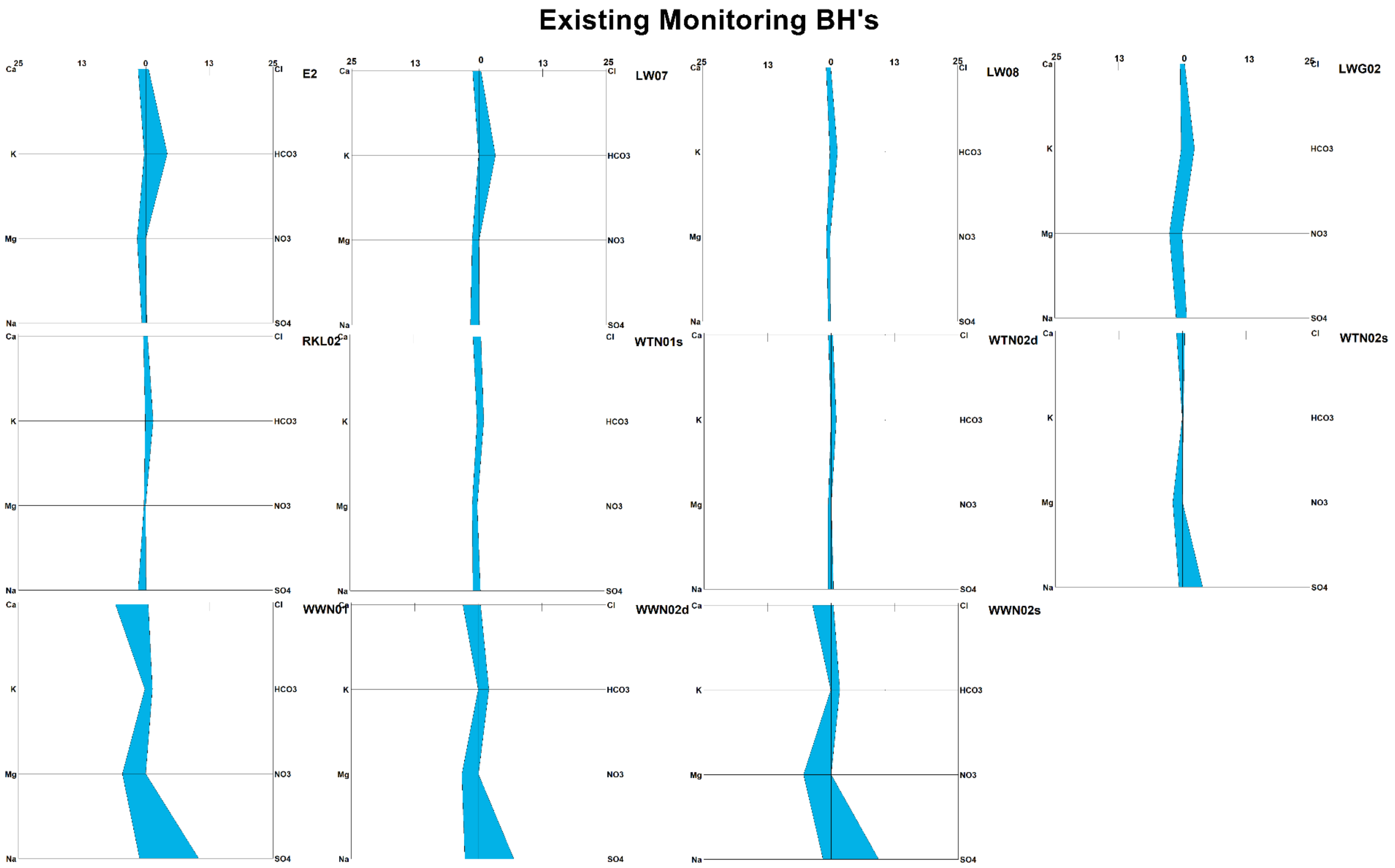


Figure 4-36: Stiff Diagrams for the Existing Monitoring Boreholes (also refer to specialist study)

4.7.4 Existing Monitoring Boreholes' Water Quality Results (2012)

The existing groundwater monitoring boreholes exceeded the following compliance objectives (**Table 4.12**):

- The fluoride concentration in monitoring borehole WTN02s exceeded SANS 241 Drinking water standard of 1.5 mg/l;
- Three monitoring boreholes (WTN02s and WTN01s), exceeded the concentration compliance objectives for manganese;
- Monitoring boreholes E2, WWN02s and WWN02s exceeded the SANS 241 Drinking water standard for iron;
- The sulphate concentrations that were detected in monitoring borehole WWN01 exceeded the SANS 241 Drinking water standard 500 mg/l; and
- Although the sulphate concentrations in borehole WWN02d, WWN02s were compliant with the SANS 241 Drinking water standard, they were elevated and exceeded the SAWG Domestic Use Target Value. Boreholes WWN02s and WWN02d are located up gradient of the dam west of the OD block opencast. Borehole WNN01 is located up gradient of this dam.

Table 4.12 Existing Monitoring Borehole Chemistry Results (2012)

Parameter (mg/l)	SAWQG Domestic Use Target Values	SANS 241-1: 2011 Drinking Water Standards	Background groundwater quality	WTN01s	WTN02d	WTN02s	E2	LW07	LW08	RKL02	WWN01	WWN02d	WWN02s	LWG02
pH at 22ºC	6-9	5-9.7	7.6	7.97	7.67	6.87	7.35	8.34	7.97	8.84	6.97	7.88	7.86	8.79
Conductivity mS/m @ 25˚C	<70	<170	39	20.3	12.7	12.5	61.0	43.4	18.3	22.0	102.6	84.4	98.4	42.8
Total Dissolved Solids	<450	<1200	239	153.0	104.0	277.0	264.0	219.0	97.0	122.0	776.0	588.0	707.0	222.0
Calcium, Ca	<32	NS	28	16.5	11.7	24.0	30.3	25.1	15.7	9.1	119.0	61.4	73.3	7.5
Magnesium, Mg (mg/l)	<30	NS	15	12.0	7.2	23.3	20.7	16.4	8.7	4.0	55.6	39.7	65.9	30.2
Sodium, Na	<100	<200	23	19.5	14.3	15.8	17.9	39.0	8.2	33.9	27.6	61.5	36.7	26.8
Potassium, K	<50	NS	5	1.3	1.3	2.1	11.8	3.1	2.0	2.4	6.7	1.9	3.2	5.8
Total Hardness as $CaCO_3$	NS	NS	130	90.0	59.0	156.0	161.0	130.0	75.0	39.0	526.0	317.0	454.0	143.0
Bicarbonate, HCO_3	NS	NS	160	78.3	60.6	8.8	257.6	196.2	88.7	89.9	80.6	124.7	103.7	148.8
Chloride, Cl	<100	<300	25	25.9	10.9	16.0	19.0	12.7	4.8	13.7	17.9	14.6	16.1	18.0
Sulphate, SO_4	<200	<500	18	30.6	21.0	189.9	9.1	4.9	4.0	4.4	501.1	334.5	449.0	43.9
Nitrate as NO_3	<6	<11	4	0.21	0.93	0.30	0.26	0.09	0.21	0.31	0.12	0.13	0.13	0.17
Fluoride, F	1	1.5	0.3	<0.183	<0.183	1.87	0.337	0.244	<0.183	<0.183	<0.183	0.409	0.191	<0.183
Aluminium, Al	<0.15	NS	0.1	<0.006	0.02	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
Manganese, Mn	<0.05	0.5	0.2	1.002	<0.001	5.3	0.14	<0.001	<0.001	<0.001	<0.001	<0.001	0.018	<0.001
Iron, Fe	<0.1	2	0.2	<0.006	<0.006	10.6	2.24	<0.006	<0.006	0.024	0.163	<0.006	2.03	<0.006
Zinc, Zn	<3	5	0.1	<0.004	<0.004	<0.004	0.017	<0.004	<0.004	<0.004	0.023	<0.004	<0.004	<0.004
Cobalt, Co	NS	<0.5	BDL	0.011	<0.002	0.021	<0.002	-0.002	<0.002	-0.002	<0.002	<0.002	<0.002	<0.002
Copper, Cu	<1.0	2	BDL	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Exceeding least stringent limit														
Exceeding most stringent limit														

4.7.5 New Monitoring Boreholes Water Quality Results (2013-2014)

A total of fourteen (14) groundwater samples were collected from the water bearing boreholes. Six (6) groundwater samples were collected during the aquifer testing from 4 December to 14 December 2013. An additional eight (8) groundwater samples were collected on 10 January 2014 using disposable bailers. Borehole KENMB1, KENMB2_S and LEEMB18_S could not be sampled due an insufficient water column in the boreholes at the time of sampling.

The water quality results are presented in Table 4.8 graphically presents the dominant water quality domain of the groundwater at Leeuwpan in the form of a piper plot.

The following observations were made from the results:

- The SANS 241 Drinking water standard was exceeded for sulphate in boreholes: KENMB3_D, MOAMB10, LEEMB18_D and KENMB2_D;
- The TDS concentrations exceeded SANS 241 Drinking water standard in boreholes: KENMB3_D, MOAMB10 and KENMB2_D; and
- Manganese concentrations exceeded the SANS 241 Drinking water standard in MOAMB10 and WELMB13_D.

In KENMB2_D and WELMB13_D the concentrations for electrical conductivity (EC) and iron exceeded the SANS 241 drinking water standard.

Table 4.13 Water Quality Results for the New Monitoring Boreholes (2013-2014)

Parameter (mg/l)	SAWQG Domestic Use Target Values	SANS 241-1: 2011 Drinking Water Standard	Background groundwater quality	WOLMB15_D	WOLMB15_S	KENMB3_D	KENMB3_S	MOAMB10	LEEMB18_D	MOAMB4	MOAMB9	WITMB14	WELMB13_D	WELMB13_S	KENMB2_D	WWNMB16	MOAMB7
pH at 22ºC	6-9	5-9.7	7.6	7.55	6.74	7.7	6.63	7.19	7.63	6.54	7.37	7.72	5.83	8.37	7.63	8.11	5.88
Conductivity mS/m @ 25˚C	<70	<170	39	54.1	69.3	170	86.2	166	112	10.6	30.5	75.2	31	36.7	179	26.7	11.2
Total Dissolved Solids	<450	<1200	239	384	499	1327	648	1268	903	81	193	466	191	203	1498	162	82
Calcium, Ca	<32	NS	28	52.5	69.5	210	61.9	216	148	4	23.7	63.8	23.2	27.3	223	22.2	4.79
Magnesium, Mg	<30	NS	15	24.3	38.2	122	28.4	115	61.4	3.13	11.1	38.8	15.5	13.3	126	12.5	4.63
Sodium, Na	<100	<200	23	18.9	11.5	34.8	84	16.8	29.8	4.85	18.7	36.3	0.804	11.2	32.3	4.81	3.56
Potassium, K	<50	NS	5	3.93	4.73	8.31	2.59	4.94	4.52	4.43	3.6	2.68	1.45	3.44	7.17	3.94	3.24
Free and Saline Ammonia as NH_4	<1	NS	0.5	0.315	0.083	0.03	0.104	0.36	0.036	0.048	0.089	0.069	0.233	1.69	0.042	0.637	0.081
Total Hardness as CaCO3	NS	NS	130	231	331	1028	271	1014	624	23	105	319	122	123	1073	107	31
Total Alkalinity as $CaCO_3$	NS	NS	57	118	46.3	218	219	121	140	-2.48	109	275	16.5	55.1	227	105	17.5
Bicarbonate, HCO_3	NS	NS	160	117	46.3	217	219	121	139	-0.01	109	274	16.5	53.8	226	104	17.5
Chloride, Cl	<100	<300	25	19.3	15	15.1	19.6	9.77	11.6	14.4	24.5	15.6	3.45	13.1	11.8	6.02	6.17
Sulfate, SO_4	<200	<500	18	135	274	749	211	809	520	15.1	11.9	105	112	93.3	901	8.08	15.9
Nitrate, NO_3	<26.6	<48.7	4	3.17	2.49	0.457	8.99	0.442	1.77	0.968	0.568	1.6	0.262	0.357	0.263	4.06	1.24
Fluoride,F	1	1.5	0.3	0.232	0.135	0.091	0.235	0.132	0.226	0.332	0.314	0.299	1.16	0.336	0.094	0.187	0.135
Aluminium, Al	<0.15	NS	0.1	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	0.748	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
Manganese, Mn	<0.05	0.50	0.2	-0.001	-0.001	-0.001	0.173	0.797	0.093	-0.001	0.058	0.033	0.612	0.077	-0.001	0.212	-0.001
Iron, Fe	<0.1	2	0.2	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	0.124	-0.003	-0.003	3.25	-0.003	-0.003	-0.003	-0.003
Zinc, Zn	<3	5	0.1	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	0.009	-0.002
Lead, Pb	<0.01	0.01	BDL	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004
Copper, Cu	<1.0	2.0	BDL	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Total Chromium, Cr	NS	0.05	BDL	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Boron, B	NS	NS	0.03	0.014	0.008	-0.003	0.018	0.05	0.014	0.017	0.018	0.023	0.023	0.095	0.006	0.019	-0.003
Phosphate as PO_4	NS	NS	BDL	-0.008	-0.008	-0.008	-0.008	-0.008	-0.008	-0.008	-0.008	-0.008	-0.008	-0.008	-0.008	-0.008	-0.008
Barium, Ba	NS	NS	0.1	0.08	0.091	0.042	0.192	0.054	0.072	0.249	0.104	0.231	0.103	0.065	0.019	0.04	0.138
Beryllium, Be	NS	NS	BDL	-0.001	0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	0.001	0.001	-0.001	0.001	-0.001	-0.001
Bismuth, Bi	NS	NS	0.01	0.041	0.017	0.036	-0.004	0.017	0.034	0.019	0.033	0.034	0.015	-0.004	0.023	-0.004	-0.004
Cadmium, Cd	<0.005	<0.005	BDL	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Cobalt, Co	NS	<0.5	0.00	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Lithium, Li	NS	NS	0.01	0.014	0.001	0.012	0.005	0.028	0.016	0.01	0.03	0.008	0.05	0.004	0.012	0.002	0.004
Molybdenum, Mo	NS	NS	0.01	0.018	0.012	0.014	0.019	0.02	0.019	0.009	0.013	0.016	0.008	0.015	0.016	0.018	0.013
Nickel, Ni	NS	<0.15	BDL	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Silver, Ag	NS	NS	BDL	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Strontium, Sr	NS	NS	0.1	0.308	0.256	1.2	0.344	1.38	0.626	0.068	0.207	0.199	0.15	0.18	1.02	0.094	0.044
Thallium, Tl	NS	NS	BDL	-0.037	-0.037	-0.037	-0.037	-0.037	-0.037	-0.037	-0.037	-0.037	-0.037	-0.037	-0.037	-0.037	-0.037
Vanadium, V	<0.1	<0.2	BDL	-0.001	-0.001	0.002	0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	0.006	-0.001	-0.001

Exceeding least stringent limit
Exceeding most stringent limit

The dominant water type according to Figure 4-37 is calcium/magnesium-sulphate rich which is indicative of mining related impacts. Only boreholes: WITMB14, KENMB3_S, WWNMB16 and MOAMB9 are calcium/magnesium-bicarbonate of the plot.

A compilation of stiff diagrams for the various new monitoring boreholes were compiled and presented in Figure 4-37.

The results in the stiff diagrams correlate with the results obtained in the piper plot.

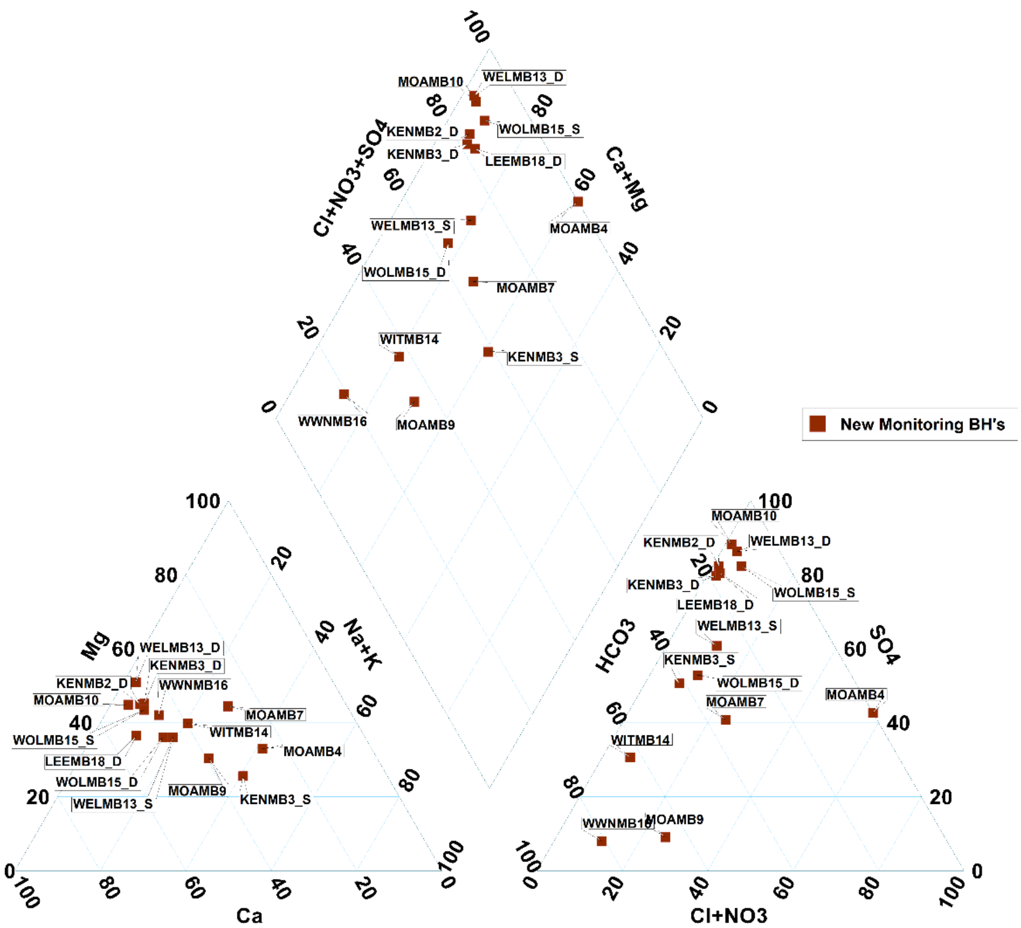


Figure 4-37: New Monitoring Borehole Piper Plot

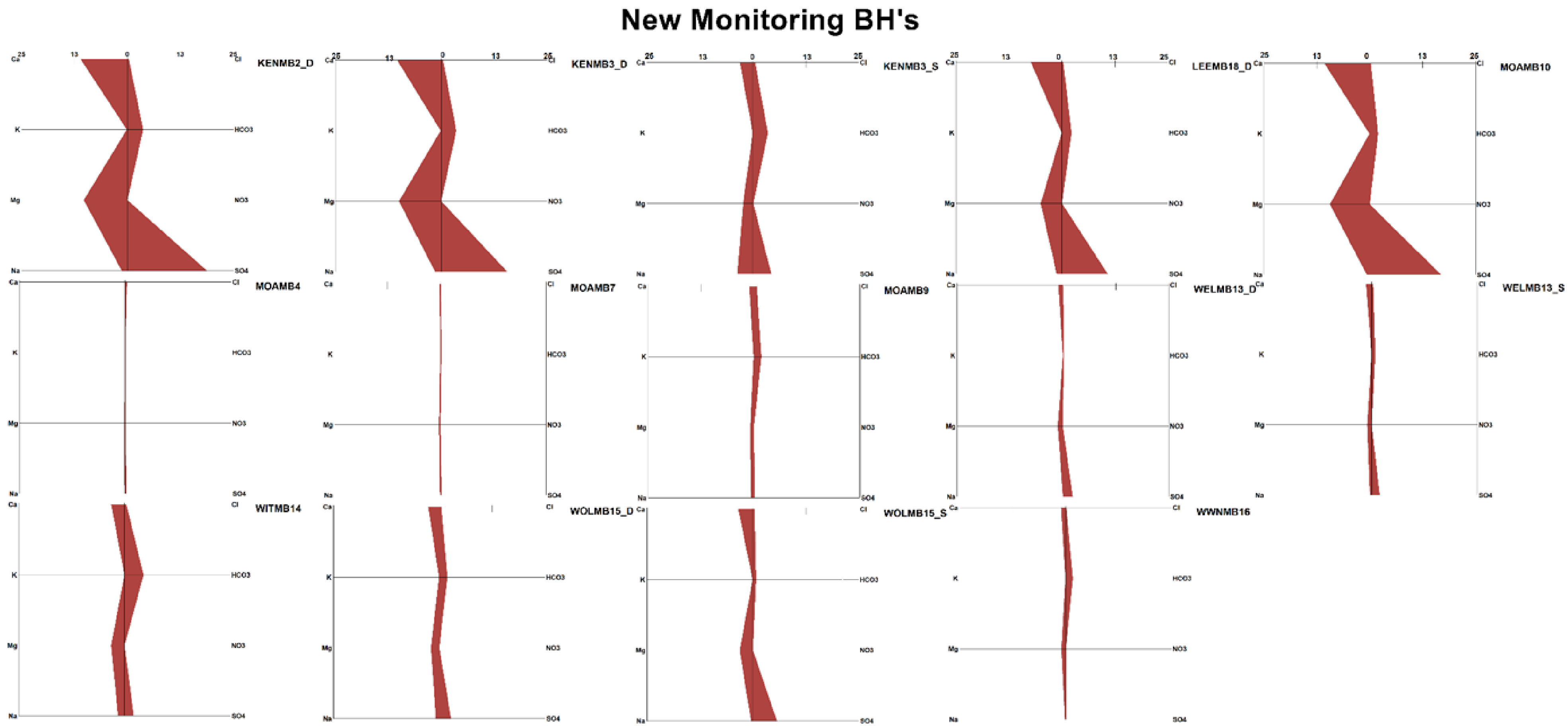


Figure 4-38: Stiff Diagrams of the New Monitoring Boreholes (refer to specialist study)

4.7.6 Spatial Analysis

The hydrochemical results for all of the boreholes were compiled and spatially analysed in order to determine the collective influence of contamination across the entire Leeuwpan Coal Mine area. Figure 4-39 presents a collective piper plot for all of the boreholes discussed.

The dominant water type remains the calcium/magnesium-bicarbonate water which is indicative of water that is un-impacted by coal mining activities. A secondary type of calcium/magnesium-sulphate-chloride water is also found which indicates groundwater impacts related to mining activities. Sodium-bicarbonate type water is also present in the area.

Figure 4-40 presents the distribution of the SO_4 concentrations for the entire mining area. Figure 4-41 shows a spatial pie chart plot with all the major anions and cations. The SO_4 concentrations correlate with the concentrations shown in Figure 4-41. The boreholes that did not show high sulphate concentrations were bicarbonate dominant which correlates with the piper plot in Figure 4-39. Figure 4-42 shows the spatially consolidated stiff diagrams which re-affirm the findings of Figure 4-40 to Figure 4-41. Each mining section is discussed in the headings below:

Plant, PCD, OF Block Opencast

The figure shows that the sulphate concentrations are high in boreholes LEEMB18_D, KENMB3_S, KENMB3_D, and KENMB2_D located within the plant area. Boreholes WOLMB15s and WOLMB15d located down gradient of the plant PCD also indicate impact of mining related activities.

OWM_WTN and OWM_MN Block Opencast

High sulphate concentrations were also encountered in the north easterly part of the mine toward the Moabsvelden and Weltevreden pits in boreholes, WTN02d, WTN02s, WELMB13S and WELMB13D. Shallow and deep boreholes (WELMB13_D and WELMB13_S) located down gradient of the OWM_MN Block (Moabsvelden) opencast are also slightly impact by mining related contaminants.

Boreholes WTN02s and WTN02d are located adjacent to a haul road and is most likely impacted by a secondary source. The shallow borehole WTN02s contained sulphate concentrations above the background levels (although still compliant). It is likely that this borehole has been impacted by a shallow contaminant source associated with the haul road (coal spillage).

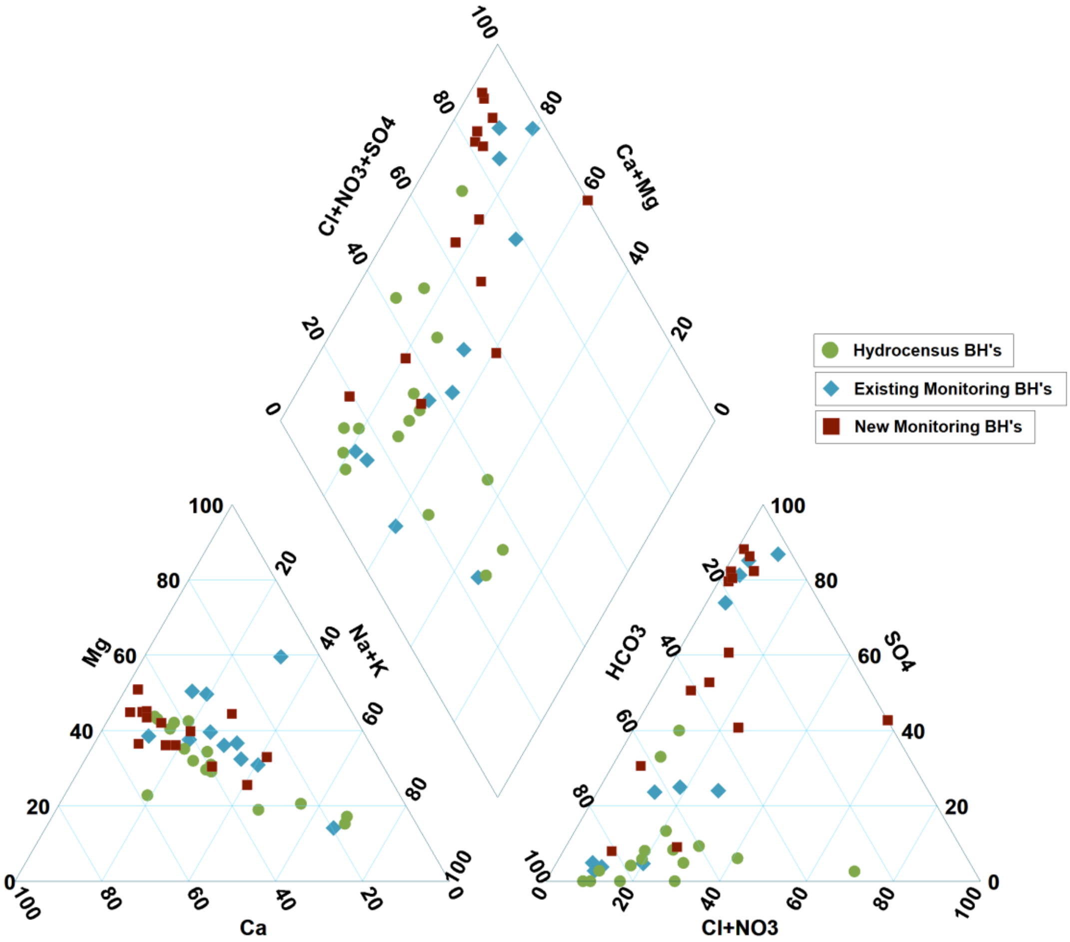


Figure 4-39: Collective Piper Plot

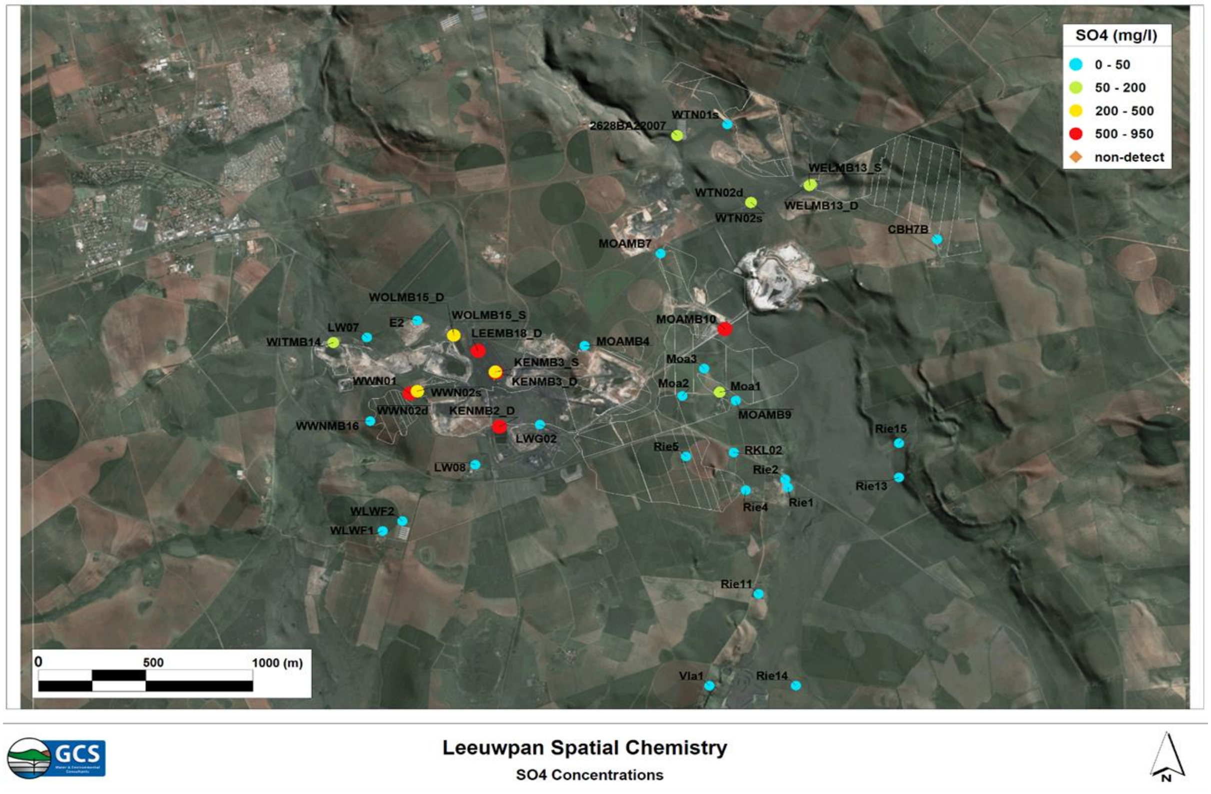


Figure 4-40: Spatial SO4 Concentrations (mg/l)

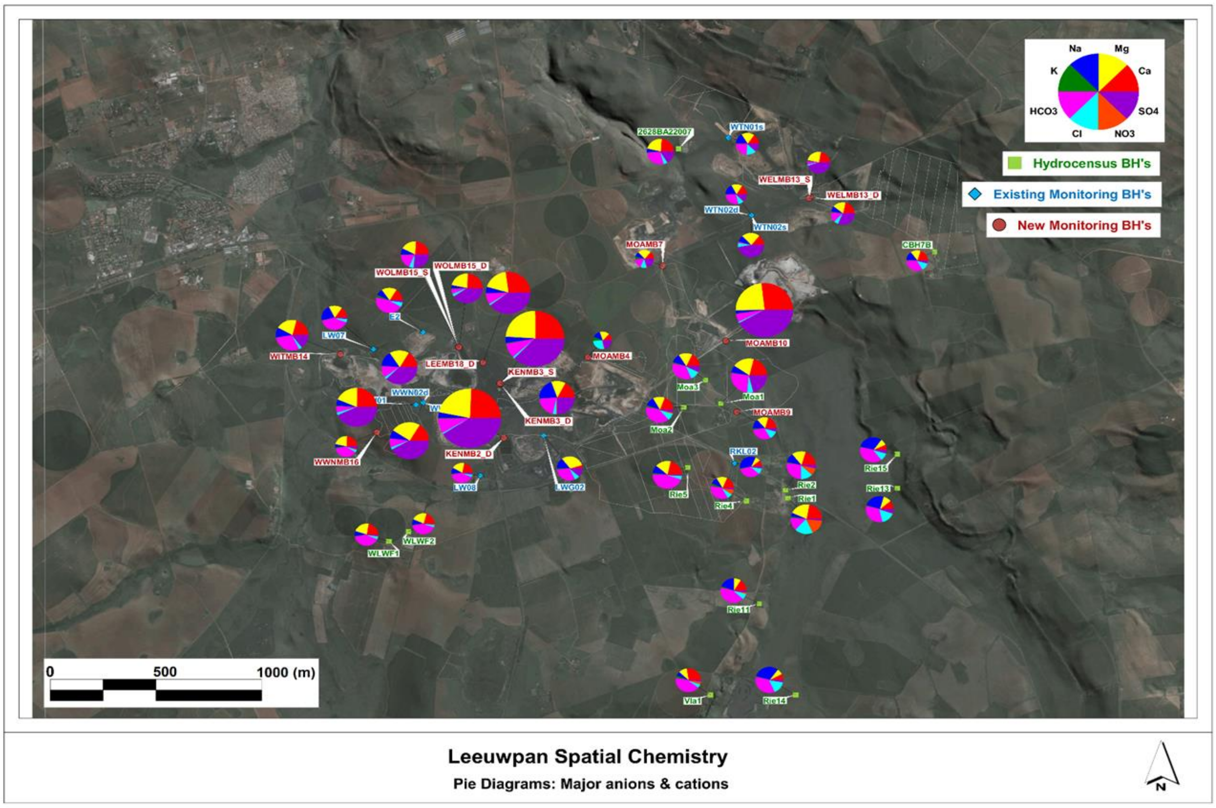


Figure 4-41: Pie Charts (in meq/l)

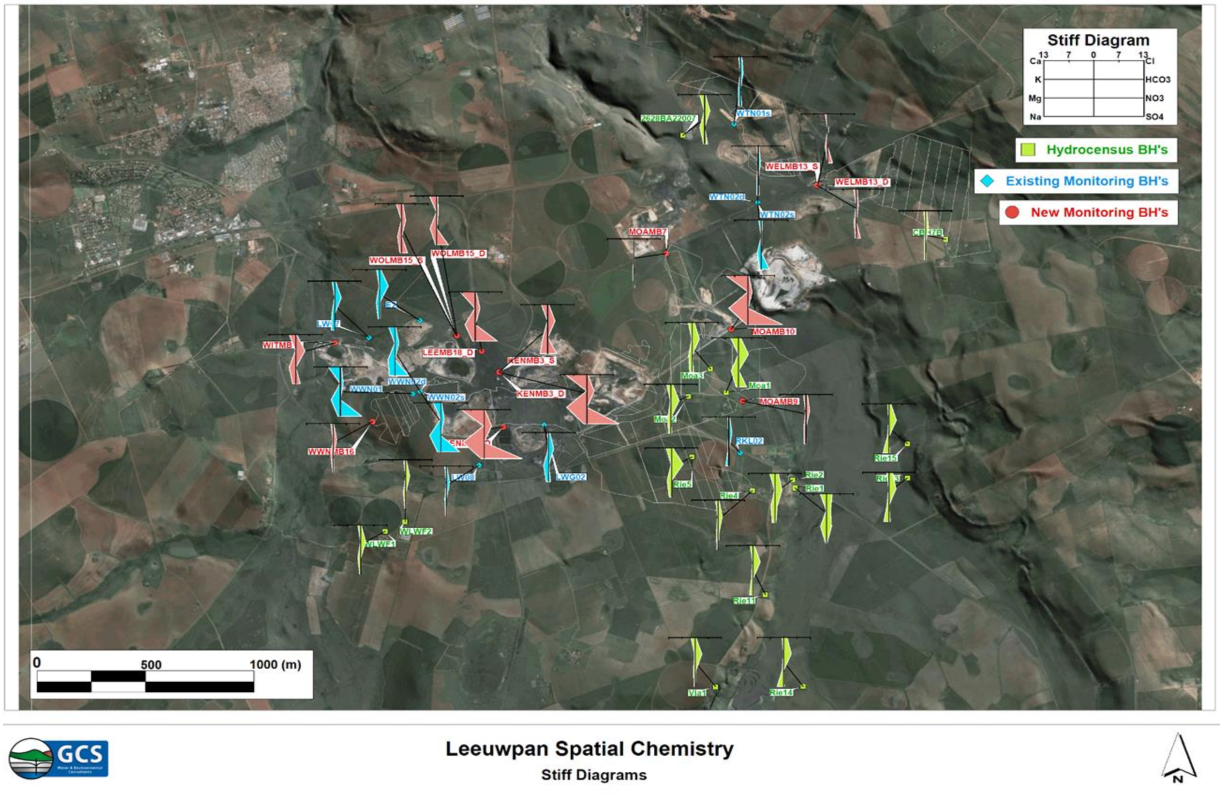


Figure 4-42: Consolidated Stiff Diagrams (in meq/l)

OJ Block Opencast

The borehole MOAMB10 located adjacent to OJ Block opencast has been negatively impacted by mining in term of elevated sulphate, TDS and EC. The private borehole Moa1 contains elevated SO_4 concentrations (although still complaint), it is however unlikely to be directly impacted by mining related activities.

4.7.7 Ground water uses

Groundwater uses other than the Leeuwpan Coal, were identified to include the following:

- Domestic use;
- Surrounding Mines in the area;
- Livestock watering;
- Garden;
- Maize milling; and
- Crop irrigation.

4.8 Wetlands

The information contained in this section of the report was obtained from the Wetland Assessment conducted by Wetland Consulting Services (Pty) Ltd, attached herewith as Appendix C-5.

The National Wetland Inventory (SANBI, 2011) and the Atlas of Freshwater Ecosystem Priority Areas in South Africa (Nel et al., 2011) indicates a number of valley bottom, hillslope seepage and pan wetlands as occurring on site. None of the wetlands are classed as FEPA's (Freshwater Ecosystem Priority Areas), and no FEPA wetlands occur within 3km of the study area boundary.

4.8.1 Wetland Delineation

In total the area classified as wetland covers 1 382ha, which makes up roughly 32.5% of the study area. Approximately 820ha of the site has however already been disturbed by surface mining activities, suggesting that the wetland extent on site was likely significantly more prior to the onset of mining activities.

Table 4.14: Extent of wetland types identified on site

Wetland Type	Wetland Area (ha)	% of wetland area	% of study area
Channelled Valley Bottom	77.77	5.63	1.83
Hillslope Seepage	906.55	65.58	21.28
Pan	37.02	2.68	0.87
Unchannelled Valley Bottom	321.78	23.28	7.55
Dam	35.98	2.6	0.84
River Diversion	3.15	0.23	0.07
Total	1382.25	100	32.45

The wetland extent on site is dominated by extensive hillslope seepage wetlands. These wetlands make up more than 65% of the wetland area on site and cover more than 20% of the entire site. The majority of the seepage wetlands are considered seasonal to temporary wetlands (i.e. implying temporary to seasonal saturation of the soil profile) that are maintained by a shallow perched water table within the soil profile. The perched water table is derived and maintained from rainfall that infiltrates the soil profile and is prevented from deeper infiltration by an aquitard within the soil profile, usually a hard of soft plinthic layer. It is suspected that little interaction between deeper groundwater and this perched water table occurs, though no testing or modeling to support this statement was undertaken on site.

In many areas the temporary edges of the hillslope seepage wetlands have been cultivated and are either still currently under maize cultivation or have been converted to planted pastures. Especially on the Farm Rietkuil the intrusion of cultivation into the hillslope seepage wetlands has been extensive. Nonetheless, the remaining areas of hillslope seepage wetland characterised by natural vegetation represent, together with the two large valley bottom wetlands, the largest expanse of natural grassland within the study area.

Three (3) valley bottom wetlands were delineated within the study area, consisting of the Bronkhorstspruit and two of its tributaries. Some confusion exists with regards to the naming of the Bronkhorstspruit, as the 1:50 000 topographical maps name the large valley bottom wetland in the east of the site as the Bronkhorstspruit, while road signs along the R50 tar road name the western valley bottom as the Bronkhorstspruit. For the purpose of this study, the naming as per the 1:50 000 topographical maps will be followed.

The Bronkhorstspruit valley bottom wetland consists of a broad, mostly unchannelled system characterised by vertic clay soils. The upper catchment as well as the upper reach of the wetland on site is utilised agriculturally, with livestock grazing the main activity within the wetland. On site, mining takes place on either side of the wetland and includes the Silica Mine that extends significantly into the wetland. A dam as well as several berms have been constructed within this reach of the wetland to control flows through the mining area. Downstream of the study area the character of the wetland changes significantly as flows become confined and a clearly incised channel forms where the alluvial deposits associated with the upper wetland end and the river flows over dolomite.

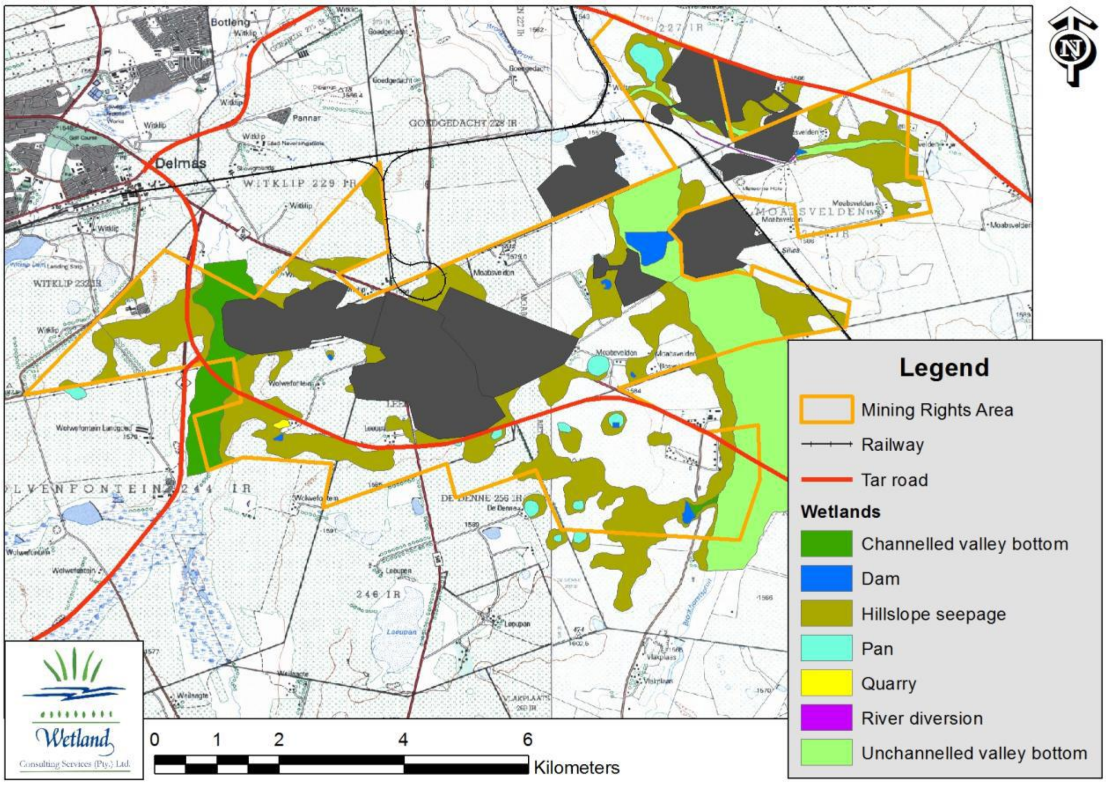


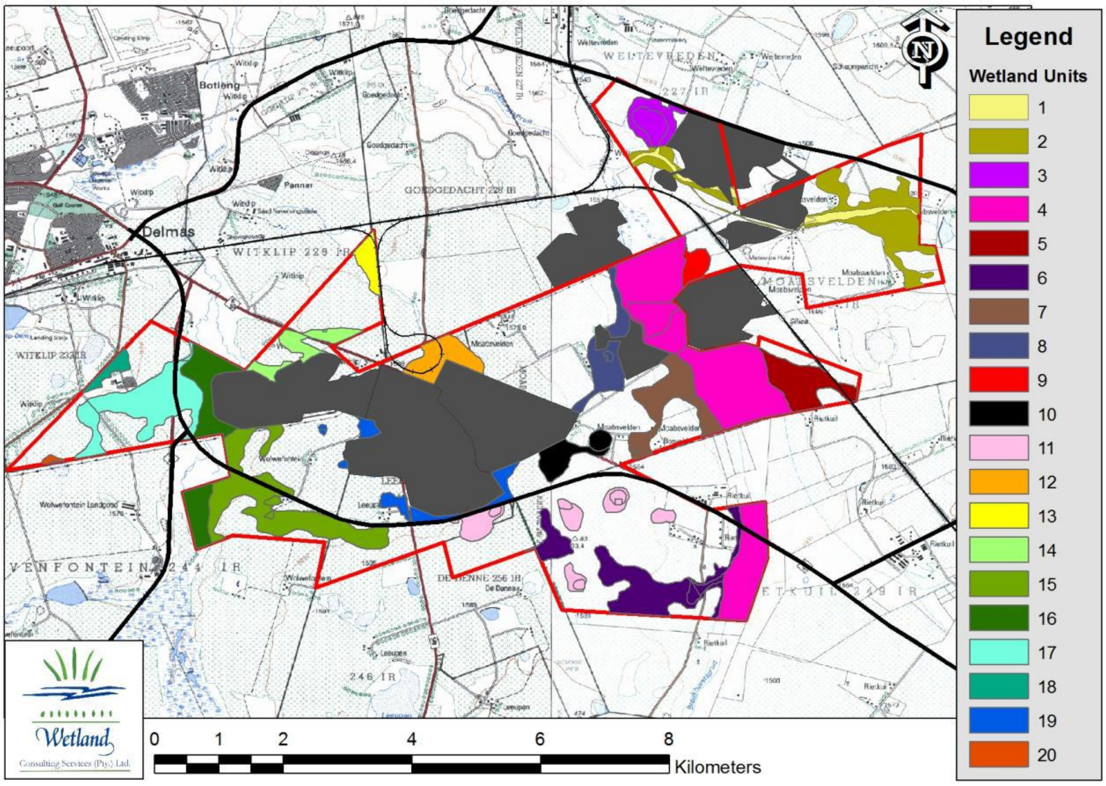
Figure 4.43 Map showing wetland areas identified within the mining right area of Leeuwpan Coal Mine and the immediate surroundings

A small unnamed tributary enters the Bronkhorstspruit from the east. This valley bottom wetland passes between the Leeuwpan Coal Mine's mining activities and the Stuart East Colliery mining area and has necessitated a river diversion. A dam has been constructed on the upstream side of the mining activities and channels flows via a narrow, approximately 3m wide trench, around the mining activities.

In the east of the study area a further unnamed tributary of the Bronkhorstspruit flows from south to north across the study area. This is again a broad valley bottom wetland characterised by mostly vertic soils, though in contrast to the Bronkhorstspruit system on site, this system is clearly incised. Existing mining activities also extend into this wetland system and have required the construction of a large berm to divert flows around the mine activities. This activity has been authorized under the WULA that was submitted and approved for the mining of the OWM Reserves.

Eight (8) pans occur within the study area, ranging in size from 0.4 to over 18ha. Most of these pans are shallow, seasonal depressions that are characterised by *Leersia hexandra* across their full width, though the pan at sampling point LP2 (see figure below) appears to be a permanent pan as it is lined by *Phragmites australis*.

This pan is thought to be used as water storage for irrigation and is thus a highly modified system. A number of further pans have been significantly impacted by the construction of roads and irrigation dams within the pan basins.



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 4.44 Map showing wetland units

4.8.2 Functional Assessment

Wetlands have been shown to perform a wide range of functions related to water quality improvement, flood attenuation, resource provision and erosion control, among others. However, each wetland is unique in the extent to which it is able to perform these functions, and the opportunity it is provided to perform these functions.

Many of the functions and services attributed to a wetland are inferred from the HGM classification of the wetland, as well as the levels of disturbance, cultural importance, and potential for the wetland to perform various functions. The nature of the functions that the wetlands perform and the services they provide were assessed using the WET-EcoServices tool, whereby both existing information and a field assessment were required.

At a site specific scale, as well as at the local and regional scale, the wetlands (especially the large valley bottom wetlands) represent the dominant remaining extent of natural vegetation and thus play a highly significant role in biodiversity support at this level. Virtually all terrestrial habitat on site has been significantly transformed due to agricultural and mining activities and most terrestrial areas are under cultivation, forcing species that under natural conditions might not be directly dependent on wetland habitats to frequent wetland habitats on site.

Loss of the wetland habitat on site would thus result not only in the loss of wetland dependent fauna, but also impact significantly on terrestrial faunal species that remain on site. At the National and International level, the importance of many of the smaller hillslope seepage wetlands and pans in biodiversity support is limited due to the disturbances that have already taken place within these systems, the generally low species richness of wetlands compared to other ecosystems (e.g. terrestrial grassland), and the limited number of Red Data species likely to occur on site.

4.8.2.1 Hillslope Seepage Wetlands

As alluded to earlier, hillslope seepage wetlands are maintained by shallow sub-surface interflow, derived from rainwater.

Rainfall infiltrates the soil profile, percolates through the soil until it reaches an impermeable layer (e.g. a plinthic horizon or the underlying sandstone), and then percolates laterally through the soil profile along the aquitard (resulting in the formation of a perched water table). Such a perched water table occurs across large areas of the Mpumalanga Highveld, not only within hillslope seepage wetlands, but also within terrestrial areas, only at greater depth.

The hillslope seepage wetlands are merely the surface expression of this perched water table in those areas where a shallow soil profile results in the perched water table leading to saturation of the profile within 50cm of the soil surface. The importance of individual seepage wetlands in temporarily storing and then discharging flows to downslope wetlands (flow regulation) varies and depends on a number of factors. Generally, seepage wetlands associated with springs and located adjacent to terrestrial areas characterised by deep, well-drained soils are more likely to play an important role in flow regulation than seepage wetlands where the wetland and catchment are characterised by shallower soils. Such seepage wetlands are likely often maintained mostly by direct rainfall and lose most of their water to evapotranspiration, and surface run-off during large storm events.

Hillslope seeps can support conditions that facilitate both sulphate and nitrate reduction as interflow emerges through the organically rich wetland soil profile, and are thus thought to contribute to water quality improvement and/or the provision of high quality water. The greatest importance of the hillslope seepage wetlands on site is thus taken to be the movement of clean water through the hillslope seepage wetlands and into the adjacent valley bottom wetlands, though the flow contribution from hillslope seepage wetlands to downslope wetlands was not quantified.

As hillslope seepage wetlands, for the most part, are dependent on the presence of an aquiclude, either a hard or soft plinthic horizon, they are not generally regarded as significant sites for groundwater recharge (Parsons, 2004). However, by retaining water in the landscape and then slowly releasing this water into adjacent valley bottom or floodplain wetlands, some hillslope seepage wetlands can contribute to stream flow augmentation, especially during the rainy season and early dry season.

From an overall water yield perspective there is evidence that seepage wetlands contribute to water loss. The longer the water is retained on or near the surface the more likely it is to be lost through evapo-transpiration (McCartney, 2000).

Hillslope seepage wetlands are not generally considered to play an important role in flood attenuation, though early in the season, when still dry, the seeps have some capacity to retain water and thus reduce surface run-off. Later in the rainy season when the wetland soils are typically saturated, infiltration will decrease and surface run-off increase. Further flood attenuation can be provided by the surface roughness of the wetland vegetation; the greater the surface roughness of a wetland, the greater is the frictional resistance offered to the flow of water and the more effective the wetland will be in attenuating floods (Reppert et al., 1979).

In terms of the hillslope seepage wetlands on site, the surface roughness is taken to be moderately low, given that most of the seepage wetlands are either cultivated of characterised by typical grassland vegetation, thus offering only slight resistance to flow.

4.8.2.2 Valley Bottom Wetlands

The linear nature of valley bottom wetlands within the landscape and their connectivity to the larger drainage system provides the opportunity for these wetlands to play an important role as an ecological corridor allowing the movement and migration of fauna and flora between remaining natural areas within the landscape.

Although modified in certain respects due to changes in landuse having brought about hydrological changes to these wetlands as well as vegetation transformation, the wetlands still provide a natural refuge for biodiversity, and within the study area and surroundings, the large valley bottom wetlands with associated footslope seepage wetlands represent the most significant extent of remaining natural vegetation, further enhancing their importance from a biodiversity support function.

Channelled valley bottom wetlands, through the erosion of a channel through the wetland, indicate that sediment trapping is not always an important function of these wetlands, except where regular overtopping of the channel occurs and flows spread across the full width of the wetland. Under low and medium flows, transport of sediment through, and out, of the system are more likely to be the dominant processes. Erosion may be both vertical and/or lateral and reflect the attempts of the stream to reach equilibrium with the imposed hydrology. From a functional perspective channelled valley bottom wetlands can play a role in flood attenuation when flows over top the channel bank and spread out over a greater width, with the surface roughness provided by the vegetation further slowing down the flood flows. These wetlands are considered to play only a minor role in the improvement of water quality given the short contact period between the water and the soil and vegetation within the wetland.

Un-channelled valley bottom wetlands reflect conditions where surface flow velocities are such that they do not, under existing flow conditions, have sufficient energy to transport sediment to the extent that a channel is formed. In addition to the biodiversity associated with these systems it is expected that they play an important role in retaining water in the landscape as well as in contributing to influencing water quality through for example mineralisation of rain water. These wetlands could be seen to play an important role in nutrient removal, including ammonia, through adsorption onto clay particles. The large size of the unchannelled valley bottom wetland associated with the Bronkhorstspruit suggests that this wetland plays an important role in flood attenuation – the temporary storage of flood waters within the wetland.

4.8.2.3 Pans/Depressions

Given the position of many pans within the landscape, which is usually isolated from any stream channels, the opportunity for pans to attenuate floods is fairly limited, though some run-off is stored in pans. In the cases where pans are linked to the drainage network via seep zones, the function of flood attenuation is somewhat elevated.

Pans are also not considered important for sediment trapping, as many pans are formed through the removal of sediment by wind when the pan basins are dry. Some precipitation of minerals and de-nitrification is expected to take place within pans, which contributes to improving water quality. Some of the accumulated salts and nutrients can however be exported out of the system and deposited on the surrounding slopes by wind during dry periods.

An important function usually performed by pans is the support of faunal and floral biodiversity, which is enhanced by the diversity in habitat types offered by different pans. Within the study area however, the small size of most of the pans, together with their seasonal nature and the disturbed vegetation, the biodiversity support of these pans individually is expected to be limited. All of the pans are seasonal or even ephemeral systems, though the differences in pan basin size and depth, as well as catchment size and catchment soil characteristics results in pans that fill up and drain at different rates and times. As a consequence a great diversity of habitat is provided by the pans on site and in the surrounding area, and though they are all seasonal systems, the differing hydroperiods result in the fact that at least some of the pans are likely to have water at any one time. The pans when seen as a complex of pan wetlands are thus of high importance in terms of biodiversity support, whereas if each pan is assessed in isolation, its importance in terms of biodiversity is limited.

4.8.3 Present Ecological Status (PES)

A present ecological state (PES) and ecological importance and sensitivity (EIS) assessment was conducted for every hydro-geomorphic wetland unit identified and delineated within the study area. This was done in order to establish a baseline of the current state of the wetlands and to provide an indication of the conservation value and sensitivity of the wetlands in the study area. For the purpose of this study, the scoring system as described in the document "Resource Directed Measures for Protection of Water Resources. Volume 4. Wetland Ecosystems" (DWAF, 1999) was applied for the determination of the PES.

In the case of the Leeuwpan Coal Mine study area, the Atlas indicates numerous wetlands falling within the study area, but no wetland or river FEPA's occur within or within the direct vicinity of the site. The fact that no wetland FEPA's are indicated as occurring on site does however not imply that the wetlands on site are of lesser importance, though the PES assessment detailed further below in this report highlights that the wetlands on site have been extensively impacted and degraded by both agricultural activities and mining activities.

The wetlands on site exist within a landscape currently dominated by agricultural (cultivation, grazing) and mining activities, and these land uses have had an influence on the current extent and condition of the majority of the wetlands within the study area. Many of the wetlands and their catchments are currently, or have historically been, cultivated, or lie in close proximity to active mining activities, disturbances that have had an influence on the vegetation composition, geomorphology and hydrology of the wetlands.

No pristine wetlands were found to occur within the Leeuwpan Coal Mine study area, and the majority of the wetlands were found to be Moderately Modified (C). Almost 19 % of wetlands were classified as seriously modified (E), consisting mostly of hillslope seepage wetlands cultivated in their entirety, as well as a number of heavily impacted pans. The results of the Present Ecological State (PES) assessments are displayed in the figure below. For specific wetlands, the overall PES category was adjusted upwards (by one level) when one of the threat categories received a score over 8 (F).

Table 4.15: PES Assessment

Wetland Type	PES Rating				Total
	C	D	D/E	E	
Chanelled Valley Bottom		74.07		3.71	77.77
Hillslope Seepage	402.64	282.46		179.05	864.15
Pan	0.21	5.96	26.39	46.75	79.31
Unchanelled Valley Bottom	300.21			21.56	321.78
Total	703.06	362.49	26.39	251.07	1343.01
% of wetland area	52.35%	26.99%	1.96%	18.69%	100%

The Present Ecological Status of the pans on site was assessed separately, as the Level 1 WETHealth assessment does not allow for the assessment for pan wetlands. Instead, the scoring system as used in the RDM Methods developed for the DWA were used (“Resource Directed Measures for Protection of Water Resources. Volume 4. Wetland Ecosystems” (DWAF, 1999)).

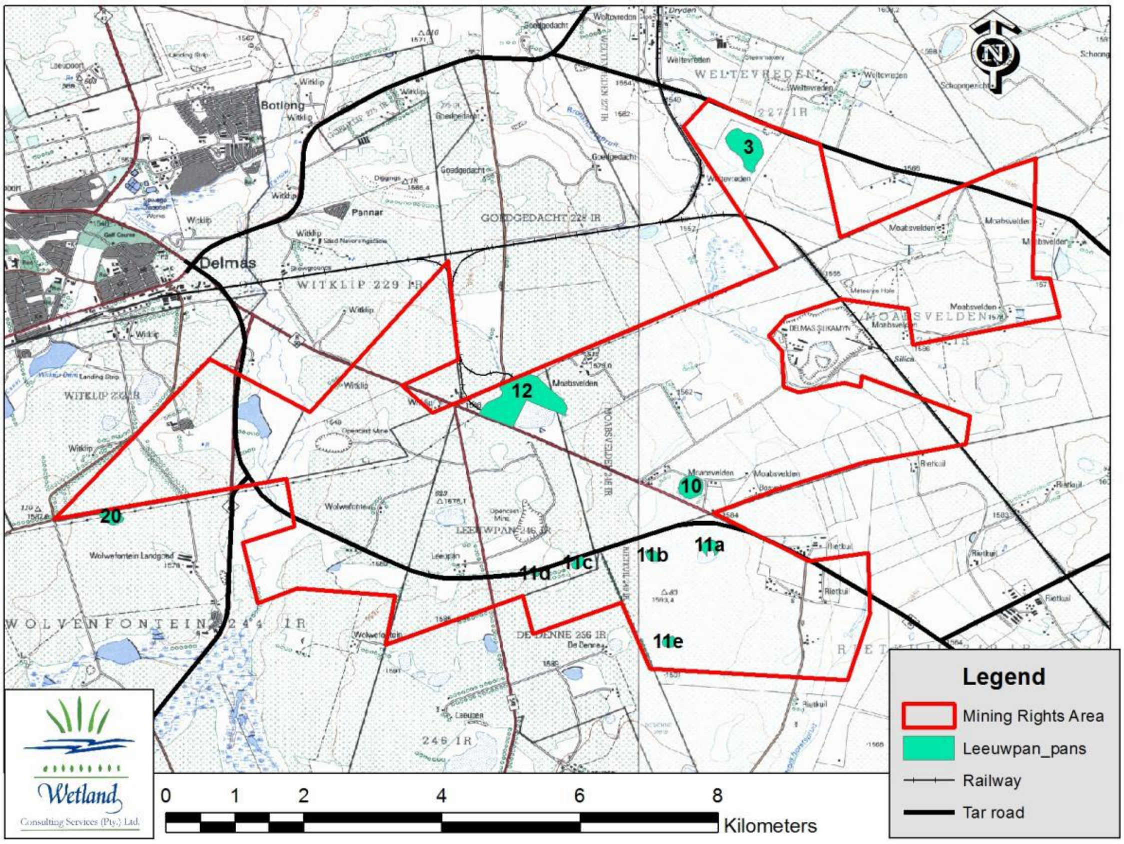


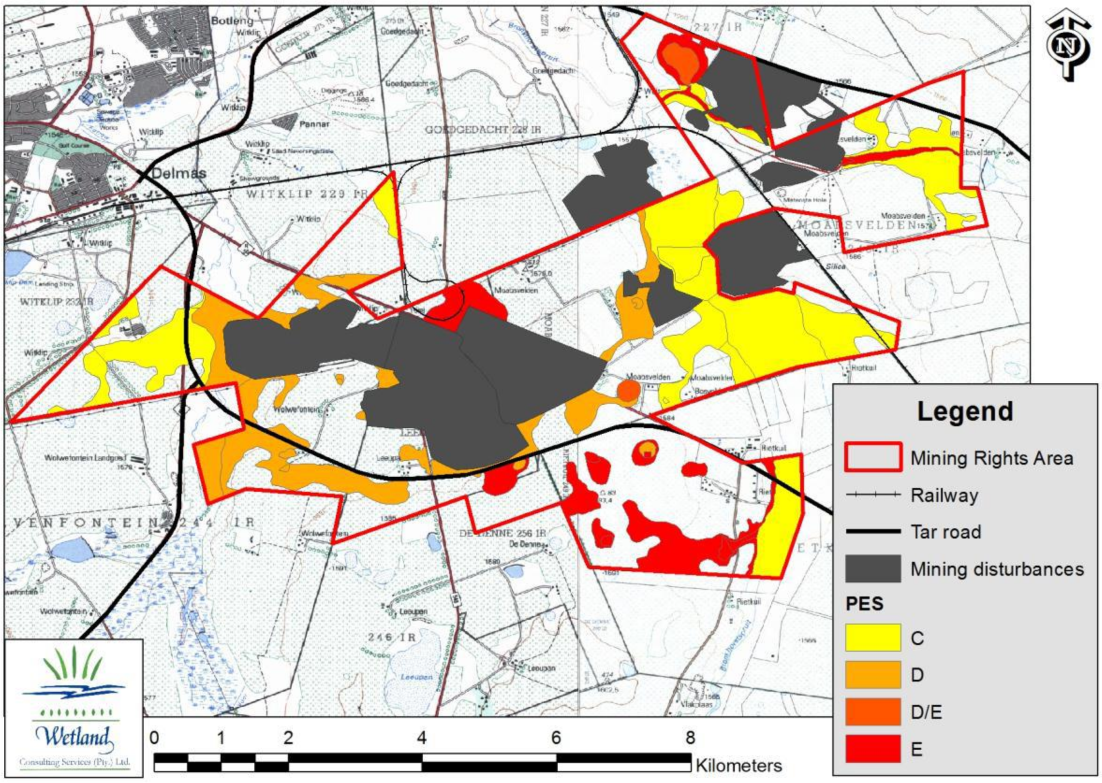
Figure 4.45: Numbering System used for Pans

Table 4.16: PES Assessment for Pans on site

Wetland Unit	Wetland Type	PES
3	Pan	D/E
10	Pan	D/E
11a	Pan	D
11b	Pan	D/E
11c	Pan	D
11d	Pan	D
11e	Pan	E
12	Pan	E
20	Pan	C

Table 4.17: Rating Scale for PES Assessment

Description	Combined impact score	PES Category
Unmodified, natural.	0-0.9	A
Largely natural with few modifications. A slight change in ecosystem processes is discernable and a small loss of natural habitats and biota may have taken place.	1-1.9	B
Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact	2-3.9	C
Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4-5.9	D
The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6-7.9	E
Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8 - 10	F



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 4.46: Results of PES Assessment

The pans that will be impacted upon my mining activities is Pans from wetland unit 11a and 11b. The other pans from unit 11 will be indirectly impacted on by the OI mining project.

4.8.3.1 Ecological Importance and Sensitivity (EIS)

Ecological Importance and Sensitivity is a concept introduced in the reserve methodology to evaluate a wetland in terms of:

- Ecological Importance;
- Hydrological Functions; and
- Direct Human Benefits.

The scoring assessments for these three aspects of wetland importance and sensitivity have been based on the requirements of the NWA, the original Ecological Importance and Sensitivity assessments developed for riverine assessments (DWAF, 1999), and the work conducted by Kotze et al (2008) on the assessment of wetland ecological goods and services (the WET-EcoServices tool). Based on this methodology, an EIS assessment was undertaken for all the delineated wetlands on site, with the result discussed and illustrated below.

Ecological Importance - At a site specific scale, as well as at the local and regional scale, the wetlands (especially the large valley bottom wetlands) represent the dominant remaining extent of natural vegetation and thus play a highly significant role in biodiversity support at this level. Virtually all terrestrial habitat on site has been significantly transformed and most terrestrial areas are under cultivation, forcing species that under natural conditions might not be directly dependent on wetland habitats to frequent wetland habitats on site. Loss of the wetland habitat on site would thus result not only in the loss of wetland dependent fauna, but also impact significantly on terrestrial faunal species that remain on site.

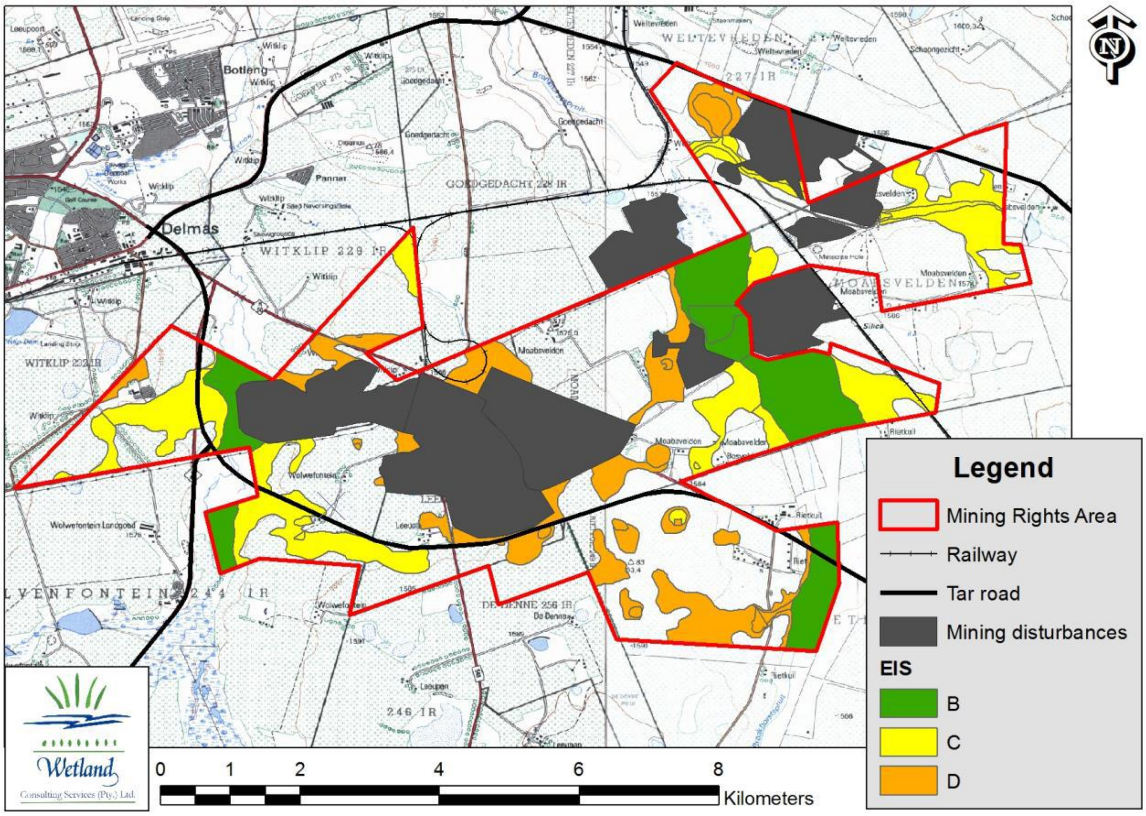
At the National and International level, the importance of many of the smaller hillslope seepage wetlands and pans in biodiversity support is limited due to the disturbances that have already taken place within these systems, the generally low species richness of wetlands compared to other ecosystems (e.g. terrestrial grassland), and the limited number of Red Data species likely to occur on site.

Hydrological Functions – The hydrological functions of the wetlands are discussed under the functional assessment above. To summarise, the hillslope seepage wetlands are considered to be most valuable in terms of water quality maintenance, while the valley bottom wetlands, specifically the large unchannelled valley bottom wetland of the Bronkhorstspruit, are also important in terms of flood attenuation and sediment trapping. Direct Human Benefits – Some of the wetlands on site are extensively used for crop cultivation (e.g. hillslope seepage wetlands), while others (e.g. the large valley bottom wetlands and uncultivated seepage wetlands) are used for livestock grazing.

Dams within some of the wetlands also provide drinking water for livestock, and limited use for irrigation. No known cultural practices take place within the wetlands on site.

The two large valley bottom wetland systems on site, the Bronkhorstspruit and its tributary in the west of the study area, are considered to be of High (B) ecological importance and sensitivity, mostly due to the role they play in biodiversity support and as an ecological corridor.

The remainder of the wetlands are either of Moderate (C) or Low (D) ecological importance, related mostly to the level of disturbance these system have undergone.



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 4.47: EIS Assessment

Table 4.18: Scoring System Used for EIS Assessment

Ecological Importance and Sensitivity categories	Range of Median	Ecological Management Class
Very high Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers.	>3 and <=4	A
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	>2 and <=3	B
Moderate Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.	>1 and <=2	C
Low/marginal Wetlands that is not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers.	>0 and <=1	D

4.8.4 Diatoms

Pans and valley bottom wetlands may have naturally elevated salinity and nutrient levels in comparison to some freshwater systems, and any attempt to use indices of biotic integrity suitable for freshwater ecosystems in South Africa (Specific Pollution Index IPS, Coste in CEMAGREF, 1982, Biological Index for Diatoms BDI, Lenoir and Coste, 1996, Prygiel and Coste, 2000) will likely result in misleading interpretations.

Analyses of diatoms were therefore based on measures of relative abundance and species composition (i.e. assemblage patterns) to infer baseline water quality conditions at these sites. There were insufficient cell counts at site LP1 therefore any conclusions on water quality based on diatom communities could not be formulated. Appendix A displays a list of species and abundances recorded for sites LP2-6.

To further determine water quality based on diatom composition at the Leeuwpan Coal Mine sites, diatoms assemblages collected from 206 sites throughout the Highveld were included in a cluster analysis to provide a more reliable inference of water quality. Diatom assemblage patterns at the Leeuwpan Coal Mine sites (Appendix A) suggest the following (remembering that ‘pollution indicators’ used to determine anthropogenic stress in freshwater systems may be equally tolerant to the natural stressors that accompany healthy, eutrophic wetland systems):

- Site LP2 is dominated by species found in waters with moderate electrolyte content such as Amphora pediculus and Cyclostephanos invisitatus. The presence of taxa Nitzschia fonticola, Gomphonema exilissimum and Placoneis placentula, good indicators of clean waters and tolerant of slight to moderate levels of pollution may imply that the water quality at this site is in relatively good condition. The presence of taxa Aulacoseira granulata and Nitzschia palea points to some nutrient enrichment.
- At site LP3, prevalent taxon Gomphonema parvulum is usually a red flag for some type of pollution. G. parvulum is often linked to a source of organic and nutrient inputs. Sub-dominant taxa such as Navicula symmetrica and Nitzschia palea are found in waters with elevated nutrient and electrolyte concentrations. Dominant taxon Fragilaria ulna var. acus points to elevated levels of inorganic nutrients.
- At site LP4, to note is the high abundance of Mayamaea atomus, one of the most pollution resistant diatoms found in alkaline, heavily polluted waters with high electrolyte content, but also occurring in moderate quality waters often associated with organic detritus. Dominant taxon Nitzschia palea points to nutrient and electrolyte enrichment.
- The overall diatom assemblage for sites LP5 and LP6 indicates reasonably good water quality. The sites are comprised of species found in standing and slow flowing waters of moderate to high electrolyte content such as Gyrosigma attenuatum, Rhopalodia gibba, Epithemia adnata and Epithemia sorex. Both sites are dominated by the Achnanthidium genus which may occur across a gradient of nutrient and salinity impacts but never found in waters with critical levels of organic pollution. The presence of taxon Nitzschia dissipata var. media is a good indicator of hard water (calcium based salinity) and favours alkaline conditions.
- Species present at sites LP5 and LP6 such as Navicula trivialis, Nitzschia palea, Mayamaea atomus, Eolimna minima and Sellaphora seminulum indicate some level of nutrient and organic input at these sites.
- Cluster analysis of Leeuwpan Coal Mine sites along with 206 wetland sites across the Highveld (WCS diatom database, unpublished data) revealed the following:
    - Site LP2 was related (but not so closely) to a pan with elevated salinity as a result of high sulphate concentrations.
    - Site LP3 was closely related to a channelled system impacted by organics and nutrients from urban developments.

- Site LP4 was grouped with a channelled valley bottom site downstream of a mine, having relatively good water quality with some nutrient and electrolytes inputs.
- Sites LP5 and LP6 were closely grouped with channelled valley bottom sites in relatively good condition with some signs of organic and nutrient inputs.

4.9 Air quality

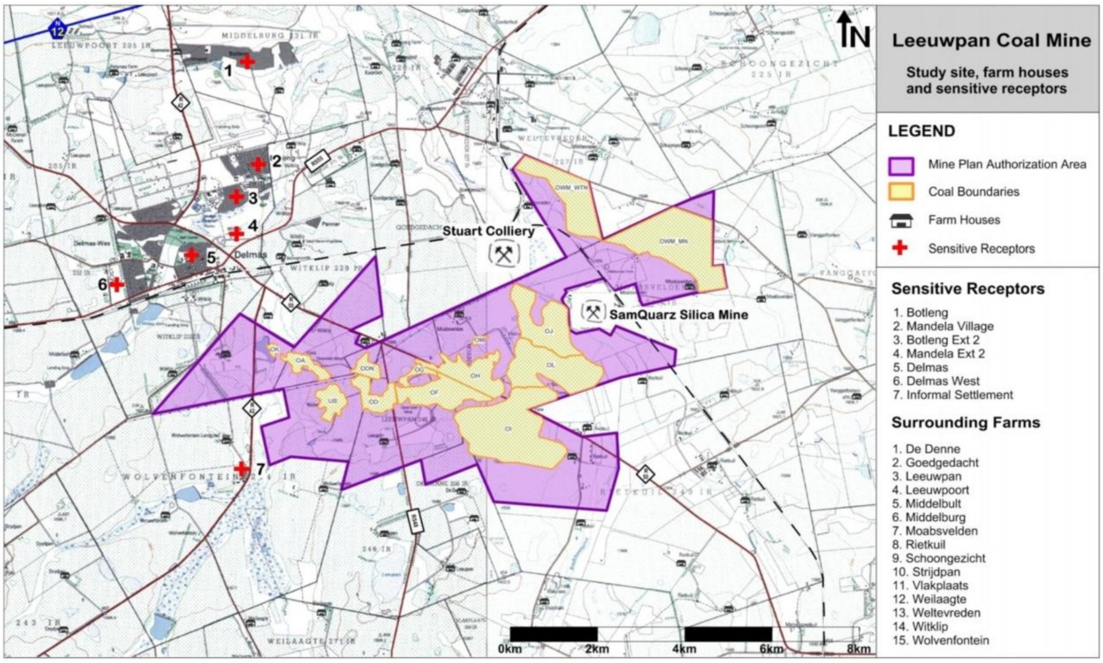
The information contained in this section of the report was obtained from the Baseline Air Quality Assessment conducted by Airshed Planning Professionals (Pty) Ltd, attached herewith as Appendix C-6

The local study area for the assessment was selected based on the expected extent of air quality impacts and possible sensitive receptors such as individual homes and communities. A study area of 20 km east-west and 15 km north-south was identified.

4.9.1 Sensitive Receptors

The sensitive receptors closest to the mine (numbered 1 to 7 in Figure 4-40) are the residential areas of Botleng, Mandela Village, Botleng Ext 2, Mandela Ext 2, Delmas, Delmas West and an informal settlement. The various farmsteads scattered around the project area are indicated in grey using a house symbol.

The extent of the study area, surrounding mines (SamQuarz Silica Mine and Stuart Colliery), farm houses, main roads and closest sensitive receptors relative to the opencast pit areas are shown in Figure 4.48.



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 4.48 Leeuwpan Coal Mine study area air quality assessment

4.9.2 Atmospheric Dispersion Potential

Meteorological mechanisms govern the dispersion, transformation, and eventual removal of pollutants from the atmosphere. The analysis of hourly average meteorological data is necessary to facilitate a comprehensive understanding of the ventilation potential of the site. The vertical dispersion of pollution is largely a function of the wind field. The wind speed determines both the distance of downward transport and the rate of dilution of pollutants. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness. In the absence of representative measured meteorological data, reference was made to modelled MM5 data for the project area for the period January 2010 to December 2011.

4.9.2.1 Wind Field

The wind field is characterised by dominant northerly and easterly winds. Calm conditions prevailed 13.12% during the 2010-2011 period with a period average wind speed of 3.1m/s. Wind speeds exceeding 5m/s occurred with a frequency of 13%. The north-westerly wind flow increases during day-time conditions with easterly wind flow increasing during the night.

A distinct shift in the prevailing wind field between seasons was noted. During spring months, the strongest winds were from the northerly direction. Summer and autumn months were characterised by a higher frequency in moderate winds with a wind flow field similar to that of the period windrose. Winter months were found to be dominated by strong winds from the southeasterly and southerly sectors, with a small component from the northwest.

4.9.3 Existing Ambient Air Quality

The characterisation of existing air quality is crucial for assessing the potential for cumulative impacts due to the emissions from mining operations at Leeuwpan Coal Mine. The focus of this discussion is on PM10 as no information is yet available on ambient PM2.5. Measured dust deposition values for monitoring stations around the Leeuwpan site are also included.

4.9.3.1 Inhalable particulate matter (PM10)

The Mpumalanga Highveld has frequently been the focus of air pollution studies for two reasons. Firstly, elevated air pollution concentrations have been noted to occur in the region itself. Secondly, various elevated sources of emissions located in this region have been associated with long-range transportation of pollutants and with the potential for impacting on the air quality of adjacent and more distant regions (Piketh, 1994). The Minister of Environmental Affairs and Tourism therefore declared the Highveld Priority Area (HPA) on 23 November 2007 (Highveld Priority Area Air Quality Baseline Assessment, 2010).

Leeuwpan Coal Mine is located in the local municipality of Delmas. According to the HPA Baseline Assessment Delmas is considered a “hotspot” area for PM_{10} (where ambient air quality is poor and where ambient PM_{10} generally exceeds air quality standards.

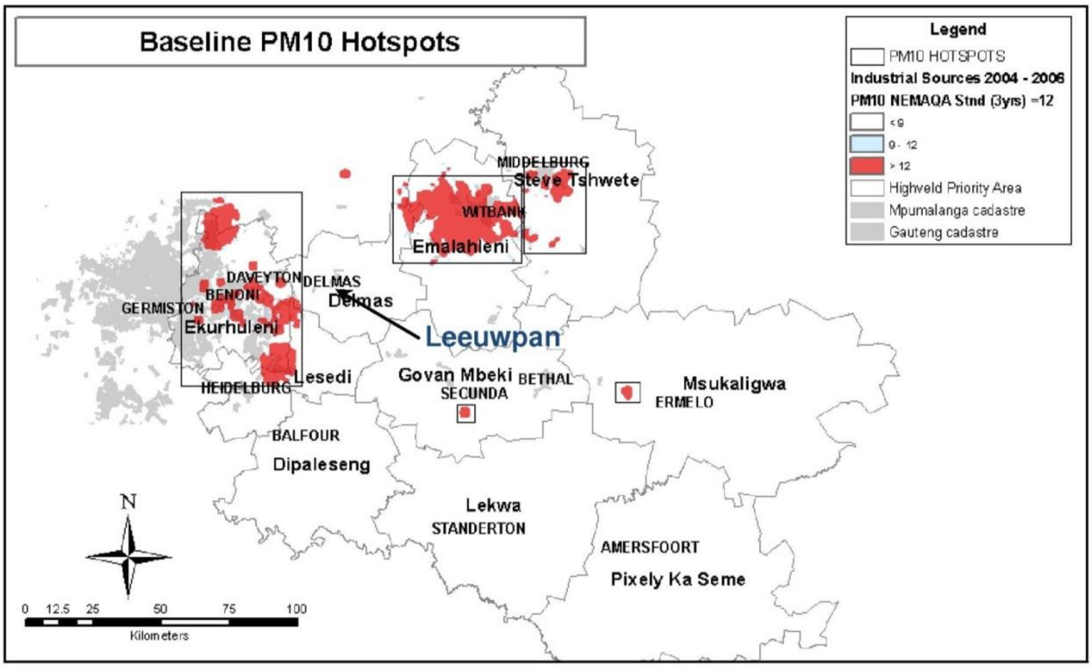


Figure 4.49 Modelled frequency of exceedance of 24-hour ambient PM_{10} standards in the HPA, indicating the air quality hot spot areas (Draft HPA AQMP, 2011).

Leeuwpan is located in the Highveld Priority Area (HPA). According to the HPA Baseline Assessment Delmas is considered a "hotspot" area for PM10 (where ambient air quality is poor and where ambient PM_{10} generally exceeds air quality standards) indicated in Figure 4.49. The HPA dispersion modeling results showed that the study site does not fall within an area where more than the allowable 4 exceedances of the PM10 air quality standard were predicted per annum.

The contribution of residential fuel burning, motor vehicles and coal mining were found to be less significant than industrial sources in the total air quality loading in the Delmas local municipality.

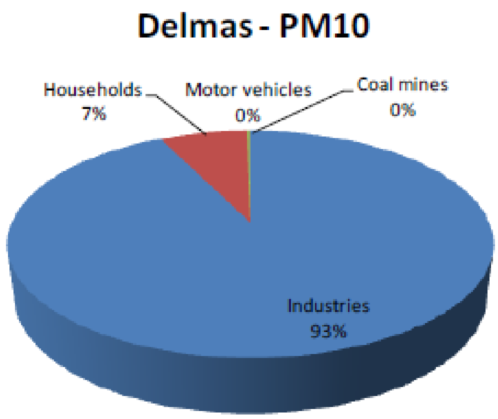
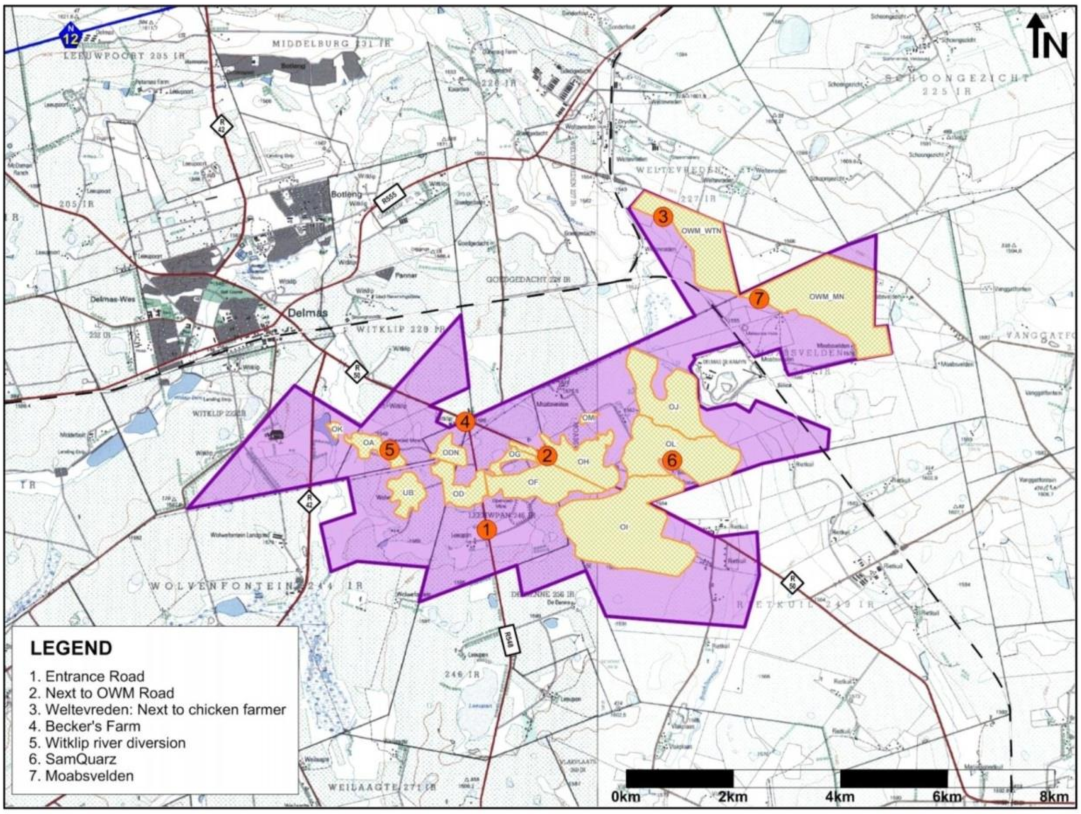


Figure 4.50: Contribution of different sources to ambient PM10 concentrations in the Delmas Hotspot (Draft HPA AQMP, 2011)

The findings from the HPA baseline assessment apply to the greater Delmas region. Local source contributors to ambient PM10 concentrations in the vicinity of the study site are: domestic fuel burning and vehicle activity in residential areas (Delmas town to the northwest, Botleng and Mandela Village to the north and the informal settlement to the southwest of the mine), mining activities – Stuart Coal Mine and SamQuarz Silica Mine directly adjacent to Leeuwpan; and agricultural activities on the surrounding cultivated farm lands. However, the pollutants originating at the Leeuwpan Coal Mine may also impact the air quality of surrounding areas. It is expected that vehicle entrainment will be the largest source of dust emissions at the mine.

4.9.4 Dust Deposition (Fallout)

Dust deposition has been measured at a number of locations around the Leeuwpan Coal Mine site Figure 4.51.



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 4.51 Locations of dust fallout monitoring stations within the mining right area of Leeuwpan Coal Mine

The gauges at the 7 monitoring stations are directional. For these stations, conclusions can only be drawn on the direction of the most prominent source of dust deposition impact, although the frequency of the wind from that direction also has to be taken into account. Dust deposition (TSP) results for Feb/Mar 2012, Apr/May 2012 and June 2012 show that the units with the highest and second highest average monthly fallout are monitoring unit 2 (East) and monitoring unit 4 (South) located next to a haul road and a farm respectively.

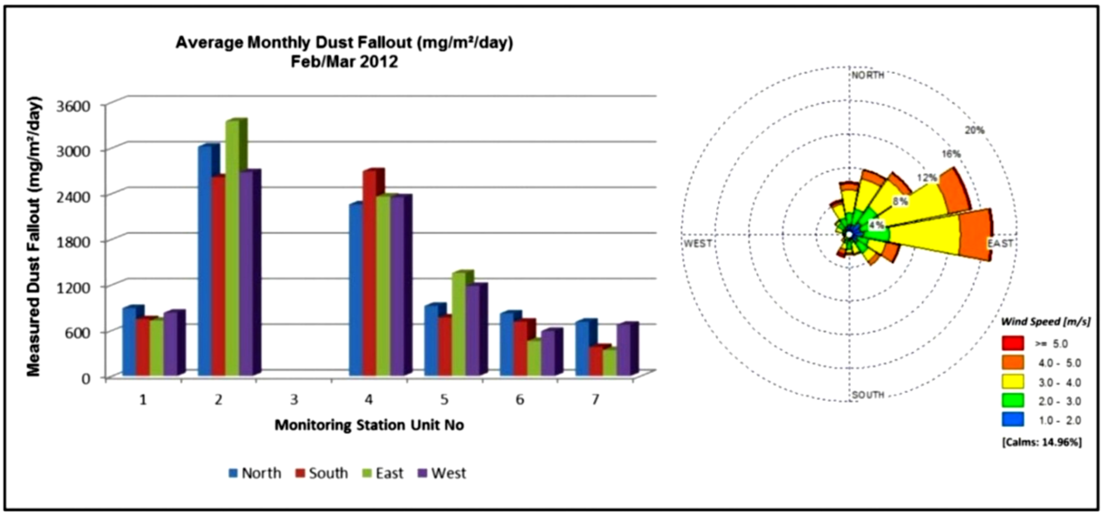


Figure 4.52 Average monthly dust fallout (mg/m²/day) (Feb/Mar 2012)

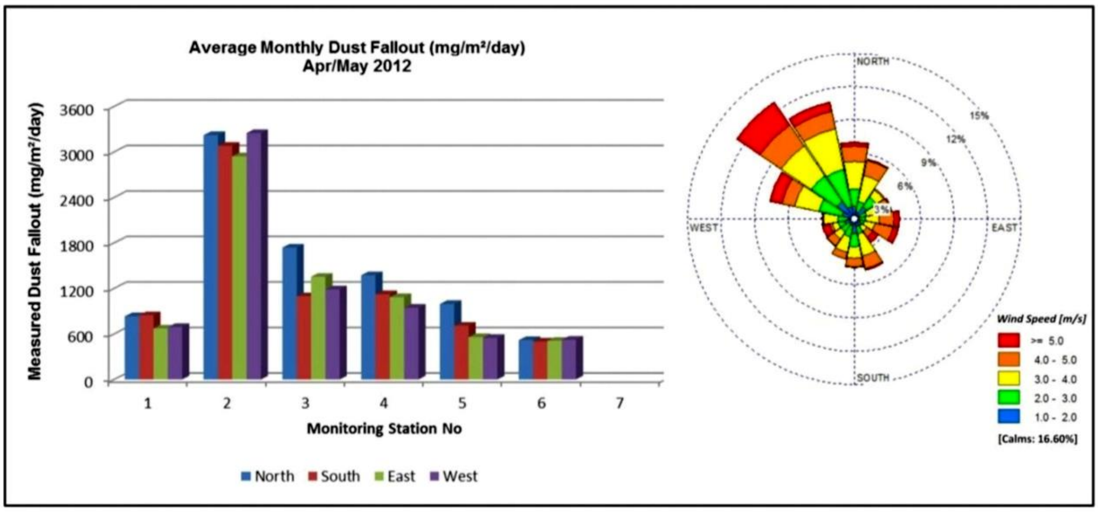


Figure 4.53 Average monthly dust fallout (mg/m²/day) (Apr/May 2012)

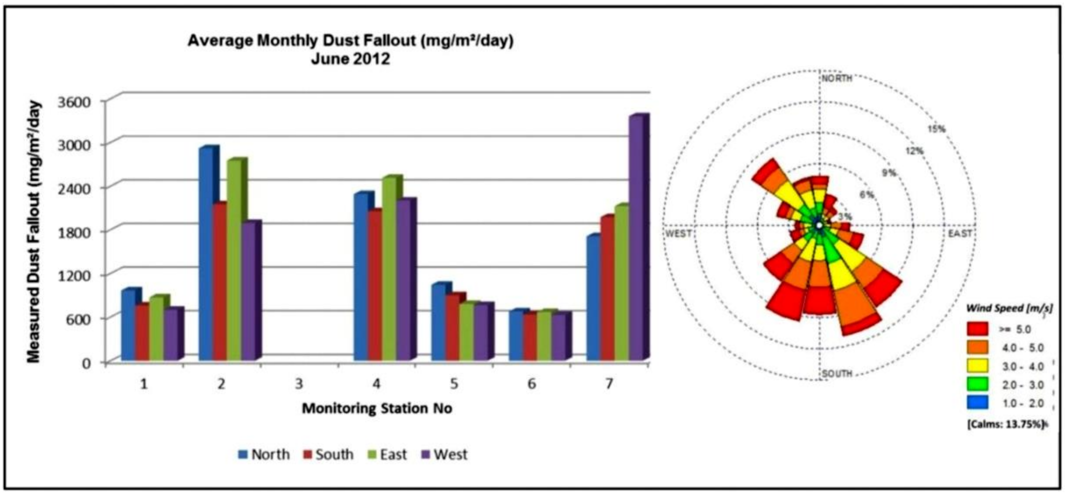


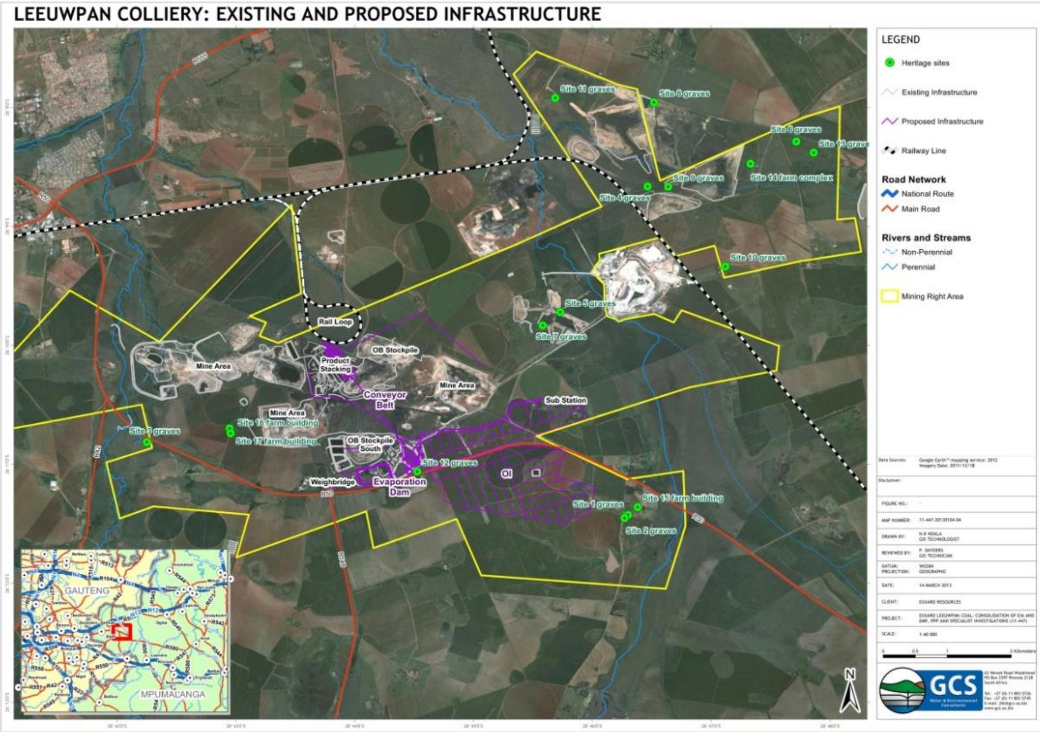
Figure 4.54 Average monthly dust fallout (mg/m²/day) (Jun 2012)

4.10 Sites of historical and cultural importance

The information contained in this section of the report was obtained from the Heritage Assessment conducted by Archaetnos, attached herewith as Appendix C-7

The Mpumalanga Province is a cultural heartland and a tourist's destination for most of its parts, as it is home to some well-known natural wonders and nature reserves. The expansion of early farmers who, among other things, cultivated crops, raised livestock, mined ore, and smelted metals occurred in this area between AD 400 and AD 1100. Early Iron Age settlements, homesteads and Bushmen drawings are widespread in Mpumalanga. Large cattle byres with pits are also significant feature to be found in the area.

In the surveyed area seventeen sites of cultural significance have been found (**Figure 4.55**). Thirteen of these are grave sites. The others are farm buildings.



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 4.55 Sites of historical importance found within the Leeuwpan Coal Mine project area

4.10.1 Site 1

This is a large grave yard found in close proximity to a blue gum plantation. It consists of at least 63 graves (Figure 4-56). Pistorius counted more than 50 here. The graves have all kinds of grave dressings or borders and headstones – cement, stone, brick and granite. Many of the graves have no legible information meaning that it has an unknown date of death. Those with dates seem to range between 1972 and 2005. Some of the surnames identified include Mtsweni, Sithole, Masilela, Mabena and Kgomo.

Figure 4.56: Graves at Site 1

4.10.2 Site 2

This is another grave site found within a maize field and fairly close to the first one. In fact, it is so close with only a farm road in between that one gets the impression it may have been one site and that some graves may be underneath the road. It consists of at least 6 graves, although Pistorius counted at least 20. Some of the graves have cement borders and headstones. One has a brick border and two of them have a metal fence around them. Two of the graves have no information meaning that it has an unknown date of death. The others range between 1968 and 2003. Surnames identified include Mahlangu and Mabena.

Figure 4.57: Graves at Site 2

4.10.3 Site 3

This site is a very large grave yard consisting of at least 99 graves (Figure 4-50). The have all types of dressings and headstones – granite, cement, stone and brick. Some do not have headstones. The dates of death seem to range between 1947 and 1973 while some are unknown. All three categories of graves therefore are present. Surnames identified include Mabena, Ngoma, Ndlopfu, Mzizi and Malaza.

Figure 4.58: Graves at Site 3

4.10.4 Site 4

Site 4 is another grave yard. This one consists of at least 90 graves (Figure 4-49). There are three kinds of dressings or borders and headstones being granite, stone or cement. Not all the graves have legible information making it unknown. The dates seem to range between 1972 and 2004. Surnames identified include Ngomalwa, Mapos and Mahlangu.

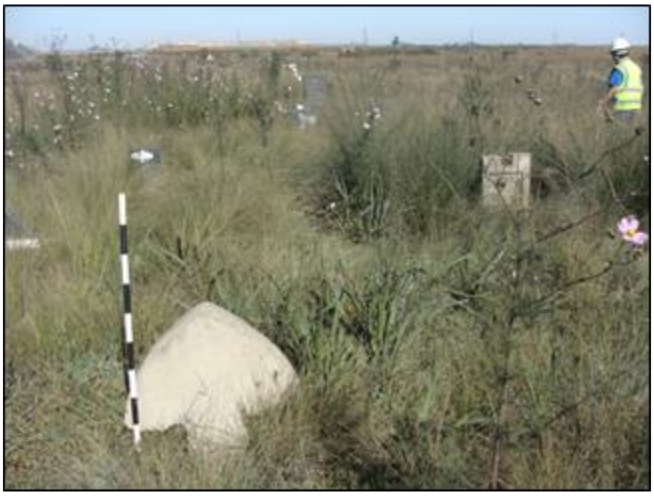


Figure 4.59: Graves at Site 4

4.10.5 Site 5

Site 5 is another grave yard. This one consists of at least 31 graves. Van Schalkwyk counted more than 30. There are two kinds of dressings or borders and headstones being stone or cement. Most of the graves are unknown and does not even have headstones. The dates seem to range between 1939 and 1940. Surnames identified include Makau, Diale and Mackau.

Figure 4.60: Graves at Site 5

4.10.6 Site 6

Site 6 is also a grave yard. It consists of at least 20 graves. There are three kinds of dressings or borders and headstones being stone, brick or cement. Most of the graves are unknown and does not even have headstones.

Only one date was identified, being 1958. Surnames identified include Mbonau, Mbonani and Mulitana.

Figure 4.61: Graves at Site 6

4.10.7 Site 7

Site 7 is site no 2 from the report of Van Schalkwyk. It consists of 3 graves. No photograph was included in his report.

4.10.8 Site 8

Site 8 is site no 01 from the report of Pistorius. It consists of more than 100 graves.

Figure 4.62: Graves at Site 8

4.10.9 Site 9

Site 9 is site no 02 from the report of Pistorius. It consists of more than 50 graves.

Figure 4.63: Graves at Site 9

4.10.10 Site 10

Site 10 is site no 03 from the report of Pistorius. It consists of more than 50 graves. Pistorius did not include a photograph of this site.

4.10.11 Site 11

Site 11 was identified by personnel from the mine. No photograph was included. The number of graves is unknown.

4.10.12 Site 12

Site 12 was identified by personnel from the mine. No photograph was included. The number of graves is unknown.

4.10.13 Site 13

Site 13 was identified by personnel from the mine. No photograph was included. The numbers of graves are unknown.

4.10.14 Site 14

Site 14 was identified by Pistorius. It is a historical farm complex with at least three buildings older than 60 years.

The Historical Complex is located in the midst of a modern farm homestead on Moabsvelden 248. The farm homestead incorporates the following components of infrastructure, namely:

- The Historical Complex comprising of four historical structures.
- At least two modern farm residences with associated outbuildings.
- Modern farm infrastructure comprising of several sheds.
- Shacks occupied by farm labourers, some of which have been partly demolished whilst others are still occupied.

Only the Historical Complex has relevance to this heritage impact assessment. The complex includes the following four structures:

- A shed which was used for milking cows (milk shed).
- A shed which was probably used to store fodder, wagons and other farm implements (wagon shed).
- A large residence.
- A small residence.

It seems as if these structures were constructed contemporary and that they respectively served as the main dwelling, a second smaller dwellings and sheds which were part of a farm homestead which probably dates from the 1930's or 1940's.

None of the structures in this complex was altered significantly on the outside and all the structures are in a relatively good condition. The various buildings were constructed with the same building material and all the structures adhere to a single architectural style.

Figure 4.64: Buildings at Site 14

The Historical farm complex on Moabsvelden 248 incorporates two residences and two sheds which were part of a farm homestead which probably dates from the 1930's to the 1940's.

4.10.15 Site 15

Site 15 was identified by Pistorius. It is a historical farm building older than 60 years. This house occurs on Rietkuil 249 and is in a severely dilapidated state. It was constructed with clay bricks and cement and fitted with a pitched corrugated iron roof.

Parts of the walls of the house were recently plastered with a fresh layer of cement as the windows were removed from the house and closed with brick and cement. The structure is currently used as a 'kraal' in which sheep is penned during the night. It is associated with a two roomed outbuilding and a stand for a water tank. Both structures, like the house, are severely dilapidated.

Figure 4.65: Buildings at Site 15

4.10.16 Site 16

Site 16 was identified by Pistorius. It is two historical farm buildings older than 60 years. This house is also located on Wolwenfontein 244. It was renovated extensively in the more recent past and probably dates from the 1940's, but has therefore lost much of its original fabric. It probably consisted of four rooms in the past. It is possible that they were used as a kitchen, sitting room and two bedrooms.

Figure 4.66: Building at Site 16

4.10.17 Site 17

Site 17 was identified by Pistorius. It is a historical farm house that may be just older than 60 years. It is severely dilapidated and is structurally unsafe. The house is located on Wolwenfontein 244 and was built with face bricks and cement. It is covered with a pitch corrugated iron roof and fitted with steel window frames. It was connected in more times with a water stand and a nearby shed. It is possible that the house, shed and water tank may date from the same time period, namely the 1940's or the 1950's.

Figure 4.67: Buildings at Site 17

4.11 Noise

The information contained in this section of the report was obtained from the Noise Assessment conducted by dBAcoustics, attached herewith as Appendix C-8.

Sound is a wave motion, which occurs when a sound source sets the nearest particles of air in motion. The movement gradually spreads to air particles further away from the source. Sound propagates in air with a speed of approximately 340 m/s. The sound pressure level in free field conditions is inversely proportional to the square of the distance from the sound source – Inverse Square Law. Expressed logarithmically as decibels, this means the sound level decrease 6 dB with the doubling of distance. This applies to a point source only. If the sound is uniform and linear then the decrease is only 3 dB per doubling of distance.

The decibel scale is logarithmic therefore decibel levels cannot be added together in the normal arithmetic way, for example, two sound sources of 50 dB each do not produce 100 dB but 53 dB, nor does 50 dB and 30 dB equal 80 dB, but remains 50 dB. Air absorption is important over large distances at high frequencies and it depends on the humidity but is typically about 40 dB/km @ 4000 Hz. Traffic noise frequencies are mainly mid/low and will be unaffected below 200m.

When measuring the intensity of a sound, an instrument, which duplicates the ear variable sensitivity to sound of different frequency, is usually used. This is achieved by building a filter into the instrument with a similar frequency response to that of the ear. This is called an A-weighting filter because it conforms to the internationally standardized A-weighting curves. Measurements of sound level made with this filter are called A-weighted sound level measurements, and the unit is dB.

Sound propagation is affected by wind gradient rather than the wind itself. The profile of the ground causes such a gradient. The sound may be propagated during upwind conditions upwards to create a sound shadow. A downwind refracts the sound towards the ground producing a slight increase in sound level over calm isothermal conditions.

The velocity of sound is inversely proportional to the temperature therefore a temperature gradient produces a velocity gradient and a refraction of the sound. Temperature decreases with height and the sound is refracted upwards. For a source and receiver close to the ground quite large attenuation can be obtained at certain frequencies over absorbing surfaces, noticeably grassland. This attenuation is caused by a change in phase when the reflected wave strikes the absorbing ground and the destructive interference of that wave with the direct wave. The reduction in sound tends to be concentrated between 250 Hz and 600 Hz.

Noise screening can be effective when there is a barrier between the receiver and the source i.e. walls, earth mounds, cuttings and buildings. The performance of barriers is frequency dependent. To avoid sound transmission through a barrier the superficial mass should be greater than 10 Kg/m2.

There is a complex relation between subjective loudness and the sound pressure level and again between annoyance due to noise and the sound pressure level. In general the ear is less sensitive at low frequencies and the ear will only detect a difference in the sound pressure level when the ambient noise level is exceeded by 3-5 dBA.

There are certain effects produced by sound which, if it is not controlled by approved acoustic mitigatory measures, seem to be construed as undesirable by most people and they are:

- Long exposure to high levels of sound, which may damage the hearing or create a temporary threshold shift – in industry or at areas where music is played louder than 95 dBA. This will seldom happen in far-field conditions;
- Interference with speech where important information by the receiver cannot be analyzed due to loud noises;
- Excessive loudness;
- Annoyance.

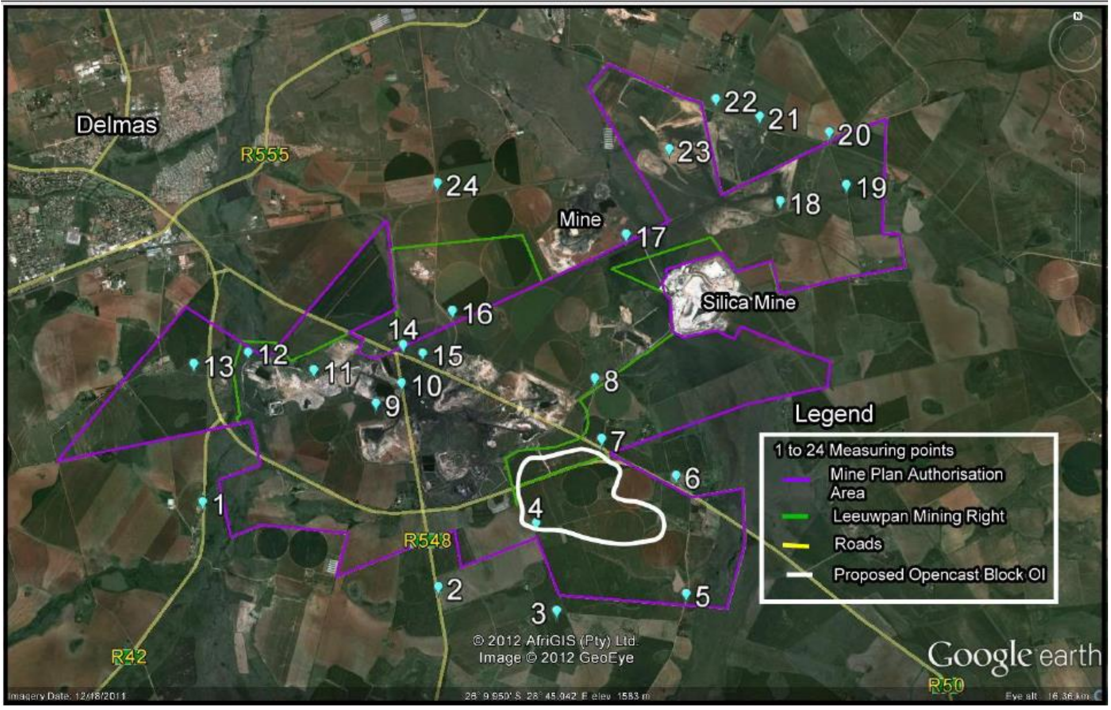
A number of factors, for example clarity of speech, age of listener and the presence of noise induced threshold displacement, will influence the comprehensibility of speech communication. The effect of noise (with the exception of long duration, high level noise) on humans is limited to disturbance and/or annoyance and the accompanying emotional reaction. This reaction is very difficult to predict and is influenced by the emotional state of the complainant, his attitude towards the noisemaker, the time of day or night and the day of the week.

The difference between the actual noise and the ambient noise level and the time of the day and the duration of the activity, will determine how people will respond to sound and what the noise impact will be.

4.11.1 Prevalent Ambient Noise Levels

The prevailing ambient noise levels for the study area are typical of the noise levels expected next to roads and mine activities and the mine activities becomes audible at a distance from the mine.

The night time noise levels are higher than during the daytime because of insect noises and increased hauling vehicles up to midnight and from early morning up to 6h00.



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 4.68: Noise Monitoring Points within the Leeuwpan Coal Mine

The prevailing ambient noise levels within the boundaries of the mine vary between 40.0dBA and 70.0dBA and the noise levels is relative to the distance from the point or linear sources that may record between 85.0dBA and 90.0dBA. These noise levels for the day and night time periods are illustrated in **Figure 4.69**

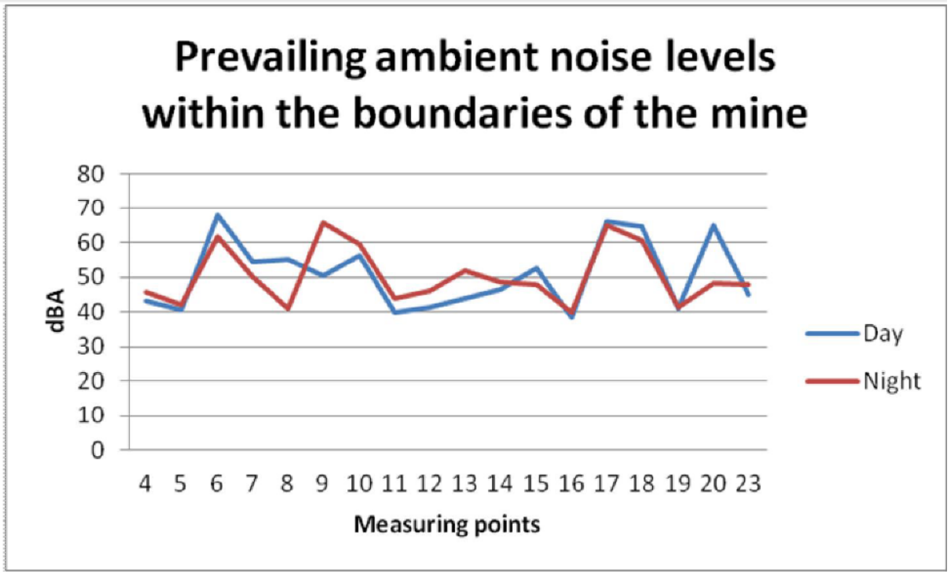


Figure 4.69: Ambient Noise Levels within the boundaries of the mine

The prevailing ambient noise levels as measured along the boundaries of the mine plan authorisation area never exceeded the recommended noise level of 70.0dBA. The recommended noise level may be exceeded during a blast at the open cast pit area of which the increase above 70.0dBA will be for 3-seconds only. The prevailing ambient noise levels when the mine was fully operational are illustrated in **Figure 4.69**. The higher noise levels were during the time when traffic passed the measuring points on the feeder roads which formed the boundaries of the mine.

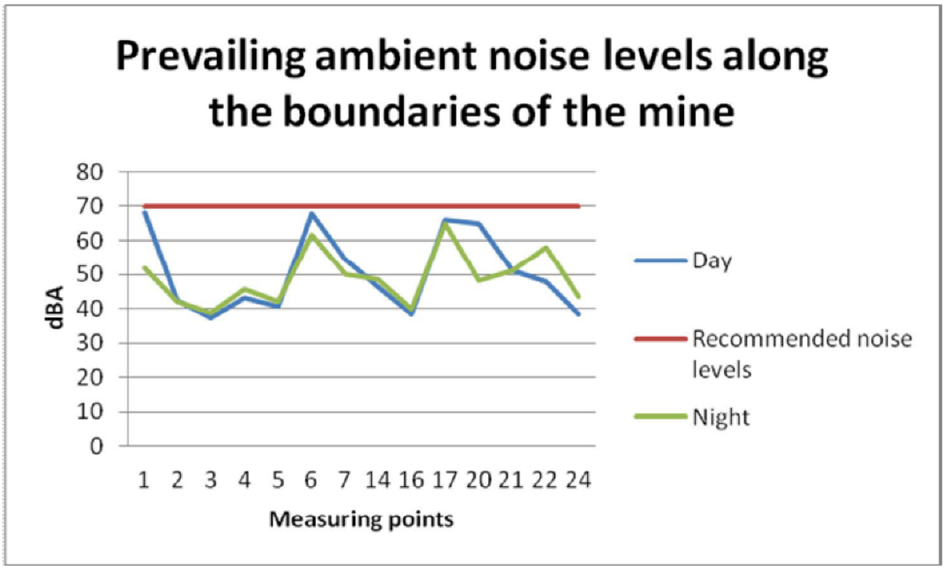
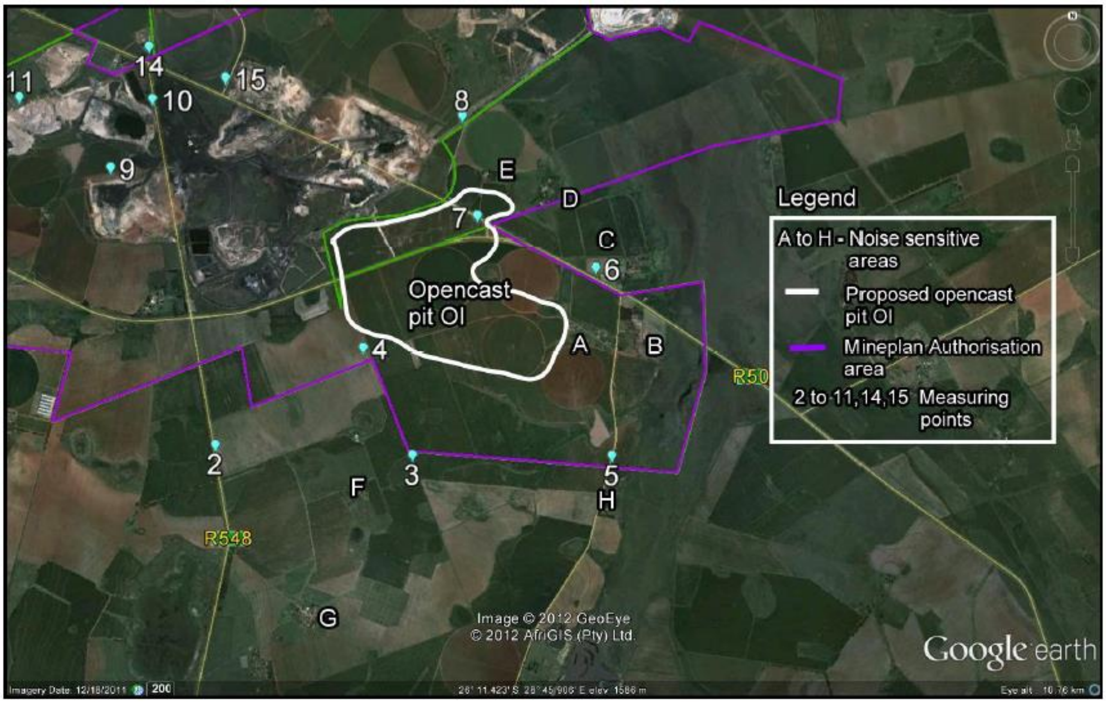


Figure 4.70: Ambient Noise Levels along the boundaries of the mine

The mining at the proposed open cast mine will take place in the vicinity of existing mining operations and busy feeder roads. The people living in the vicinity of these mining activities are already used to the increased noise levels created by the mining activities, hauling vehicles and motor-vehicles. The vegetation such as trees and natural grass will play an important role on how the noise from the opencast activities will be propagated and how the people in the vicinity of the proposed mine will perceive the increased noise levels.



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 4.71: Noise sensitive areas in the vicinity of the proposed opencast pit OI

The type of blasting method at the opencast pit will determine the over-air pressure level and the subsequent increase in the noise level during a blast. The safe distance from a blasting site is 500m.

The prevailing ambient noise level along the northern boundary is higher because of the traffic noise along the R50 Road. The vegetation and the topography play an important role on how the sound is propagated and screened off from the roads and the mine activities along the eastern, southern and western boundaries. The night time noise levels were higher because of a combination of the distant mining activity noise that was audible at most of the measuring points and increased insect activity such as cricket noises. These prevailing ambient noise levels are the environmental noise levels.

Noise or sound is part of our daily exposure to different sources which is part of daily living and some of the sounds which may be intrusive such as traffic noise forms part of the ambient noise which people get accustomed to without noticing the higher sound levels.

The proposed mining activities will create a shift in the near field prevailing ambient noise levels and at times this will create a temporary shift in the far field noise levels. The noise intrusion can however be controlled by means of approved acoustic screening measures, state of the art equipment, proper noise management principles and compliance to the International Finance Corporation's Environmental Health and Safety Guidelines.

4.12 Blasting and Vibrations Assessment

The information contained in this section of the report was obtained from the Blasting Assessment conducted by Blast Management, attached herewith as Appendix C-9.

4.12.1 Blasting Points of Interest (POI)

For the blasting and vibration assessment surface structures that are present in a 3500m radius from the proposed mine boundary that will require consideration during modelling of blasting operations were reviewed and included as Points of Interest (POI). This could consists of houses, general structures, power lines, pipe lines, reservoirs, mining activities, roads, shops, schools, gathering places, possible historical sites etc. A list was prepared as best possible for each structure in the vicinity of the pit areas and assessed, refer to Figure 4.72.

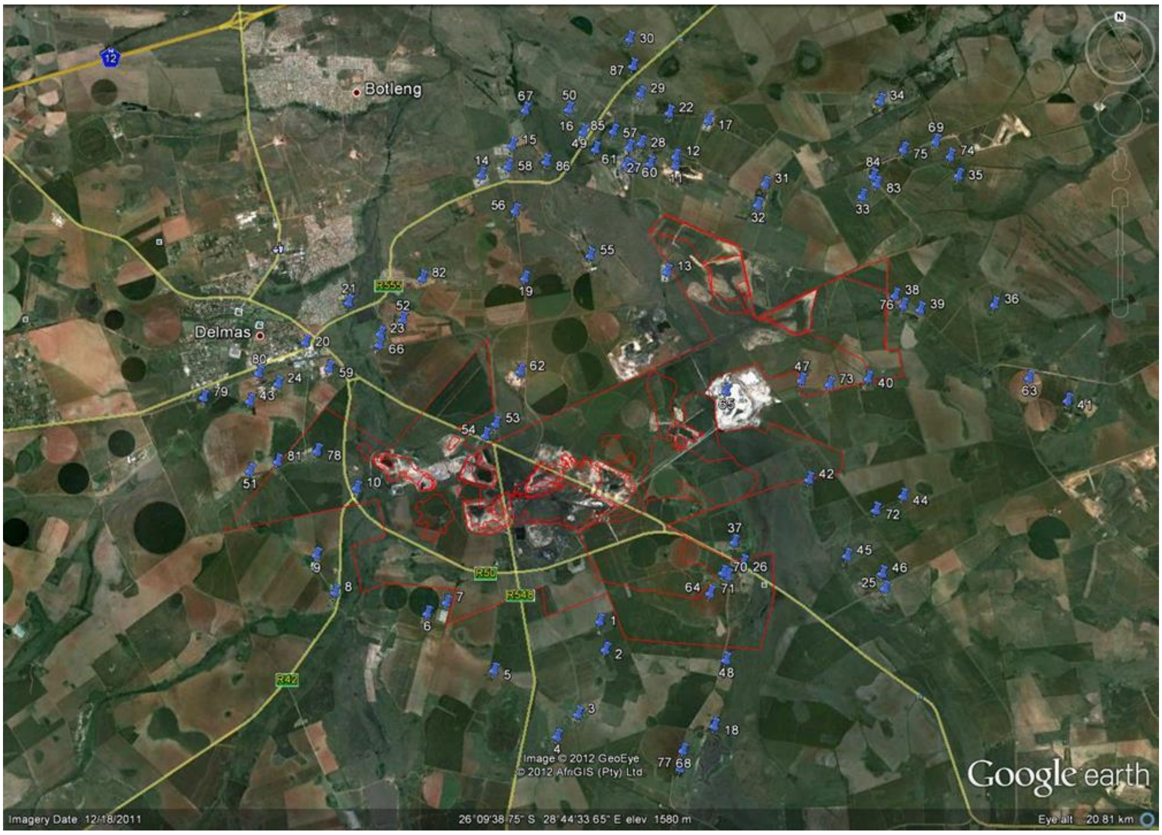


Figure 4.72 Blasting Point of Interest (POI) for Leeuwpan Coal Mine

The mining method applied is typical strip, drill and blast with conventional opencast truck and shovel for haulage. There are various pit areas being mined and drilling and blasting differ between these areas and the type of blasting done. Information for the operation was obtained and reviewed. Drilling and blasting operations are conducted in two types of blasting, production blasts and pre-split blasts.

Figure 4.73 to Figure 4.75 shows summary of the different pit areas, types of blasting done, drill patterns, charging information and blasting information applicable for the past two years.

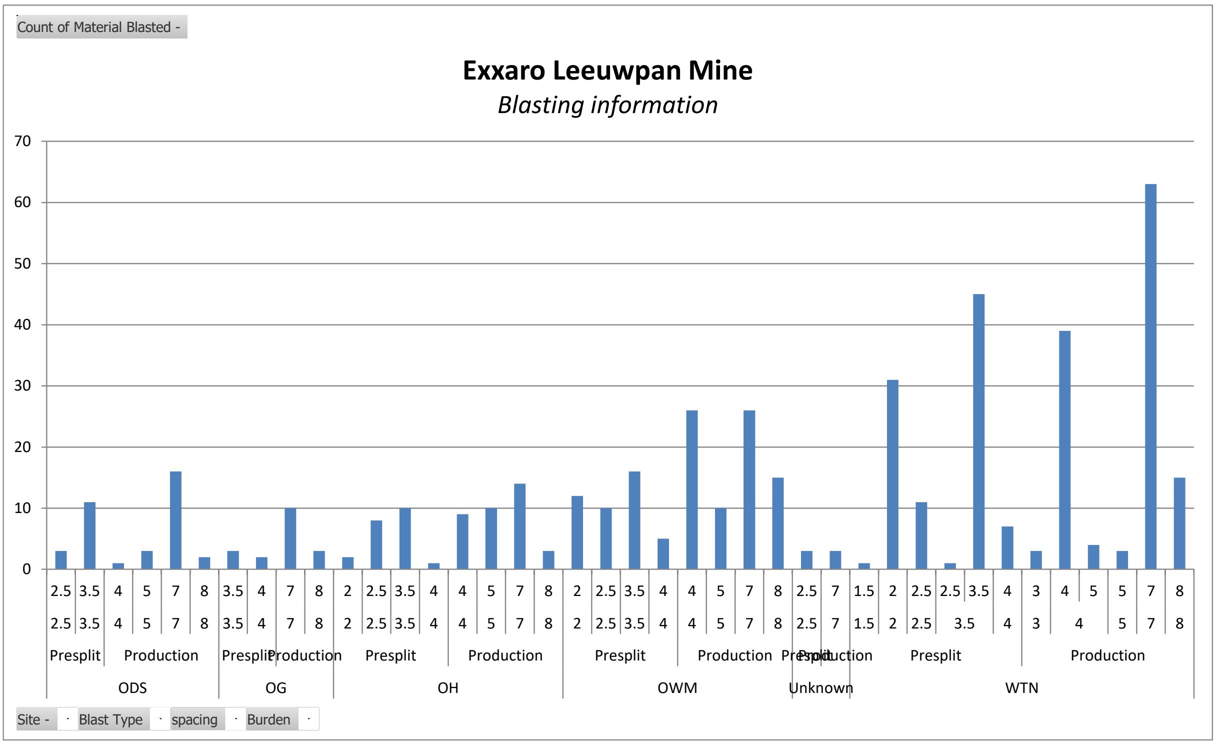


Figure 4.73 Drilling Information

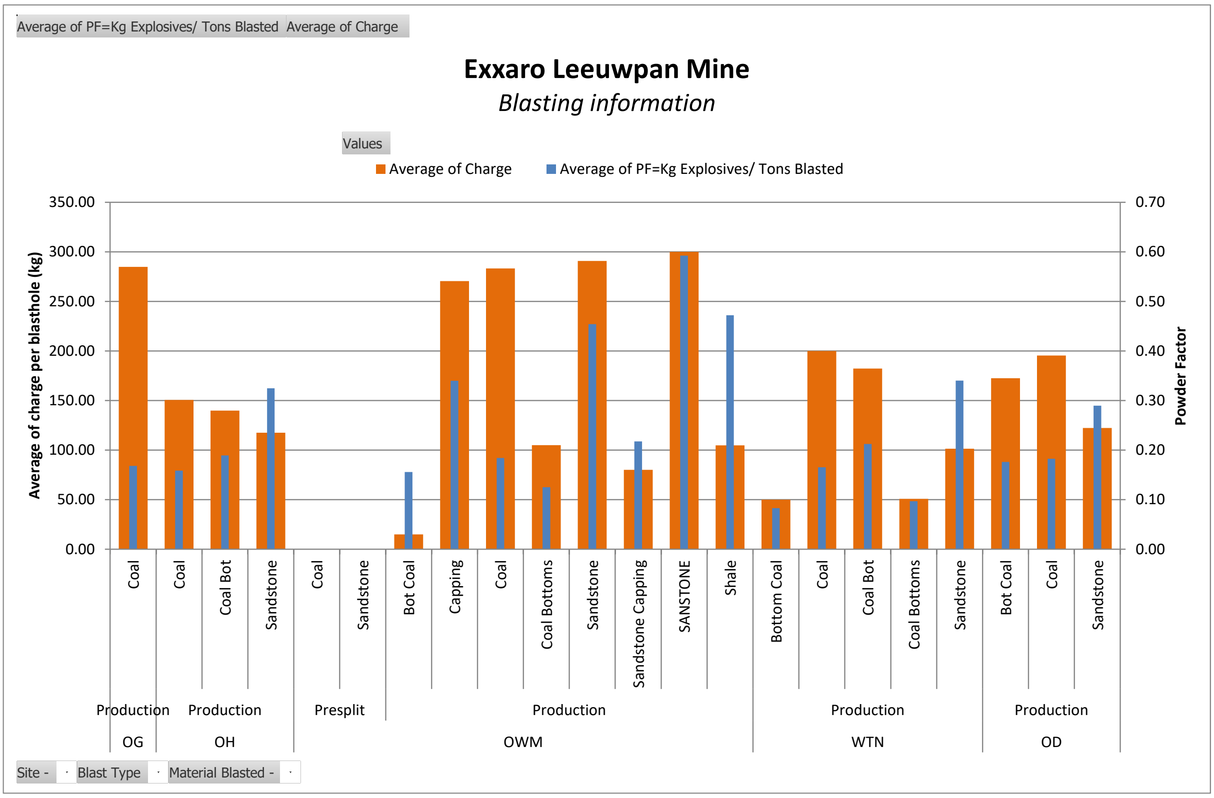


Figure 4.74: Charging Information

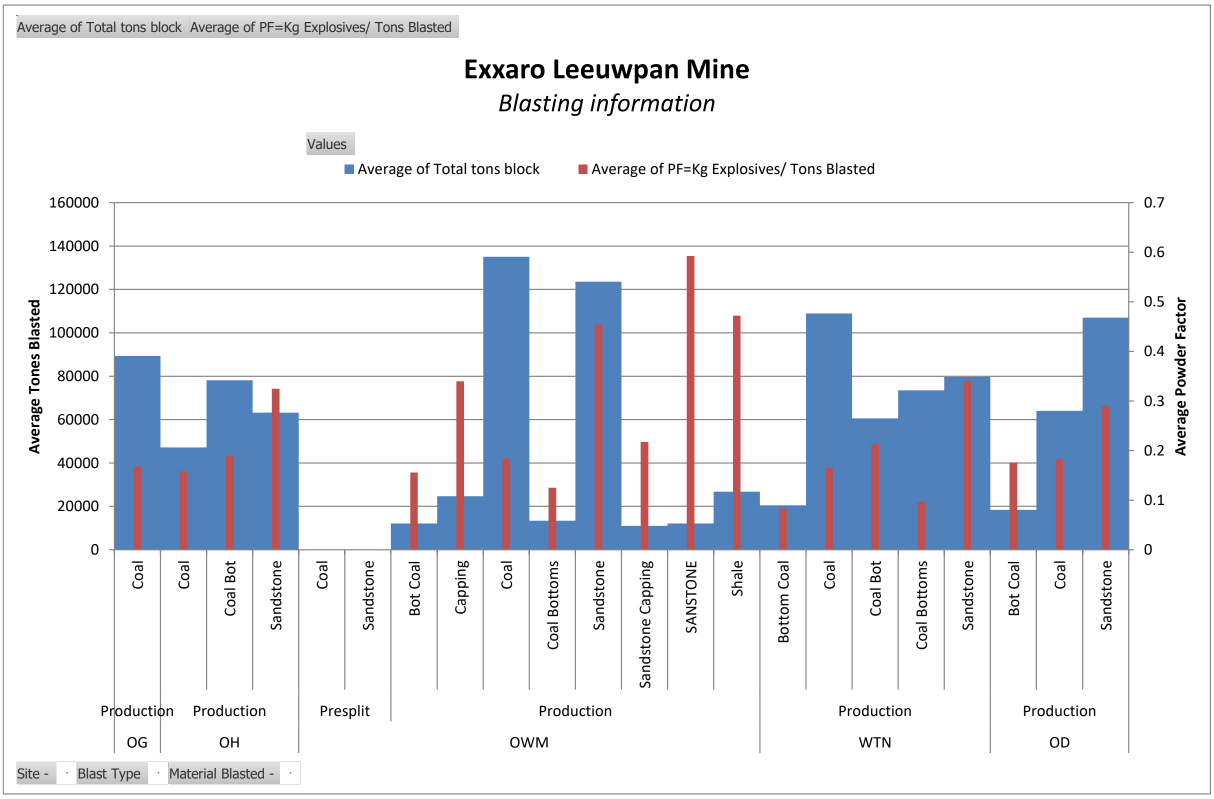


Figure 4.75: Blasting Information

4.12.2 Effects of Blasting Operations

Blasting operations have an effect on its surroundings. These effects can manifest in the form of ground vibration, air blast, fumes, fly rock etc. The application of explosives breaking rock will always have a positive and negative manifestation of different energies. It is the effects that have a negative outcome that will need to be managed.

4.12.2.1 Ground Vibration

Ground Vibration results evaluated show that predicted influence is limited and all levels calculated for the nearest structures or installations as identified are within accepted norms and standards with the exception of maybe five points of interest. These points are located close to the mining areas and could experience significant levels of ground vibration. The maximum ground vibration calculated at nearest farmstead 52m from boundary used was 283mm/s. The rest of the levels observed ranged between none and 37.2mm/s. Levels at four installations showed levels greater than the recommended limits considered. Blasting at nearest points to these installations must be controlled in order to ensure that damages are not induced.

There is a possibility that people and farm animals may be present in areas around the project area. Consideration was given to the possible influence of blasting on people and animals. All animals and people should not be present within 500m from the blasting operations. Possible injury is not expected at distances further than the 500m boundary.

4.12.2.2 Air Blast

Air blast evaluated showed to be more of a concern than ground vibration. Review of the air blast for the two different areas indicates significant more points of interest influenced than ground vibration. Air blast levels as high as 153.6dB at nearest structure from the boundary is expected. Installations or structures further away showed lower levels but for at least five other installations to be as high as 142dB. Consideration must be given to control on air blast. Levels predicted could certainly give reason for complaints and in some cases cause damage to be done.

Leeuwpan Coal Mine operations are currently conducted in a manner that ground vibrations are generally in the safe blasting criteria. Air blast has the possibility to be more problematic. High levels of air blast were observed in recorded data but not necessarily causing damage at the specific identified structures. Careful blast planning and design should still be practised to ensure good neighbourship. Refer to Appendix C-9 for calculations and predictions regarding blasting operations.

4.13 Social and Socio-economic conditions

The information contained in this section of the report was obtained from the Social Impact Assessment conducted by GCS, attached herewith as Appendix C-10.

When conceptualising a proposal to expand a coal mine, the anticipated social and environmental impacts are generally broad and not limited to one specific area or town. The proposed project falls within the Mpumalanga Province, Victor Khanye Local Municipality (LM), which is part of the Nkangala District Municipality (DM).

In order to assess the potential impact of the proposed project, it is important to consider the particular Province, DM, LM as well as the nearby towns in a holistic way.

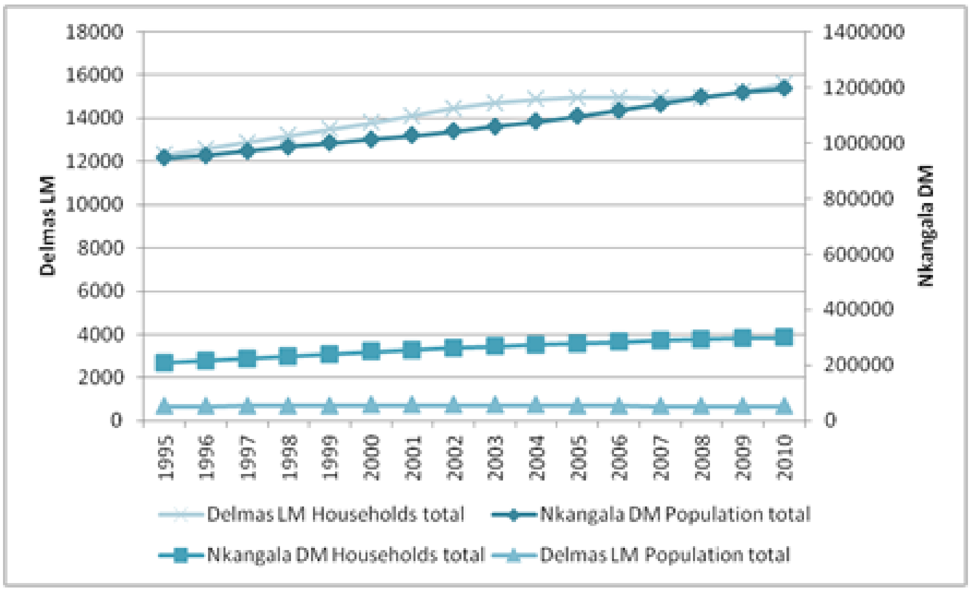
The regional context of the socio-economic factors in Mpumalanga Province and the Victor Khanye LM with a thorough investigation into Delmas are discussed in the Socio Economic baseline assessment in Annexture O.

4.13.1 Demographic profile

4.13.1.1 Population and household profile

The population according to the '96 census was 34 894 in Delmas. This increased by 2006 to an estimated 56 208 people, of which women comprised 51.4%. According to

Figure 4.76, the population size (persons) for the Victor Khanye LM increased only slightly between the 1995 to 2010 time period, growing by 0.23% since 1995. Households have however increased at the same rate as that of the Nkangala DM over the specified time period, growing by 21.16% and 20.91% respectively.



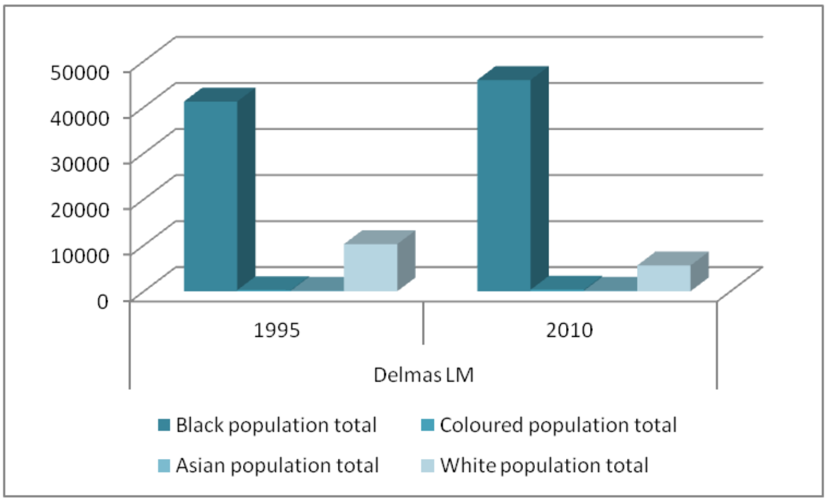
Source: Quantec Research (Pty) Ltd

Figure 4.76: Population and household size (1995 – 2010)

4.13.1.2 Population group

The Victor Khanye LM population in 2010 were composed of mostly Black African persons (69.88%) followed by 8.53% White persons. The number of Black African person has increased by 10.17% since 1995, whereas the number of White persons has decreased by 82.73% since 1995.

The Nkangala DM population in 2010 consisted of mostly (93.78%) Black African persons. The number of White persons living within the DM has decreased by 44.46% since 1995 with the Black and Asian populations growing strongly.

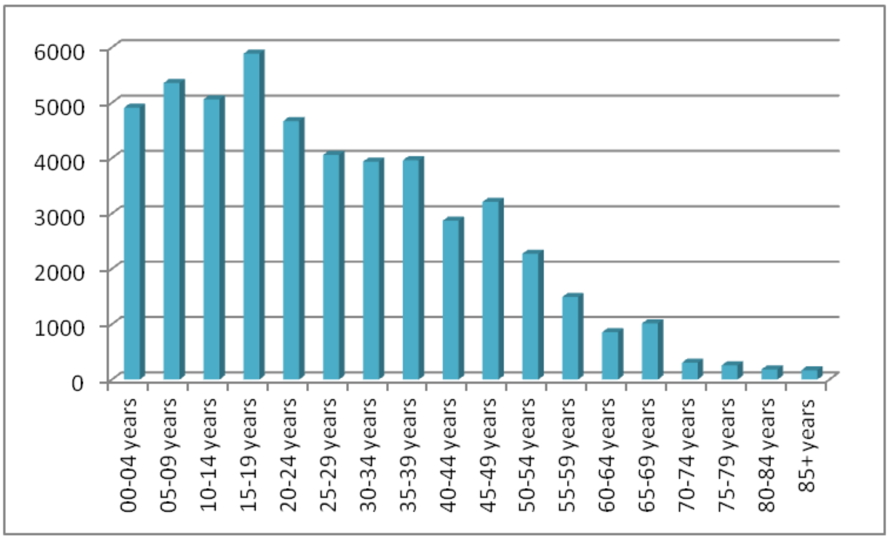


Source: Quantec Research (Pty) Ltd

Figure 4.77 Population group (1995 - 2010)

4.13.1.3 Age

The Victor Khanye LM population has a large adolescent population with 26.07% of the population being younger than 15 years of age (Figure 4.78) indicating that they do not form part of the Economically Active Population (EAP) of the area.



Source: Quantec Research (Pty) Ltd

Figure 4.78 Age (2007)

Approximately two thirds (65.80%) of the Victor Khanye LM population falls among the EAP (16 to 64 year) age band. These persons normally have more work experience and usually fall within the higher skilled and higher salary bracket. One can clearly note that the population starts decreasing from the age of 19 years, leaving fewer economically active individuals. The elderly population (65 years and older) is very small (3.82%), which means that less burden is placed on the EAP to support persons that are no longer economically active.

4.13.1.4 Education

During 1995, the largest percentage (17.58%) of the Victor Khanye LM population has not obtained a Grade 0 or any other schooling; however, by 2010 this number had improved by 113.21%. The number of persons that have achieved a Grade 12 level of education improved by 17.33% in the same period.

4.13.2 Economic profile

This section provides a delineation of the study area and a brief economic status quo pertaining to employment and labour profile.

4.13.2.1 Employment and labour profile

The employment status of the population has a variety of important implications. Economically active and employed persons can contribute to the overall welfare of a specific community by paying their taxes, looking after the youth and aged and by stimulating the economy. However, should a community have a large number of economically inactive and / or unemployed persons, the burden on the EAP of that community are amplified.

Even though the working age population for the Victor Khanye LM has increased by 7.58% between 1995 and 2009, the number of employed persons has decreased by 20.53% in the same period. The unemployment rate has fortunately decreased by 17.04% since 1995; however, the labour force participation rate has decreased by 29.48%. According to the South African census "96 the unemployment figure was determined to 20.31%. In 2003, of the 34 894 inhabitants, 37.43% were employed and 42.44% were not working. This included those not looking for work, housewife, students, pensioners/retired persons and disabled persons. By 2006, the number of full time employed people was approximately 13200 from approximately 23000 people. In 2007 the unemployment figure was 27.1%. Of the 36111 inhabitants, 36% was unemployed and 36.26 were economically active.

The wholesale and retail industry is currently creating the most employment opportunities within the Victor Khanye LM (21.45%). The agriculture, forestry and fishing industry has shown a significant decrease since 1995, marking a change of 252.97% for Victor Khanye LM. The major employers in the area include I&J, Voest-Alpine, Meadow foods, the Municipality of Delmas and Delmas Colliery.

4.13.3 Services and infrastructure profile

Social service delivery centres on the provision of health, education and community development facilities and services. The concept of service delivery also comprises various elements such as affordability, quality, efficiency and access.

The following social infrastructure can be found:

- Education
  - Primary schools- 3 in Delmas
2 in surrounding areas
  - Secondary schools- 2 in Delmas
8 in surrounding areas
- Healthcare
  - Hospital 1 in Delmas
  - Clinic 1 in Botleng
- Sports and recreation - Available sports facilities in Delmas include golf, athletics, rugby, soccer, tennis, squash, badminton, basketball, bowls and jukskei.

This indicator therefore examines the level of service provision in the study area. Services assessed include sanitation, water, housing and electrification. There are three priority services (water, sanitation and electricity) for the promotion of health, convenience and quality of life.

4.13.4 Housing

There are approximately 1200 houses and flats in Delmas. A very limited number of houses for are available for renting in the town. Mining labourers use existing farmsteads and temporary houses as accommodation.

The Victor Khanye LM has been steadily formalising informal settlements within its municipal area. Persons residing within formal houses[4] have increased by 28.54% between 1995 and 2010. There has been a decrease of 61.97% in informal housing[5] within the Victor Khanye LM. Significant decreases in the number of 1) traditional dwelling/hut/structure made of traditional materials (150.42%), 2) house/flat/room, in backyard (223.42%) and 3) room/flatlet not in backyard but on a shared property (229.09%) has been noted within the Victor Khanye LM.

4.13.4.1 Energy use

The use of electricity for lighting has increased by 36.80% between 1995 and 2010 within the Victor Khanye LM. With the increase in electrification, all other sources for light generation have decreased, except for paraffin which has increased by 23.49%.

4.13.4.2 Water

The level of water supply to households in Victor Khanye LM has incrementally increased with a 46.02% improvement in piped water inside a dwelling or yard. The use of a water-carrier/tanker/water vendor within the Victor Khanye LM has decreased by 329.41% since 1995. The number of persons relying on a nearby dam/river/stream/spring for water has been reduced by 363.27% in the same period.

***4.13.4.3** Healthcare*

The number of HIV positive persons living within the Victor Khanye LM in 2010 has increased by 73.72% since 1995. The number of HIV related deaths has increased dramatically by 92.11%, with the number of other deaths actually decreasing slightly with 11.17%. This indicates that HIV/AIDS has had a real impact on the Victor Khanye LM since 1995, even though this trend has slowed slightly from 2004.

[4] Formal housing includes: 1) House or brick structure on a separate stand or yard, 2) Flat in a block of flats and 3) Town/cluster/semi-detached house (simplex, duplex or triplex).
[5] Informal housing includes: 1) Informal dwelling/shack, in backyard and 2) Informal dwelling/shack, NOT in backyard, e.g. in an informal/squatter settlement

4.14 Traffic

The information contained in this section of the report was obtained from the Traffic Impact Assessment conducted by ITS, attached herewith as Appendix C-11.

A site visit has been conducted on the 5th of April 2012, for the purpose of the scoping investigation. Traffic counts were carried out during the morning and afternoon peaks hours (6:00 – 9:00 morning and 16:00 – 19:00 afternoon) at the above mentioned intersections. Light vehicles, heavy vehicles (2 - 4 axles) and very heavy vehicle (5 and more axles), were counted at the intersections. The AM and PM Peak hour was determined based on the highest traffic volumes registered during the morning and afternoon period respectively. The AM Peak was found to be from 7:30 to 8:30 and the PM Peak hour was recorded at 16:45 to 17:45.

The R50, R548 and R42 routes are single carriage way (2 lanes, one lane per direction), paved roads with a capacity of ±1500 vehicles/hour/direction.

4.14.1 Existing Accesses

- Access 1 is located at the R50 Road / R548 Road west of the mining area and is mainly use for mining staff, deliveries and contractors; and
- Access 2 is located on Goedgedacht Road north of the mining area. Despatch of coal is controlled through this access.

4.14.2 Intersection Geometry

- The R50 Road / R548 Road intersection is a priority controlled intersection with priority on the R50 Road and currently provided access to the mine (Access 1).
- The R50 Road / R42 Road intersection is a priority controlled T-intersection with priority on the R50 Road.
- The R50 Road / Goedgedacht Road intersection is a priority controlled intersection with priority on the R50 Road. Goedgedacht Road links Access 2 with the R50 Road.

4.14.3 Existing Traffic Volumes

The R50 Road is situated on the eastern side of the Exxaro Leeuwpan Coal Mine site and is part of the provincial road network in the area. The traffic data indicates that the highest flow occurs along the R50 Road with approximately 550 vph and 530 vph during the morning AM and afternoon PM peak (two-way flows) respectively. The main direction during the morning peak (± 360vph) is in an easterly direction. During the afternoon peak the main direction is westbound with approximately 370 vph. Approximately 20% of the total traffic volume during the peak hours is heavy vehicles.

The R548 Road carries approximately 80 vph and 70 vph during the morning AM and afternoon PM peak (two-way flows) respectively with approximately 9% of the total traffic volume being heavy vehicles during the morning peak and approximately 19% during the afternoon peak.

The R42 Road carries approximately 200 vph and 260 vph during the morning AM and afternoon PM peak (two-way flows) respectively with approximately 26% of the total traffic volume being heavy vehicles during the morning peak and approximately 42% during the afternoon peak.

Goedgedacht Road is situated on the northern side of the Exxaro Leeuwpan Coal site and carries low traffic volumes with approximately 10 vph and 55 vph during the morning AM and afternoon PM peak (two-way flows) respectively with approximately 33% of the total traffic volume being heavy vehicles during the morning peak and approximately 19% during the afternoon peak.

The following external roads might be affected by the mining activities:

- R50 Road, R548 Road and Access to the mine
- R42 Road; and
- Goedgedacht Road, north of the proposed site and Access 2 to the mining area.

The following intersections will be investigated:

- R50 Road / R548 Road (Access 1);
- R50 Road / R42 Road; and
- R50 Road / Goedgedacht Road (Access 2)

5 PUBLIC PARTICIPATION PROCESS

This chapter describes the stakeholder engagement process undertaken, as well as the proposed process to be undertaken during the NEMA application process, thereby fulfilling the requirements as per Regulation 50 (f) of the MPRDA Regulation R527 and headings 11 to 13.

REGULATION 50 (f):

- *(Section 11): Identification of interested and affected parties (I&APs). (Including the community, and list as identified according to the scoping report guideline and identified in the scoping report).*
- *(Section 12): The details of the engagement process. (Including the community, and list as identified according to the scoping report guideline and identified in the scoping report and any further consultation since the compilation of the scoping report).*

(Section 13): Details regarding the manner in which the issues raised were addressed. (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department).

This chapter describes the stakeholder engagement process undertaken thus far. The proof of public consultation undertaken to date is included in Appendix D of this report.

5.1 Purpose of public participation

5.1.1 Legal Requirements

The Public Participation Process (PPP) forms an integral part of the environmental authorization application in terms of the following legislative processes:

- MPRDA: Section 48 (f) and 49(f) respectively of the MPRDA regulation R527, published in terms of Section 107(1) of the MPRDA Government Gazette No. 26275, dated 23 April 2004;
- NEMA: Chapter 6, R543, Government Gazette No. 33306 dated 18 June 2010; and

- NWA: Section 41 (4) of the NWA provides that the competent authority (DWA) may, at any stage of the application process, require the applicant to place a suitable notice in newspapers and other media, and to take other reasonable steps as directed by the competent authority to bring the application to the attention of relevant organs of state, interested persons and the general public.

Due to the legislative requirements listed above, the PPP has been integrated as far as possible to present all environmental authorization application processes to I&APs.

5.2 Identification of Interested and Affected Parties (I&APs)

The following stakeholder groups were identified and informed of the project:

- Landowners;
- Lawful occupiers of land;
- Relevant authorities;
- Utilities; and
- Members of the public within the Delmas area.

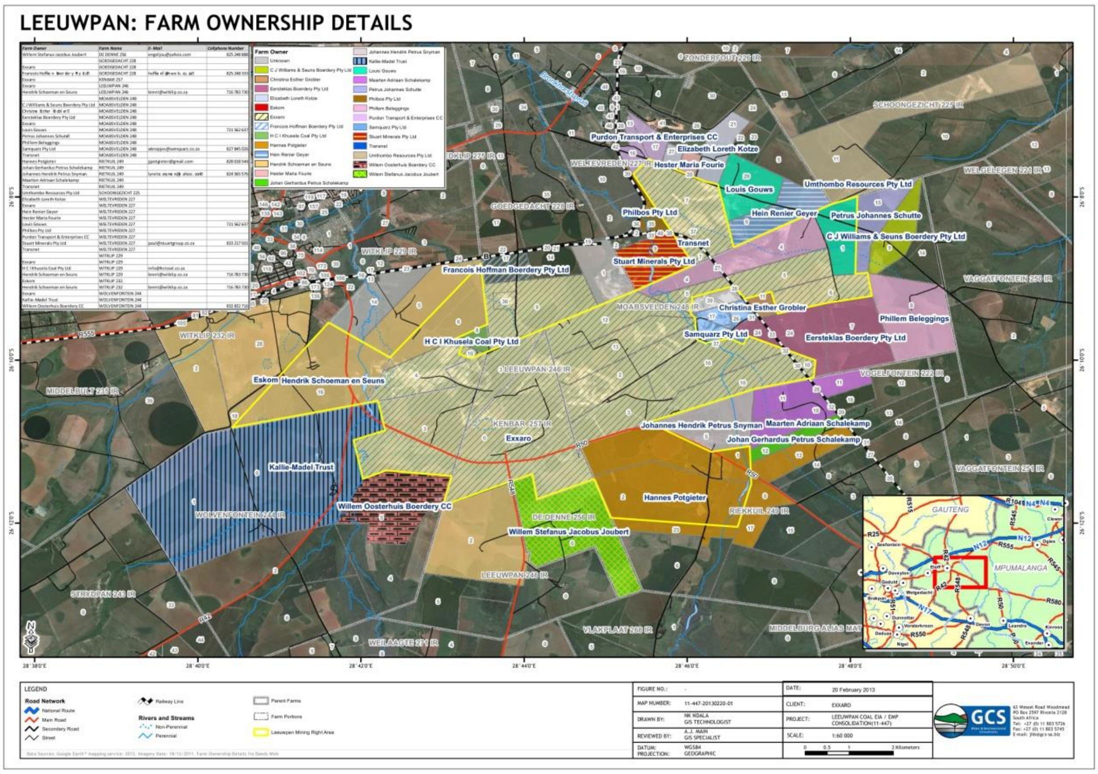
The stakeholder database for Leeuwpan Coal Mine is provided in Appendix D of this report.

5.2.1 Landowner Consultation

Landowners were consulted in the following manner:

- Written communication (Background Information Document) sent via email, fax and registered mail; and
- A public meeting was held on 27 November 2012 in Delmas (Refer to the description under Section 5.4.1 of this report).

See Figure 5.1 for surrounding and neigbouring land owners.



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 5.1 Surrounding Landowners (See Appendix A for A3)

5.2.2 List of Authorities consulted

The following authorities were informed, in writing, of the project application processes being undertaken:

- Department of Minerals and Resources (DMR);
- Department of Economic Development, Environment and Tourism (MDEDET);
- Department of Water Affairs (DWA);
- South African Heritage Resources Agency (SAHRA);
- Mpumalanga Tourism and Parks Agency (MTPA);
- Department of Roads, Transport and Public Works (DRTPW); and
- Department of Agriculture, Rural Development and Land Administration (DARDLA).

These authorities were automatically registered as I&APs on the stakeholder database developed for the project.

5.3 Notification of Stakeholders

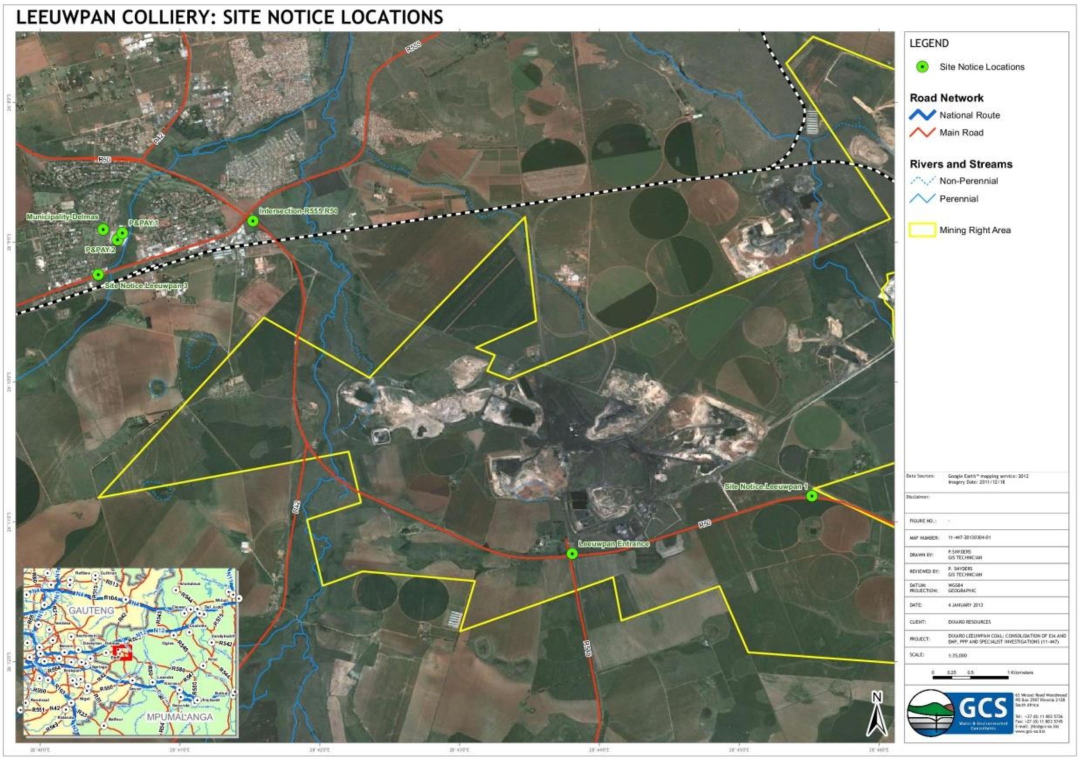
Various methods of written notification were utilized to inform the I&APs. These are discussed in the sections below. The process undertaken thus far is described in this section of the report and proof thereof is included in Appendix D of this report.

Each of the documents which were used to notify stakeholders and the public of the project contained the following information:

- The geographic location of the project;
- The name of the applicant;
- The reference numbers issues for the environmental authorization application which were issued by the MDEDET;
- The applications being undertaken in terms of the MPRDA, NEMA and NWA;
- The listed activities being applied for in terms of the NEMA regulations;
- An invitation to register as an I&AP;
- The contact details and deadline for registration; and
- Notification that a public meeting will be held to present the project (as part of the NEMA and NWA), informing the public that all registered I&APs will be informed of the date, time and venue for the public meeting once these details have been finalized.

5.3.1 Site Notices

Site notices were placed at six (6) locations on the proposed project area. The locations where these site notices were placed are shown in Figure 5.2 and the copy of the site notices and proof of placement (photographs) is presented in the proof of public participation document included in Appendix D.



(not to scale, please refer to Appendix A for a enlarged Map)

Figure 5.2: Location of Site Notices

5.3.2 Media advertisement

An advertisement, according to Regulation 54 of NEMA regarding the project background and the assessment process being followed were placed on 9 and 16 November 2012 (Scoping Phase) in the Citizen and Streeknuus newspapers and the process to initiate advertisements regarding the EIA phase was initiated in January 2014 after the update of specialist studies is complete (refer Appendix D).

5.3.3 Background Information Documents

Background Information Documents (BIDs) were distributed via email, fax and post to the following people listed on the Leeuwpan stakeholder database:

- Landowners of the properties within the proposed Project Area;
- Local, provincial and national authorities;
- All I&APs who contacted GCS following the placement of the advertisements, and

- BIDs (including registration forms) were placed on the table at the library.

5.4 Public Meetings

5.4.1 Introductory Public Meeting

A public Open Day was held on 27 November 2012 at the Agri Lapa, Delmas. Minutes and an attendance register were taken and are presented in Appendix D.

5.4.2 Authorities Consultation Meetings

An authority consultation meeting will be held after submission of the draft EIA/EMP for Authority Review to discuss the project and obtain the views and comments of the decision makers on the projects. (Refer to Annexure D)

5.5 Stakeholder Database

A stakeholder database was developed for the project. The database contains the contact details of the landowners, local, provincial and national authorities as well as all people who requested registration. This is included in Appendix C.

5.6 Issues and Responses

5.6.1 Issues raised by the Public

The issues raised during the public consultation period thus far are summarized in Table 5.1. Any issues received from I&APs will be recorded and presented as the process progresses.

Table 5.1: Issues and Response Trail

No	Comment Raised	By Whom	Designation	Where and Date	Environmental Parameter Impacted	Response by EAP
1	Mines don't implement their Corporate Social Responsibility	Mopale Nyakale; George Mtshweni	Resident at Delmas Settlement	Open Day - 27 November 2012	Social	Exxaro commits to regularly have stakeholder meetings with surrounding landowners and stakehodlers to ensure compliance with commitments.
2	PM10 - Mine pollute the air	Mopale Nyakale; George Mtshweni	Resident at Delmas Settlement	Open Day - 27 November 2012	Air Quality	New PM10 monitoring programme suggested as part of Air Quality Assessment
3	Wetlands will be destroyed	Mopale Nyakale; George Mtshweni	Resident at Delmas Settlement	Open Day - 27 November 2012	Wetlands	Impacts identified as part of Wetland Assessment, management measures identified. Exxaro itends to continue with mining but will investigagte in conjunction with DWA wetland offsets.
4	People will possibly be removed or displaced by the mine	Mopale Nyakale; George Mtshweni	Resident at Delmas Settlement	Open Day - 27 November 2012	Social	A relocation Programme for residents on the farm Rietkuil will be negotioated with all stakehodlers involved.
5	The mining area is located next to a food production area	Mopale Nyakale; George Mtshweni	Resident at Delmas Settlement	Open Day - 27 November 2012	Social	Area identified as agricultural but also mining area, not only food production area.
6	The EIA / PP process is a waste of time	Mopale Nyakale; George Mtshweni	Resident at Delmas Settlement	Open Day - 27 November 2012	Social	All PP process comply to legislation, Exxaro commit to more regular stakeholder feedback meetings
7	Mining companies don't fullfill their promises after the documents have been submitted and approval for mining given	Mopale Nyakale; George Mtshweni	Resident at Delmas Settlement	Open Day - 27 November 2012	Social	Annual performance audits are conducted by all government departments as required by law.
8	Affected Parties are not being consulted	Mopale Nyakale; George Mtshweni	Resident at Delmas Settlement	Open Day - 27 November 2012	Social	Leeuwpan to reinstate annual stakeholder meetings
9	Delmas is the wrong area for mining, mining compromises land that can be used for farming	Mopale Nyakale; George Mtshweni	Resident at Delmas Settlement	Open Day - 27 November 2012	Social	Mine development determined by geology of an area. Land will be rehabilitated back to grazing with farming potential.

No	Comment Raised	By Whom	Designation	Where and Date	Environmental Parameter Impacted	Response by EAP
10	Residents only use 16% of the power that the coal will be used for, Mining industry uses the rest and gets the electricity at lower rates.	Mopale Nyakale; George Mtshweni	Resident at Delmas Settlement	Open Day - 27 November 2012	Social	Comment related to South Africa and mining, not directly related to the project, but an issue to discuss with DMR
11	Through Mining we are negotiating our own extinction	Mopale Nyakale; George Mtshweni	Resident at Delmas Settlement	Open Day - 27 November 2012	Social	Comment related to South Africa and mining, not directly related to the project, but an issue to discuss with DMR
12	Mines don't employ the local people	Mopale Nyakale; George Mtshweni	Resident at Delmas Settlement	Open Day - 27 November 2012	Social	Leeupwan employ 500 permanent staff and 400 contractor staff. Employees are sources locally when individual can illustrate skills for mining.
13	Exxaro only invested in one project - a clinic which was demolished and vandalised	Mopale Nyakale; George Mtshweni	Resident at Delmas Settlement	Open Day - 27 November 2012	Social	Leeuwpan submitted an updated Social and Kabour Plan to DMR, new projects were identified, management thereof will also be looked at.
14	Massess aren't consulted	Mopale Nyakale; George Mtshweni	Resident at Delmas Settlement	Open Day - 27 November 2012	Social	Registered stakehodlers are consulted with.
15	Exxaro Leeuwpan has displaced a lot of people and nothing was done about them	Mopale Nyakale; George Mtshweni	Resident at Delmas Settlement	Open Day - 27 November 2012	Social	Leeuwpan did not displace people to start mining, where relocation required families will be negotiated with.
16	We are not negotiating in good faith - how long are we going to take this?	Mopale Nyakale; George Mtshweni	Resident at Delmas Settlement	Open Day - 27 November 2012	Social	Registered stakehodlers are consulted with as required. Expanion of mine will be a positive for all employees and dependants.
17	No one informed him	Peet Bezuidenhout	Farmer	Open Day - 27 November 2012		An email was sent to your email address on the 9th of November 2012. Will continue to be consulted though the process.

No	Comment Raised	By Whom	Designation	Where and Date	Environmental Parameter Impacted	Response by EAP
18	Will the whole area become Leeuwpan?	Peet Bezuidenhout	Farmer	Open Day - 27 November 2012		It is not a consolidation of farms, it is a consolidation of the existing EMP's. Rietkuil will be an extension of the existing mine, no additional mining rights are required.
19	We want the previous EMP's	Elise Tempelhoff	Journalist - Beeld	Open Day - 27 November 2012		The reports done by GCS will be available for public review and comment. Previous EMP's can be requested from the DMR or Exxaro Head Office
20	Are you mining Weltevredenpan?	Elise Tempelhoff	Journalist - Beeld	Open Day - 27 November 2012	Ecology	Mining has stopped at Weltevredenpan pending court case (2012) Not applicable end 2013.
21	How far are you from the river? You know that you are not allowed to be within 100m from the river?	Elise Tempelhoff	Journalist - Beeld	Open Day - 27 November 2012	Wetlands; Surface water	No mining will take place within any rivers. The proximity to wetlands will be applied for with the DWA under Section 21(c) and (i).
22	Where is the Water Use Licence for Weltevredenpan?	Elise Tempelhoff	Journalist - Beeld	Open Day - 27 November 2012		That matter is not open for discussion and not part of the current project (Exxaro comment)
23	Part of this project is the rehabilitation, will we get the rehabillitation plan?	Elise Tempelhoff	Journalist - Beeld	Open Day - 27 November 2012	Closure	The mine works with concurrent rehab. The berm at the channel in front of the offices will be permanent. Excess clay is sold.
24	Is it approved in the current EMP to sell excess clay?	Elise Tempelhoff	Journalist - Beeld	Open Day - 27 November 2012		It was approved as a management measure in Addendum EMP

No	Comment Raised	By Whom	Designation	Where and Date	Environmental Parameter Impacted	Response by EAP
25	Is the underground mine now going to be an opencast mine?	Elise Tempelhoff	Journalist - Beeld	Open Day - 27 November 2012		Yes, and this is part of the current EMP. OI replaces UI as resource for opencast.
26	What will happen to the land after it has been mined? We need the costs of mining.	Elise Tempelhoff	Journalist - Beeld	Open Day - 27 November 2012	Social	Mine will be rehabilited back to grazing with agriculture potential.
27	How will they get the coal from Rietpan to the main plant?	Elise Tempelhoff	Journalist - Beeld	Open Day - 27 November 2013		Overland conveyors that will go through under the R50 at present, other options are still being investigated.
28	Where will the R50 be diverted to?	Willie Joubert	Farmer	Open Day - 27 November 2012		Not part of this process, will be dealt with at a later stage in a different process. Road will be on property that the mine wants to buy for Block OI.
29	I'm worried about the quality of the groundwater at my farm.	Willie Joubert	Farmer	Open Day - 27 November 2012	Groundwater	Groundwater study not completed yet, impact cannot be determined.
30	Water quality has decreased over the past couple of years.	Willie Joubert	Farmer	Open Day - 27 November 2012	Groundwater	Groundwater study not completed yet, impact cannot be determined.
31	Where will the overburden be placed?	Willie Joubert	Farmer	Open Day - 27 November 2012		Overburden will be backfilled, and will be located close to the backfill area.
32	Will I loose farm land that I've been renting, and will there be other areas to rent for farming?	Willie Joubert	Farmer	Open Day - 27 November 2012	Social	Lease areas can be discussed with Leeuwpan directly, but current lessee's will not be asked to vacate land in near future.
33	How would this benefit us and our masses?	Mopale Nyakale	Resident at Delmas Settlement	Email reply to the Openday Proceedings - 11 December 2012	Social	This is addressed in the Social and Labour Plan submitted DMR

No	Comment Raised	By Whom	Designation	Where and Date	Environmental Parameter Impacted	Response by EAP
34	Right now as we are engaging there are people who are maliciosuly treated in Exxaro. Part of them were the members of my union of whom some of them were dismissed, expelled in 2007 for questioning the malacious treatment and for complaining salary adjustment. People are coming complaining day and night about the treatment they are receiving at exxarro. Your contractors are paying slavery wages some are refusing at all remunerate people after they have worked. So how would this assist our community while it has already proven immaterial and have displayed none prepairedness to empower our society. How would this benefit our community and why should we allow you to mine our area?	Mopale Nyakale	Resident at Delmas Settlement	Email reply to the Openday Proceedings - 11 December 2012	Social	GCS is independent, and follows the law as stipulated in the MPRDA and NEMA for the public participation process. GCS can not comment on the past relationship between Exxaro and the Community
35	The relationship you are trying to build with us is a relationship of a horse and the man.	Mopale Nyakale	Resident at Delmas Settlement	Email reply to the Openday Proceedings - 11 December 2012	Social	GCS is independent, and follows the law as stipulated in the NEMA for the public participation process. GCS can not comment on the past relationship between Exxaro and the Community

No	Comment Raised	By Whom	Designation	Where and Date	Environmental Parameter Impacted	Response by EAP
36	Water quality is poor and I need to pump water a great distance to my farm. Someone took water quality samples and I would like to have a look at the results.	Jaco Oosterhuis	Neighbouring farmer	4 March 2013 - in reply to mail notification of the DSR.	Hydrology	Monitoring report are available from Exxaro. Water Quality result presented in Section 4.6
37	Chicken houses and residence have cracks that seem to originate from blasting activities, can this be addressed?	Jaco Oosterhuis	Neighbouring farmer	4 March 2013 - in reply to mail notification of the DSR.	Blasting and Vibration	Blasting activities assessed in Section 4.12
38	The mine used to have regular meetings with the surrounding landowners and this has stopped. It worked well because people knew what was happening. Can this be re-instated?	Jaco Oosterhuis	Neighbouring farmer	4 March 2013 - in reply to mail notification of the DSR.	Social	Exxaro will be arranging a stakeholder engagement meeting (appart from this project) to keep stakeholders updated on what is happening at the mine.
39	Request to review the Social and Labour Plan.	Xolisile Nkosi	Victor Khanye Local Municipality	8 March 2013 - Telephone conversation	Social	The SLP can be requested from the DMR or trhough the Exxaro VKLM SED Forum
40	What will happen to the residents on Rietkuil farm?	Xolisile Nkosi	Victor Khanye Local Municipality	8 March 2013 - Telephone conversation	Social	A Relocation Programme will be actively implemented with community living on Rietkuil. Negotiations will be initiated by Exxaro.
41	With the diversion of the road , we now have to drive 11 km instead of 5 km. Now the road will be moved again! This has a finacial impact on the farm, the further you are from the market the more expensive it becomes to produce your product.	JHP Snyman	Farmer	18 April 2013 - Fax received	Social	The relation of the R50 is not yet decided upon by Exxaro. The project is being investigated by different environmental consultants. Comment noted for future reference.

No	Comment Raised	By Whom	Designation	Where and Date	Environmental Parameter Impacted	Response by EAP
42	The danger of heavy vehicle movement becomes a threat to slow moving farming vehicles.	JHP Snyman	Farmer	18 April 2013 - Fax received	Traffic assessment	This is addressed in the Traffic Assessment done by ITS engineers Section 4-14
43	The tar road caused changes to the wetland and flow of water. We complained constantly to the Mine, phoned and even tried to make appointments, with no reaction.	JHP Snyman	Farmer	18 April 2013 - Fax received	Surface water and Wetland Assessments	This is addressed in the surface water and wetland Assessment done by GCS and Wetland Consulting Services respectively Section 4.6 and Section 4.8
44	The water mass on both sides of the road gets thrown into one stream. The water mass is too much and floods the road at two places, increasing the risk of accidents.	JHP Snyman	Farmer	18 April 2013 - Fax received	Surface water and Wetland Assessments	This is addressed in the surface water and wetland Assessment done by GCS and Wetland Consulting Services respectively Section 4.6 and Section 4.8
45	Cement tunnels weren't placed at the entrance of the farm road , thus the water washes away all the topsoil causing erosion. This has become so bad that no farming implements can move through it.	JHP Snyman	Farmer	18 April 2013 - Fax received	Soils assessment	This is addressed in the Soils Assessment done by TerraAfrica Section 4.3
46	A video was recorded and submitted to the mine. Mr Harmse was involved with the construction of the road, and we constantly phoned him, Mr Schutte was also approached to come and look at the flow direction of the water in order to come up with a solution. No response was received.	JHP Snyman	Farmer	18 April 2013 - Fax received	Social	This impact is not part of this project, and can thus not be addressed directly. Exxaro has been notified of this concern.

No	Comment Raised	By Whom	Designation	Where and Date	Environmental Parameter Impacted	Response by EAP
47	The water table lowered.	JHP Snyman	Farmer	18 April 2013 - Fax received	Groundwater assessment	Groundwater study not completed yet, impact cannot be determined.
48	The water has a strong Sulpher smell, and we had to buy two filter systems in order to be able to drink the water.	JHP Snyman	Farmer	18 April 2013 - Fax received	Groundwater assessment	Groundwater study not completed yet, impact cannot be determined.
49	Our water tank is cracked around the circumference due to blasting.	JHP Snyman	Farmer	18 April 2013 - Fax received	Blasting and Vibration	Blasting impacts are addressed and detailed in the blasting and vibration report done by Blast Management Section 4.12
50	The irrigation dam does not hold watet any more due to cracks from blasting.	JHP Snyman	Farmer	18 April 2013 - Fax received	Blasting and Vibration	Blasting impacts are addressed and detailed in the blasting and vibration report done by Blast Management Section 4.12
51	A submersible pump of roughly R30 000 is stuck in the borehole due to the shaft that moved. We had to give up the pump and the water.	JHP Snyman	Farmer	18 April 2013 - Fax received	Groundwater and Social assessment	Groundwater study not completed yet, impact cannot be determined.
52	Our house walls and windows are badly cracked. We had to do repair work in 2004 and 2010, and it is already cracked again.	JHP Snyman	Farmer	18 April 2013 - Fax received	Blasting and Vibration	Blasting impacts are addressed and detailed in the blasting and vibration report done by Blast Management Section 4.12

No	Comment Raised	By Whom	Designation	Where and Date	Environmental Parameter Impacted	Response by EAP
53	The black Powder after every blast stays in the air and we have to inhale it.	JHP Snyman	Farmer	18 April 2013 - Fax received	Blasting and Vibration, and Air Quality assessment	Blasting impacts are addressed and detailed in the blasting and vibration report done by Blast Management Section 4.12. Mitigation measures for the Air quality impacts are adressed in the Air Quality report done by Airshed Planning Proffesionals Section 4.9
54	Leeuwpan Mine surrounds us and we cant stay on the farm produictively and maintain our health any more.	JHP Snyman	Farmer	18 April 2013 - Fax received	Social	Social impacts are addressed and detailed in theSocial Impact Assessment report done by GCS Section 4.13
55	Wants to know why they are not receiving any notification regarding the project?	Peet Bezuidenhout	Farmer	24 October 2013 - phone call	PP	Project back in Pre-Feasibility Phase, infrastructure being investigated, delayed the project. EIA will commence again as soon as decisions have been made by Exxaro.
56	Can GCS supply them with the previously approved EMPr's?	Peet Bezuidenhout	Farmer	25 October 2013 - phone call	PP	GCS did not conduct the work on the previous EMPr's. Anyone wanting these can apply to see them through the PAIA.

5.6.2 Issues raised by the Commenting Authorities

The issues raised during the public consultation period thus far by the authorities are summarized in Table 5.1.

Table 5.2: Issues and Response Trail from Authorities

No	Comment Raised	By Whom	Designation	Where and Date	Environmental Parameter Impacted	Response by EAP
1	All sites identified in the project area must be properly mapped in relation to the mining infrastructure and development	Phillip Hine	SAHRA Heritage Officer	1 March 2013 - email correspondence	Heritage	See Section 4.10
2	The four sites related to the Built Environment must be properly documented, i.e. with site photographs, field descriptions and assessments of their significance as this has not been done in the current study	Phillip Hine	SAHRA Heritage Officer	1 March 2013 - email correspondence	Heritage	See Section 4.10
3	A palaeontological assessment must be undertaken or a letter of exemption must be provided by a	Phillip Hine	SAHRA Heritage Officer	1 March 2013 - email correspondence	Heritage	Prof Bruce Rubidge has been contacted and will advise on the best option for the study.
4	Land Development application must be lodged with the local municipality to procure the appropriate land use right for the proposed development	T Berlington	DARDLA official	4 March 2013 - email correspondence		Exxaro is in the process of application to rezone to applicable zoning for the areas.
5	The proposed development must adhere to all other legal requirements pertaining the proposed development	T Berlington	DARDLA official	4 March 2013 - email correspondance		Leeuwpan will conduct application processes under MPRDA, NEMA and NWA for applicable environmental permits.
6	The applicant must make sure that the proposed development is in line with municipality and District strategic plan; and	T Berlington	DARDLA official	4 March 2013 - email correspondance		See Section 4.13
7	The Department of Agriculture, Rural Development and Land Reform Ermelo (Scientific Control Technician) still retains the right to support or not support the application despite this recommendation	T Berlington	DARDLA official	4 March 2013 - email correspondance		Comment noted
8	Please send all applications to our Head Office in Nelspruit (as you did) FOR THE ATTENTION of Frans Krige or Komilla Knarasoo. Hannes Botha no longer works with this and if you address the parcel to him it delays the process, because the parcel goes from Nelspruit to Groblersdal to Nelspruit again.	Joyce Botha	MTPA Administrative Officer	31 May 2013 - Email correspondance		Noted

5.7 Document Review

The reports which have been, and will be submitted for public review are listed in Table 5.3. The reports were available in the following manner:

- One (1) hard copy at the Delmas Library, and at the Leeuwpan Security Office (2 in total);
- The GCS website (www.gcs-sa.biz); and
- On CD which will be posted to the I&AP upon request.

Table 5.3: Documents for public review

Report	Public Review period
Draft ESR in terms of NEMA	18 January 2013 until 18 February 2013
Final ESR in terms of NEMA for all I & AP's	28 March 2013 until 18 April 2013
Final ESR in terms of NEMA for MDEDET	5 April 2013 until August 2013
FINAL EIA/EMP amendment Report compiled in terms of the MPRDA	November 2014
Drat EIA/EMP in terms of NEMA	November 2014
Final EIA/EMP in terms of NEMA	December - January 2015 - only available on the GCS website, and CD if requested.
IWULA and IWWMP in terms of the NWA	26 August 2014 - Submitted

6 ENVIRONMENTAL MANAGEMENT GOALS AND OBJECTIVES

This chapter of the EIA/EMP report relates to Section 51 (a) (ii) of the MPRDA Regulation 527 and Section 2- 2 of the EMP Template:

- *(Section 2 – 2): Description of environmental objectives and specific goals for the management of identified environmental impacts emanating from the proposed mining operation. (As informed by the information provided in the EIA in terms of Regulation 50 (h)).*

6.1 Activities

Before the current and potential environmental impacts posed by the Leeuwpan Coal may be identified, the activities associated with the establishment, operation and decommissioning of the proposed expansion of the mine's activities must be identified.

The following infrastructure was approved for the previous EMP under the MPRDA:

- Original EMP
    - Equipment workshop;
    - Coal mixing bed and off-load facilities;
    - Railroad of ± 3 km for the transport of coal from Leeuwpan Coal Mine;
    - Weighbridge for the road transport;
    - Ablution block and administration offices;
    - A linking road with the R 50 route (between Delmas and Leandra) including security buildings;
    - A linking road with the P 36-2 route between Delmas and Devon;
    - Pit water dam and silt dams;
    - Evaporation ponds;
    - Additional storm water control measures (berms);
    - Electricity supply network;
    - Closed water network for process water;
    - Potable water supply via pipeline;
    - Sewerage infrastructure;
    - River Diversion;
    - Mining of mining blocks;

- Addendum2
  - New plant (final phase plant)
  - Demolition of old plant
  - Opencast block (Block OE)
  - River Diversion
- Addendum3
  - Extension of existing haul roads to Block OM, Block OH as well as Block OFPAD and Block OD;
  - Relocation of the 11 kV powerlines and associated mini substations
  - Clean and dirty water systems around the mining area of Block OM, Block OH, Block OFPAD and Block OD; and
  - Road diversions and associated infrastructure.
  - Mining of mining blocks
- Addemdum4
  - Storage of water in dams and reservoirs
  - Infrastructure in the one in ten year flood line of a river or stream, or within 32 meters of the bank of a river or stream
  - The construction of a road that is wider than 4m
  - Mining of mining blocks
- Addendum5
  - Topsoil and overburden stockpiles
  - ROM stockpile
  - Storm water diversion channels
  - Expansion of existing haul roads
  - Water pollution management system
  - Water supply system
  - Ablution facilities
  - Diesel fuel tank
  - Workshop
  - Site offices
  - Explosives magazine
  - Haul road and access roads
  - Portable ablution facilities
  - Temporary workshop
  - Portable site office

  - Mining of mining blocks

Proposed

Infrastructure that will be associated with the Proposed Block OI development will be:

- Two boxcuts for access to opencast pits
- Explosive magazine
- Mining of OI (opencast)
- New and extension of haul road from the mine entrance ramp to the tip terrace
- Tip terrace, crushers, conveyors
- Screen house
- Crushing and screening plant (DMS)
- Weirs
- Plant buildings
- Stockyard, including stockyard conveyors
- ROM and product stockpiles
- Diesel storage of 1000 cubic metres - Fuel Depot
- Water pipelines (from OI) and pipelines between PCDs
- Existing return water dams will be put back in use – combined capacity of 80000 Cubic metres
- Stormwater drains, trenches and cut-off trenches
- Clean and dirty water systems
- Evaporation dam, pollution control dam;
- Services including potable water, process water, fire water, electricity reticulation
- 11kV bulk electrical supply from Eskom substation

The existing and proposed infrastructure for the mine is described in detail in chapter 2 of this EIA/EMP report. The main activities which will create impacts during the different phases of the mine life cycle were assessed during the EIA and mitigation and management measures developed thereto (Refer to Chapter 7 of this document). The main activities are summarised in Figure 6.1.

Construction

- Land clearing
- Soil stripping and stockpiling
- Infrastructure establishment
- Boxcut establishment (earthworks only)
- Waste handling

Operational

- Opencast mining of existing and new blocks
- Operation of existing and new plants
- Operation and maintenance of linear infrastructure (haul road, powerlines and conveyors)
- Storage of dangerous goods (diesel and explosives)
- Operation and maintenance of dirty water containment dams
- Operation of stockpiles (topsoil, product, including coal mixing bed)
- Maintenance of river diversion

Decommissioning and Closure

- Removal of infrastructure
- Active rehabilitation
- Post closure aftercare and monitoring

Figure 6.1 Leeuwpan Main Activities

6.1.1 Construction

The construction phase will be undertaken over a two (2) year period and will involve:

- Land Clearance:
  - Removal of vegetation;
  - Leveling the area (and/or terracing in steeper sections of the infrastructure area);
  - The movement of vehicles on site, and on regional road;
- Topsoil stripping and stockpiling;
- Establishment of surface infrastructure;
  - Establishment of contractor's laydown area;
  - Fencing of construction area;
  - Construction of haul roads, powerlines and water pipelines;
  - Construction of plant, offices;
  - Construction of storm water management infrastructure (channels, berms and pollution control dams);
  - Management and disposal of domestic and hazardous waste generated during the construction phase;;
  - Construction of conveyor;
- Boxcut Establishment; and
- Waste Handling.
  - Domestic and construction waste generation;
  - Waste storage;
  - Movement of vehicles on site to storage facilities; and
  - Diesel storage for construction activities.

6.1.2 Operation

The total LOM for the Leeuwpan Coal Mine will be 17 years up to 2029. The operation of the mine will include the following activities (described in detail under Chapter 2 of this report):

- Opencast mining of existing and new blocks;
  - Including ongoing backfilling and rehabilitation;
- Operation of existing and new plants
- Operation and maintenance of linear infrastructure (railway line, haul road, powerlines and conveyors)

- Storage of dangerous goods (diesel and explosives)
- Operation and maintenance of dirty water containment dams
- Operation of stockpiles (topsoil, product, including coal mixing bed)
- Maintenance of river diversion

6.1.3 Closure and Decommissioning

The following activities will be conducted in the closure phase:

- Removal of surface infrastructure and removing the gravel surface of haul roads;
- Active Rehabilitation of disturbed areas:
  - Ripping of soils to reduce compaction;
  - Applying topsoil and gravel mixture to areas which are to be rehabilitated;
  - Re-vegetation disturbed areas; and
- After monitoring and maintenance of rehabilitated areas (to ensure that rehabilitation is successful).

6.2 Environmental Management Objectives

6.2.1 Construction Phase

6.2.1.1 Land Clearance, Soil Stripping and Stockpiling

The environmental objectives associated with land clearance and removal of vegetation for construction purposes are:

- Understand the ecological characteristics of the area in which the mine is located, implement and ecological (fauna and flora) rescue programme.
- To limit activities to the indicated and approved areas to ensure that no new additional land surface, vegetation and habitats outside of the project area are destroyed, disturbed and/or alienated;
- To avoid ecological sensitive areas as far as practically possible;
- Deleniate ecological sensitive (no-go) zones prior to construction taking place and remain outside of these areas;
- To investigate opportunities for offsetting (tying into the Provincial Conservation Plan) where avoidance of sensitive areas is not possible;
- Removal of weeds and other invasive species over the mining area;

- To prevent any cumulative impact associated with the removal of vegetation and footprint clearance;
- To reduce the dust dispersion as a result of the removal of earth material as far as possible;
- To ensure an effective surface run-off control system is in order from the commissioning of the construction activities to deal with the separation of clean and dirty water;
- To ensure that the necessary approvals are in-place should any red-data or protected species be relocated or removed;
- To strictly manage the activities taking place within the lay down area by implementing clear and effective ground rules; and
- To rehabilitate the area as per the closure objectives in order to address all environmental impacts as far as possible and practical.

6.2.1.2 Establishment of Infrastructure

The environmental objectives associated with the establishment of infrastructure associated with this project are:

- To remain within the approved project scope and prposed development footprint area; take care that no new land surface, vegetation and habitats outside of the proposed project footprint area are destroyed, disturbed and/or alienated;
- To ensure that the area over which the infrastructure will be placed is stable;
- To ensure that the placement of infrastructure will not sterilize any potential future mining reserves;
- To prevent/limit any cumulative impact associated with the removal of vegetation and topsoil as far as practical possible;
- To reduce the noise associated with the construction and operational activities as far as possible;
- To manage any other nuisance which may occur as a result of the establishment of new infrastructure;
- To manage the influx of people seeking work and the potential for informal establishment and associated petty crimes;
- To accommodate the use of natural material and colours where possible to reduce the potential visual impact on the surrounding area; and
- To rehabilitate the area as per the closure objectives in order to address all environmental impacts as far as possible and practical.

6.2.1.3 Boxcut Establishment

The environmental objectives associated with the establishment of boxcut infrastructure associated with this project are:

- To prevent any cumulative impact associated with the removal of vegetation and topsoil during and after eartheworks; and
- To reduce the noise associated with the construction and operational activities as far as possible.

6.2.1.4 Waste handling

The objectives for waste generation and handling of domestic, diesel and chemical storage are to:

- Ensure that storage takes place in such a manner as not to cause any pollution to the environment;
- Ensure that storage facilities comply with best practice guidelines;
- Prevent any contamination of water resources by ensuring that an effective surface runoff control system is in place;
- Prevent any contamination of wetlands and pans as far as practical possible;
- Implement NWA GN 704 in all areas applicable;
- Prevent, contain and clean up any spillages during the life of the mine; and
- Ensure that all facilities are monitored on a regular basis.

6.2.2 Operational phase

6.2.2.1 Opencast Mining of Coal

The environmental objectives associated with the open cast mining of coal are:

- Maintain an open channel of communication with all stakeholders and I&APs;
- To optimally utilise the coal mineral reserves within a well planned mining strategy;
- To have an open channel of communication with the surrounding land owners to ensure that all the needs of parties are adhered to as far as practically possible;
- To limit the potential for decant through design planning;
- To continuously backfill the opencast voids as part of ongoing rehabilitation;
- To dispose of mine related waste (slurry and waste rock) in a responsible manner;
- To ensure that the area is safe and will not present a hazard to animal and/or human life; and

- To rehabilitate the area as per the closure objectives in order to address all environmental impacts as far as possible and practical.
- To achieve overall legal compliance.

6.2.2.2 Processing of ore at the beneficiation plants (new and existing)

The objectives for the environmental management at the beneficiation plant are:

- To prevent any spillages into the environment;
- To manage and mitigate any spillage which may occur;
- Implement the conditions and requirements of Water Use License or the DWA Best Practice Guidelines where the Water Use License is not specific;
- To reuse water as far as practically possible by structuring the operations as a closed water circuit;
- To reduce dust creation; and
- To ensure legal compliance.

6.2.2.3 Transportation of ore via conveyors

The objectives for the transportation of ore via conveyors between the shafts and the ROM stockpile are:

- To prevent, contain and clean up any spillages in the environment; and
- To ensure that the conveyor is well maintained to prevent any spillages.

6.2.2.4 Stockpiling (Topsoil, Product, coal mixing bed)

The environmental objectives associated with the product stockpiling and transportation is:

- To contain the stockpiles in order to reduce the alienation of land;
- To utilise existing road systems as far as practically possible to serve as service roads to avoid travelling over stockpile areas;
- To implement measures as part of the management programme to reduce any potential impact on rare or endangered species;
- Ameliorate and fertilize soils as and when required to maintain its integrity for the purposes of rehabilitation;

- To prevent any cumulative impact associated with the transportation of ore;
- To prevent, contain and clean up any spillages in the environment;
- To reduce the noise associated with the operational activities as far as possible;
- To reduce the dust dispersion as a result of the disposal of material as far as possible; and
- To rehabilitate the area as per the closure objectives in order to address all environmental impacts as far as possible and practical.

6.2.2.5 Operation of Clean and Dirty Water systems

The objectives set for the clean and dirty water system, including water stored in voids are to:

- To maintain all pollution control systems in such a manner as to reduce any possibility of dirty water entering the natural or clean water systems;
- To operate the mine in a closed water circuit;
- To introduce measures to retain as much dirty water on site for reuse as possible;
- To ensure compliance to all best practices in terms of the operation of the dirty water systems;
- To maintain the integrity of the dirty water system, including the berms, bunds, drains;
- To ensure that all dirty water systems are cleaned and maintained on a regular basis to prevent pollution of the water resources and where pollution prevention is not possible, to minimise the impact on water sources (ground and surface);
- Implement the requirements of NWA GN 704 in all areas applicable;
- Implement the requirements of Water Use License or the DWA Best Practice Guidelines where the Water Use License is not specific;
- To achieve overall legal compliance; and
- To rehabilitate the area as per the closure objectives in order to address all environmental impacts as far as possible and practical.

6.2.2.6 Dangerous Goods storage (diesel and explosives)

The environmental management objectives for hydrocarbon storage are:

- To ensure that all hydrocarbons are stored in a manner which will prevent any harm to the environment;
- To prevent spillages of hydrocarbons;
- To capture, contain and manage any spillage;
- To ensure that any area which has been affected by a hydrocarbon spill is suitably rehabilitated and monitored until rehabilitation efforts have been successful.

6.2.3 Closure and Decommissioning

6.2.3.1 Removal of surface infrastructure

The objectives for removal of surface infrastructure are:

- To ensure that discussions are held with the relevant stakeholders to determine whether any existing infrastructure could be on a social or economic benefit before final removal is commenced;
- To ensure that the removal of infrastructure is done in a manner which has the smallest possible impact on the environment;
- To limit all rehabilitation activities and the movement of people to within the disturbed area footprint; and
- To ensure that no building rubble or rubbish remains after the removal of infrastructure.

6.2.3.2 Active rehabilitation of disturbed areas

The objectives for the rehabilitation of disturbed areas are to:

- Ensure the removal of all contaminated material;
- Ensure that all compacted areas have been ripped; and
- Ensure that all disturbed areas are topsoiled and vegetated.

6.2.3.3 After monitoring and maintenance

The objectives for after care monitoring and maintenance are to:

- Ensure that an inspection of the water management infrastructure such as solution trenches, sumps, etc. is undertaken to identify which components need to be replaced to ensure long term functionality, until such time that monitoring indicates that there is no more potential for contamination;
- Ensure that monitoring takes place until rehabilitation measures are considered successful; and
- Ensure that storm water management infrastructure is rehabilitated and the area is made free-draining only once rehabilitation is completed.

7 IDENTIFICATION OF IMPACTS AND CONCERNS WITH MANAGEMENT MEASURES AND ACTION PLANS

This chapter of the report fulfills the requirements of regulations 50 (a) to (e) and 51 (a) and (b) of the MPRDA Regulations, R527.

REGULATION 50 (a):

- *(Section 1- 3): The potential impacts*
  - *(Section 1-3.1): List of the potential impacts, on environmental aspects separately in respect of each of the aforesaid main mining actions, activities, processes, and activities listed in the NEMA EIA regulations.(include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department);*
  - *(Section 1 - 3.2): List of all potential cumulative environmental impacts;*
  - *(Section 1 - 3.3): State specifically whether or not there is a risk of acid mine drainage or potential groundwater contamination associated with the mineral to be mined. (If such a risk is associated with the mineral to be mined provide a summary of the findings and recommendations of a specialist geo-hydrological report in that regard).*

REGULATION 50 (b)

- *(Section 1 - 5)The potential impacts of the alternative land use or development*
  - *(Section 1 - 5.1): List of the potential impacts of each of the aforesaid main features and infrastructure related to the alternative land use or development and related listed activities;*
  - *(Section 1 - 5.2): Description of all potential cumulative impacts of the main features and infrastructure related to the identified alternative land uses or developments.*

REGULATION 50 (c)

- *(Section 1 - 6): Identification of potential social and cultural impacts.*
  - *(Section 1 - 6.1): List of potential impacts of the proposed mining operation on the socio- economic conditions of other parties' land use activities. .(include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department);*

- *(Section 1 - 6.2): Description of the cultural aspect that will potentially be affected, and describe the potential impact on such cultural aspect. . (In cases where such features are not applicable the applicant must still include the item in the list and describe it as not applicable);*
- *(Section 1 - 6.3): Description of heritage features and the potential impact on such heritage feature. (In cases where such features are not applicable the applicant must still include the item in the list and describe it as not applicable);*
- *(Section 1 - 6.4): Quantification of the impact on the socio-economic conditions of directly affected persons, as determined by the findings and recommendations of a specialist report in that regard*
  - *(Section 1 - 6.4.1): The amount of the quantified potential impact on property or infrastructural assets;*
  - *(Section 1 - 6.4.2): State the amount of the quantified potential impact on commercial, economic or business activity which will be impacted upon as a result of the mining activity*
  - *(Section 1 - 6.4.3): The sum of the amounts, referred to in paragraphs 6.6.1 and 6.6.2 above.*

- *(Section 1-7): Assessment and evaluation of potential impacts.*
  - *(Section 1- 7.1.): List of each potential impact identified in paragraphs 3 and 6 above. (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department)*
  - *(Section 1 - 7.2.): Concomitant impact rating for each potential impact listed in paragraph 7.1 above in terms of its nature, extent, duration, probability and significance.(Provide a definition of the criteria used for each of the variables used for rating potential impacts and ensure that the potential impacts are rated specifically with the assumption that no mitigation measures are applied).*
  - *(Section 1 - 7.3.): Indication of the phases (construction, operational, decommissioning) and estimated time frames in relation to the potential impacts rated.*

REGULATION 50 (e)

- *(Section 1 - 10): List of all the significant impacts as identified in the assessment conducted in terms of Regulation 50 (c) (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department).*

Regulation 51 (a)

- *(Section 2 -1): Description of environmental objectives and specific goals for mine closure.*
    - *(Section 2 - 1.1): Environmental aspects that describe the pre-mining environment.*
    - *(Section 2 - 1.2): Measures required to contain or remedy any causes of pollution or degradation or the migration of pollutants, both for closure of the mine and post-closure.*
- *(Section 2 – 2): Description of environmental objectives and specific goals for the management of identified environmental impacts emanating from the proposed mining operation. (As informed by the information provided in the EIA in terms of Regulation 50 (h)).*
    - *(Section 2 - 2.1): List of identified impacts which will require monitoring programmes.*
    - *(Section 2 - 2.2): List of the source activities that are the cause of the impacts which require to be managed.*
    - *(Section 2 - 2.3): Management activities which, where applicable, will be conducted daily, weekly, monthly, quarterly, annually or periodically as the case may be in order to control any action, activity or process which causes pollution or environmental degradation.*
    - *(Section 2 - 2.4): The roles and responsibilities for the execution of the monitoring and management programmes.*
- *(Section 2 – 3) Description of environmental objectives and specific goals for the socio-economic conditions as identified in the social and labour plan. (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department).*
- (Section 2 – 4): Description of environmental objectives and specific goals for historical and cultural aspects.
    - *(Section 2 - 4.1): Environmental objectives and goals in respect of historical and cultural aspects identified in specialist studies conducted during the EIA phase.*

Regulation 51 (b) – Outline of the implementation programme

- *(Section 2 – 5): The appropriate technical and management options chosen for each environmental impact, socio-economic condition and historical and cultural aspect in each phase of the mining operation, as follows;*
    - *(Section 2 - 5.1): Actions, activities or processes, including any NEMA EIA Regulation listed activities, which cause pollution or environmental degradation. (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department).*

- *(Section 2 - 5.2): Concomitant list of appropriate technical or management options chosen to modify, remedy, control or stop any action, activity, or process which will cause significant impacts on the environment, socio-economic conditions and historical and cultural aspects as identified. (Attach detail of each technical or management option as appendices).*

- (Section 2 – 6): Action plans to achieve the objectives and specific goals contemplated in ***Regulation 50 (a)***

(Section 1 – 17): Time schedules of deadlines for each action to be undertaken to implement each technical or management option chosen. (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department).

7.1 Environmental Impact Significance Rating Methodology

To ensure uniformity, the assessment of potential impacts will be addressed in a standard manner so that a wide range of impacts is comparable. For this reason a clearly defined rating scale will be provided to the specialist to assess the impacts associated with their investigation.

Each impact identified will be assessed in terms of probability (likelihood of occurring), scale (spatial scale), magnitude (severity) and duration (temporal scale). To enable a scientific approach to the determination of the environmental significance (importance), a numerical value will be linked to each rating scale.
The following criteria will be applied to the impact assessment for the EIA/EMP:
Occurrence

- Probability of occurrence (how likely is it that the impact may occur?); and
- Duration of occurrence (how long may impact last?).

Severity

- Magnitude (severity) of impact (will the impact be of high, moderate or low severity?); and
- Scale/extent of impact (will the impact affect the national, regional or local environment, or only that of the site?).

Status of Impact

- +: Positive impact

- -: Negative impact
- N: Neutral (no impact)

In order to assess each of these factors for each impact, the following ranking scales were used:

Probability:=P	*Duration:=D*
5 - Definite/don't know	5 - Permanent
4 - Highly probable	4 - Long-term (ceases with the operational life)
3 - Medium probability	3 - Medium-term (5-15 years)
2 - Low probability	2 - Short-term (0-5 years)
1 - Improbable	1 - Immediate
0 - None	
Scale:=S	*Magnitude:=M*
5 - International	10 - Very high/don't know
4 - National	8 - High
3 - Regional	6 - Moderate
2 - Local	4 - Low
1 - Site only	2 - Minor
0 - None	
Status of Impact	
+: Positive	
-: Negative	
N: Neutral	

Once the above factors have been ranked for each impact, the environmental significance of each was assessed using the following formula:

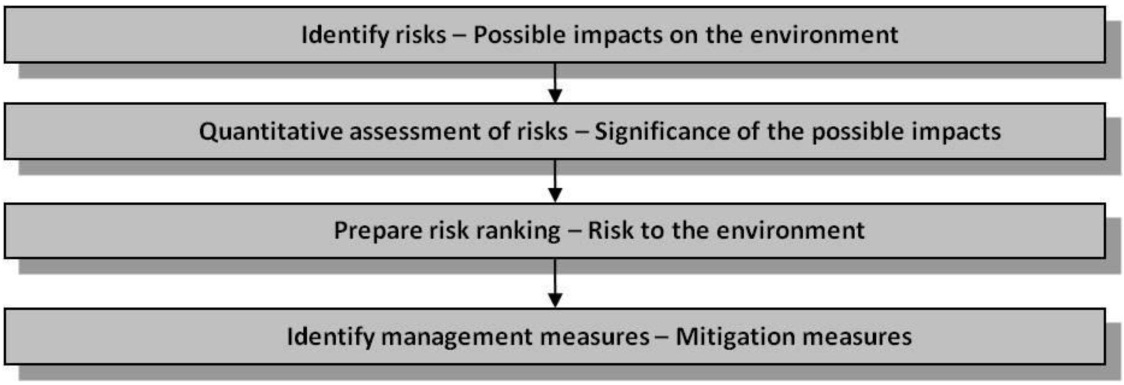
SP = (magnitude + duration + scale) x probability

The maximum value that can be achieved is 100 Significance Points (SP).Environmental effects were rated as follows:

Significance	***Environmental Significance Points***	***Colour Code***
High (positive)	>60	H
Medium (positive)	30 to 60	M
Low (positive)	<30	L
Neutral	0	N

Low (negative)	>-30	L
Medium (negative)	-30 to -60	M
High (negative)	<-60	H

The following process will be followed:



No specialist findings have been modified by the EAP. The information provided within this report reflects the opinion of the specialists, in agreement with the EAP. The applicant has reviewed all the conditions.

7.2 Construction Phase

Leeuwpan will commence with the construction phase for their project related infrastructure in line with their approved environmental authorisations.

During the construction phase the following activities will take place on site:

- Land Clearance:
- Topsoil stripping and stockpiling;
- Establishment of surface infrastructure;
- Boxcut Establishment; and
- Waste Handling.

Table 7.1: Construction Phase Impacts and Management Measures

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
Issues related to GEOLOGY																				
No impacts anticipated	Construction phase activities	Block OI	0	0	0	0	0	N	L	No mitigation measures necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
Change to natural topography	Footprint clearance and soil stripping and stockpiling leading to runoff from cleared surfaces	Block OI	2	4	1	3	21	-	L	• Clearly demarcate construction areas and limit all construction activities to demarcated area; • Limit the vegetation clearance to the smallest area possible; • Removal of vegetation must be in a phased approach to limit surface exposure; • Install erosion control measures and stormwater management infrastructure (particularly in areas downstream of the site) prior to the clearing of land; • Linear infrastructure must follow as far as practically possible the natural contours of the area; and • Topsoil stockpiles must be correctly place, e.g. away from drainage lines.	1	4	1	2	12	-	L	Prepare detailed clearance and construction schedules Construct and maintain approved SWMP infrastructure Implement Soil Management Plan as per Annexure 1 of the Soils Report	Prior to construction phase Prior to construction phase, monthly maintenance During construction phase	Environmental Officer/ Contractor Environmental Officer/ Contractor Environmental Officer/ Contractor
Issues related to BLAST AND VIBRATION																				
No impacts anticipated	Construction phase activities	Block OI	0	0	0	0	0	N	L	No mitigation measures necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to FLORA																				
Loss in vegetation	Vegetation Stripping		6	5	3	4	56	-	M	• Protection of the soil resources should be prioritized for the purpose of ongoing rehabilitation. • Demarcate areas for construction clearly • Remain within demarcated areas • Undertake a vegetation rescue programme • Establish a nursery for vegetation on site • Vegetation establishment (revegetation) strategies should be implemented as soon as possible once construction has been completed (this should be planned in a phased approach).	4	5	3	3	36	-	M	Topsoil management and protection plan should be implemented. Establish a detailed vegetation stripping plan which should be implemented strictly. Clearly demarcate all areas considered to be sensitive. Investigate and identy offsetting potentials which will tie into the provincial conservation plan (i.e. areas, financial contributions, scientific investigations, etc.) Early and ongoing rehabilitation strategies should be implemented in a phased approached already during the construction phase. It is important that rehabilitation should be planned part and parcel with the construction activities (i.e. once construction is completed in an area,	Prior to construction phase and upon completion of area of consturction	Environmental Officer/ Contractor (in consultation with an ecological specialist)
Loss in sensitive and protected vegetation	Vegetation Stripping		6	5	3	4	56	-	M	• Demarcate areas for construction clearly • Remain within demarcated areas • Undertake a vegetation rescue programme • Vegetation establishment (revegetation) strategies should be implemented as soon as possible once construction has been completed (this should be planned in a phased approach). • Establish a nursery for vegetation on site • Apply for the necessary permit to remove any protected or vulnerable species.	4	5	3	3	36	-	M			

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
																		rehabilitation must be commenced). All areas of rehabilitation (i.e. topsoil and revegetatioin) must be protected and cordoned off until proven successful.		
Increased dust covering the vegetation and reducing their palatability resulting in a lowered grazing capacity/stocking rates of the remaining natural vegetation. This will also result in the over utilisation of the remaining vegetation not affected by dust	Construction phase activities	Block OI	6	5	3	4	56	-	M	• Implement effective dust suppression measures; • Rehabilitate disturbed areas outside the construction footprint as soon as possible.	4	5	3	3	36	-	M	Provide dust suppression equipment and water	Prior to construction phase	Environmental Officer/ Contractor
																		Compile and implement rehabilitation strategy for the construction phase	Prior to construction phase	Environmental Officer/ Contractor
																		Monitor post-construction rehabilitation (and implement corrective measures where necessary) until vegetation re-establishment has been successful	End of construction phase	Environmental Officer
Issues related to FAUNA																				
Animal species which are sensitive to noise and the presence of other animals would leave the area resulting in a decrease in biodiversity and an increase in competition for resources elsewhere	Construction phase activities	Block OI	6	5	3	4	56	-	M	• A wilderness area should be established in consideration of existing or remaining natural area, these areas should be managed using rotational cropping systems and low grazing pressure; • Limit the construction footprint as far as possible; • All construction equipment to comply with the standards as for construction vehicles as explained in the IFC's Environmental Health & Safety Regulations	6	5	3	3	42	-	M	Identify potential areas for the establishment of a wilderness area	Prior to construction phase	Environmental Officer
																		Demarcate construction footprint using markers and pegs or fencing	During construction phase	Environmental Officer/ Contractor
																		Conduct noise monitoring during construction	During construction phase	Environmental Officer
																		Compile and implement vehicle and equipment maintenance schedule	Prior to construction phase	Contractor
Mortality of small animals due to increased vehicle traffic in the area	Movement of vehicles and machinery during construction phase	Block OI	6	5	3	4	56	-	M	• Limit the movement of vehicles to established routes; • Implement speed limits on all roads within the MRA.	4	5	3	3	36	-	M	Conduct environment induction to make all employees aware of no-go areas	Prior to construction phase	Environmental Officer/ Contractor
																		Enforce penalties (e.g. fines or warnings) for non-compliance	During construction phase	Environmental Officer
Issues related to WETLANDS																				
Disturbance to wetland habitat	Movement of vehicles and machinery during construction phase	Block OI	6	2	1	4	36	-	M	• Restrict movement of vehicles and machinery to existing roads and authorised access roads; • Prohibit off-road driving through wetland areas; • All vehicle parking areas and turning circles should be located outside wetland areas; • Where possible, fence the wetland areas falling outside the development footprints to prevent vehicle access.	6	2	2	2	20	-	L	Demarcate construction footprint using markers and pegs or fencing	During construction phase	Environmental Officer/ Contractor
																		Conduct environmental induction to make workers aware of no-go areas	During construction phase	Environmental Officer/ Contractor

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
Loss and disturbance of wetland habitat	Topsoil stripping and stockpiling	Block OI	8	5	1	5	70	-	H	• Limit soil stripping activities to the footprint area; • Fence off/demarcate construction footprint or fence off wetland area to prevent access; • Locate all stockpiles outside wetland areas; • Install sediment barriers between construction area and downslope wetlands; • Should wetland areas be damaged or destroyed, a wetland offset should be investigated.	8	5	1	5	70	-	H	Demarcate construction footprint using markers, pegs or fencing	During construction phase	Environmental Officer/ Contractor
																		Implement Soil Management Plan as per Annexure 1 of the Soils Report	During construction phase	Environmental Officer/ Contractor
																		Investigate and identy offsetting potentials which will tie into the provincial conservation plan (i.e. areas, financial contributions, scientific investigations, etc.)	Prior to and during Construction	Environmental Officer (in consultation with MDEDET and MTPA)
																		Construct and maintain approved SWMP infrastructure	Prior to construction phase, monthly maintenance	Environmental Officer/ Contractor
																		Investigate wetland offsets as a means to mitigate against the loss of wetland habitat. Apply SANBI offset guideline methodology for any offsets.	End of construction phase (if necessary)	Environmental Officer
Loss and disturbance of wetland habitat	Land clearing and establishment of linear infrastructure	Block OI	8	5	1	5	70	-	H	• Demarcate the servitude for the linear infrastructure and limit construction activities to the demarcated area; • Undertake construction during the dry season; • No materials may be stockpiled in the wetland area; • Hay bales should be put along the downslope edge of the conveyor servitude to trap any sediments that may be washed off the construction area; • Stormwater from the roads to the crossing should be diverted off the road and into adjacent grassland; • Rehabilitate disturbed area following the construction phase.	4	5	1	5	50	-	M	Demarcate construction footprint using markers, pegs or fencing	During construction phase	Environmental Officer/ Contractor
																		Investigate and identy offsetting potentials which will tie into the provincial conservation plan (i.e. areas, financial contributions, scientific investigations, etc.)	Prior to and during Construction	Environmental Officer (in consultation with MDEDET and MTPA)
																		Investigate the opportunity for the re-establishment of wetlands on site as part of ongoing rehabilitation strategies - this could be undertaken in the form of research projects.	Prior to and during Construction, depending on the success rate, but also ongoing as part of ongoing improvement during the LoM	Environmental Officer (in consultation with MDEDET and MTPA)
																		Prepare detailed clearance and construction schedules	Prior to construction phase	Environmental Officer/ Contractor
																		Construct and maintain approved SWMP infrastructure	Prior to construction phase, monthly maintenance	Environmental Officer/ Contractor
																		Compile and implement rehabilitation strategy for the construction phase	Prior to construction phase	Environmental Officer/ Contractor
																		Monitor post-construction rehabilitation (and implement corrective measures where necessary) until vegetation re-	End of construction phase	Environmental Officer

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
																		establishment has been successful		
Loss and disturbance of wetland habitat	Infrastructure establishment	Block OI	6	5	1	5	60	-	M	• Demarcate the construction footprint and servitude for the linear infrastructure and limit construction activities to the demarcated area; • Undertake construction during the dry season as far as possible; • Ideally all wetland systems should be fenced off using standard 5 strand cattle fences to prevent vehicular access to these areas; • Water may not be abstracted from wetlands for construction unless authorized by the DWA; • Rehabilitate disturbed wetlands immediately after construction; • Use indigenous sedges, shrubs, and grasses to re-vegetate disturbed area in consultation with an indigenous plant expert; • No materials may be stockpiled in the wetland area; • Hay bales should be put along the downslope edge of the conveyor servitude to trap any sediments that may be washed off the construction area; • Stormwater from the roads to the crossing should be diverted off the road and into adjacent grassland; • Rehabilitation of disturbed wetland habitat shall commence immediately after construction by re-establishing vegetation. All disturbed areas shall be re-vegetated in consultation with an indigenous plant expert, and only indigenous sedges, shrubs, and grasses shall be used to restore biodiversity	4	2	1	3	21	-		Prepare detailed clearance and construction schedules	Prior to construction phase	Environmental Officer/ Contractor
																		Demarcate construction footprint using markers, pegs or fencing. Fencing must be used around wetlands where necessary.	During construction phase	Environmental Officer/ Contractor
																		Construct and maintain approved SWMP infrastructure, prioritizing the free flow of clean water throughout the mining area as far as practically possible to avoid or limit impact on downstream wetlands.	Prior to construction phase, monthly maintenance	Environmental Officer/ Contractor
																		Compile and implement post-construction rehabilitation plan	Prior to construction phase	Environmental Officer
																		Monitor post-construction rehabilitation (and implement corrective measures where necessary) until vegetation re-establishment has been successful	End of construction phase	Environmental Officer
Loss and disturbance of wetland habitat	Linear infrastructure	Block OI	6	2	1	4	36	-	M	• The construction servitude for linear infrastructure should be kept as small as possible and should be clearly demarcated in the field; • Linear infrastructure design should allow for suitable culverts to allow the free flow of water to lmit the impact on water resources and wetlands as far as practically possible • No activities should take place outside the construction servitude and no materials may be stockpiled in the wetland area; • Construction should be undertaken in the dry season; • Following completion of construction activities, all disturbed areas should be rehabilitated – where required this will require ripping, scarifying and landscaping of the soil to the natural landscape	4	2	1	3	21	-		Demarcate construction footprint using markers, pegs or fencing	During construction phase	Environmental Officer/ Contractor
																		Prepare detailed clearance and construction schedules	Prior to construction phase	Environmental Officer/ Contractor
																		Construct and maintain approved SWMP infrastructure, prioritizing the free flow of clean water throughout the mining area as far as practically possible to avoid or limit impact on downstream wetlands.	During construction phase	Environmental Officer/ Contractor
																		Compile and implement post-construction rehabilitation plan	Prior to construction phase	Environmental Officer

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
										profile and to encourage vegetation re-establishment								Monitor post-construction rehabilitation (and implement corrective measures where necessary) until vegetation re-establishment has been successful	End of construction phase	Environmental Officer
Increased surface runoff from bare soil areas	Topsoil stripping and stockpiling	Block OI	6	2	1	4	36	-	M	• The footprint of vegetation clearing should be kept as small as possible; • Vegetation clearing should be phased so as to limit the extent of bare soil areas at any one time; • Vegetation establishment (revegetation) strategies should be implemented as soon as possible once construction has been completed (this should be planned in a phased approach). • Concentrated runoff from cleared areas should be avoided; and • Any preferential flows paths that do develop should be plugged as soon as possible.							L	Demarcate construction footprint using markers, pegs or fencing	During construction phase	Environmental Officer/ Contractor
																		Prepare detailed clearance and construction schedules	Prior to construction phase	Environmental Officer/ Contractor
																		Early and ongoing rehabilitation strategies should be implemented in a phased approached already during the construction phase. It is important that rehabilitation should be planned part and parcel with the construction activities (i.e. once construction is completed in an area, rehabilitation must be commenced).	During construction phase	Environmental Officer/ Contractor
																		All areas of rehabilitation (i.e. topsoil and revegetatioin) must be protected and cordoned off until proven successful.	During construction phase	Environmental Officer/ Contractor
																		Construct and maintain approved SWMP infrastructure	Prior to construction phase, monthly maintenance	Environmental Officer/ Contractor
Increased sediment transport into wetlands	Land clearing	Block OI and linear infrastructure	6	2	1	4	36	-	M	• Demarcate the construction footprint and servitude for the linear infrastructure and limit construction activities to the demarcated area; • Undertake construction during the dry season as far as possible to limit erosion; • Construct a shallow berm between the proposed opencast footprint and the downslope wetlands ; Place hay bales along the downslope edge of the conveyor servitude to trap any sediments that may be washed off the construction area; • No materials may be stockpiled in the wetland area; • Stormwater from the roads to the crossing should be diverted off the road and into adjacent grassland; • Construction activities should be phased to minimise the extent of bare soils at any one time; • Limit vegetation clearing activities to the last moment possible within the construction schedule;	4	2	1	3	21	-	L	Demarcate construction footprint using markers, pegs or fencing	During construction phase	Environmental Officer/ Contractor
																		Prepare detailed clearance and construction schedules	Prior to construction phase	Environmental Officer/ Contractor
																		Construct and maintain approved SWMP infrastructure	Prior to construction phase, monthly maintenance	Environmental Officer/ Contractor

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
										• Construction should be begin as soon after clearing and topsoil stripping to avoid areas of bare soil being unprotected for extended periods; • Implement stormwater management measures prior to construction to limit concentration of flows and the generation of high velocity flows that will exacerbate erosion risk; • Hay bales should be put along the downslope edge of the conveyor servitude to trap any sediments that may be washed off the construction area; • Regular low level humps should be installed along linear preferential flow paths such as construction roads/tracks that run perpendicular to the slope to slow down and disperse flows; • Install sediment barriers; • Rehabilitate disturbed areas at the end of construction activities - where required this will require ripping, scarifying and landscaping of the soil to the natural landscape profile and to encourage vegetation re-establishment; • Hydro seeding with a mix of species should be done with regular monitoring to ensure 70% cover in re-vegetated areas within 3 months.								Compile and implement post-construction rehabilitation plan Monitor post-construction rehabilitation (and implement corrective measures where necessary) until vegetation re-establishment has been successful	Prior to construction phase End of construction phase	Environmental Officer Environmental Officer
Piping and creation of preferential flow paths	Pipelines	Linear infrastructure	6	5	2	4	52	-	M	• It is recommended that trench breakers be installed along the pipeline trench. • A material with low hydrological conductivity (a Bentonite mix is recommended), in the form of trench breakers should be packed around the pipe and should be installed at regular intervals to prevent the pipeline behaving as a conduit and to intercept any concentrated flow down the pipeline route; • Spacing between trench breakers should vary depending on the slope of the landscape - the steeper the slope the smaller the distance between trench breakers; • Spacing should be such that flows backing up behind one trench breaker extend back to the base of the previous trench breaker.	4	4	1	2	18	-	L	Construct and maintain approved SWMP infrastructure	Prior to construction phase, monthly maintenance	Environmental Officer/ Contractor
Altered water movement through the landscape	Pipelines	Linear infrastructure	6	5	1	3	36	-	M	• Where subsurface control features such as rock banks or ledges are damaged by the trench excavations, these control features should be re-created within the trench to prevent the formation of preferential flow paths	4	1	1	2	12	-	L	Construct and maintain approved SWMP infrastructure	Prior to construction phase, monthly maintenance	Environmental Officer/ Contractor
Increased sediment transport into wetlands	Infrastructure establishment	Block OI	6	2	1	4	36	-	M	• The proposed development footprints must be kept as small as possible; • Construction activities should be undertaken during the dry season; • Construction activities within the development footprint should also be phased to minimise the extent of bare soils at any one time, with vegetation	4	2	1	3	21	-	L	Demarcate construction footprint using markers, pegs or fencing	During construction phase	Environmental Officer/ Contractor

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			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
										clearing activities delayed to the absolute last moment possible within the construction schedule; • Clearing of vegetation and the subsequent stalling of construction activities so as to leave areas of bare soil unprotected for extended periods must be avoided; • Stormwater management measures must be implemented during the construction phase to limit concentration of flows and the generation of high velocity flows that will exacerbate erosion risk; • Regular low level humps should be installed along linear preferential flow paths such as construction roads/tracks that run perpendicular to the slope to slow down and disperse flows; • Sediment barriers as per the guidelines provided below (Section 8 – Rehabilitation) should be installed at the start of construction activities.								Prepare detailed clearance and construction schedules	Prior to construction phase	Environmental Officer/ Contractor
																		Construct and maintain approved SWMP infrastructure	Prior to construction phase, monthly maintenance	Environmental Officer/ Contractor
Increased erosion and sedimentation	Linear infrastructure	Block OI	6	2	1	4	36	-	M	• The construction servitude for the linear infrastructure should be kept as small as possible and should be clearly demarcated in the field; • Construction should be undertaken in the dry season. As the wetland is a seasonal system, undertaking construction during the dry season should ensure that no surface flows occur in the wetland during the time of construction; • No activities should take place outside the construction servitude and no materials may be stockpiled in the wetland area; • Hay bales should be put along the downslope edge of the conveyor servitude to trap any sediments that may be washed off the construction area; • Stormwater from the approach and departure roads to the crossing should be diverted off the road and into adjacent grassland at regular intervals, already during the construction phase to prevent sediment from these areas being washed into the wetland; • Rehabilitate disturbed areas at the end of construction activities – where required this will require ripping, scarifying and landscaping of the soil to the natural landscape profile and to encourage vegetation re-establishment.	4	2	1	3	21	-	L	Demarcate construction footprint using markers, pegs or fencing	During construction phase	Environmental Officer/ Contractor
																		Prepare detailed clearance and construction schedules	Prior to construction phase	Environmental Officer/ Contractor
																		Construct and maintain approved SWMP infrastructure	Prior to construction phase, monthly maintenance	Environmental Officer/ Contractor
																		Compile and implement post-construction rehabilitation plan	Prior to construction phase	Environmental Officer
																		Monitor post-construction rehabilitation (and implement corrective measures where necessary) until vegetation re-establishment has been successful	End of construction phase	Environmental Officer

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Piping and creation of preferential flow paths	Pipelines	Block OI	6	5	2	4	52	-	M	• It is recommended that trench breakers be installed along the pipeline trench; • A material with low hydrological conductivity (a Bentonite mix is recommended), in the form of trench breakers should be packed around the pipe and should be installed at regular intervals to prevent the pipeline behaving as a conduit and to intercept any concentrated flow down the pipeline route; • Spacing between trench breakers should vary depending on the slope of the landscape - the steeper the slope the smaller the distance between trench breaker; • Spacing should be such that flows backing up behind one trench breaker extend back to the base of the previous trench breaker	4	4	1	2	18	-	L	Construct and maintain approved SWMP infrastructure	Prior to construction phase, monthly maintenance	Environmental Officer/ Contractor
Altered water movement through the landscape	Pipelines	Block OI	6	5	1	3	36	-	M	• Where subsurface control features such as rock banks or ledges are damaged by the trench excavations, these control features should be re-created within the trench to prevent the formation of preferential flow paths	4	1	1	2	12	-	L	Construct and maintain approved SWMP infrastructure	Prior to construction phase, monthly maintenance	Environmental Officer/ Contractor
Loss and disturbance of wetland habitat	Boxcut establishment	Block OI	8	5	1	5	70	-	H	• Limit soil stripping activities to the footprint of the proposed developments only; • Fence off either the development footprint or the adjacent wetlands to prevent access to the wetland areas. All wetland areas adjacent to the mining areas should be clearly demarcated as such and all staff educated as to the sensitivity of the wetland areas; • Locate all stockpiles outside wetland areas; • Sediment barriers to be installed between stripped areas and downslope wetlands. Investigate wetland offsets as a means to mitigate against the loss of wetland habitat. Apply SANBI offset guideline methodology for any offsets	8	5	1	5	70	-	H	Demarcate construction footprint using markers, pegs or fencing	During construction phase	Environmental Officer/ Contractor
																		Conduct environmental induction to make workers aware of no-go areas	During construction phase	Environmental Officer/ Contractor
																		Construct and maintain approved SWMP infrastructure	Prior to construction phase, monthly maintenance	Environmental Officer/ Contractor
Increased sediment transport into wetlands	Boxcut establishment	Block OI	6	2	1	4	36	-	M	• Vegetation clearing and earthworks should be limited to as small an area as possible; • Bare soil areas falling outside the direct footprint should be landscaped to the original landscape profile and re-vegetated as soon as possible. • Hydroseeding with a mix of species should be done with regular monitoring to ensure 70% cover in re-vegetated areas within 3 months; • Where practically possible, the major earthworks should be undertaken during the dry season (roughly from June to September) to limit erosion due to rainfall runoff; • A shallow berm should be constructed between the proposed opencast footprint and the downslope wetlands to prevent sediment rich runoff from the construction site entering the wetlands. These	4	2	1	3	21	-	L	Demarcate construction footprint using markers, pegs or fencing	During construction phase	Environmental Officer/ Contractor
																		Conduct environmental induction to make workers aware of no-go areas	During construction phase	Environmental Officer/ Contractor
																		Prepare detailed clearance and construction schedules	Prior to construction phase	Environmental Officer/ Contractor
																		Construct and maintain approved SWMP infrastructure	Prior to construction phase, monthly maintenance	Environmental Officer/ Contractor
																		Compile and implement post-construction rehabilitation plan	Prior to construction phase	Environmental Officer

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			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
										berms should thus be constructed prior to the commencement of construction on the opencast pit.								Monitor post-construction rehabilitation (and implement corrective measures where necessary) until vegetation re-establishment has been successful	End of construction phase	Environmental Officer
Decreased water make to downslope wetlands	Opencast pits	Block OI	6	4	2	4	48	-	M	None possible, unless opencast pits are adjusted.	6	4	2	4	48	-	M	N/A	N/A	N/A
Water quality deterioration	Waste handling	Block OI	8	2	2	5	60	-	M	• Designated waste handling and storage facilities must be put in place at the start of the construction phase. These facilities must be located outside wetlands (ideally 100m from any wetland if possible) and on bunded areas that do not allow seepage of pollutants into the ground or the run-off of polluted water; • All waste must be disposed of in registered waste disposal facilities. Sufficient spill clean-up material to deal with small spills must be kept on site at all times.	4	2	1	2	14	-	L	Construct designated storage areas and ensure the MSDS for all substances are readily available	Prior to construction	Environmental Officer/Contractor
																		Construct and maintain approved SWMP infrastructure	Prior to construction phase, monthly maintenance	Environmental Officer/ Contractor
																		Provide spillkits and make sure these are readility available in all areas on site.	During construction	Environmental Officer/ Contractor
																		Instruct workers on the use of spillkits during environmental induction and on-site.	Prior to construction and ongoing	Environmental Officer/Contractor
Disturbance to wetland habitat	Construction - all activities	Block OI	6	2	1	4	36	-	M	• Movement of vehicles and machinery should be restricted to existing roads and authorised access roads; • No off-road driving through wetland areas should be permitted; • All vehicle parking areas and turning circles should be located outside wetland areas; • Ideally, all wetland areas falling outside the development footprints should be fenced to prevent vehicle access.	6	2	2	2	20	-	L	Conduct environmental induction to make workers aware of no-go areas.	Prior to construction	Environmental Officer/Contractor
																		Enforce the rules by the implementation of penalties (e.g. fines or warnings) for non-compliance	During construction	Environmental Officer/Contractor
																		Fence in wetland areas where necessary	Prior to construction	Environmental Officer/Contractor
Issues related to SURFACE WATER																				
Additional sediment transport in rivers due to ground particles ending up in rivers from cleared land	Land clearing	Block OI and linear infrastructure	6	4	2	4	48	-	M	• Capture and contain runoff from the footprint area; • Divert clean water around the footprint toward the natural water resource.	4	1	1	2	12	-	L	Construct and maintain approved SWMP infrastructure	Prior to construction phase, monthly maintenance	Environmental Officer/ Contractor

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Additional sedimentation of rivers	Movement of vehicles and machinery during construction phase	Block OI and linear infrastructure	4	4	2	3	30	-	M	• Use of dust suppression to prevent dust outfall on areas outside of the development footprint; • Capture and contain runoff from the footprint area; • Divert clean water around the footprint toward the natural water resource.	2	1	1	2	8	-	L	Provide dust suppression equipment and water	During construction	Contractor
																		Construct and maintain approved SWMP infrastructure	Prior to construction phase, monthly maintenance	Environmental Officer/ Contractor
Production of dirty water due to runoff originating from stockpiles and reacting with the metals and oxygen	Soil stripping and stockpiling	Block OI and linear infrastructure	6	4	3	3	39	-	M	• Capture and contain runoff from the footprint area; • Divert clean water around the footprint toward the natural water resource.	2	1	1	1	4	-	L	Construct and maintain approved SWMP infrastructure	Prior to construction phase, monthly maintenance	Environmental Officer/ Contractor
Production of dirty water due to runoff from infrastructure	Infrastructure establishment	Block OI and linear infrastructure	4	1	2	4	28	-	L	• Capture and contain runoff from the footprint area; • Divert clean water around the footprint toward the natural water resource.	2	1	1	2	8	-	L	Construct and maintain approved SWMP infrastructure	Prior to construction phase, monthly maintenance	Environmental Officer/ Contractor
Stream flow reduction due to containment of runoff from construction areas	Construction activities	Block OI and linear infrastructure	8	1	2	4	44	-	M	• Keep the construction footprint as small as possible; • Divert clean water around the footprint toward the natural water resource.	2	1	1	2	8	-	L	Construct and maintain approved SWMP infrastructure	Prior to construction phase, monthly maintenance	Environmental Officer/ Contractor
Production of dirty water due to spillage of waste or leakages from waste containment areas	Waste handling	Block OI and linear infrastructure	8	1	2	4	44	-	M	• Capture and contain runoff from the footprint area.	2	1	1	4	16	-	L	Construct and maintain approved SWMP infrastructure	Prior to construction phase, monthly maintenance	Environmental Officer/ Contractor
Issues related to SOIL, LAND USE AND CAPABILITY																				
Soil compaction	Driving over soil profiles	Block OI and linear infrastructure	8	5	1	5	70	-	H	• Restrict vehicle and machinery movement to existing roads and limit new haul roads.	8	4	1	4	52	-	M	Conduct environmental induction to make workers aware of no-go areas.	Prior to construction	Environmental Officer/Contractor
																		Enforce the rules by the implementation of penalties (e.g. fines or warnings) for non-compliance	During construction	Environmental Officer/Contractor
Reduced water infiltration leading to increased soil erosion	Driving over soil profiles	Block OI and linear infrastructure	8	5	1	5	70	-	H	• Restrict vehicle and machinery movement to existing roads and limit new haul roads.	8	4	1	4	52	-	M	Conduct environmental induction to make workers aware of no-go areas.	Prior to construction	Environmental Officer/Contractor
																		Enforce the rules by the implementation of penalties (e.g. fines or warnings) for non-compliance	During construction	Environmental Officer/Contractor
Soil chemical pollution with hydrocarbons	Spillage from vehicles	Block OI and linear infrastructure	6	3	1	3	30	-	M	• Regular vehicle checking of all construction vehicles and machinery for oil leaks;	4	2	1	2	14	-	L	Compile and implement equipment and vehicle maintenance schedule	Prior to construction, monthly maintenance	Contractor
																		Provide spillkits	During construction	Contractor

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										• Undertake all vehicle maintenance within a designated area using drip trays to capture any spillage; • Use spillkits to clean up areas where spillages have occurred; • Monitor remediated soils until these areas are considered rehabilitated. • Follow emergency response procedures								Instruct workers on the use of spillkits during environmental induction and on-site.	Prior to construction and ongoing	Environmental Officer/Contractor
																		Monitoring of remediated areas	Weekly, minimum of four weeks after spillage	Environmental Officer
Mixing of topsoil with subsoil resulting in reduced productivity	Stripping and stockpiling topsoil	Block OI and linear infrastructure	6	5	1	4	48	-	M	• Follow Soil Management Plan and Stripping and Stockpiling guidelines to prevent stripping unsuitable profiles	6	4	1	3	33	-	M	Ensure that the Soil Management Plan is incorporated into the construction EMP	Prior to construction and ongoing	Environmental Officer/Contractor
Soil erosion	Exposing soil surfaces to wind and water energy	Block OI and linear infrastructure	8	5	1	4	56	-	M	• Avoid stripping of topsoil during the rainy season wherever possible.	6	5	1	3	36	-	M	Prepare detailed clearance and construction schedules	Prior to construction phase	Environmental Officer/ Contractor
Loss of topsoil	Moving of topsoil to areas for stockpiling	Block OI and linear infrastructure	8	5	1	5	70	-	H	• Restrict movement of topsoil over long distances for stockpiling.	6	5	1	4	48	-	M	Ensure that the Soil Management Plan is incorporated into the construction EMP	Prior to construction and ongoing	Environmental Officer/Contractor
Loss of arable and grazing capabilities	Removal of fertile topsoil	Block OI and linear infrastructure	10	5	1	5	80	-	H	• Limited mitigation	10	5	1	5	80	-	H	N/A	N/A	N/A
Loss of wetland land capability	Removal of hydromorphic soil forms	Block OI and linear infrastructure	10	5	1	5	30	-	H	• No mitigation possible	10	5	1	5	14	-	H	N/A	N/A	N/A
Loss of topsoil (volume) loss of topsoil stabilisation	Land clearance	Block OI and linear infrastructure	8	5	1	5	70	-	H	• Limited mitigation measures - minimise areas of vegetation removal.	6	5	1	4	48	-	M	Demarcate construction footprint using markers, pegs or fencing	During construction phase	Environmental Officer/ Contractor
																		Prepare detailed clearance and construction schedules	Prior to construction phase	Environmental Officer/ Contractor
Change in land use from arable and grazing to mining	Removal of vegetation	Block OI and linear infrastructure	10	5	2	5	85	-	H	• Restore land to original land use as soon as possible	8	4	2	4	56	-	M	Undertake rehabilitation at the end of LoM in accordance with the approved Rehabilitation Plan	Decommissioning Phase	Environmental Officer/ Contractor
Chemical soil pollution with hydrocarbons and building material	Vehicle movement and mixing of building material on site	Block OI and linear infrastructure	6	4	1	3	33	-	M	• Use spillkits to clean up areas where spillages have occurred; • Monitor remediated soils until these areas are considered rehabilitated.	4	3	1	3	24	-	L	Provide spillkits	During construction	Contractor
																		Monitoring of remediated areas	Weekly, minimum of four weeks after spillage	Environmental Officer
Issues related to GROUNDWATER																				

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Clearing topsoil for footprint areas can increase infiltration rates of water to the groundwater system and decrease buffering capacity of soils to absorb contaminants from spills on surface. This can worsen contamination of the groundwater system.	Vegetation clearance and topsoil stripping and stockpiling	Block OI and linear infrastructure	2	2	1	2	10	-	L	• Limit the vegetation clearance and topsoil stripping to the smallest area possible	2	2	1	2	10	-	L	Prepare detailed clearance and construction schedules	Prior to construction phase	Environmental Officer/ Contractor
Handling of waste and transport of building material can cause various types of spills which can infiltrate and cause contamination of the groundwater system.	Waste Handling	Block OI and linear infrastructure	2	2	1	4	20	-	L	• Waste needs to be discarded; • Spills cleaned up immediately according to the WULA conditions (once the license has been issued); • The DWA should be notified in the event of a spill.	2	1	1	4	16	-	L	Provide appropriate waste skips for different types of waste in a designate bunded area	Prior to construction	Environmental Officer/ Contractor
																		Ensure regular removal of waste by an external, accredited contractor	Daily or weekly during construction phase	Environmental Officer
																		Provide spillkits	During construction	Contractor
																		Monitoring of remediated areas	Weekly, minimum of four weeks after spillage	Environmental Officer
																		Inform the relevant DWA officer	Immediately after a spill	Environmental Officer
Issues related to AIR QUALITY																				
General construction	Establishment of infrastructure	Block OI and linear infrastructure	6	2	1	4	36	-	M	• Dust suppression on materials handling; • Use of wind speed reduction through sheltering to minimise wind erosion.	4	2	1	4	28	-	L	Provide dust suppression equipment and water	During construction	Environmental Officer/ Contractor
Excavation of overburden and coal	Boxcut establishment	Block OI	8	2	1	5	55	-	M	• Dust suppression (70% on drilling, 62% on materials handling).	6	2	1	5	45	-	M	Provide dust suppression equipment and water	During construction	Environmental Officer/ Contractor
Stockpiling of overburden and topsoil	Stockpiling	Block OI	8	2	1	5	55	-	M	• Dust suppression of stockpiles thought the best available method, wet suppression, vegetation or other methods.	8	2	1	4	44	-	M	Provide dust suppression equipment and water	During construction	Environmental Officer/ Contractor
Building of haul roads, in-pit road operations	Construction activities	Block OI and linear infrastructure	10	2	1	5	65	-	H	• Use of dust suppression/chemical stabilisation; • Implement speed limits; • Use covers over haul trucks; • Limit the movement of vehicles to established routes.	8	2	1	4	44	-	M	Provide dust suppression equipment and water	During construction	Environmental Officer/ Contractor
																		Conduct environmental induction to make workers aware of no-go areas and speed limits	Prior to construction	Environmental Officer/Contractor
																		Enforce the rules by the implementation of penalties (e.g. fines or warnings) for non-compliance	During construction	Environmental Officer/Contractor
Issues related to NOISE																				

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Noise disturbance	Grading and construction of new internal feeder road and haul roads	Linear infrastructure	6	2	2	4	40	-	M	• All construction equipment to comply with the standards as for construction vehicles as explained in the IFC's Environmental Health & Safety Regulations; • The work to be undertaken during normal working hours only	4	2	2	3	24	-	L	Compile and implement detailed construction schedule	Prior to construction	Contractor
																		Compile and implement vehicle and equipment maintenance schedule	Prior to construction	Contractor
																		Undertake noise monitoring	During construction	Environmental Officer
																		Environmental audits during the construction phase	During construction	Mine manager/Environmental Officer
Noise disturbance	Preparation of footprint area, earthworks and construction	Block OI and linear infrastructure	6	2	2	4	40	-	M	• All construction equipment to comply with the standards as for construction vehicles as explained in the IFC's Environmental Health & Safety Regulations. • The work to be undertaken during normal working hours only	4	2	2	3	24	-	L	Compile and implement detailed construction schedule	Prior to construction	Contractor
																		Compile and implement vehicle and equipment maintenance schedule	Prior to construction	Contractor
																		Undertake noise monitoring	During construction	Environmental Officer
																		Environmental audits during the construction phase	During construction	Mine manager/Environmental Officer
Issues related to CULTURE & HERITAGE																				
Grave sites 3 and 8	Construction activities	Block OI and linear infrastructure	2	5	2	5	45	-	M	• Fence in and sustainable management plan	2	4	2	2	16	-	L	Sites to be monitored annually	Annually	Heritage expert
Grave sites 1, 2, 4, 6, 9, 10, 11 and 13	Construction activities	Block OI and linear infrastructure	10	5	2	4	68	-	H	• Exhumation and relocation	2	1	2	5	25	-	L	Exhumation and relocation procedures to be implemented	Once off	Heritage expert
Grave sites 5, 7 and 12	Construction activities	Block OI and linear infrastructure	10	5	2	5	85	-	H	• Exhumation and relocation	2	1	2	5	25	-	L	Exhumation and relocation procedures to be implemented	Once off	Heritage expert
Farm buildings site 14 and 15	Construction activities	Block OI and linear infrastructure	6	5	2	4	52	-	M	• Document and demolish	2	1	2	5	25	-	L	Documentation by heritage expert and permit application at SAHRA	Once off	Heritage expert
Farm buildings site 16	Construction activities	Block OI and linear infrastructure	6	5	2	5	65	-	H	• Document and demolish	2	1	2	5	25	-	L	Documentation by heritage expert and permit application at SAHRA	Once off	Heritage expert
Farm buildings site 17	Construction activities	Block OI and linear infrastructure	2	5	2	2	18	-	L	• No action necessary	2	5	2	2	18	-	L	N/A	N/A	N/A
Issues related to VISUAL																				

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No significant impacts on the landscape are envisaged as the development will be within an existing mining area	Construction activties	Block OI and linear infrastructure	0	0	0	0	0	N	L	• No mitigation is proposed for the construction	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to TRAFFIC																				
Potential safety hazard due to increased use of access Road R50	Footprint clearance and infrastructure establishment	Block OI	2	5	2	3	27	-	L	• Provision of sufficient street lights at access road	2	4	3	2	18	-	L	Install and maintain street lights	During construction and ongoing (monthly or quarterly) maintenance	Mine management
Potential safety hazard associated with mine access road	Footprint clearance and infrastructure establishment	Block OI	2	5	2	3	27	-	L	• Ensure proper design of access roads though Geometry and proper surfacing	2	4	2	2	16	-	L	Construct access	During construction and ongoing (monthly or quarterly) maintenance	Mine management
Potential safety hazard due to public transport of workers	Footprint clearance and infrastructure establishment	Block OI	6	5	3	4	56	-	M	• Provision of public transport facility.	2	4	2	2	16	-	L	Construction of public transport facility	During construction and ongoing (monthly or quarterly) maintenance	Mine management
Potential safety hazard due to insufficient street lights at access intersection	Footprint clearance and infrastructure establishment	Block OI	8	5	3	4	64	-	H	• Provision of Street lights	2	4	2	2	16	-	L	Install and maintain street lights	During construction and ongoing (monthly or quarterly) maintenance	Mine management
Potential safety hazard associated with access road D2001 Road (surfacing of approximately 3,2km)	Footprint clearance and infrastructure establishment	Block OI	6	5	3	5	70	-	H	• Ensure proper design of access roads though Geometry and proper surfacing	2	4	3	2	18	-	L	Construct road and surfacing	During construction and ongoing (monthly or quarterly) maintenance	Mine management
Issues related to SOCIAL																				
Demographic processes: Resettlement	Construction phase activities	Block OI	10	5	1	5	80	-	H	• Full disclosure and consultation with affected landowners; • Develop a relocation plan to address impacts of resettlement, which will address issues of compensation, etc.; • Establish communication with affected landowners to ensure that their needs and preferences are taken into consideration.	8	5	1	5	70	-	H	Develop relocation plan in consultation with affected parties	Prior to construction phase	Exxaro Head Office/Mine Manager
Demographic processes: Effect of temporary workers on social dynamics	Construction phase activities	Block OI	6	3	2	3	33	-	M	• Employ local or existing labour as far as possible (within a 20 km radius). • Avoid the establishment of camps, hostels or temporary accommodation for workers;	4	3	2	3	27	-	L	Establish/update skills database in consultation with local municipality for use during recruitment for construction phase	Prior to construction phase	Human Resources Manager

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
										• Daily housing allowances should be provided for contact staff (residing outside a 20 km radius) during the construction phase to avoid the establishing of informal settlements, or the assimilation with existing informal settlements.								Project contracts between Exxaro and the specialist contractor should stipulate the use of local labour for unskilled and semi-skilled positions and tasks	Prior to construction phase	Human Resources Manager
																		Determine rates for housing allowance	Prior to construction phase	Human Resources Manager
Economic processes: Waged Labour	Construction phase activities	Block OI	4	3	2	2	18	+	L	• Unskilled and unemployed labour should be sourced from the surrounding local communities as far as possible; • Maximise employment opportunities for the local communities and reduce the influx of a foreign labour force whilst ensuring the effective expansion and operation of the mine; • Provide skills development opportunities to community members and local job seekers, where needed, taking into consideration Exxaro's existing vacancy policies; • Ensure that local businesses, especially those of Historically Disadvantaged Individuals (HDI), women and of Small, Micro and Medium Enterprises (SMMEs) get allocated the maximum appropriate share of project related business opportunities; and • Ensure that the Labour Relations Amendment Act, 2002 (Act No. 12 of 2002) as well as the necessary policies and procedures are taken into consideration to ensure the correct procurement procedures	6	3	3	3	36	+	M	Develop a Recruitment Manual, taking into consideration Exxaro's existing vacancy policies, to include a list of employment opportunities that will become available during the project phases and provide guidelines on procedures to be followed by aspiring employment seekers.	Prior to construction phase	Human Resources Manager
																		Establish an employment information desk to assist with the day to day management of project related labour issues	Prior to construction phase	Human Resources Manager
																		Capture all project relevant skills in the project area with the aim to ensure maximum local employment.	Prior to construction phase	Human Resources Manager
Economic processes: Standard of living	Construction phase activities	Block OI	4	3	2	2	18	+	L	• To increase the standard of living locally, the contractors employed should aim to ensure that local or surrounding people are employed where possible; and • The employment of local residents during operation (as far as practically possible) would increase the standard of living, since they would have a higher disposable income and less transportation costs.	6	3	2	3	33	+	M	Establish/update skills database in consultation with local municipality for use during recruitment for construction phase	Prior to construction phase	Human Resources Manager
																		Project contracts between Exxaro and the specialist contractor should stipulate the use of local labour for unskilled and semi-skilled positions and tasks	Prior to construction phase	Human Resources Manager
Economic processes Employment creation and decrease in unemployment	Construction phase activities	Block OI	4	3	3	3	30	+	M	• It is suggested that non-locals should only be hired when specialist skills, which are not available locally, are required and local business providing such skills cannot be created; • Local residents and communities should be employed, wherever possible; • Local construction companies should be used whenever possible, especially for subcontracting work; and • Local suppliers should be used as far as possible.	6	4	3	3	39	+	M	Establish/update skills database in consultation with local municipality for use during recruitment for construction phase	Prior to construction phase	Human Resources Manager
																		Project contracts between Exxaro and the specialist contractor should stipulate the use of local labour for unskilled and semi-skilled positions and tasks	Prior to construction phase	Human Resources Manager

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
																		Preference should be given to local contractors and suppliers as far as possible	Prior to construction phase	Procurement Manager
Institutional and Legal processes: Functioning of government agencies	Construction phase activities	Block OI	4	5	3	3	36	-	M	• Assist the LM with the diversification of the local economy; • Emphasise the use of local service providers and SMMEs and focus on the development of LED programmes; and	2	4	2	2	16	-	L	Preference should be given to local contractors and suppliers as far as possible	Prior to construction phase	Procurement Manager
																		Institute a joint municipal coordinating and implementing committee to support the municipality's local economic and social develop needs and requirements, where feasible	Prior to construction phase	Human Resources Manager
Institutional and Legal processes: Impact equity	Construction phase activities	Block OI	8	4	1	3	39	-	M	• Negative impacts on the local property owners should be limited as far as possible such as intrusion impacts (dust, noise, and air pollution); • Safety and security measures are critical to avoid any increase in criminal activities within the local study area; • Skills training and development should be maximised to benefit as many local employees as possible; and • The use of local labour must be maximised as far as possible.	6	3	1	2	20	-	L	Mitigation measures from the specialist studies should be strictly implemented.	During construction phase	Environmental Officer
																		Implement Safety and Security measures.	During construction phase	Health and Safety Officer
																		Project contracts between Exxaro and the specialist contractor should stipulate the use of local labour for unskilled and semi-skilled positions and tasks	Prior to construction phase	Human Resources Manager
																		Implement skills training and development programmes.	During construction phase	Human Resources Manager
Socio-cultural processes: Actual health and fertility	Construction phase activities	Block OI	6	4	2	4	48	-	M	• Exxaro should make employees aware physical health issues. • Environmental pollution must be limited as far as possible and the requirements of the EMP be implemented to reduce the impact on surrounding landowners; • The necessary safety precautions should be taken and first aid supplies should be made available on site; • It is advised that Exxaro, through consultation with the LM investigate ways in which their LED programmes and infrastructure development component of their SLP can assist in improving the overall health services within the communities; and	4	4	2	3	30	-	M	Provide HIV / Aids awareness campaigns all mine employees on a regular basis	Ongoing during LoM	Human Resources Manager
																		Investigate how the company can assist in implementing a community health awareness programme in liaison with the LM	Ongoing during LoM	Human Resources Manager
																		Requirements of the EMP should be strictly enforced	During construction phase	Environmental Officer
																		Have first aid supplies readily available.	Ongoing during LoM	Health and Safety Officer

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
										• The required safety equipment should be provided to employees as well as on site and should be in a good working order.								All mine employees (including contractors) should undergo health and safety training on a regular basis.	Quarterly/Annually during LoM	Health and Safety Officer/Environmental Officer
																		The general health of employees should be monitored on an on-going basis and employees should be given free access to clinic services.	Ongoing during LoM	Health and Safety Officer
Socio-cultural processes: Feelings in relation to the project	Construction phase activities	Block OI	6	3	2	3	33	-	M	• A comprehensive PPP should be implemented to effectively consult and involve the affected landowners and communities; • Exxaro must be transparent about the areas they intend mining and the proposed mining method and technology; and • Information about the proposed mining methods should be made available to stakeholders to educate them about mining in general as well as the proposed mining methods.	6	2	2	2	20	-	L	Continuous consultation with the surrounding residents to understand, assess and mitigate their concerns where appropriate;	Ongoing during LoM	Human Resources Manager
Socio-cultural processes: Aspirations for future	Construction phase activities	Block OI	4	4	2	2	20	-	L	• It is critical that Exxaro maintain an open and trusting relationship with the affected communities subsequent to the granting of the mining right; and • Exxaro must be honest and transparent about the potential economic benefits and employment opportunities that the proposed mine expansion is likely to effect in these communities, in order to manage any undue expectations; and • Exxaro must acknowledge the financial impact on affected landowners and consult with the landowner in order to obtain a mutually agreed upon outcome.	2	2	2	2	12	-	L	Continuous consultation with the surrounding residents to understand, assess and mitigate their concerns where appropriate;	Ongoing during LoM	Human Resources Manager
Socio-cultural processes: Physical quality of the living environment (actual and perceived	Construction phase activities	Block OI	8	4	2	4	56	-	M	• Existing community forums must serve as liaison between the affected stakeholders and Exxaro and can discuss traffic, dust, noise and construction related concerns with them; If no community forums are available, a Mining Forum, as described above should be established; • Management plans must include protocols for informing neighbours of blasting times and complaints; • The maximum acceptable night time noise levels should not be exceeded; • A hearing conservation programme must be implemented where noise exceeds 85dB(A) in the mine or must not be more than 7dB(A) above ambient residual noise levels beyond mine boundary or nearest residential community; • Traffic calming measures should be put in place to minimise traffic noise; • Adequate monitoring of the biophysical impacts should occur in order to address any unnecessary inconveniences to stakeholders;	6	4	2	3	36	-	M	Implement environmental management measures set out in the EMP	Ongoing during LoM	Environmental Officer
																		Prepare a noise reduction plan to cover all significant impacts at source and implement noise reduction and screening to limit exposure.	During construction phase	Health and Safety Officer
																		Prepare hearing conservation plan	During construction phase	Health and Safety Officer
																		Appoint specialists to undertake necessary environmental monitoring	Ongoing during LoM	Environmental Officer
																		Plant tall trees as barriers in gardens or in road reserve to reduce the visual and light intrusion, as well as noise impacts	During construction phase	Environmental Officer/Contractor

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
Socio-cultural processes: Personal safety and hazard exposure	Construction phase activities	Block OI	6	4	2	4	48	-	M	• Strict security measures should be put in place. • A Health and Safety Plan should be implemented and it must be ensured that all managers are trained in First Aid and other relevant safety courses; • Exxaro should, in conjunction with the property owners, develop and implement emergency procedures; • Operational safety risks should be addressed as part of the OHS Act; • The mining area should be fenced to avoid unauthorised entry by humans or animals onto the mining area; • Appropriate fire fighting equipment should be on site and construction workers should be appropriately trained for fire fighting; • Speeding of mine vehicles must be strictly monitored and fined where appropriate. • Workers must not be allowed to leave the designated mining areas without permission; • Implement safety measures to limit fire hazards and implement fire breaks if possible; • It would be important to regularly review the functionality and efficiency of the Fire/Emergency Plan in conjunction with the local emergency teams, mine management and neighbouring landowners; Speed limits on the local roads surrounding the mine works should be enforced	4	3	2	3	27	-	L	Security personnel should be on site on a permanent basis.	Ongoing during LoM	Mine Manager/Human Resources Manager
																		Update Health and Safety Plan where necessary	Ongoing during LoM	Health and Safety Officer
																		A Fire/Emergency Management Plan should be developed and implemented.	Prior to construction	Health and Safety Officer
																		Provide fire fighting and other safety equipment in good working order	Ongoing during LoM	Health and Safety Officer
																		Implement speed limits and enforce the rules by means of penalties for non-compliance	Construction phase and ongoing during LoM	Health and Safety Officer
Socio-cultural processes: Adequacy and access to social infrastructure	Construction phase activities	Block OI	6	3	2	2	22	-	L	• In consultation with the municipality and other mines operating in the area, ensure that the necessary planning for upgrades of social infrastructure, where lacking due to the proposed mine expansion, take place; • Involvement in upliftment programmes should be done according to the priority needs and projects identified as part of the LMs IDP, as well as in consultation with other stakeholders such as the local community representatives, ward committees and youth organisations; • Continuous involvement of the mine would be necessary and should be undertaken in a transparent and supportive manner; • Communication of the projects that Exxaro would be involved in should filter through to all community levels to ensure maximum benefit to the community; and • Community development projects initiated by Exxaro should follow a broad based approach, whilst also taking budgeting constraints into consideration.	4	3	2	2	18	-	L	Implement a regular and formalised consultation process with local government to ensure synergy between the mine's social development and LED focus	Ongoing during LoM	Human Resources Manager
Socio-cultural processes: Crime and violence	Construction phase activities	Block OI	4	4	2	3	30	-	M	• Exxaro must liaise with the LMs and labour unions to establish a protocol for ensuring community safety; • The AgriSA protocol for access to farms should be followed in all instances where access to farmers' land is required;	2	3	1	2	12	-	L	Ensure regular consultation with labour unions	Ongoing during LoM	Human Resources Manager

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
										• Mine workers should be clearly identifiable by ensuring they wear uniforms and identification cards that should be exhibited in a visible place on their body; and local, unemployed labour should be employed as far as possible.								Provide uniforms and PPE for all workers		
Socio-cultural processes: Loss of natural and cultural heritage	Construction phase activities	Block OI	8	5	1	3	42	-	M	• Local residents and farmers should be consulted to determine any possible heritage sites not identified by the HIA; and • Local residents and farmers should inform mitigation measures when addressing any potential impact on cultural heritage sites or graves.	8	2	1	1	11	-	L	The recommendations of the HIA should be implemented	During construction	Environmental Officer
Geographic processes: Conversion and diversification of land use	Construction phase activities	Block OI	6	4	3	4	52	-	M	• Ensure that landowners are consulted and not left in the dark with regard to the mining operations and construction; • Educate landowners in terms of their rights and responsibilities prior to the project going ahead; • Take into account surrounding land uses and design post-mining land use options to support and enhance long-term development options; • Develop clear communication lines when consulting with affected landowners and their employees;	4	4	3	4	44	-	M	Continuous consultation with the surrounding residents to understand, assess and mitigate their concerns where appropriate	Ongoing during LoM	Human Resources Manager
Geographic processes: Transport and accesibility	Construction phase activities	Block OI	6	4	3	4	52	-	M	• The applicant should, in liaison with the relevant Roads and Traffic Department, identify problem areas and assist with the regular maintenance and law enforcement of the roads frequently used by construction and mine traffic; • Speed limits on the local roads surrounding the mining site should be enforced; • Appropriate traffic management measures should be planned for and implemented; Recommendations made by the TIA should be employed; • Roads should be maintained.	4	4	3	4	44	-	M	Consult with local traffic departments	Ongoing during LoM	Health and Safety Officer
																		Implement speed limits within the MRA and enforce the rules by means of penalties (e.g. fines or warnings) for non-compliance	Ongoing during LoM	Environmental Officer/Human Resources Manager
																		Maintain all roads and road intersections at mine access points	Ongoing during LoM	Mine manager
Socio-cultural processes: Unacceptable social behaviour	Construction phase activities	Block OI	4	4	2	3	30	-	M	• Mine workers should adhere to a code of conduct with strict control measures; • Mine personnel should wear identification badges to distinguish them from trespassers or unwanted loiterers; • Establish a code of conduct for mine workers • Liaise with the SAPD in order to implement effective crime prevention strategies;	2	4	2	2	16	-	L	Conduct health, safety and environmental induction and follow up training to inform workers of code of conduct	Prior to starting work at the mine and ongoing training	Environmental Officer/Health and Safety Officer/Human Resources Manager
																		Provide access control and issue all workers with the necessary access control cards/tags	Ongoing during LoM	Security contractor

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
										• Liaise with existing forums in the community to communicate information to the community and to assist in the monitoring of compliance; and • Establish a Delmas Mining Forum representing all applicable stakeholders.								Continuous engagement with local authorities and organisations regarding health and safety	Ongoing during LoM	Human Resources Manager
Socio-cultural processes: Gendered division of labour	Construction phase activities	Block OI	4	3	3	2	20	+	L	• Women must have equal employment opportunities; • Salaries of women should be equal to that of men when undertaking the same job; • Commitments made in the SLP with regard to the employment of women should be adhered to; and • Training and skills development should take place for women; Institute a well-designed gender equality strategy on the mine.	6	4	3	3	39	+	M	Update the SLP with the progress to date in respect of the commitments made in with regards to women, as well as any new policies or strategies	Every two years	Human Resources Manager
Empowerment processes: Capacity building and skills transfer	Construction phase activities	Block OI	4	2	3	3	27	+	L	• Stakeholders should be mutually accountable for increased opportunities regarding skills and competency development (general education and technical training); • Training should be concentrated on skills that can be readily transferred to other employment opportunities in the local area to avoid persons with trained skills leaving the area for work elsewhere; • Ensure that stakeholders have knowledge of the support of legislation and regulations; • Where possible, recruit and train local residents to supply unskilled labour during the mine expansion; • It is recommended that a comprehensive program for recruiting, hiring, training, orienting and counselling be established, in line with the SLP. • The implementation of the SLP should be monitored on an annual basis; Ensure compliance to the BBSEC and MPRDA; and • Ensure that the employment and training of HDSA and women meet the requirements of the BBSEC	6	2	3	4	44	+	M	Establish/update skills database in consultation with local municipality for use during recruitment for construction phase	Prior to construction phase	Human Resources Manager
																		Continuous consultation with the surrounding residents to understand, assess and mitigate their concerns where appropriate and to educate stakeholders with regards to the environmental management	Ongoing during LoM	Human Resources Manager
																		Update the SLP with the progress to date in respect of the commitments made in with regards to women, as well as any new policies or strategies	Every two years	Human Resources Manager

7.3 Operational Phase

This section comprises of the description of potential impacts associated with the proposed operation of the mine on the biophysical, socio-economic and heritage and cultural environment. These descriptions are followed by the impact tables which contain the assessment of the significance of each identified impact without, then with mitigation measures. Each mitigation measure proposed is assigned a proposed action plan, frequency, associated management cost, as well as person responsible for implementation of the mitigation measures proposed to mitigate and/or manage each impact.

The total LOM for the Leeuwpan Coal will be 16 years up to 2029. The operation of the mine will include the following activities:

- Opencast mining of existing and new blocks;
    - Including ongoing backfilling and rehabilitation;
- Operation of existing and new plants
- Operation and maintenance of linear infrastructure (railway line, haul road, powerlines and conveyors)
- Storage of dangerous goods (diesel and explosives)
- Operation and maintenance of dirty water containment dams
- Operation of stockpiles (topsoil, product, including coal mixing bed)
- Maintenance of river diversion

Table 7.2: Operational Phase Impacts and Management Activities

OPERATIONAL PHASE - ACTIVITY 1: MINING OF COAL

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
OPERATIONAL PHASE ACTIVITY 1: MINING OF COAL																				
Issues related to GEOLOGY																				
Impact on the geology of the MRA due to the disturbance of the overlying strata and the extraction of the coal reserves. The physical properties of the overlying strata will thus be destroyed.	Open cast mining	All open cast sections	8	5	1	5	70	-	H	• The mining will take place according to the approved mine plans; • The aim should be to limit damage to the surrounding stratigraphy of the reserve areas, and exploit the greatest portion of economically extractable coal from the various mineral reserves, while minimising the contribution of the operation to the deterioration of the environment; • The mine will use specialised blasting techniques, specific to opencast coal mining, that leave the underlying and surrounding strata undisturbed; • Shales and discard material will be replaced in the mining pits to a height lower than the coal seam elevation in the area; • Rehabilitation of the open cast workings will be concurrent with the mining operation. Compaction of the overburden and sub-soils will be undertaken before the placement of topsoil; • Any clay (forming part of the overburden) will be backfilled into the Open Pit as part of the rehabilitation process.	6	5	1	5	60	-	M	Undertake mining in accordance with the mining works programme and approved EMP	Operational Phase	Engineering Manager/Mine Manager
																		Ensure that all mining, including blasting and drilling is undertaken by competent, qualified persons	Operational Phase	Engineering Manager/Mine Manager
																		Undertake concurrent and final rehabilitation in accordance with the approved Rehabilitation Plan (updated plan included in this report)	Operational Phase	Engineering Manager/Environmental Officer
Issues related to TOPOGRAPHY																				
Change to topography and natural drainage due to the creation of voids.	Open cast mining	All open cast sections	8	4	2	4	56	-	M	• Rehabilitation of the opencast mining areas at the mine will be conducted concurrently with mining. Backfilling of waste rock to open pits has been approved previously by DMR, and will be a continuous practise. • Suitable rehabilitation techniques will be employed for the backfilling of the opencast voids with discard to ensure that a free-draining post-mining topography is attained. • Spoil areas will be levelled and profiled, while voids will be backfilled and profiled. Open voids will be backfilled with overburden and subsoil. • Filled voids will be compacted to promote encapsulation, prior to the placement of the subsoil and topsoil layers. The shaped area will then be seeded with a mixture of grasses in order to obtain a vegetative cover in order to reduce erosion.	6	3	1	4	40	-	M	Undertake concurrent and final rehabilitation in accordance with the approved Rehabilitation Plan (updated plan included in this report)	Operational Phase	Engineering Manager/Environmental Officer
Issues related to BLAST AND VIBRATION																				
Ground Vibration	Blasting	All opencast sections	6	5	2	2	26	-	L	• It is suggested that ground and airblast recommended levels are followed (as per section 10.5 of the Blasting and Vibration report); • A standard blasting time should be fixed and displayed on fixed blasting notice boards at various entrance	4	5	2	2	22	-	L	Prepare or update blasting schedule and procedures taking cognisance of the Blast and Vibration Report	Operational Phase	Contractor/Engineering Manager

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
										routes that will inform local residents of dates of blasting and blast times; • Blasting should not be done too early in the morning when it is still cool or the possibility of inversion is present or too late in the afternoon in winter; • Do not blast in fog or in the dark; • Avert from blasting when the wind is blowing strongly in the direction of an outside receptor; • Do not blast with low overcast clouds; • Third party consultation and monitoring should be considered for all ground vibration and air blast monitoring work.								Determine the need for third party vibration and air blast in consultation with surrounding/affected persons	Operational Phase	Contractor/Engineering Manager
																		Ensure the blast notice board is legible, in at least two official languages and always contains the most recent information	Operational Phase	Contractor/Engineering Manager
Air Blast	Blasting	All opencast sections	8	5	2	4	60	-	M	• Air blast control is obtained through control on stemming material and stemming lengths; • The current monitoring program should reviewed (consider changing from three to five monitors) and continue; • It is recommended that a standard blasting time is fixed and blasting notice boards setup at various entrance routes that will inform local residents of dates of blasting and blast times. • It is suggested that ground and airblast recommended levels are followed (as per section 10.5 of the Blasting and Vibration report); • Third party consultation and monitoring should be considered for all ground vibration and air blast monitoring work; • It is recommended not to blast too early in the morning when it is still cool or the possibility of inversion is present or too late in the afternoon in winter; • Do not blast in fog; • Do not blast in the dark; • Avert from blasting when the wind is blowing strongly in the direction of an outside receptor; • Do not blast with low overcast clouds.	6	5	2	3	39	-	M	Prepare or update blasting schedule and procedures taking cognisance of the Blast and Vibration Report	Operational Phase	Contractor/Engineering Manager
																		Update current blast and vibration monitoring program to five monitors	Operational Phase	Contractor/Engineering Manager
																		Determine the need for third party vibration and air blast in consultation with surrounding/affected persons	Operational Phase	Contractor/Engineering Manager
Fly rock	Blasting	All opencast sections	6	2	5	2	26	-	L	• A minimum distance of 500m must be maintained from the blast. It is also a function of the blast contractor to determine what is considered as a safe distance; • All persons and animals within 500m from a blast must be cleared and where necessary evacuation must be conducted with all the required pre-blast negotiations. • Maintain a Blasting corridor of minimum 500m. • Blasting operations in area 2 (north eastern area) will require road closures due to the close proximate of the pit areas to the road.	4	2	5	2	22	-	L	Determine the blast radius based on the minimum recommendation o 500m	Prior to blasting at new pit	Contractor
																		Use sign boards or other advertising to warn road users of future road closures at least one (1) week in advance	Operational Phase	Contractor/Engineering Manager
Fumes	Blasting	Block OI	6	2	5	2	26	-	L	• A minimum distance of 500m must be maintained from the blast. It is also a function of the blast contractor to determine what is considered as a safe distance;	4	2	5	2	22	-	L	Determine the blast radius based on the minimum recommendation o 500m	Prior to blasting at new pit	Contractor

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
										• All persons and animals within 500m from a blast must be cleared and where necessary evacuation must be conducted with all the required pre-blast negotiations; • Maintain a Blasting corridor of minimum 500m; • Blasting operations in area 2 (north eastern area) will require road closures due to the close proximate of the pit areas to the road.								Ensure that no animals or people reside within the blast radius using and resettlement/relocation programme and fencing	Operational Phase	Environmental Officer/Human Resources Manager
Issues related to FLORA																				
Impact on the cultivated land vegetation unit and some remnants of natural vegetation.	Open cast mining	All open cast sections	4	5	1	5	50	-	M	• No mitigation possible until the end of LoM	4	5	1	5	50	-	M	N/A	N/A	N/A
Impact on a small area (11 ha) of natural vegetation (moist grassland), which contains the protected Gladiolus crassifolius.	Open cast mining	OD, OH, OM	6	5	1	5	60	-	M	• No mitigation possible until the end of LoM	6	5	1	5	60	-	M	N/A	N/A	N/A
Deterioration of the condition of the plants in the surrounding vicinities through the life of the mine	Creation of dust due to mining and encroachment into surrounding areas	All mining areas	8	4	1	4	52	-	M	• Limit the movement of vehicles to designated pathways; • Minimise the extent of dirty water management areas; • Rehabilitate surrounding areas which may be disturbed; • Undertake a maintenance programme (involving periodic visual inspections) to ensure that the plants used for rehabilitation remain in optimal condition; • Continuously remove declared weed species from the surrounding area; • Conduct daily dust suppression.	4	4	1	4	36	-	M	Use fences to mark off no-go areas and inform workers of these during induction. Enforce the rules by means of penalties (e.g. fines or warnings) for non-compliance	Operational Phase	Environmental Officer
																		Undertake concurrent and final rehabilitation in accordance with the approved Rehabilitation Plan (updated plan included in this report)	Operational Phase	Engineering Manager/Environmental Officer
																		Update and implement weed eradication plan	Operational Phase	Environmental Officer
																		Provide dust suppression equipment and water	Operational Phase	Contractor/Engineering Manager
Establishment of declared weeds and invader species along the borders of the disturbed land use areas.	Open cast mining	All mining areas	8	4	1	4	52	-	M	• Limit the movement of vehicles to designated pathways; • Minimise the extent of dirty waiter management areas; • Rehabilitate surrounding areas which may be disturbed; • Undertake a maintenance programme (involving periodic visual inspections) to ensure that the plants used for rehabilitation remain in optimal condition;	4	4	1	4	36	-	M	Use fences to mark off no-go areas and inform workers of these during induction. Enforce the rules by means of penalties (e.g. fines or warnings) for non-compliance	Operational Phase	Environmental Officer

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
										• Continuously remove declared weed species from the surrounding area; • Preserve the seed bank in topsoil by limiting the height of the stockpile and by vegetating it to assist in the prevention of erosion of the topsoil; • Import seed to establish plant communities with a similar profile to that of surrounding vegetation (and that will sustain grazing and wildlife habitat).								Undertake concurrent and final rehabilitation in accordance with the approved Rehabilitation Plan (updated plan included in this report)	Operational Phase	Engineering Manager/Environmental Officer
																		Update and implement weed eradication plan	Operational Phase	Environmental Officer
																		Undertake inspections and maintenance of topsoil stockpiles	Operational Phase	Environmental Officer
In ability of plants to function	Creation of dust due to the Operational Phase activities may settle	All opencast sections	6	4	2	4	48	-	M	• Measures to prevent nuisance dust deposition will be implemented; • Activities that may contribute to dust generation will be minimised or managed as far as possible; • Dust suppression within dirty water management areas will be undertaken, in suitable volumes, avoiding excessive ponding; • Road dust suppression will be undertaken, in suitable volumes, avoiding excess runoff; • Quarterly dust monitoring must be undertaken around the mining area	6	4	1	4	44	-	M	Provide dust suppression equipment and water	Operational Phase	Contractor/Engineering Manager
																		Undertake quarterly dust monitoring and submit the reports to the MDEDET	Quarterly during Operational Phase	Environmental Officer
Issues related to FAUNA																				
Potential death of animals which become trapped within the mining surface infrastructure or infrastructure areas (such as the Open Pit)	Open cast mining	OWM	8	4	1	4	52	-	M	• Areas should be monitored for the presence of animals. • A monitoring programme will be implemented and all animals found on site will be removed as necessary by a qualified handler; • Injured animals should be treated where possible.	4	4	1	4	36	-	M	Implement daily monitoring for the presence of animals within mining areas	Daily, Operational Phase	Environmental Officer
																		Compile and implement procedures for dealing with trapped/injured animals within the mining area	Operational Phase	Environmental Officer
Impact on animal species from the vicinity of the area.	Night-time illumination of sites	All mining areas	8	4	1	4	52	-	M	• Restrict activities to pre-determined designated areas; • Minimise operational activities to as small an area as practically possible.	6	4	1	4	44	-	M	Use fences to mark off no-go areas and inform workers of these during induction. Enforce the rules by means of penalties (e.g. fines or warnings) for non-compliance	Operational Phase	Environmental Officer
Smaller faunal species making use of natural grassland will be impacted on during the operational phase.	Plant operations	All mining areas	4	5	1	3	30	-	M	• Considering that the animal life in the area is already highly limited due to farming activities, management options are limited. It will be endeavoured to protect the bird life in the area. It has been noted that certain water birds, such as the yellow billed duck, have settled in the water storage dams;	2	5	1	3	24	-	L	N/A	N/A	N/A
Issues related to WETLANDS																				

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
Loss of vegetation and habitat due destruction of wetlands	Open cast mining	All mining areas	6	5	1	5	60	-	M	• Maintain stormwater management infrastructure; • Fence off and maintain existing fencing around wetland areas/or mining areas to prevent access to wetlands.	4	5	1	5	50	-	M	Compile and implement a maintenance schedule for the stormwater management infrastructure	Operational Phase	Environmental Officer
																		Include the regular inspection and maintenance of fences in the maintenance schedule	Operational Phase	Environmental Officer
Change in Hydrology and water quality of the wetlands	Open cast mining	All mining areas	6	5	1	5	60	-	M	• Maintain stormwater management infrastructure; • Fence off and maintain existing fencing around wetland areas/or mining areas to prevent access to wetlands.	4	5	1	5	50	-	M	Compile and implement a maintenance schedule for the stormwater management infrastructure	Operational Phase	Environmental Officer
																		Include the regular inspection and maintenance of fences in the maintenance schedule	Operational Phase	Environmental Officer
Issues related to SOILS, LAND USE AND LAND CAPABILITY																				
The open cast mining operation will result in the area not being available for agriculture (particularly maize production) for the duration of the mining operation.	Open cast mining operation	All opencast sections	8	4	1	5	65	-	H	• Little mitigation is possible until the end of the LoM • Ensure that all erosion control measures are in place and operational	4	4	1	4	36	-	M	N/A	N/A	N/A
Issues related to SURFACE WATER																				
Change to drainage patterns and reduction of the effective catchment area.	Open cast mining operation	OD, OH, OM, OWM, Odext	6	5	1	5	60	-	M	• Storm water diversion trenches will be constructed in order to divert clean runoff around the open cast area; • A clean water cut-off trench (storm water diversion trench) will be installed around Block OM, Block OH, Block OFPAD and Block OD; • This storm water diversion trench will be designed to cater for the runoff water from a 1:50 year 24-hour storm event with a 0.8m freeboard.	4	5	1	3	30	-	M	Compile and implement a maintenance schedule for the stormwater management infrastructure	Operational Phase	Environmental Officer
Creation of dirty water and the subsequent requirement to pump water out pits and contain it	Stormwater runoff and direct rainfall into opencast pits	All open cast sections	10	4	1	5	75	-	H	• An upstream clean and dirty water separation system to be installed close to the edge of the open pit area; • This separation system should be designed in terms of the GN704 requirements as to divert a 1:50 year flood event and take the clean water around the site without allowing the water to spill into the pit area;	4	2	2	2	16	-	L	Ensure the approved SWMP infrastructure have all been correctly constructed	Operational Phase	Contractor/Environmental Officer
																		Compile and implement a maintenance schedule for the stormwater management infrastructure	Operational Phase	Environmental Officer

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
										• Therefore this diversion structure should take into account the size of the upstream catchment area and should be sized accordingly; • The diversion channel to be protected against erosion through the installation of energy dissipaters as to break the velocity of the water; • Concurrent rehabilitation of pits will ensure that voids which are not in use will not retain runoff.								Undertake concurrent and final rehabilitation in accordance with the approved Rehabilitation Plan (updated plan included in this report)	Operational Phase	Engineering Manager/Environmental Officer
Issues related to GROUNDWATER																				
Dewatering of the surrounding aquifers.	Pumping out of water entering the mining void to allow for safe mining	All open cast sections	6	5	2	4	52	-	M	• The water levels in the monitoring boreholes should be measured on a quarterly basis; • These results should be recorded on a data sheet • Determine the extent and origin of impact, implement management measures, commission consultation with impacted parties to determine short and long term solutions.	4	5	2	4	44	-	M	Appoint a qualified groundwater specialist to undertake quarterly monitoring	Operational Phase	Environmental Officer
																		Maintain/update centralised monitoring database (for surface water and groundwater)	Operational Phase	Environmental Officer
Groundwater quality impacts	Backfilling of carbonaceous material in the pit areas as part of concurrent rehabilitation	All open cast sections	6	5	2	4	52	-	M	• Opencast areas will be rehabilitated as soon as possible to reduce the availability of oxygen and volume of infiltration, the carbonaceous material is deposited in the bottom of the pit below the coal horizon to ensure permanent inundation under water after Closure; • This will be according to sequential layeringof carbonaceous material with highest pollution potential at the bottom of the pit. • Determine the extent and origin of impact, implement management measures, commission consultation with impacted parties to determine short and long term solutions.	4	5	2	4	44	-	M	Undertake concurrent and final rehabilitation in accordance with the approved Rehabilitation Plan (updated plan included in this report)	Operational Phase	Engineering Manager/Environmental Officer
Impacts on groundwater levels and thereby the potential abstraction rates in surrounding boreholes	Open cast mining	All opencast areas	6	5	2	4	52	-	M	• Monitor static groundwater levels in all boreholes within the affected zone surrounding the mine (i.e. within at least 2 km radius from the mine) as identified during the hydrocensus; • Water levels should be monitored on a quarterly basis; • This will ensure that any change in the quantity of groundwater for the utilisation of legitimate groundwater users can be detected and can be reacted to appropriately; • These results should be recorded on a data sheet; • this may be done through the installation of additional boreholes for water supply purposes or an alternative water supply for farmers abstracting water from the Karoo sediments.	2	5	2	4	36	-	M	Appoint a qualified groundwater specialist to undertake quarterly monitoring	Operational Phase	Environmental Officer
																		Maintain/update centralised monitoring database (for surface water and groundwater)	Operational Phase	Environmental Officer
																		Maintain a relationship with surrounding groundwater users to determine if there are any potential issues	Operational Phase	Environmental Officer/Human Resources Manager
The mining of Block OH will result in the destruction of boreholes ILB 12 and ILB13.	Open cast mining operation	OH	8	5	1	5	70	-	H	• Water should be supplied from an alternative source or the future use of these boreholes should be agreed and settled with the owner/users;	6	5	1	5	60	-	M	Appoint a qualified groundwater specialist to undertake quarterly monitoring	Operational Phase	Environmental Officer

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION M	D	S	P	TOTAL	STATUS	SP	RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION M	D	S	P	TOTAL	STATUS	SP	ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
										• The mine should compensate the affected parties. This may be done through the installation of additional boreholes for water supply purposes or an alternative water supply for farmers abstracting water from the Karoo sediments.								Maintain a relationship with surrounding groundwater users to determine if there are any potential issues	Operational Phase	Environmental Officer/Human Resources Manager
The yield of boreholes ILB11, ILB24 and ILB25 might be affected.	Open cast mining	OD, OH, OM	2	4	1	3	21	-	L	• Monitor static groundwater levels in all boreholes within the affected zone surrounding the mine (i.e. within at least 2 km radius from the mine) as identified during the hydrocensus; • Water levels should be monitored on a quarterly basis. This will ensure that any change in the quantity of groundwater for the utilisation of legitimate groundwater users can be detected and can be reacted to appropriately; • These results should be recorded on a data sheet. • If it can be proven that the quantity of groundwater available to certain users are being affected by the proposed mine, the mine should compensate the affected parties. This may be done through the installation of additional boreholes for water supply purposes or an alternative water supply for farmers abstracting water from the Karoo sediments.	2	4	1	3	21	-	L	Appoint a qualified groundwater specialist to undertake quarterly monitoring	Operational Phase	Environmental Officer
																		Maintain/update centralised monitoring database (for surface water and groundwater)	Operational Phase	Environmental Officer
																		Maintain a relationship with surrounding groundwater users to determine if there are any potential issues	Operational Phase	Environmental Officer/Human Resources Manager
Borehole ILB7 will be destroyed by the mining of Block OD.	Open cast mining	OD, OH, OM, OWM	8	5	1	5	70	-	H	• Water should be supplied from an alternative source or • The future use of these boreholes should be agreed and settled with the owner/users; • The mine should compensate the affected parties. This may be done through the installation of additional boreholes for water supply purposes or an alternative water supply for farmers abstracting water from the Karoo sediments.	6	5	1	5	60	-	M	Appoint a qualified groundwater specialist to undertake quarterly monitoring	Operational Phase	Environmental Officer
																		Maintain a relationship with surrounding groundwater users to determine if there are any potential issues	Operational Phase	Environmental Officer/Human Resources Manager
The yield of boreholes ILB6 and ILB10 might be affected.	Open cast mining	OD, OH, OM	2	4	1	3	21	-	L	• Monitor static groundwater levels in all boreholes within the affected zone surrounding the mine (i.e. within at least 2 km radius from the mine) as identified during the hydrocensus; • Water levels should be monitored on a quarterly basis. This will ensure that any change in the quantity of groundwater for the utilisation of legitimate groundwater users can be detected and can be reacted to appropriately; • These results should be recorded on a data sheet; • If it can be proven that the quantity of groundwater available to certain users are being affected by the proposed mine, the mine should compensate the affected parties. This may be done through the installation of additional boreholes for water supply purposes or an alternative water supply for farmers abstracting water from the Karoo sediments.	2	4	1	3	21	-	L	Appoint a qualified groundwater specialist to undertake quarterly monitoring	Operational Phase	Environmental Officer
																		Maintain/update centralised monitoring database (for surface water and groundwater)	Operational Phase	Environmental Officer
																		Maintain a relationship with surrounding groundwater users to determine if there are any potential issues	Operational Phase	Environmental Officer/Human Resources Manager
Issues related to AIR QUALITY																				

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
Air quality impact created by dust on the nearby provincial road and the agricultural lands depending on the wind direction.	Open cast mining operation	All opencast sections	6	4	2	4	48	-	M	• Measures to prevent nuisance dust deposition will be implemented; • Activities that may contribute to dust generation will be minimised or managed as far as possible; • Dust suppression within dirty water management areas will be undertaken, in suitable volumes, avoiding excessive ponding; • Road dust suppression will be undertaken, in suitable volumes, avoiding excess runoff; • Quarterly dust monitoring will be undertaken at the proposed Block OWM land use area.	6	4	1	4	44	-	M	Provide dust suppression equipment and water	Operational Phase	Contractor/Engineering Manager
																		Undertake quarterly dust monitoring and submit the reports to the MDEDET	Quarterly during Operational Phase	Environmental Officer
Impact on the nearby provincial R548 road, the nearby Leeuwpan offices, the residences of Swanepoel and Becker and the agricultural lands depending on the wind direction	Open cast mining operation	Block OD	6	4	1	4	44	-	M	• Measures to prevent nuisance dust deposition will be implemented; • Activities that may contribute to dust generation will be minimised or managed as far as possible; • Dust suppression within dirty water management areas will be undertaken, in suitable volumes, avoiding excessive ponding; • Road dust suppression will be undertaken, in suitable volumes, avoiding excess runoff, Quarterly dust monitoring will be undertaken at the proposed Block OWM land use area.	4	4	1	3	27	-	L	Provide dust suppression equipment and water	Operational Phase	Contractor/Engineering Manager
																		Undertake quarterly dust monitoring and submit the reports to the MDEDET	Quarterly during Operational Phase	Environmental Officer
Impact on air quality	Spontaneous combustion of coal	Open cast pits	6	4	2	4	48	-	M	• Measures to prevent nuisance dust deposition will be implemented, Activities that may contribute to dust generation will be minimised or managed as far as possible; • Dust suppression within dirty water management areas will be undertaken, in suitable volumes, avoiding excessive ponding; • Road dust suppression will be undertaken, in suitable volumes, avoiding excess runoff; • Quarterly dust monitoring will be undertaken at the proposed Block OWM land use area.	6	4	1	4	44	-	M	Provide dust suppression equipment and water	Operational Phase	Contractor/Engineering Manager
																		Undertake quarterly dust monitoring and submit the reports to the MDEDET	Quarterly during Operational Phase	Environmental Officer
Dust related air pollution may result in contamination of products associated with surrounding mining activities, e.g. Delmas Silica (SamQuarz)	Open cast mining operation	OWM, ODext	6	4	2	4	48	-	M	• Measures to prevent nuisance dust deposition will be implemented, Activities that may contribute to dust generation will be minimised or managed as far as possible; • Dust suppression within dirty water management areas will be undertaken, in suitable volumes, avoiding excessive ponding; • Road dust suppression will be undertaken, in suitable volumes, avoiding excess runoff; • Quarterly dust monitoring will be undertaken at the proposed Block OWM land use area.	6	4	1	4	44	-	M	Provide dust suppression equipment and water	Operational Phase	Contractor/Engineering Manager
																		Undertake quarterly dust monitoring and submit the reports to the MDEDET	Quarterly during Operational Phase	Environmental Officer
Dust creation	Drilling and blasting, grading, excavation, backfilling, in-pit hauling, stockpiling	Block OI	10	4	2	5	80	-	H	• 70% mitigation on drilling through wet suppression, 75% mitigation on in-pit roads through level 2 water suppression, 62% control efficiency on materials handling (excavation, backfilling and stockpiling), 50% mitigation on grading of overburden and coal discard	8	4	2	4	56	-	M	Provide dust suppression equipment and water	Operational Phase	Contractor/Engineering Manager
																		Undertake quarterly dust monitoring and submit the reports to the MDEDET	Quarterly during Operational Phase	Environmental Officer

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
Issues related to NOISE																				
Impact on ambient noise levels	Blasting (exceeding 130 dBA)	OD, OH, OM, OWM, Odext	10	1	2	5	65	-	H	• The mine will adhere to the requirements of the OHSA at the mine and the Explosives Act and Regulations with regards to blasting; • The mining operation will, at all times, also comply with all relevant legislation; • Where the standards have been exceeded, appropriate action should be taken to rectify the situation; • Where possible and necessary, scheduling of blasting at regular times of the day and on regular days of the week will reduce community discernment and aid habituation. • A standard blasting time should be fixed and displayed on fixed blasting notice boards at various entrance routes that will inform local residents of dates of blasting and blast times; • Working procedures will be structured so as to avoid the unnecessary generation of noise (banging of tailgates, wagon doors, etc. • Equipment used on site will be properly muffled and maintained so as to reduce noise generation to the minimum.	8	1	2	5	55	-	M	Undertake noise monitoring and compare results to the relevant standards. Submit monthly reports to the MDEDET and Department of Health	Daily, operational phase	Environmental Officer/Health and Safety Officer
																		Prepare or update blasting schedule and procedures taking cognisance of the Blast and Vibration Report	Operational Phase	Contractor/Engineering Manager
Impact on ambient noise levels	Drilling	All opencast areas	8	4	2	4	56	-	M	• Acoustic screening measures as recommended by the IFC; • Undertake noise monitoring	6	4	2	3	36	-	M	Undertake noise monitoring and compare results to the relevant standards. Submit monthly reports to the MDEDET and Department of Health	Daily, operational phase	Environmental Officer/Health and Safety Officer
Impact on ambient noise levels	Overburden blasting and coal blasting	All opencast areas	8	4	2	4	56	-	M	• Acoustic screening measures as recommended by the IFC; • An earthberm of 15m to be erected along the northern and western boundary of the property opposite the residential properties along the open cast mine; • Undertake noise monitoring.	6	4	2	3	36	-	M	Undertake noise monitoring and compare results to the relevant standards. Submit monthly reports to the MDEDET and Department of Health	Daily, operational phase	Environmental Officer/Health and Safety Officer
																		Construct berm and undertaken monthly inspections and maintenance	Monthly, Operational Phase	Environmental Officer/Contractor
Impact on ambient noise levels	Removal of coal by means of free digging.	All opencast areas	8	4	2	4	56	-	M	• Acoustic screening measures as recommended by the IFC; • Undertake noise monitoring.	6	4	2	3	36	-	M	Undertake noise monitoring and compare results to the relevant standards. Submit monthly reports to the MDEDET and Department of Health	Daily, Operational Phase	Environmental Officer/Health and Safety Officer

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
Issues related to VISUAL																				
The open cast mining operation visible from the provincial R50 road and the surrounding agricultural lands.	Open cast mining	All opencast areas	6	4	1	5	55	-	M	• Use of visual screening using trees and berms where necessary.	4	4	1	4	36	-	M	Plant trees, or construct berms where necessary to screen operations	Operational Phase	Environmental Officer
Visual impacts in terms of night-time illumination will especially affect those land users situated in close proximity to the proposed site.	Mining operations	All opencast areas	6	4	1	4	44	-	M	• Focus lighting away from the direction of sensitive receptors. • Any new security lighting should be strategically placed so as not to visually intrude on the surrounding landscape.	4	4	1	3	27	-	L	Take cognisance of potential sensitive receptors before the installation of lighting	Operational Phase	Environmental Officer

OPERATIONAL PHASE - ACTIVITY 2: PLANT OPERATIONS

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
OPERATIONAL PHASE ACTIVITY 2: Plant																				
Issues related to GEOLOGY																				
No impacts envisaged	Operation of plants	All mining areas	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
No impacts envisaged	Operation of plants	All mining areas	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to BLAST AND VIBRATION																				
No impacts envisaged	Operation of plants	All mining areas	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to FLORA																				
None	Operation of plants	All plant areas	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	-	L	N/A	N/A	N/A
Issues related to FAUNA																				
None	Operation of plants	All plant areas	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	-	L	N/A	N/A	N/A
Issues related to WETLANDS																				
Increased surface runoff and erosion	Surface infrastructure	Plant operations	6	4	1	5	55	-	M	• Minimise extent of hardened surfaces; • Implement a detailed stormwater management plan which aims to retain the pre-development run-off characteristics of the site for regular return storm events; • Convey stormwater in grassed swales rather than lined canals/trenches as far as possible to maximise infiltration and minimise erosion; • Stormwater discharge points should be protected against erosion and incorporate energy dissipaters; • Flows should be encouraged to disperse across a wide an area of the wetland as possible; • Stormwater should be discharged into adjacent grassland and not directly into the delineated wetlands as far as possible; • Fixed point photography should be undertaken of the discharge points to monitor for erosion damage. Photographs should be taken pre-development to provide a baseline, and then in December and March during the rainy season. If erosion is observed, corrective measures should be implemented via the appointment of a wetland rehabilitation specialist	4	4	1	3	27	-	L	Ensure the approved SWMP infrastructure have all been correctly constructed	Operational Phase	Contractor/Environmental Officer
																		Compile and implement a maintenance schedule for the stormwater management infrastructure	Operational Phase	Environmental Officer
																		Undertake erosion monitoring using fixed point photography and update photographic database	Operational Phase	Environmental Officer

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
Deterioration in water quality	Surface infrastructure	Plant operations	6	4	1	5	55	-	M	• A detailed surface water management plan should be drawn up that complies fully with GN704 in terms of the separation of clean and dirty stormwater; • Dirty stormwater should be captured in a pollution control dam on site and no discharge of dirty stormwater should be allowed into the wetlands on site; • The dirty water management system should have a minimum capacity to cope with a 1:50 year storm event without overflow; • Dirty water should be re-used as far as possible within the mining operations	4	4	1	4	36	-	M	Ensure the approved SWMP infrastructure have all been correctly constructed Compile and implement a maintenance schedule for the stormwater management infrastructure	Operational Phase Operational Phase	Contractor/Environmental Officer Environmental Officer
Issues related to SOILS, LAND CAPABILITY, LAND USE																				
Contamination, compaction, deterioration in nutritional value, chemical deterioration and physical deterioration of the soil due to the plant operations	OE	Plant operations	6	5	1	4	48	-	M	• Limit the extent of plant operations using fencing, berms, walls etc.; • Implement clean and dirty water seperation; • Original land capability, will serve as a guide to restore the area to its original natural state after closure; • The soil decomposition will also serve as a guide for soil enrichment; • During the Operational Phase, the overburden will be selectively removed and stockpiled. These will be placed back After operation has ceased and the plant is dismantelled	6	5	1	4	48	-	M	Ensure the approved SWMP infrastructure have all been correctly constructed Compile and implement a maintenance schedule for the stormwater management infrastructure	Operational Phase Operational Phase	Contractor/Environmental Officer Environmental Officer
The presence of these structures will continue to impact on the soils of the site. In addition, soil erosion and the subsequent loss of topsoil could take place if these structures are not designed correctly and maintained on a regular basis.	Construction and utilization of the stormwater diversion trenches/berms	Surface infrastructure areas	6	5	1	4	48	-	M	• Inspect and maintain stormwater management infrastructure on a regular basis.	6	5	1	4	48	-	M	Ensure the approved SWMP infrastructure have all been correctly constructed Compile and implement a maintenance schedule for the stormwater management infrastructure	Operational Phase Operational Phase	Contractor/Environmental Officer Environmental Officer
Issues related to SURFACE WATER																				
Water input from the catchment is reduced due to the presence of the infrastructure	Plant operations	All plants	6	4	2	3	36	-	M	• Maintain a closed water circuit throughout the LoM; • Trenches will be put in place in such a way to allow clean run-off to be directed towards the Bronkhorstspruit; • The river diversion berm at the Witklip section will be maintained throughout the life of mining operations in order to ensure that no run-off enters the open pit.	4	4	2	3	30	-	M	Ensure the approved SWMP infrastructure have all been correctly constructed Establish a dynamic operational water balance. Implement inspection and maintenance schedule for river diversions	Operational Phase Ongoing Monthly	Contractor/Environmental Officer Environmental Office / Process Engineer Environmental Officer

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
Surface water quality can be affected if Clean and dirty areas not adequately separated and isolated or if the capacity of clean and dirty water systems not sufficient,	Construction and utilization of the stormwater diversion trenches/berms	Plant operations	6	4	2	3	36	-	M	• The potential to generate contaminated water will be minimised; • Clean runoff will be diverted past the dirty areas; • The proposed dirty water management area at the proposed site will be secured and all dirty runoff will be contained for re-use; • Regular maintenance and repair work will be undertaken to storm water management measures; • The contaminated water generated on-site will be contained within the dirty water management system and will not be discharged (or allowed to flow) to clean downstream areas. Isolation barrier berms for the proposed mining area will be provided; • Any surface diversion berms and drains will be kept free from any obstructions (debris) to ensure that the efficiency is not affected.	2	3	2	3	21	-	L	Ensure the approved SWMP infrastructure have all been correctly constructed	Operational Phase	Contractor/Environmental Officer
																		Compile and implement a maintenance schedule for the stormwater management infrastructure	Operational Phase	Environmental Officer
Clean surface run-off water entering the crushing and screening area from the upstream and becoming contaminated.	Clean run-off becoming contaminated	All plants	8	4	2	4	56	-	M	• Clean and dirty water seperation system to be constructed upstream from the beneficiation area and divert clean water around the area as to prevent it from entering the area.	4	4	2	3	30	-	M	Ensure the approved SWMP infrastructure have all been correctly constructed	Operational Phase	Contractor/Environmental Officer
																		Compile and implement a maintenance schedule for the stormwater management infrastructure	Operational Phase	Environmental Officer
Rainwater falling onto the area and causing areas of ponding.	Ponding	All plants	8	4	2	4	56	-	M	• Sloping of the area is required in order to divert contaminated storm water to a pollution control collection facility purposely designed in terms of GN704; • Design should be based on a number of years rainfall record and allow for the wettest year and a freeboard of 0.8 m above the full water supply level.	4	4	2	2	20	-	L	Ensure the approved SWMP infrastructure have all been correctly constructed	Operational Phase	Contractor/Environmental Officer
																		Compile and implement a maintenance schedule for the stormwater management infrastructure	Operational Phase	Environmental Officer
Contaminated surface water run-off causing erosion gullies and collecting dust and coal particles.	Erosion	All plants	8	4	2	4	56	-	M	• Regular inspections and maintenance of plant areas; • Seperation trenches and gullies to be provided with energy dissipators where required.	4	4	2	2	20	-	L	Conduct maintenance of plant areas in accordance with maintenance schedule	Monthly, Operational Phase	Plant Manager
																		Appoint surface water specialist to undertake monthly surface water monitoring and capture all results in water quality database	Operational Phase	Environmental Officer
Contaminated run-off from beneficiation area to be collected within a	Collection of dirty water	All plants	10	4	2	5	80	-	H	• Downstream pollution control to be constructed for the collection of dirty water run-off from this delineated area;	6	4	2	2	24	-	L	Ensure the approved SWMP infrastructure have all been correctly constructed	Operational Phase	Contractor/Environmental Officer

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
downstream pollution control dam										• A silt trap to be installed at the inflow of the pollution control dam as to collect all suspended solids and prevent the dam from losing its design capacity through siltation; • The silt trap to be cleaned on a regular basis.								Conduct maintenance of plant areas in accordance with maintenance schedule	Monthly, Operational Phase	Plant Manager
																		Appoint surface water specialist to undertake monthly surface water monitoring and capture all results in water quality database	Operational Phase	Environmental Officer
Issues related to GROUNDWATER																				
Coal will be exposed at the washing plant area to water and oxygen, resulting in ARD, and spills from the site can contaminate groundwater.	Crushing, Screening and Washing Plant	All plants	6	4	2	4	48	-	M	• Spills from the crushing, screening and washing plant area needs to be cleaned up immediately.	4	4	2	4	40	-	M	Clean up all spills	Immediately	Plant Manager
Issues related to AIR QUALITY																				
Crushing and screening, materials handling, stockpiling	Plant operations	All plants	10	4	2	5	80	-	H	• Wet suppression and enclosure of crushing and screening activities	8	4	2	4	56	-	M	Provide dust suppression equipment and water	Operational Phase	Plant Manager
Issues related to NOISE																				
Operations at the mine could impact on the ambient noise level of the immediate surroundings.	Operation of plants	All plants	6	4	2	4	48	-	M	• Standards pertaining to noise within and beyond the mine must be stipulated; • All equipment, machinery and vehicles will be regularly maintained; • Monitoring for management purposes should be carried monthly. Where the standards have been exceeded, appropriate action should be taken to rectify the situation. • The future of the potential effects of noise should be monitored and where impacts have occurred, appropriate action must be taken.	6	4	1	4	44	-	M	Maintain equipment and vehicles in accordance with the maintenance schedule	Operational Phase	Plant Manager
																		Undertake noise monitoring and compare results to the relevant standards. Submit monthly reports to the MDEDET and Department of Health	Daily, operational phase	Environmental Officer/Health and Safety Officer
Issues related to VISUAL																				
Visual impacts in terms of night-time illumination will especially affect those land users situated in close proximity to the proposed site.	Lighting at plants	All plants	6	4	2	4	48	-	M	• Focus lighting away from the direction of sensitive receptors; • Any new security lighting should be strategically placed so as not to visually intrude on the surrounding landscape.	4	4	2	4	40	-	M	Take cognisance of potential sensitive receptors before the installation of lighting	Operational Phase	Environmental Officer
The presence of the stormwater diversion trenches/berms will continue to impact on the visual aspect of the site.	OD, OH, OM, OWM, Odext	Construction and utilization of the stormwater diversion trenches/berms	4	4	1	4	36	-	M	• The proposed land use area will be kept neat and tidy at all times, i.e. good housekeeping principles will be implemented and adhered to; • All buildings will to be maintained in optimal condition, and repair work will be undertaken regularly, when necessary.	4	3	1	3	24	-	L	Implement inspection and maintenance schedule for river diversions	Monthly	Environmental Officer
Issues related to CULTURE & HERITAGE																				

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
None	Operation of plants	All plant areas	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	-	L	N/A	N/A	N/A

OPERATIONAL PHASE - ACTIVITY 3: LINEAR INFRASTRUCTURE

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
OPERATIONAL PHASE ACTIVITY 3: Linear infrastructure																				
Issues related to GEOLOGY																				
No impacts envisaged	Operation of linear infrastructure	All mining areas	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
Change to topography over time	Increased runoff from disturbed areas	Haul roads	2	4	1	4	28	-	L	• Limit the movement of vehicles to designated pathways; • Rehabilitate surrounding areas which may be disturbed; • Undertake a maintenance programme (involving periodic visual inspections) to ensure that the plants used for rehabilitation remain in optimal condition.	2	4	1	4	28	-	L	N/A	N/A	N/A
Issues related to BLAST AND VIBRATION																				
No impacts envisaged	Operation of linear infrastructure	All mining areas	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to FLORA																				
Establishment of weeds, especially to declared weeds and invader species, along the borders of the disturbed land use areas.	Open cast mining	All mining areas	8	4	1	4	52	-	M	• Limit the movement of vehicles to designated pathways, • Rehabilitate surrounding areas which may be disturbed; • Undertake a maintenance programme (involving periodic visual inspections) to ensure that the plants used for rehabilitation remain in optimal condition; • Continuously remove declared weed species from the surrounding area.	4	4	1	4	36	-	M	Use fences to mark off no-go areas and inform workers of these during induction. Enforce the rules by means of penalties (e.g. fines or warnings) for non-compliance	Operational Phase	Environmental Officer
																		Update and implement weed eradication plan	Operational Phase	Environmental Officer
Issues related to FAUNA																				

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
Road mortality of animals	Use and maintenance of haul roads; conveyors and powerlines	All mining areas	8	4	1	4	52	-	M	• Limit the movement of vehicles to designated pathways; • Warning signs, speed limit enforcement, speed humps	4	4	1	4	36	-	M	Use of signage and speed humps, as well as penalties (e.g. fines or warnings) to enforce speed limits	Operational Phase	Engineering manager
Issues related to WETLANDS																				
Deteriorating water quality due to coal spillages	Operation of conveyor and roads	All mining areas	6	4	1	4	44	-	M	• Gantries should be used for all conveyor wetland crossings to minimise spills and dust; • Should larger spillages occur due to malfunctioning of the conveyor or for any other reason, clean-up of the spillages should be undertaken as soon as possible following the event; • In this regard regular inspection of the entire conveyor route should be undertaken; • No belt transfers are to be located within the wetland areas on site; • Where belt transfers are located in close proximity to wetland areas a small, shallow berm should be constructed between the belt transfer site and the wetland area to prevent direct run-off of storm water from the belt transfer site into the valley bottom wetland	4	4	1	3	27	-	L	Conduct weekly inspection along conveyor route and maintain conveyor on a regular basis	Operational Phase	Engineering manager
																		Clean up spillages when they occur	Operational Phase	Engineering manager
																		Compile and implement a maintenance schedule for the stormwater management infrastructure	Operational Phase	Environmental Officer
Stormwater discharge into wetlands	Roads	All mining areas	6	4	1	5	55	-	M	• Stormwater should not be allowed to accumulate on the road surface; • Regular discharge points into adjacent grassland should be provided; • Discharge points should be protected against erosion; • No stormwater should be discharged directly into the wetland	4	4	1	3	27	-	L	Compile and implement a maintenance schedule for the stormwater management infrastructure	Operational Phase	Environmental Officer
Altered flows in wetlands	conveyor and roads	All mining areas	6	4	1	4	44	-	M	• Any proposed bridge structures should aim to be clear span across the active channels of wetlands, and aim to maintain wetting of the full wetland front downslope of the crossing through the incorporation of as many culvert structures as required to achieve this; • Use of a single pipe culvert for crossings over hillslope seepage wetlands should be avoided; • Capacity of crossing structures should be such that no impounding of flows upslope of the crossing occurs under normal flow events.	4	4	1	3	27	-	L	Compile and implement a maintenance schedule for the stormwater management infrastructure	Operational Phase	Environmental Officer
Water quality deterioration due to leaks or pipe failure	Pipeline	All mining areas	8	4	2	3	42	-	M	• Leak detection measures should be installed along the pipeline so that pipe failure, should it occur, will be noticed immediately and water flow through the pipe can be stopped; • Twice monthly checks along the route should be undertaken to scan for signs of leaks.	6	4	1	2	22	-	L	Construct and maintain leakage detection structures	Monthly	Engineering Manager
																		Compile and implement a maintenance schedule for the stormwater management infrastructure	Operational Phase	Environmental Officer

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
Disturbance to wetland habitat due to maintenance activities	Powerline	All mining areas	4	4	1	4	36	-	M	• No burning of vegetation within the wetlands should take place unless it forms part of the burning regime established in a fire management plan for the colliery compiled by a suitably qualified expert; • Maintenance access to the servitudes should be via a single access track, with no vehicular movement through the wetlands along the servitudes other than along the maintenance track.	2	4	1	3	21	-	L	Fence off wetlands and conduct induction to inform workers of no-go areas	Operational Phase	Mine Manager/Environmental Officer
																		Compile and implement a maintenance schedule for the stormwater management infrastructure	Operational Phase	Environmental Officer
Stormwater discharge into wetlands	Roads	All mining areas	6	4	1	5	55	-	M	• Stormwater should not be allowed to accumulate on the road surface; • Regular discharge points into adjacent grassland should be provided. Discharge points should be protected against erosion; • No stormwater should be discharged directly into any wetland.	4	4	1	3	27	-	L	Compile and implement a maintenance schedule for the stormwater management infrastructure	Operational Phase	Environmental Officer
Deteriorating water quality due to coal spillages	Roads	All mining areas	4	4	1	4	36	-	M	• Should larger spillages occur due to truck accidents, immediate clean-up of the spillage should be undertaken; • All spilled material should be removed and the disturbed area rehabilitated.	4	1	1	4	24	-	L	Clean up spillages when they occur	Operational Phase	Engineering manager
																		Rehabilitate affected soils after an initial site assessment (removal of contaminated soils or bioremediation)	Operational Phase	Plant Manager
Issues related to SOILS, LAND USE AND LAND CAPABILITY																				
Spillage of carbonaceous material, diesel and oil could lead to the contamination of the soil of the haul roads and its immediate surroundings.	Haulage of the ROM product from the open cast area to the washing plant	Haul roads	6	5	1	3	36	-	M	• Avoid coal spillages on Haul Roads during the transport of ROM product; • Gravel roads should be maintained; • The extent of areas of surface disturbance will be minimised, by strictly controlling the movement of vehicles to, from, and within the proposed land use areas; • The haul roads will be monitored for coal spillage on a regular basis; • The haul roads will be graded on a regular basis and will be kept free of coal; • No discard or coal will be used for road building; • If a coal spill occurs, it will be cleared within 24 hours. The coal spill will be returned to the plant at Leeuwpan Coal Mine; • All gravel roads (associated with the proposed mining and related operations) will be maintained when necessary to ensure that erosion remains under control; • Maintenance will involve the filling and compaction of erosion gullies or holes.	4	3	1	3	24	-	L	Fence off wetlands and conduct induction to inform workers of no-go areas	Operational Phase	Mine Manager/Environmental Officer
																		Undertake daily inspections of haul roads	Operational Phase	Environmental Officer
																		Undertake maintenance of haul roads in accordance with the maintenance schedule	Operational Phase	Engineering manager
																		Clean up spillages when they occur	Operational Phase	Engineering manager

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
Soil compaction and reduced infiltration leading to increased soil erosion	Driving over soil profiles	Haul roads	8	5	1	5	70	-	H	• Restrict vehicle and machinery movement to existing roads and limit new haul roads	8	4	1	4	52	-	M	Conduct induction to inform workers of no-go areas	Operational Phase	Mine Manager/Environmental Officer
Issues related to SURFACE WATER																				
The haulage of ROM could impact on surface water quality as a result of spillage.	Utilization of the haul road	Haul roads	2	1	1	3	12	-	L	• Spillage of coal from haul trucks will be minimised by adhering to reduced speed limits; • A speed limit of 30km/h must be enforced on site.	2	1	1	2	8	-	L	Use of signage and speed humps, as well as penalties (e.g. fines or warnings) to enforce speed limits	Operational Phase	Engineering manager
Impact of the quality of the receiving surface water environment	Use of contaminated water for dust suppression purposes on the proposed haul road	Haul roads	6	4	2	3	36	-	M	• The volume of contaminated water used for dust suppression will be controlled to ensure that excessive ponding or runoff is not generated; • The potential to generate contaminated water will be minimised; • Clean runoff will be diverted past the dirty areas; • The proposed dirty water management area at the proposed site will be secured and all dirty runoff will be contained for re-use; • Regular maintenance and repair work will be undertaken to storm water management measures; • The contaminated water generated on-site will be contained within the dirty water management system and will not be discharged (or allowed to flow) to clean downstream areas. Isolation barrier berms for the proposed mining area will be provided; • Any surface diversion berms and drains will be kept free from any obstructions (debris) to ensure that the efficiency is not affected.	4	4	2	2	20	-	L	Compile and implement a maintenance schedule for the stormwater management infrastructure	Operational Phase	Environmental Officer
Impact on surface water quality	Clean and dirty areas not adequately separated and isolated or Capacity of clean and dirty water systems not sufficient	Haul roads	6	4	2	3	36	-	M	• The potential to generate contaminated water will be minimised; • Clean runoff will be diverted past the dirty areas; • The proposed dirty water management area at the proposed site will be secured and all dirty runoff will be contained for re-use; • Regular maintenance and repair work will be undertaken to storm water management measures. • The contaminated water generated on-site will be contained within the dirty water management system and will not be discharged (or allowed to flow) to clean downstream areas. Isolation barrier berms for the proposed mining area will be provided; • Any surface diversion berms and drains will be kept free from any obstructions (debris) to ensure that the efficiency is not affected.	4	4	1	2	18	-	L	Compile and implement a maintenance schedule for the stormwater management infrastructure	Operational Phase	Environmental Officer
Issues related to GROUNDWATER																				
No impacts envisaged	Operation of linear infrastructure	All mining areas	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
Issues related to AIR QUALITY																				
Impact on the air quality of the site and the immediate surroundings	Dust created by the utilization of the haul road	Haul roads	6	4	1	4	44	-	M	• Haul Roads should be wetted to avoid excessive dust; • The mine manager or his appointed representative will ensure that dust is kept to a minimum; • The haul roads will be wetted twice daily by use of water carts; • In the event of excessive wind conditions, this wetting frequency will be increased as necessary to suppress the dust; • Water for dust suppression will be obtained from the pollution control dam.	4	3	1	3	24	-	L	Provide dust suppression equipment	Operational Phase	Environmental Officer/Engineering Manager
Airborne dust may settle on plants in the immediate vicinity of the site and may affect the ability of plants to function	Dust created by the utilization of the haul road	Haul roads	6	4	2	4	48	-	M	• Measures to prevent nuisance dust deposition will be implemented; • Activities that may contribute to dust generation will be minimised or managed as far as possible; • Dust suppression within dirty water management areas will be undertaken, in suitable volumes, avoiding excessive ponding; • Road dust suppression will be undertaken, in suitable volumes, avoiding excess runoff; • Quarterly dust monitoring will be undertaken.	2	4	1	4	28	-	L	Provide dust suppression equipment	Operational Phase	Environmental Officer/Engineering Manager
																		Conduct dust monitoring (empty dust buckets on a monthly basis) and submit the results thereof to the to the MDEDET	Monthly, Operational Phase	Environmental Officer/Health and Safety Officer
Air quality impact	Hauling of ROM coal to plant and discard to opencast areas	Haul roads	10	4	2	5	80	-	H	• Wet suppression and chemical stabilisation of haul road surface, weekly measurement of silt cover on chemically stabilised roads and further chemical stabilisation according to the results.	8	4	2	4	56	-	M	Provide dust suppression equipment	Operational Phase	Environmental Officer/Engineering Manager
Access and haul roads also generate dust problems as vehicles travel on site.	Vehicle movement	Haul roads	6	5	2	3	39	-	M	• Equipment, processes and machinery will be installed in such a way that the air quality within, as well as beyond, the mine complies with lawful and other applicable norms and standard; • Air quality standards have been developed for dust, gasses and fumes and other undesirable air-related factors and are kept within accepted standards; • Monitoring takes place at specified times to ensure that the standards are being followed.	6	3	1	3	30	-	M	Maintain equipment and vehicles in accordance with the maintenance schedule	Operational Phase	Plant Manager
																		Conduct dust monitoring (empty dust buckets on a monthly basis) and submit the results thereof to the to the MDEDET	Monthly, Operational Phase	Environmental Officer/Health and Safety Officer
Issues related to NOISE																				
Impact on the ambient noise level of the immediate surroundings.	The utilization of the haul road by haul trucks	Haul roads	4	4	1	3	27	-	L	• Working procedures will be structured so as to avoid the unnecessary generation of noise (banging of tailgates, wagon doors, etc.); • Speed limits on the haul and access roads will be enforced;	4	3	1	3	24	-	L	Conduct induction to inform all workers of necessary procedures	Operational Phase	Environmental Officer
																		Maintain equipment and vehicles in accordance with the maintenance schedule	Operational Phase	Plant Manager

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
										• All equipment, machinery and vehicles will be regularly maintained; • Equipment used on site will be properly muffled and maintained so as to reduce noise generation to the minimum; • Monthly noise monitoring will be undertaken								Undertake noise monitoring and compare results to the relevant standards. Submit monthly reports to the MDEDET and Department of Health	Daily, operational phase	Environmental Officer/Health and Safety Officer
Issues related to VISUAL																				
Impact on the visual aspect of the site	The presence and utilization of the haul road by trucks	Haul roads	4	4	1	4	36	-	M	No mitigation possible until the end of LoM	4	4	1	4	36	-	M	N/A	N/A	N/A
Impact on the visual aspect of the site	The presence of powerlines and conveyors	Haul roads	4	4	1	4	36	-	M	No mitigation possible until the end of LoM	4	4	1	4	36	-	M	N/A	N/A	N/A
Issues related to CULTURE & HERITAGE																				
No impacts envisaged	Operation of linear infrastructure	All mining areas	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A

OPERATIONAL PHASE - ACTIVITY 4 HANDLING OF DANGEROUS GOODS

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	AREA APPLICABLE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
OPERATIONAL PHASE ACTIVITY 4: GENERATION AND HANDLING OF WASTE AND DANGEROUS GOODS																				
Matters pertaining to GEOLOGY																				
No significant operational impacts are envisaged.	N/A	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A
Matters pertaining to TOPOGRAPHY																				
No significant operational impacts are envisaged.	N/A	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A
Matters pertaining to GEOHYDROLOGY																				
Potential groundwater contamination	Overburden	Mining Area	6	4	1	3	33	-	M	Compaction of base, stormwater management in lined PCD	3	4	1	2	16	-	L	Groundwater quality monitoring	Quarterly	Mine Environmental Manager
generation, handling of waste and transport of material can cause various types of spills (domestic waste, sewage water, hydrocarbons) which can infiltrate and contaminate the groundwater.	waste generation	Mining Area	4	3	1	3	24	-	L	Waste management and handling procedures implemented and managed	2	1	1	2	8	-	L	Soild waste must be stored at site on an approved waste disposal area, or removed from site by credible/licensed contractors.	Ongoing	Environmental control officer
Groundwater contamination, potential impact downstream receptors	Discard	Mining Area	8	5	2	5	75	-	H	Discard water management to minimise infiltration (low rate of rise - more evaporation), lined return water dam	8	4	1	4	52	-	M	Groundwater quality monitoring	Monthly	Mine Environmental Manager
Matters pertaining to HYDROLOGY																				
The generation of waste may lead to surface water contamination.	Waste generation	Mining Area	8	4	2	4	56	-	M	Surface water quality monitoring networks must be set up prior to the construction phase so that any surface water quality issues can be addressed accordingly.	6	4	2	3	36	-	M	Surface water quality sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Monthly	Environmental control officer
																		Quarterly surface water monitoring reports will be generated by the mine or through a qualified water quality specialist.	Quarterly	Environmental control officer/Water Quality Specialist
																		In the event that water quality issues are identified based on the monitoring programme, an independent specialist should be consulted to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental control officer/Water Quality Specialist
Disposal of any type of waste to an area with a waste skip.	Waste generation	Mining Area	8	2	2	5	60	-	M	A dedicated area for the placement of waste skips must be determined prior to operational activities, and the area will to be cemented. Allowance for keeping clean water run-off away from the skip area through the correct bunding design.	4	2	1	2	14	-	L	The mine will adopt a cradle-to-grave approach to ensure that the waste is removed and disposed of in a prescribed/correct manner, and must be stored in a designated area as part of the waste management strategy.	Ongoing	Environmental control officer

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	AREA APPLICABLE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
OPERATIONAL PHASE ACTIVITY 4: GENERATION AND HANDLING OF WASTE AND DANGEROUS GOODS																				
																		Waste generated will be collected and disposed of in a licensed waste facility and a copy of the valid waste disposal permits will be kept on site.		
Waste generated at the mine could pollute local water resources.	Waste generation	Mining Area	6	4	2	3	36	-	M	Control the storage, handling and safe disposal of waste.	4	4	1	1	9	-	L	The mine will adopt a cradle-to-grave approach to ensure that the waste is removed and disposed of in a prescribed/correct manner, and must be stored in a designated area as part of the waste management strategy.	Ongoing	Environmental control officer
Matters pertaining to SOILS, LAND USE AND LAND CAPABILITY																				
Chemical soil pollution	Spillage and seepage of wastewater	Mining Area	2	5	8	5	75	-	H	Proper chemical waste management	1	3	4	4	32	-	M	Ensure that adequate stormwater management measures and clean and dirty separation mechanisms are implemented on site.	Ongoing	Environmental control officer
Change in natural landscape	Ground clearance and waste disposal	Mining Area	1	5	6	5	60	-	M	Keep infrastructure to a minimum to reduce footprint	1	5	4	4	40	-	M	Operational activities should be limited to designated areas. No related activities may be undertaken outside of the designated areas. The boundaries will be fenced off to prevent unnecessary impacts on surrounding land capabilities. All fences will be routinely inspected and maintained. The surrounding land (not used for mining or operational purposes) will be kept in the state it was prior to the mining related construction activities.	Ongoing	Environmental control officer
The generation of waste may lead to soil contamination.	Waste generation	Mining Area	8	2	2	5	60	-	M	Monitoring of waste generation and soil contamination must be implemented and maintained.	4	2	2	3	24	-	L	In the event that soil contamination occurs, immediate soil clean-up should be undertaken.	In the event of occurrence	Environmental control officer
Matters pertaining to FAUNA & FLORA																				
Loss or disruption of mammal migration routes.	Waste generation & handling	Mining Area	4	4	3	2	22	-	L	Develop dedicated waste handling areas; prevent access to rodents and opportunistic species; prevent the spread of waste.	4	4	3	1	11	-	L	Develop control measures; develop a monitoring plan; implement an awareness programme; and provide adequate waste disposal facilities.	Ongoing	Environmental control officer/Heath & Safety officer/ Ecologist/ Proponent

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	AREA APPLICABLE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
OPERATIONAL PHASE ACTIVITY 4: GENERATION AND HANDLING OF WASTE AND DANGEROUS GOODS																				
Direct impacts on sensitive/pristine habitat types.	Waste generation & handling	Mining Area	6	4	3	3	39	-	M	Develop dedicated waste handling areas; prevent the spread of waste.	6	4	3	2	26	-	L	Develop control measures; develop a monitoring plan; implement an awareness programme; and provide adequate waste disposal facilities.	Ongoing	Environmental control officer/Heath & Safety officer/ Ecologist/ Proponent
Direct impacts on common fauna species of the study area.	Waste generation & handling	Mining Area	6	4	2	3	36	-	M	Develop dedicated waste handling areas; prevent access to rodents and opportunistic species; prevent the spread of waste.	6	4	2	2	24	-	L	Develop control measures; develop a monitoring plan; implement an awareness programme; and provide adequate waste disposal facilities.	Ongoing	Environmental control officer/Heath & Safety officer/ Ecologist/ Contractor/Site Manager
Faunal interaction with structures, servitudes and/or personnel.	Waste generation & handling	Mining Area	4	4	2	4	40	-	M	Develop dedicated waste handling areas; prevent access to rodents and opportunistic species; prevent the spread of waste.	4	4	2	2	20	-	L	Develop control measures; develop a monitoring plan; implement an awareness programme; and provide adequate waste disposal facilities.	Ongoing	Environmental control officer/Heath & Safety officer/ Ecologist/ Contractor/Site Manager
Impacts on surrounding habitat/species, including ecosystem functioning.	Waste generation & handling	Mining Area	4	4	2	3	30	-	M	Develop dedicated waste handling areas; prevent the spread of waste.	4	4	2	2	20	-	L	Develop control measures; develop a monitoring plan; implement an awareness programme; provide adequate waste disposal facilities; and implement waste sorting and the re-use of materials.	Ongoing	Environmental control officer/Heath & Safety officer/ Ecologist/ Contractor/Site Manager
Matters pertaining to AIR QUALITY																				
No significant operational impacts are envisaged.	N/A	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A
Matters pertaining to NOISE																				
No significant operational impacts are envisaged.	N/A	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A
Matters pertaining to TRAFFIC																				
No significant operational impacts are envisaged.	N/A	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A
Matters pertaining to VISUAL																				
No significant operational impacts are envisaged.	N/A	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A
Matters pertaining to WETLANDS																				

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	AREA APPLICABLE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
OPERATIONAL PHASE ACTIVITY 4: GENERATION AND HANDLING OF WASTE AND DANGEROUS GOODS																				
Water quality deterioration related to accidental spills during general operational activities (fuels, cement, etc). Storm water flushing contaminated areas as well as dust can carry pollutants into water bodies either directly or indirectly via groundwater. Water quality deterioration will especially affect aquatic fauna intolerant to water quality alteration but can have an impact on all aquatic fauna (especially fuel and sewage spills).	Spillages	Mining Area	10	4	3	4	68	-	H	Designated waste handling and storage facilities must be put in place at the start of the construction phase. These facilities must be located on bunded areas that do not allow seepage of pollutants into the ground or the run-off of polluted water. All waste must be disposed off in registered waste disposal facilities. The waste facilities should be located within the dirty water area of the mine. Identify potential areas where seepage and spills can occur into the natural environment. Take necessary precautions to reduce potential spills and seepage. Ensure that hazardous substances (e.g. fuels) do not wash into drains or nearby water bodies. Maintain aquatic biomonitoring programme. Hazardous waste should be responsibly disposed of by a certified service provider. An emergency preparedness plan should be compiled detailing required actions in case of spills or leaks. Any spill/leak incidents should be followed up by auditable actions.	6	4	3	2	26	-	L	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer
Increased hazardous waste (e.g. PVC, tyres, hydrocarbons, etc)	Hazardous waste	Mining Area	8	4	3	4	60	-	M	Hazardous waste should be responsibly stored (in bunded/cemented areas) and disposed of by a certified service provider. The generation of hazardous waste should be minimised and recycling implemented as far as possible (e.g. oil recycling).	2	2	1	2	10	-	L	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer
Matters pertaining to HERITAGE																				
No significant operational impacts are envisaged.	N/A	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A
Matters pertaining to SOCIAL																				
The generation of waste may lead to surface water and/or soil contamination affecting neighbouring residents.	Waste generation	Mining Area	6	4	2	3	36	-	M	Surface and groundwater quality monitoring networks must be set up prior to the construction phase so that any surface water quality issues can be addressed accordingly.	4	3	1	3	24	-	L	Surface and groundwater quality sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Monthly	Environmental Control Officer/Project Manager
																		Quarterly surface and groundwater monitoring reports will be generated by the mine or through a qualified water quality specialist.	Quarterly	Environmental control officer/Water Quality Specialist

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	AREA APPLICABLE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
OPERATIONAL PHASE ACTIVITY 4: GENERATION AND HANDLING OF WASTE AND DANGEROUS GOODS																				
																		In the event that water quality issues are identified based on the monitoring programme, an independent specialist should be consulted to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental control officer/Water Quality Specialist

OPERATIONAL PHASE - ACTIVITY 5 CONTAINMENT DAMS

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
OPERATIONAL PHASE ACTIVITY 5: CONTAINMENT DAMS																				
Issues related to GEOLOGY																				
No impacts envisaged	Operation of dirty water containment dams	All mining areas	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
No impacts envisaged	Operation of dirty water containment dams	All mining areas	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to BLAST AND VIBRATION																				
No impacts envisaged	Operation of dirty water containment dams	All mining areas	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to FLORA																				
No impacts envisaged	Operation of dirty water containment dams	All mining areas	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to FAUNA																				
Harm to fauna	Drinking from dirty water dams	All mining areas	8	5	2	4	60	-	M	Fence of dams to prevent animals from entering the area and drinking there	4	5	2	3	33	-	M	Continue monitoring dams to determine the quality of the water stored therein.	Ongoing	Environmental control officer/Project Manager
Issues related to WETLANDS																				
Water quality deterioration - seepage out of dams	Operation of dirty water containment dams	All mining areas	8	4	1	4	52	-	M	All dirty water dams should be lined (liner to be determined in consultation with the DWA). Regular inspections and maintenance of the liner should be undertaken to ensure no seepage of polluted water out of the dams. If damaged, the liner should be repaired or replaced as soon as possible. The existing water quality monitoring plan should be expanded to include all water management infrastructures on the colliery (existing and proposed).	4	4	1	3	27	-	L	Sampling sites should be located so that any contamination of water resources from the water management infrastructure can be rapidly identified and located. Emergency response procedures for failure of any water infrastructure on the mine should be established and regularly tested. All staff should be aware of the procedures and how to alert management of any failures	Ongoing	Environmental control officer/Project Manager

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
OPERATIONAL PHASE ACTIVITY 5: CONTAINMENT DAMS																				
Water quality deterioration - dam overflow	Operation of dirty water containment dams	All mining areas	6	4	1	3	33	-	M	It should be ensured that the storage capacity of all dams is sufficient and compliant with legislation and best practice guidelines. Water levels in the dams should at all times be carefully managed so as to ensure sufficient storage capacity. Daily inspections of water levels should be undertaken during the summer months (October to April) and a log book kept. Every overflow of dirty water dams should be recorded in a detailed log book, including reasons for overflow (e.g. amount of rainfall preceding overflow event).	4	4	1	3	27	-	L	Silt traps should be installed upstream of all pollution control dams and dirty water storage dams to limit silt deposition in the dams. Dams should be inspected for siltation and cleaned (if necessary) before the start of every summer rainfall season	Ongoing	Environmental control officer/Project Manager
Erosion due to overflow of dams	Operation of dirty water containment dams	All mining areas	4	4	1	4	36	-	M	See mitigation measures recommended above to minimise overflow events. In addition, any overflow spillways as well as their discharge points should be protected from erosion by ensuring establishment of dense vegetation cover within the spillway and at its discharge point. Should erosion pose a significant problem, protection of the spillway with harder measures (e.g. gabions, rock aprons etc.) should be considered, as well as the use of energy dissipaters	4	4	1	3	27	-	L	The spillways and discharge points should be inspected for erosion damage at the end of every rainfall season and all erosion damage repaired.	Ongoing	Environmental control officer/Project Manager
Issues related to SOILS, LAND USE AND LAND CAPABILITY																				
Stream flow reduction will be caused by separating the clean and dirty water through berms and trenches.	Clean and dirty water separation infrastructure	All dams	8	3	2	4	52	-	M	Discharge points for clean storm water and treated effluent should include erosion protection measures as well as energy dissipaters and should release flows in a diffuse manner to encourage dispersion.	4	3	1	3	24	-	L	Optimum operation and maintenance of control measures will be conducted to ensure proper flow of clean water from the site.	Ongoing	Environmental control officer
Issues related to SURFACE WATER																				
Reduction in catchment yield. Stream flow reduction will be caused by separating the clean and dirty water through berms and trenches.	Clean and dirty water separation infrastructure	All dams	6	3	2	4	44	-	M	Ensure the dirty water catchment area is as small as possible to avoid unnecessary losses to the stream flow.	4	3	2	3	27	-	L	Maintenance and operation of clean and dirty water system and erosion control measures will be ensured at all times	Ongoing	Environmental Control Officer/Project Manager
																		A dynamic water and salt balance will be drawn up by the mine prior to commencing with operational activities.	Monthly	Environmental Control Officer/Project Manager

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
OPERATIONAL PHASE ACTIVITY 5: CONTAINMENT DAMS																				
										Surface water quality monitoring networks must be set up prior to the construction phase so that any surface water quality issues can be addressed accordingly.	6	4	2	3	36	-	M	Surface water quality sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Quarterly	Environmental control officer/Water Quality Specialist
																		Quarterly surface water monitoring reports will be generated by the mine or through a qualified water quality specialist.	In the event of occurrence	Environmental control officer/Water Quality Specialist
																		In the event that water quality issues are identified based on the monitoring programme, an independent specialist should be consulted to determine the best course of action to ameliorate the situation.	Prior to operational activities	Environmental control officer/Water Quality Specialist
Runoff from clean water areas if allowed to flow into the dirty water footprint area could mix with polluted water and overflows into river systems or reduce flow into local river systems.	Clean and dirty water separation infrastructure	PCD	4	4	3	3	33	-	M	A designed system of berms and drains separating clean and dirty water and allowing clean water to pass into local streams must be established.	4	4	2	1	10	-	L	Ensure that adequate storm water management measures and clean and dirty separation mechanisms are implemented on site.	Ongoing	Environmental control officer
Issues related to GROUNDWATER																				
Poor quality seepage may occur into the underlying strata if the dams are situated on permeable soil formation or on a groundwater flow path like dykes and/or faults systems. Overflow of dams can also result in down-stream contamination of surface water bodies and seepage into groundwater.	PCDs	All mining areas	6	4	2	3	36	-	M	Lining of all pollution control dams will be undertaken by the mine.	4	3	1	2	16	-	L	PCDs will be inspected regularly to monitored and mitigate the possibility of seepage.	Weekly	Environmental Control Officer/Project Manager
										Dam levels will be kept at the required levels (refer to GN 704).								Maintenance and operation of clean and dirty water system will be ensured at all times	Ongoing	Environmental Control Officer/Project Manager
										Groundwater quality monitoring networks must be set up prior to the construction phase so that any groundwater quality and quantity issues can be addressed accordingly.	6	4	2	3	36	-	M	Groundwater quality sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Monthly	Environmental Control Officer/Project Manager
																		Quarterly groundwater monitoring reports will be generated by the mine or through a qualified water quality specialist.	Quarterly	Environmental control officer/Water Quality Specialist

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
OPERATIONAL PHASE ACTIVITY 5: CONTAINMENT DAMS																				
																		In the event that water quality or quantity issues are identified based on the monitoring programme, an independent specialist should be consulted to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental control officer/Water Quality Specialist
Negative impact on groundwater quality from the infiltration of dirty water into the groundwater environment and contamination of the groundwater environment.	Contamination of groundwater	All mining areas	4	2	1	3	21	-	L	Storm water management and implementation	2	2	1	2	10	-	L	Separate clean and dirty water and contain dirty water to prevent it to recharge the local aquifers.	Prior to operational activities	Environmental control officer/Water Quality Specialist
Seepage of dirty water into underlying aquifer.	Groundwater contamination	All mining areas	8	5	3	4	64	-	H	Lining of dirty water retention facilities	8	4	2	2	28	-	L	Monitor lining of the dirty return water dams & facilities	Monitor during low water conditions	Mine Environmental Unit & Plant Engineer
Issues related to AIR QUALITY																				
No impacts envisaged	Operation of dirty water containment dams	All mining areas	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to NOISE																				
No impacts envisaged	Operation of dirty water containment dams	All mining areas	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to VISUAL																				
No impacts envisaged	Operation of dirty water containment dams	All mining areas	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to CULTURE & HERITAGE																				
No impacts envisaged	Operation of dirty water containment dams	All mining areas	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A

OPERATIONAL PHASE - ACTIVITY 6 STOCKPILING OF OVERBURDEN, TOPSOIL and WASTE ROCK

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
OPERATIONAL PHASE ACTIVITY : Stockpiling																				
Issues related to GEOLOGY																				
No impacts envisaged	Stockpiling of soils and overburden	All mining areas	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
Impact on topography due to formation of unnatural hills by the stockpiling of topsoil, subsoil and overburden	Stockpiling	All open cast sections	6	4	2	4	48	-	M	Concurrent rehabilitation of the mining area will take place, which will involve the filling of the pits (i.e. removal of stockpiles) and the sloping, levelling and shaping of the area to be free draining. The shaped area will then be seeded with a mixture of grasses in order to obtain a vegetative cover in order to reduce erosion. Pits will be filled with stockpiles; areas will be sloped, levelled and shaped. The shaped area will then be seeded with a mixture of grasses in order to obtain a vegetative cover in order to reduce erosion.	6	3	1	4	40	-	M	Determine the height restriction for the stockpiles and implement	Ongoing	Environmental control officer/Project Manager
Issues related to BLAST AND VIBRATION																				
No impacts envisaged	Stockpiling of soils and overburden	All mining areas	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to FLORA																				
Impact on the cultivated land vegetation unit and some remnants of natural vegetation.	Dust created from topsoil, subsoil and overburden stockpiles	All mining areas	8	4	2	4	56	-	M	Ensure minimal human/animal conflict potential; implement awareness programmes; control movement of personnel; limit speeds of vehicles; avoid open waste areas that could be targeted by rodents and scavengers. Ongoing Removal of vegetation must be managed; Stockpiling of rock must be done with closure design in mind Ongoing rehabilitation will be undertaken, which will include revegetation if self-succession does not take place?	6	4	2	2	24	-	L	Develop and implement awareness programmes and prevent persistent and deliberate impacts on vegetation in nearby natural habitats.	Ongoing	Environmental control officer/Health & Safety officer/ Ecologist/ Contractor/Site Manager
Issues related to FAUNA																				
Loss of suitable grazing areas due to plants being less palatable	Dust created from topsoil, subsoil and overburden stockpiles	All mining areas	8	4	2	4	56	-	M	Ensure minimal human/animal conflict potential; implement awareness programmes; control movement of personnel; limit speeds of vehicles; avoid open waste areas that could be targeted by rodents and scavengers. Ongoing Removal of vegetation must be managed; Stockpiling of rock must be done with closure design in mind Ongoing rehabilitation will be undertaken, which will include revegetation if self-succession does not take place?	6	4	2	2	24	-	L	Develop and implement awareness programmes and prevent persistent and deliberate impacts on animals in nearby natural habitats.	Ongoing	Environmental control officer/Health & Safety officer/ Ecologist/ Contractor/Site Manager
Issues related to WETLANDS																				

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
OPERATIONAL PHASE ACTIVITY : Stockpiling																				
Deterioration in water quality	Stockpiles	All mining areas	6	4	1	5	55	-	M	A detailed surface water management plan should be drawn up for the main shaft area that complies fully with GN704 in terms of the separation of clean and dirty storm water. Dirty storm water should be captured in a pollution control dam on site and no discharge of dirty storm water should be allowed into the wetlands on site. The dirty water management system should have a minimum capacity to cope with a 1:50 year storm event without overflow.	4	4	1	4	36	-	M	Dirty water should be re-used as far as possible within the mining operations	Ongoing	Environmental control officer/Project Manager
Issues related to SOILS, LAND USE AND LAND CAPABILITY																				
The stockpiling of topsoil, subsoil and overburden associated with the open cast mining activity will give rise to compaction within the stockpile, decrease in microbial activity and leaching of nitrogen and phosphates from the soil.	Open cast mining operation	OD, OH, OM, OWM, ODext	6	5	1	5	60	-	M	During the operational phase, the overburden will be selectively removed and stockpiled namely, Erosion should be minimised.	4	5	1	5	50	-	M	During the operational phase, the overburden will be selectively removed and stockpiled namely, the topsoil first (up to 400 mm), followed by the sub soils and then the remaining overburden. Each will be stockpiled separately. Erosion of the topsoil will be minimised by limiting the height of the stockpile. This will also reduce the loss of the natural structural properties and functionality of the soil.	Ongoing	Environmental control officer/Project Manager
Impact on the arable land capability of the site.	Stockpiling of soils and overburden	All stockpiles	8	4	1	5	65	-	H	Concurrent rehabilitation of the mining area will take place, which will involve the filling of the pits with tailings and with waste rock. The sloping and the seeding of the area with a mixture of grasses in order to obtain a vegetative cover. It will be attempted to eventually return the sites to their arable land capability and that the farmers will once again be able to utilize the areas for agricultural production. The sub soils will be placed over the overburden material. After levelling, a topsoil layer (a minimum of 400 mm) will be spread over the area as a final topping.	4	4	1	4	36	-	M	The topsoil will be analysed to determine the imbalances prior to the replacement of the soil. Inorganic fertilizers will be used to supplement the soils before the seeding of the area takes place.	Ongoing	Environmental control officer/Project Manager

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
OPERATIONAL PHASE ACTIVITY : Stockpiling																				
The stockpiling of topsoil and overburden could impact on the quantity of runoff from the site if storm water diversion trenches are not constructed in order to divert clean runoff around the stockpile areas.	Open cast mining operation	OD, OH, OM, OWM	8	5	1	4	56	-	M	Storm water diversion trenches will be constructed in order to divert clean runoff around the open cast area. This potential impact is seen as insignificant in view of the implementation of concurrent rehabilitation and the construction of the storm water diversion trenches. A clean water cut-off trench (storm water diversion trench) will be installed around Block OM, Block OH, Block OFPAD and Block OD.	4	5	1	3	30	-	M	This storm water diversion trench will be designed to cater for the runoff water from a 1:50 year 24-hour storm event with a 0.8m freeboard.	Ongoing	Environmental control officer/Project Manager
Issues related to SURFACE WATER																				
The overlying strata have an intermediate to high potential for acid generation. This stockpiled material may thus produce acidic leachate, which may impact on the receiving surface environment.	Open cast mining operation	OD, OH, OM	6	4	1	3	33	-	M	The potential to generate contaminated water will be minimised. Clean runoff will be diverted past the dirty areas. The proposed dirty water management area at the proposed site will be secured and all dirty runoff will be contained for re-use. Water conservation will be instilled through the implementation of the environmental training and awareness programme, It will be ensured that the water quality downstream of the proposed site does not exceed any of the target water quality guidelines for all water user categories as prescribed in the South African Water Quality Guidelines, dated 1996, due to the mining and related activities associated with the proposed project,	4	4	2	2	20	-	L	The contaminated water generated on-site will be contained within the dirty water management system and will not be discharged (or allowed to flow) to clean downstream areas. Isolation barrier berms for the proposed mining area will be provided. In the case where emergencies occur, such as leakage of the water reticulation system, remedial action will be taken immediately, making use of the Standard Practice Instruction (SPI) titled “Emergency Procedures” (No. LPSHE. 005, Revision 2, dated 08 January 2007) that applies to the existing Leeuwpan Coal.	Ongoing	Environmental control officer/Project Manager
Precipitation falling on stockpiled coal will deteriorate in quality as a result of contact with carbonaceous material. If this runoff water enters the natural environment, deterioration of the quality of the receiving	Stockpiling	OWM, Odext	6	4	2	3	36	-	M	The potential to generate contaminated water will be minimised. Clean runoff will be diverted past the dirty areas. The proposed dirty water management area at the proposed site will be secured and all dirty runoff will be contained for re-use. Regular maintenance and repair work will be undertaken to storm water management measures. Water conservation will be instilled through the implementation of the environmental training and awareness programme, Spillages of any material	4	4	2	2	20	-	L	The contaminated water generated on-site will be contained within the dirty water management system and will not be discharged (or allowed to flow) to clean downstream areas. Isolation barrier berms for the proposed mining area will be provided.	Ongoing	Environmental control officer/Project Manager

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
OPERATIONAL PHASE ACTIVITY : Stockpiling																				
natural surface water resources may occur										that may cause pollution of surface water resources, such as carbonaceous material, outside of the isolated dirty water management area, will be regularly removed and mitigation measures implemented when necessary. It will be ensured that the water quality downstream of the proposed site does not exceed any of the target water quality guidelines for all water user categories as prescribed in the South African Water Quality Guidelines, dated 1996, due to the mining and related activities associated with the proposed project,								In the case where emergencies occur, such as leakage of the water reticulation system, remedial action will be taken immediately, making use of the Standard Practice Instruction (SPI) titled "Emergency Procedures" (No. LPSHE. 005, Revision 2, dated 08 January 2007) that applies to the existing Leeuwpan Coal. Any surface diversion berms and drains will be kept free from any obstructions (debris) to ensure that the efficiency is not affected.	Ongoing	Environmental control officer/Project Manager
																		All spills that have the potential to pollute water resources will be reported to the DWA and other relevant authorities. All spillages will be contained and cleaned up and all contaminated material will be disposed of in accordance with legislative requirements. Leeuwpan Coal will undertake ongoing biomonitoring (biannually)	Ongoing	Environmental control officer/Project Manager
Contamination of the soil stockpiled during the Construction Phase due to coming into contact with carbonaceous material or contaminated surface runoff.	Open cast mining operation	OWM, Odext	8	5	1	5	70	-	H	A soil monitoring schedule should be put in place. The extent of areas of surface disturbance will be minimised, by strictly controlling the movement of vehicles to, from, and within the proposed land use areas. All soils contaminated with hydrocarbons (as a result of the proposed mining and related activities) will be rehabilitated immediately after spillage, as far as practical,	6	5	1	5	60	-	M	Soil stored in stockpiles and used for the construction of surface water infrastructure and for rehabilitation will be monitored on a quarterly basis, increasing in frequency during the rainy season, so as to ensure that the soil conservation measures which have been implemented have been effective, and to highlight areas where soil management can be improved.	Ongoing	Environmental control officer/Project Manager
Issues related to GROUNDWATER																				
Deterioration of groundwater quality	infiltration of contaminated water from the ROM	Mining operations	6	5	2	4	52	-	M	Dirty water should be contained. Any accidental hydrocarbon spills will be avoided. Emergency spills will be swiftly dealt with so as to minimise the consequent impacts of such a spill on the groundwater. All significant spills will be reported to the DWAF and other relevant authorities. All spillages will be contained and cleaned up and all contaminated material will be disposed of in accordance with legislative requirements,	6	4	1	3	33	-	M	Dirty water will be contained in specially designated water holding facilities to minimise the volume of contaminated water seepage to the groundwater.	Ongoing	Environmental control officer/Project Manager
Issues related to AIR QUALITY																				

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	MINING AREA	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
OPERATIONAL PHASE ACTIVITY : Stockpiling																				
Fugitive dust emissions from stockpiles will have a negative air quality impact.	Stockpiles	All mining areas	8	4	3	4	60	-	M	Dust suppression methods must be implemented around the stockpiling areas and transfer stations and it is recommended that a dust monitoring network be established to monitor levels of dust dispersion. Should it be found that the stockpiles create excessive dust; measures must be implemented to reduce this impact.	6	4	2	3	36	-	M	Ensure optimal implementation and maintenance of the dust suppression programme and monitoring programme.	Ongoing	Environmental control officer/Project Manager
Issues related to NOISE																				
No impacts envisaged	Stockpiling of soils and overburden	All mining areas	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to VISUAL																				
The stockpiling of the topsoil, subsoil and overburden will be visible from the provincial R50 road and the surrounding agricultural lands. It will also be visible from various areas within the existing Leeuwpan mining and plant area.	Stockpiling	All mining areas	6	4	1	5	55	-	M	Those stockpiles that can be vegetated should be vegetated as soon as possible in order to reduce the visual impact. Appropriate dust control methods should also be implemented. The infrastructure required for the said mining operation will be constructed as indicated in this EMPR. The stockpiles will be sloped and vegetated .The haul roads will be wetted twice daily by use of water carts. In the event of excessive wind conditions, this wetting frequency will be increased as necessary to suppress the dust.	4	4	1	4	36	-	M	The stockpiles should be neatly maintained and kept in a good state of repair.	Ongoing	Environmental control officer/Project Manager
Issues related to CULTURE & HERITAGE																				
No impacts envisaged	Stockpiling of soils and overburden	All mining areas	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A

OPERATIONAL PHASE - ACTIVITY 7 MAINTENANCE OF RIVER DIVERSIONS

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY		ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
OPERATIONAL PHASE ACTIVITY 7: River Diversion																				
Issues related to GEOLOGY																				
No impacts envisaged	Maintenance of river diversions	River Diversions	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
No impacts envisaged	Maintenance of river diversions	River Diversions	0	0	0	0	0	-	L	No mitigation necessary	0	0	0	0	0	-	L	N/A	N/A	N/A
Issues related to BLAST AND VIBRATION																				
No impacts envisaged	Maintenance of river diversions	River Diversions	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to FLORA																				
No impacts envisaged	Maintenance of river diversions	River Diversions	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to FAUNA																				
No impacts envisaged	Maintenance of river diversions	River Diversions	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to WETLANDS																				
Altered flow to wetland areas	Maintenance of river diversions	River Diversions	0	0	0	0	0	-	L	This impact cannot be mitigated until the end of LoM. Management by means of inspections and maintenance of the river diversion should be undertake on a regular basis. Ensure that no sedimentation into the river diversion in taking place. Maintain aquatic monitoring programme	0	0	0	0	0	-	L	Implement inspection and maintenance schedule for river diversions	Monthly	Environmental Officer
Issues related to SOILS, LAND USE AND LAND CAPABILITY																				
No impacts envisaged	Maintenance of river diversions	River Diversions	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to SURFACE WATER																				
The presence of the storm water diversion trenches/berms will continue to impact on the drainage of the site.	OD, OH, OM, OWM	Construction and utilization of the storm water diversion trenches/berms	6	4	1	3	33	-	M	This impact cannot be mitigated until the end of LoM. Management by means of inspections and maintenance of the river diversion should be undertaken on a regular basis.	6	4	1	3	33	-	M	Implement inspection and maintenance schedule for river diversions	Monthly	Environmental Officer
Issues related to GROUNDWATER																				

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY		ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
OPERATIONAL PHASE ACTIVITY 7: River Diversion																				
No impacts envisaged	Maintenance of river diversions	River Diversions	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to AIR QUALITY																				
No impacts envisaged	Maintenance of river diversions	River Diversions	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to NOISE																				
No impacts envisaged	Maintenance of river diversions	River Diversions	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to VISUAL																				
No impacts envisaged	Maintenance of river diversions	River Diversions	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to CULTURE & HERITAGE																				
No impacts envisaged	Maintenance of river diversions	River Diversions	0	0	0	0	0	N	L	No mitigation necessary	0	0	0	0	0	N	L	N/A	N/A	N/A

7.4 Closure and Decommissioning Phase

This section comprises of the description of potential impacts associated with the closure, decommissioning and rehabilitation activities on the biophysical, socio-economic and heritage and cultural environment. These descriptions are followed by the impact tables which contain the assessment of the significance of each identified impact without, then with mitigation measures. Each mitigation measure proposed is assigned a proposed action plan, frequency, associated management cost, as well as person responsible for implementation of the mitigation measures proposed to mitigate and/or manage each impact.

The following activities will be conducted in the closure phase:

- Removal of surface infrastructure and removing the gravel surface of haul roads;
- Active Rehabilitation of disturbed areas:
    - Ripping of soils to reduce compaction;
    - Applying topsoil and gravel mixture to areas which are to be rehabilitated;
    - Re-vegetation disturbed areas; and
- After monitoring and maintenance of rehabilitated areas (to ensure that rehabilitation is successful).

Table 7.3: Decommissioning and Closure Impacts and Management Activities

CLOSURE AND DECOMMISSIONING PHASE - ACTIVITY 1: REMOVAL OF INFRASTRUCTURE

POTENTIAL ENVIRONMENTAL IMPACT	Mining area	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 1: REMOVAL OF INFRASTRUCTURE																				
Issues related to GEOLOGY																				
No impacts anticipated	Construction phase activities	Block OI	0	0	0	0	0	N	L	No mitigation measures necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
The filling of the final voids and the rehabilitation thereof (i.e. removal of the various stockpiles) will alleviate the impact on the topography. The voids will be filled and shaped to promote free draining (run-off) and will thus have a positive impact on the topography.	OD, OH, OM	The filling of the final voids and the rehabilitation thereof	6	5	1	5	60	+	M	The topsoil and subsoil berms will be used to re-shape the area as to allow for re-vegetation	8	4	1	5	65	+	H	The topography will be returned as close as possible to the pre-mining topography taking into account the mining method used	Ongoing	Environmental Coordinator
Final void left after mining	OJ, OL	Void left	4	5	1	5	50	-	M	Rehabilitation of pits must be undertaken as soon as practicably possible.	6	5	1	3	36	-	M	The mined out sections of the pit must be backfilled, compacted and rehabilitated as soon as possible to remove oxygen out of system. Pyrite oxidation will result in elevated concentrations of TDS and SO4. Rehabilitation must include covering with a topsoil layer as well as vegetation thereof. Installation of a soil cover will significantly decrease water infiltration and contamination of water resulting in smaller decant from the pits.	At closure	Mine Environmental Manager
Issues related to BLAST AND VIBRATION																				
No impacts anticipated	Construction phase activities	Block OI	0	0	0	0	0	N	L	No mitigation measures necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to FLORA																				
Natural Flora may be compromised and invasive and exotic species may proliferate	Witklip / Kenbar, OJ, OL	Mining activities	6	5	3	3	42	-	M	The affected areas will be restored to grazing and cultivation areas, and a weed management program implemented. Where possible, the indigenous vegetation (nursery) will be utilise to return areas within the mining area to as close to pre-mining conditions.	2	5	1	1	8	-	L	Weeds that establish on site are to be eradicated using acceptable physical and chemical measures. Stipulations in terms of the Mpumalanga Nature Conservation Act, 1998 (No. 10 of 1998) and the Conservation of Agricultural Resources Act (No. 43 of 1983) with regards to declared weeds and invaders. The affected areas that will be restored to grazing areas will be planted with an appropriate seed mixture. The remaining affected areas that should be used for crop farming will be planted with suitable crops such as mealies, grain sorgum, sun flowers, dry beans or potatoes.	Ongoing	Environmental Coordinator

POTENTIAL ENVIRONMENTAL IMPACT	Mining area	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 1: REMOVAL OF INFRASTRUCTURE																				
Spread of alien vegetation	Witklip / Kenbar, OJ, OL	Buildings, roads	6	5	3	4	56	-	M	Control alien invasive species in accordance with the Conservation of Agricultural Resource Act criteria	6	4	3	2	26	-	L	Weeds that establish on site are to be eradicated using acceptable physical and chemical measures. Stipulations in terms of the Mpumalanga Nature Conservation Act, 1998 (No. 10 of 1998) and the Conservation of Agricultural Resources Act (No. 43 of 1983) with regards to declared weeds and invaders. The affected areas that will be restored to grazing areas will be planted with an appropriate seed mixture. The remaining affected areas that should be used for crop farming will be planted with suitable crops such as mealies, grain sorgum, sun flowers, dry beans or potatoes.	Ongoing	Environmental Coordinator
Development of erosion gullies	Witklip / Kenbar, OJ, OL	Roads	6	4	2	3	36	-	M	Storm water should be controlled, bare areas should be stabilised and revegetated	4	4	2	3	30	-	M	Weeds that establish on site are to be eradicated using acceptable physical and chemical measures. Stipulations in terms of the Mpumalanga Nature Conservation Act, 1998 (No. 10 of 1998) and the Conservation of Agricultural Resources Act (No. 43 of 1983) with regards to declared weeds and invaders. The affected areas that will be restored to grazing areas will be planted with an appropriate seed mixture. The remaining affected areas that should be used for crop farming will be planted with suitable crops such as mealies, grain sorgum, sun flowers, dry beans or potatoes.	Ongoing	Environmental Coordinator
Issues related to FAUNA																				
Animal life will tend to return to the area after the end of the mining operation. Where natural vegetation takes hold, habitats are formed for the resident animal life. This will give rise to the resettlement of birds and small animals. This will however, depend on whether the sites are once again used for agriculture.	OD, OH, OM	End of mining	4	4	2	2	20	+	L	Ensure proper soil preparation, seed mixture development and establishment of sufficient vegetation cover; prevent infestation of nearby areas and rehabilitation areas by weeds and invasive species.	4	4	2	1	10	+	L	Develop a rehabilitation and re-vegetation protocol; develop an alien and invasive vegetation identification and management programme; and ensure ongoing monitoring of rehabilitation areas.	Ongoing	Environmental control officer/Proponent/Ecologist/ Contractor
Feral animal and livestock	OD, OH, OM	Peripheral human activity	6	4	1	3	33	+	M	Exclusion of livestock from sensitive areas and eradication of feral carnivores	2	4	1	1	7	-	L	Regular inspection of sensitive areas and fences to be undertaken	Ongoing	Environmental control officer/Proponent/Ecologist/ Contractor
Subsistence hunting	OD, OH, OM	Peripheral human presence	6	5	1	5	60	+	M	Periodic monitoring of fences and internal areas for snares, animal tracks and suspicious human activity	4	3	1	3	24	-	L	Regular inspection of sensitive areas and fences to be undertaken	Ongoing	Environmental control officer/Proponent/Ecologist/ Contractor

POTENTIAL ENVIRONMENTAL IMPACT	Mining area	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 1: REMOVAL OF INFRASTRUCTURE																				
Staff interacting directly with potentially dangerous snakes	OD, OH, OM	General decomissioning activities	6	4	1	1	11	+	L	Staff should be provided with safety training for potentially dangerous snakes as well as first aid treatment of snakebite	2	4	1	1	7	-	L	Provide ongoing training in terms of the Environmental Awareness Plan	Ongoing	Environmental control officer/Proponent/Ecologist/ Contractor
Re-vegetation will be undertaken on the decommissioned and rehabilitated areas before mine closure.	OD, OH, OM	General decomissioning activities	6	3	1	3	30	+	M	Compacted soils will be ripped and topsoil will be replaced. After the topsoil has been replaced the area should be ameliorated and seeded, should self-succession of vegetation not take place. Only species indigenous to the area will be included. Remove alien vegetation post decommissioning, with long term follow-up afterwards.	6	4	2	4	48	+	M	Continuous rehabilitation of the decommissioning area will be conducted in line with the Best Practice Guidelines released by the DWA. DBM will appoint a specialist to this effect.	Ongoing	Environmental control officer/Proponent/Ecologist/ Contractor
Issues related to WETLANDS																				
Removal of surface infrastructure following mine closure will largely result in similar impacts to the initial establishment of infrastructure, as soils are disturbed and exposed to erosion.	Block OI and linear infrastructure	Infrastructure removal	6	3	2	4	44	-	M	Earthworks and vegetation clearing activities should also be phased to minimize the extent of disturbed areas at any one time. Earthworks and vegetation clearing activities on site should ideally be undertaken during the dry season to minimize sediment transport during surface runoff following rainfall events.	4	5	1	1	10	-	L	Develop a wetland management and rehabilitation plan, and implement throughout the construction, operation and closure phases of the mine.	Ongoing	Environmental control officer
																		Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	During closure and decommissioning phase	Environmental Control Officer/ Project Manager/Health & Safety Officer
																		The contractor will ensure that all activities, material and equipment storage and personnel movement take place within the designated area.	During closure and decommissioning phase	Environmental Control Officer/ Project Manager/Health & Safety Officer
																		Contractors will complete induction on the EMP, Environmental Awareness Plan and Emergency Response Plan prior to construction activities being undertaken. All workers will be made aware of the penalty systems for non-compliance.	During closure and decommissioning phase	Environmental Control Officer/ Project Manager/Health & Safety Officer
										Temporary toe berms should be installed on the down slope side of large bare soils areas and any soil stockpiles to trap sediments eroded odd these areas.								The site should be monitored for erosion and sediment movement during and after rainfall events and suitable interventions put in place to repair any erosion damage and to prevent further sediment movement off the site.	During closure and decommissioning phase	Environmental Control Officer/ Project Manager/Health & Safety Officer

POTENTIAL ENVIRONMENTAL IMPACT	Mining area	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 1: REMOVAL OF INFRASTRUCTURE																				
Increase in alien vegetation	Block OI and linear infrastructure	Infrastructure removal	6	4	2	4	48	-	M	The alien vegetation management plan compiled by the ECO during the construction phase of the mine should be kept in place for several years following decommissioning of the mine (minimum of five years). All species of alien invasive vegetation should be controlled and removed from site. No spread of alien vegetation into any wetlands or adjacent properties should be allowed	2	2	1	3	15	-	L	Weeds that establish on site are to be eradicated using acceptable physical and chemical measures. Stipulations in terms of the Mpumalanga Nature Conservation Act, 1998 (No. 10 of 1998) and the Conservation of Agricultural Resources Act (No. 43 of 1983) with regards to declared weeds and invaders. The affected areas that will be restored to grazing areas will be planted with an appropriate seed mixture. The remaining affected areas that should be used for crop farming will be planted with suitable crops such as mealies, grain sorgum, sun flowers, dry beans or potatoes.	Ongoing	Environmental Coordinator
Water quality deterioration related to accidental spills during infrastructure removal activities (fuels, cement, etc.). Storm water flushing construction areas as well as dust can also carry pollutants into water bodies. Water quality deterioration will especially affect aquatic fauna intolerant to water quality alteration but can have an impact on all aquatic fauna (especially fuel spills).	Block OI and linear infrastructure	Infrastructure removal	10	2	3	3	45	-	M	Identify potential areas where seepage and spills can occur into the natural environment. Take necessary precautions to reduce potential spills and seepage. Ensure that silt, lime, cement, paint, chemicals etc. do not wash into drains or nearby watercourses. Prepare an emergency preparedness plan. Maintain aquatic bio-monitoring programme for a period after decommissioning and closure, including auditable follow-up actions. Where soils adjacent to or underlying the infrastructure has become contaminated, these soils should be removed and treated as hazardous waste.	6	4	1	2	22	-	L	Develop a biomonitoring plan, and implement throughout the construction, operation and closure phases of the mine.	Ongoing	Environmental control officer
Issues related to SURFACE WATER																				
Additional sediment transport in rivers due to ground particles ending up in rivers from cleared land	Block OI and linear infrastructure	Land clearing	6	4	2	4	48	-	M	SWMP (channels and PCDs)	4	1	1	2	12	-	L	Implement & maintain SWMP	Initially then monthly	Mine manager/Environmental officer
Ensuring that clean and dirty water separation takes place during all rehabilitation activities	Block OI and linear infrastructure	Siltation	6	2	2	3	30	-	M	Removal of all remaining materials associated with mining on site. Vegetating of the area. Ensuring that clean and dirty water separation berms remain in place and intact during all rehabilitation activities.	2	2	1	2	10	-	L	Implement & maintain SWMP	Initially then monthly	Mine manager/Environmental officer
Contaminated surface water run-off causing erosion gullies and collecting dust and coal particles.	Block OI and linear infrastructure	Erosion	8	4	2	4	56	-	M	Regular inspections. Maintenance. Separation trenches and gullies to be provided with energy dissipaters where required.	4	4	2	2	20	-	L	Implement & maintain SWMP	Initially then monthly	Mine manager/Environmental officer

POTENTIAL ENVIRONMENTAL IMPACT	Mining area	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 1: REMOVAL OF INFRASTRUCTURE																				
Contaminated run-off from infrastructure area to be collected within a downstream pollution control dam / return water dam for re-use	Block OI and linear infrastructure	Collection of dirty water	10	4	2	5	80	-	H	Downstream pollution control to be constructed for the collection of dirty water run-off from this delineated area. A silt trap to be installed at the inflow of the pollution control dam as to collect all suspended solids and prevent the dam from losing its design capacity through siltation. The silt trap to be cleaned on a regular basis. Regular inspections. Up to date water balance. Up to date records on rainfall and evaporation. Return water dams should be lined. Monitoring of water quality.	6	4	2	2	24	-	L	Implement & maintain SWMP	Initially then monthly	Mine manager/Environmental officer
Issues related to GROUNDWATER																				
Clearing topsoil for footprint areas can increase infiltration rates of water to the groundwater system and decrease buffering capacity of soils to absorb contaminants from spills on surface. This can worsen contamination of the groundwater system.	Block OI and linear infrastructure	Vegetation clearance and topsoil stripping and stockpiling	2	2	1	2	10	-	L	Limit the vegetation clearance and topsoil stripping to the smallest area possible	2	2	1	2	10	-	L	Removal of dirty soil to landfill	At closure	Mine Environmental Manager
Issues related to SOILS, LAND USE, LAND CAPABILITY																				
The removal of the topsoil and other stockpiles will give rise to the exposure of sub-soil and compacted soil lacking in nutrients. These soils will not gain vegetation cover in the short term and will thus be prone to erosion.	OD, OH, OM	The removal of the topsoil and other stockpiles	4	4	1	4	36	-	M	The stockpiles will be placed back into voids and bare areas.					0	-	L	During rehabilitation, the sub soils will be placed over the overburden material. After levelling, a topsoil layer (a minimum of 400 mm) will be spread over the area as a final topping. The topsoil will be analysed to determine the imbalances prior to the replacement of the soil. Inorganic fertilizers will be used to supplement the soils before the seeding of the area takes place.	Ongoing	Environmental Control Officer
The removal of the 100mm layer of carbonaceous material on the haul roads and the subsequent ripping of the upper compacted layer will result in the aeration of the soil. This could however, give rise to gully formation if erosion control measures are not implemented.	OD, OH, OM	The removal of the 100mm layer of carbonaceous material	6	4	1	3	33	-	M	Compacted soils will be ripped and topsoil will be replaced. After the topsoil has been replaced the area should be ameliorated and seeded, should self-succession of vegetation not take place. Only species indigenous to the area will be included.	8	2	1	4	44	+	M	Continuous rehabilitation of the decommissioning area will be conducted in line with the Best Practice Guidelines released by the DWA. Leeuwpan will appoint a specialist to this effect.	Ongoing	Environmental Control Officer
The mining land use of the area will cease during this phase and the area will revert to an agricultural land use. It will be attempted to restore the arable land capability of the sites.	OD, OH, OM	Change in Land Use	6	4	1	3	33	+	M	Appropriate soil amelioration must be implemented to this effect.	8	2	1	4	44	+	M	Implement and maintain ongoing soil amelioration to establish the pre-mining land capability	Ongoing	Environmental Control Officer

POTENTIAL ENVIRONMENTAL IMPACT	Mining area	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 1: REMOVAL OF INFRASTRUCTURE																				
The decommissioning activities may lead to increased sediment movement off the site and soil compaction.	OD, OH, OM	Exposing soil surfaces to wind and water energy	8	5	1	4	56	+	M	Only remove infrastructure when open soil surfaces can immediately be re-vegetated	6	3	1	3	30	-	M	During rehabilitation, the sub soils will be placed over the overburden material. After levelling, a topsoil layer (a minimum of 400 mm) will be spread over the area as a final topping. The topsoil will be analysed to determine the imbalances prior to the replacement of the soil. Inorganic fertilizers will be used to supplement the soils before the seeding of the area takes place.	Ongoing	Environmental Control Officer
Issues related to AIR QUALITY																				
Impacts will arise from the replacement and reworking of soils for rehabilitation and vehicle movements. The impact on air quality will show an exponential decrease with time as rehabilitation of the area occurs. This will be particularly significant during the dry season but should only be for a limited time period	OD, OH, OM	The replacement and reworking of soils	4	2	1	3	21	-	L	The dust monitoring network and dust suppression programme established during the construction phase of the project will be maintained throughout the closure phase of the mine. With respect to haul road dust levels, it is recommended to limit vehicle speeds, especially during high risk periods of high winds, high temperature and low humidity.	4	2	1	3	21	-	L	Dust sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Monthly	Environmental Control Officer
																		Monthly monitoring reports will be generated by the mine or through a suitably qualified air quality specialist.	Monthly	Environmental Control Officer/Air Quality Specialist
																		In the event that air quality or dust issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental Control Officer/Air Quality Specialist
																		Ensure optimal implementation and maintenance of the dust suppression programme.	Ongoing	Environmental Control Officer
																		The road surface will to be watered on a daily basis.	Daily	Environmental Control Officer
																		The road surface will to be maintained on a weekly basis.	Weekly	Environmental Control Officer
Issues related to NOISE																				
The noise related to the operation will comprise of noise generated by trucks and loading equipment in terms of the removal of stockpiles and the rehabilitation of the various pits.	OD, OH, OM	The removal of stockpiles and the rehabilitation of the various pits.	4	2	1	3	21	-	L	All demolition equipment to comply with the standards of the IFC's Environmental and Safety Regulations	6	2	2	2	20	-	L	Where noise becomes a nuisance, management measures will be investigated and implemented to address these.	Ongoing	Health and Safety Officer/Project Manager/ Environmental Control Officer
Issues related to CULTURE & HERITAGE																				
Grave sites 3 and 8	Construction activities	Block OI and linear infrastructure	2	5	2	5	45	-	M	Fence in and sustainable management plan	2	4	2	2	16	-	L	Sites to be monitored annually	Annually	Heritage expert
Issues related to VISUAL																				

POTENTIAL ENVIRONMENTAL IMPACT	Mining area	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 1: REMOVAL OF INFRASTRUCTURE																				
The decommissioning phase will involve the rehabilitation of the mining area as well as the removal of the stockpiles. This will bring about an improvement in the visual aesthetics of the site.	OD, OH, OM	Removal of infrastructure	4	2	1	3	21	+	L	An overall visual improvement will be noticed once all mining related infrastructure has been demolished and the area has been landscaped and re-vegetated.	8	5	2	4	60	+	M	Final shaping will be implemented such that the final profiles of the rehabilitated areas are formed to emulate natural contours of the area.	During Closure Phase	Environmental Control Officer/Project Manager
Issues related to TRAFFIC																				
Potential safety hazard due to increased use of access Road R50	Footprint clearance and infrastructure establishment	Block OI	2	5	2	3	27	-	L	Provision of sufficient street lights at access road	2	4	3	2	18	-	L	Construct road and surfacing	Once plus maintenance	Mine management
Issues related to SOCIAL																				
The main impact will be the loss of employment. This impact is however, uncertain as the persons working at Leeuwpan Coal Mine could be provided with employment at one of the other company mines.	OD, OH, OM	End of mining	6	4	1	3	33	-	M	Continue with the skills development programme to empower the workforce to undertake other activities.	4	3	3	3	30	-	M	Audit and ensure compliance with the Social and Labour Plan	Ongoing	Human Resources

CLOSURE AND DECOMMISSIONING PHASE – Activity 2: Active Rehabilitation

POTENTIAL ENVIRONMENTAL IMPACT	MINING AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 2: ACTIVE REHABILITATION																				
Issues related to GEOLOGY																				
No impacts anticipated	OD, OH, OM	Block OI	0	0	0	0	0	N	L	No mitigation measures necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
No impacts anticipated	OD, OH, OM	N/A	0	0	0	0	0	N	L	No mitigation measures necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to BLAST AND VIBRATION																				
No impacts anticipated	OD, OH, OM	Block OI	0	0	0	0	0	N	L	No mitigation measures necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to FLORA																				

POTENTIAL ENVIRONMENTAL IMPACT	MINING AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 2: ACTIVE REHABILITATION																				
During the decommissioning phase, rehabilitation of the site will occur.	OD, OH, OM	Rehabilitation of the site	6	4	1	5	55	+	M	This will involve the planting of grass on the sloped areas. The grass seed mix will contain indigenous grasses, which will enhance the natural vegetation of the area. It is also likely that natural pioneer species will enter the rehabilitated area also increasing the species diversity. Nursery vegetation will be utilised to establish an ecological character close to pre-mining conditions.					0	-	L	The disturbed areas will be topsoiled and sloped. A variety of pioneer and climax grasses will be used in order to establish a vegetative cover: Ø Cynodon dactylon (10 kg/ha) Ø Digitaria eriantha (12 kg/ha) Ø Eragrostis curvula (3 kg/ha) Ø Eragrostis tef (2 kg/ha) Ø Chloris gayana (5 kg/ha) The rehabilitated area will not be grazed before the climax species are well established. Through the process of succession, it is anticipated that indigenous species will re-establish.	Ongoing	Environmental control officer/Proponent/Ecologist/ Contractor
The likelihood of invader species, e.g. black wattle, entering the rehabilitated areas cannot be ruled out. These species will, if allowed to grow, compete with the natural vegetation for the soil nutrients.	OD, OH, OM	Rehabilitation of the site	6	4	1	4	44	-	M	Experience has shown that the invader species usually thrive on rehabilitated ground at the expense of the natural vegetation. The presence of invader species will have to be managed.					0	-	L	Regular site inspections will be conducted to identify any declared weeds or invader plants. If identified, the plants will be eradicated using the appropriate method. The stipulations, in terms of the Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998), and the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), with regards to declared weeds and plants must be noted.	Ongoing	Environmental control officer/Proponent/Ecologist/ Contractor
Issues related to FAUNA																				
Road mortality	Block OI	Transport	8	4	1	5	65	-	H	Warning signs, speed limit enforcement, speed humps	4	4	1	3	27	-	L	Implement and maintain strict vehicle movement policy	Ongoing	Environmental Control Officer
Dust	Block OI	Earth-moving: backfill, topsoil replacement, contouring	4	1	1	3	18	-	L	Dust suppression of gravel roads	4	4	1	3	27	-	L	Ensure optimal implementation and maintenance of the dust suppression programme.	Ongoing	Environmental Control Officer
Inadequate rehabilitation	Block OI	Rehabilitation	4	4	2	5	50	-	M	Rehabilitation of grassland habitat requires dramatic improvement. The structural and species diversity needs to be restored. All rock refugia removed must be replaced. A mammalogist should be called in to assist with monitoring of the rehabilitation.	4	4	1	3	27	-	L	Appoint a mammalogist specialist for recolonization	During Closure	Environmental Control Officer / mammalogist

POTENTIAL ENVIRONMENTAL IMPACT	MINING AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 2: ACTIVE REHABILITATION																				
Road and Direct mortality	Block OI	Earth-moving: backfill, topsoil replacement, contouring	4	1	1	3	18	-	L	While direct mortality will occur, only few herpetofauna will be affected and therefore no mitigation is required here.	4	4	1	3	27	-	L	N.A	N.A	N/A
Lack of recolonization	Block OI	Rehabilitation	6	5	1	5	60	-	M	Artificial ridges should be created to allow colonization of herpetofauna requiring rock shelter. A termite specialist must be consulted in order to attempt the recolonization of termites on rehabilitated areas	4	3	1	3	24	-	L	Appoint a termite specialist for recolonization	During Closure	Environmental Control Officer / Termite specialist
Issues related to WETLANDS																				
Removal of surface infrastructure following mine closure will largely result in similar impacts to the initial establishment of infrastructure, as soils are disturbed and exposed to erosion, leading to increased sedimentation in wetlands	Block OI	Rehabilitation	6	4	2	5	60	-	M	Wetlands should not overly mine out areas so as to prevent infiltration that could exacerbate decant. Replaced spoils should be landscaped to be free draining so as to prevent pooling or infiltration of water that could add to decant volumes. However, steep slopes and concentrated run-off should also be avoided to prevent erosion. The rehabilitated areas should be re-vegetated as soon as possible following completion of the earthworks to minimise erosion. Regular long-term follow up of rehabilitated areas will be required to ensure the successful establishment of vegetation and to survey for any erosion damage on site. Erosion damage should be repaired immediately. The recommendations contained within the specialist vegetation and soils reports should be fully implemented to ensure successful rehabilitation	4	3	2	5	45	-	M	Develop a wetland management and rehabilitation plan, and implement throughout the construction, operation and closure phases of the mine.	Ongoing	Environmental control officer
																		Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	During closure and decommissioning phase	Environmental Control Officer/ Project Manager/Health & Safety Officer
																		The contractor will ensure that all activities, material and equipment storage and personnel movement take place within the designated area.	During closure and decommissioning phase	Environmental Control Officer/ Project Manager/Health & Safety Officer
																		Contractors will complete induction on the EMP, Environmental Awareness Plan and Emergency Response Plan prior to construction activities being undertaken. All workers will be made aware of the penalty systems for non-compliance.	During closure and decommissioning phase	Environmental Control Officer/ Project Manager/Health & Safety Officer
																		The site should be monitored for erosion and sediment movement during and after rainfall events and suitable interventions put in place to repair any erosion damage and to prevent further sediment movement off the site.	During closure and decommissioning phase	Environmental Control Officer/ Project Manager/Health & Safety Officer
Issues related to SURFACE WATER																				
The areas will be levelled and sloped to promote runoff and prevent ponding. The net result will be positive after this phase since clean runoff will be available to the catchment. The catchment yield will therefore increase slightly due to the size of the affected area compared to the catchment.	OD, OH, OM	Rehabilitation of the site	6	5	3	4	56	+	M	Ensure ongoing and effective active rehabilitation and sloping by frequent and ongoing monitoring.	8	5	2	5	75	+	H	The possible impacts on surface water resources will be reduced.	At closure	Mine Environmental Manager

POTENTIAL ENVIRONMENTAL IMPACT	MINING AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 2: ACTIVE REHABILITATION																				
The rehabilitation of the mining areas will have a positive impact on the surface water quality since the areas will be topsoiled and grassed. This will result in clean runoff from the area. Any discard present on the haul roads will be removed before the roads are topsoiled and grassed. This will also result in clean runoff from the area. However, until the vegetative cover is established, there could be an increase in silt load.	OD, OH, OM	Rehabilitation of the site	6	5	3	4	56	+	M	Ensure ongoing and effective active rehabilitation and sloping by frequent and ongoing monitoring.	8	5	2	5	75	+	H	The possible impacts on surface water resources will be reduced.	At closure	Mine Environmental Manager
Erosion control over rehabilitated areas	OD, OH, OM	Erosion	8	5	2	4	60	+	M	Contouring of rehabilitated areas in order to control run-off direction, speed and velocity. Maintenance and control of vegetation cover over the rehabilitated areas.	8	5	2	4	60	+	M	Continuous rehabilitation of the decommissioning area will be conducted in line with the Best Practice Guidelines released by the DWA. DBM will appoint a specialist to this effect.	Ongoing	Environmental control officer/Proponent/Ecologist/ Contractor
Contribution of rainfall and run-off to the expected volume and quality of the decant	OD, OH, OM	Ingress of water	6	4	2	3	36	+	M	Sloping of areas as to allow maximum run-off of clean water and minimise ingress of water to the workings which could significantly contribute to the expected volume of decant. Prevention of ponding.	6	5	3	4	56	+	M	Drainage systems should subsequently be restored to reduce erosion and return flow patterns	At closure	Mine Environmental Manager
Issues related to GROUNDWATER																				
Groundwater quality deterioration due to surface contamination	OD, OH, OM	Rehabilitation of the site	6	5	3	3	42	+	M	The impacts on the ground water quality originating from surface would be minimised with the rehabilitation of the mining areas and the removal of carbonaceous material from the haul roads, which contributes pollutants to the ground water.	5	4	2	2	22	-	L	Ensure effective sloping during active rehabilitation phase. Drainage systems should subsequently be restored to reduce erosion and return flow patterns	At closure	Mine Environmental Manager
Backfilling, compacting and rehabilitation of the open pit will result in groundwater level recovery and resultant ARD in the backfilled pit.	OD, OH, OM	Rehabilitation of the site	10	5	2	5	85	+	H	This is a positive impact and will result in the remediation of surface topography with the resultant recovery of groundwater levels. However, groundwater levels will not recover to ambient conditions because of the lower surface topography after rehabilitation. Proper compacting and rehabilitation will lower recharge to the backfilled area and minimise infiltration of oxygen rich water, thereby minimising geochemical reactions that will occur.	10	5	2	5	85	+	H	The mined out sections of the pit must be backfilled, compacted and rehabilitated as soon as possible to remove oxygen out of system. Pyrite oxidation will result in elevated concentrations of TDS and SO4. Rehabilitation must include covering with a topsoil layer as well as vegetation thereof. Installation of a soil cover will significantly decrease water infiltration and contamination of water resulting in smaller decant from the pits.	At closure	Mine Environmental Manager

POTENTIAL ENVIRONMENTAL IMPACT	MINING AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 2: ACTIVE REHABILITATION																				
Recovery of groundwater levels will result in a flux away from the backfilled pit and ARD will now move towards / decant into surface water drainage channels.	OD, OH, OM	Rehabilitation of the site	8	5	2	5	75	+	H	No mitigation is possible. Groundwater levels in the backfilled pit will recover to the level of decant and pollution plumes will migrate to surface water bodies. Decant water / polluted surface water needs to be contained or treated.	6	5	2	4	52	-	M	The mined out sections of the pit must be backfilled, compacted and rehabilitated as soon as possible to remove oxygen out of system. Pyrite oxidation will result in elevated concentrations of TDS and SO_4. Rehabilitation must include covering with a topsoil layer as well as vegetation thereof. Installation of a soil cover will significantly decrease water infiltration and contamination of water resulting in smaller decant from the pits.	At closure	Mine Environmental Manager
Issues related to SOIL, LAND USE AND LAND CAPABILITY																				
The rehabilitation of the mining areas and the haul roads will have a positive effect on the land capability in terms of restoring the arable land capability of the site. Rehabilitation of the disturbed area will allow the soils to settle and compact. The return of the previous land capability will however, be a slow process and should be monitored.	OD, OH, OM	The rehabilitation of the mining areas and the haul roads	6	4	1	3	33	+	M	Compacted soils will be ripped and topsoil will be replaced. After the topsoil has been replaced the area should be ameliorated and seeded, should self-succession of vegetation not take place. Only species indigenous to the area will be included.	8	2	1	4	44	+	M	Continuous rehabilitation of the decommissioning area will be conducted in line with the Best Practice Guidelines released by the DWA. Leeuwpan will appoint a specialist to this effect.	Ongoing	Environmental Control Officer
Issues related to AIR QUALITY																				
Impacts will arise from the replacement and reworking of soils for rehabilitation and vehicle movements. The impact on air quality will show an exponential decrease with time as rehabilitation of the area occurs. This will be particularly significant during the dry season but should only be for a limited time period	OD, OH, OM	Rehabilitation of the site	4	2	1	3	21	-	L	A dust monitoring network must be established and implemented throughout the closure phase of the mine.	4	2	1	3	21	-	L	Dust sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Monthly	Environmental Control Officer
																		Monthly monitoring reports will be generated by the mine or through a suitably qualified air quality specialist.	Monthly	Environmental Control Officer/Air Quality Specialist
																		In the event that air quality or dust issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental Control Officer/Air Quality Specialist
																		Ensure optimal implementation and maintenance of the dust suppression programme.	Ongoing	Environmental Control Officer
																		The road surface will to be watered on a daily basis.	Daily	Environmental Control Officer
																		The road surface will to be maintained on a weekly basis.	Weekly	Environmental Control Officer
Issues related to NOISE																				
The noise related to the operation will comprise of noise generated by trucks and loading equipment in terms of the removal of stockpiles and the rehabilitation of the various pits.	OD, OH, OM	The removal of stockpiles and the rehabilitation of the various pits.	4	2	1	3	21	-	L	The removal of all infrastructures is to take place during daytime periods only.	4	2	1	3	21	-	L	Where noise becomes a nuisance, management measures will be investigated and implemented to address these.	Ongoing	Health and Safety Officer/Project Manager/ Environmental Control Officer
																		Machinery with low noise levels and maintained in a good order to be used and to comply with the IFC's Health and Safety Regulations.	Ongoing	Health and Safety Officer/Project Manager/ Environmental Control Officer

POTENTIAL ENVIRONMENTAL IMPACT	MINING AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 2: ACTIVE REHABILITATION																				
										Speed control measures will be implemented by the mine through the placement of adequate signage.								Implement a penalty system for non-compliance to speed control measures and ensure that all workers are made aware of the penalty systems.	Ongoing	Health and Safety Officer/Project Manager/ Environmental Control Officer
										Gravel roads to be maintained in as good and smooth a condition as possible.								The road surface will to be maintained on a weekly basis.	Weekly	Environmental Control Officer
Issues related to CULTURE & HERITAGE																				
Grave sites 3 and 8	Construction activities	Block OI and linear infrastructure	2	5	2	5	45	-	M	Fence in and sustain the management plan	2	4	2	2	16	-	L	Sites to be monitored annually	Annually	Heritage expert
Issues related to VISUAL																				
The decommissioning phase will involve the rehabilitation of the mining area as well as the removal of the stockpiles. This will bring about an improvement in the visual aesthetics of the site.	OD, OH, OM	Rehabilitation of the site	4	2	1	3	21	+	L	An overall visual improvement will be noticed once all mining related infrastructure has been demolished and the area has been landscaped and re-vegetated.	8	5	2	4	60	+	M	Demarcate the decommissioning area and limit the decommissioning activities as far as possible.	Prior to Decommissioning Phase	Health and Safety Officer/Project Manager/ Environmental Control Officer
																		Final shaping will be implemented such that the final profiles of the rehabilitated areas are formed to emulate natural contours of the area.	During Closure Phase	Environmental Control Officer/Project Manager
																		Foundations will be removed to a depth of 1 m below the surface and the area rehabilitated.	During Closure Phase	Environmental Control Officer/Project Manager
																		All material recovered from the demolition of buildings and/or structures will either be transported to a permitted disposal site, or made available to the local community as building materials (provided they are in a satisfactory condition following demolition).	During Closure Phase	Environmental Control Officer/Project Manager
																		Linear infrastructure constructed by the mine (i.e. roads, conveyors and power lines) will be removed if it proves to inhibit land use at decommissioning.	During Closure Phase	Environmental Control Officer/Project Manager
																		All fences erected around the mine will be dismantled and disposed of at a permitted disposal site.	During Closure Phase	Health and Safety Officer/Project Manager/ Environmental Control Officer
Issues related to TRAFFIC																				
Potential safety hazard due to increased use of access Road R50	Footprint clearance and infrastructure establishment	Block OI	2	5	2	3	27	-	L	Provision of sufficient street lights at access road	2	4	3	2	18	-	L	Construct road and surfacing	Once plus maintenance	Mine management
Issues related to SOCIAL																				

POTENTIAL ENVIRONMENTAL IMPACT	MINING AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 2: ACTIVE REHABILITATION																				
The main impact will be the loss of employment. This impact is however, uncertain as the persons working at Leeuwpan Coal Mine could be provided with employment at one of the other company mines.	OD, OH, OM	End of mining	6	4	1	3	33	-	M	Continue with the skills development programme to empower the workforce to undertake other activities.	4	3	3	3	30	-	M	Audit and ensure compliance with the Social and Labour Plan	Ongoing	Human Resources

CLOSURE AND DECOMMISSIONING PHASE – Activity 3: Residual Impacts post closure

POTENTIAL ENVIRONMENTAL IMPACT	MINING AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 3: RESIDUAL IMPACTS POST CLOSURE																				
Issues related to GEOLOGY																				
No impacts anticipated	N/A	N/A	0	0	0	0	0	N	L	No mitigation measures necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
No impacts anticipated	N/A	N/A	0	0	0	0	0	N	L	No mitigation measures necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to BLAST AND VIBRATION																				
No impacts anticipated	N/A	N/A	0	0	0	0	0	N	L	No mitigation measures necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to FLORA																				
Spread of alien species	OD, OH, OM	Alien control	6	4	3	4	52	+	M	Ensure that rehabilitated areas are covered with local species, alien species should not have established during operational phase	6	4	3	4	52	-	M			
Issues related to FAUNA																				
Changes in surface water chemistry	Construction phase activities	Acid mine drainage	10	5	3	5	90	-	H	Analyse surface water of impoundments during two seasons per annum. Implement coordinated water bird counts during two seasons per annum. Take action if trends show significant change - rectify and treat water.	10	4	3	4	68	-	H	N/A	N/A	N/A
Anthropogenic encroachment	Construction phase activities		6	4	2	3	36	-	M	Designate settlement areas to the north of study site - consolidate with existing settlements	2	4	2	2	16	-	L	N/A	N/A	N/A
Issues related to WETLANDS																				

POTENTIAL ENVIRONMENTAL IMPACT	MINING AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 3: RESIDUAL IMPACTS POST CLOSURE																				
Decant and AMD could lead to water of poor quality (high acidity, salinity and high levels of metals, especially iron and aluminium, etc.) to enter the surface water (either directly through overflowing, decanting or seepage into groundwater that reaches surface water ecosystems.	Block OI	Residual impact post-closure	10	5	5	5	100	-	H	Limit the amount of water infiltrating mined out areas by replacing spoils so as to be free-draining and prevent pooling of water. To further reduce infiltration, an impermeable or partially permeable layer should be recreated at variable depth within the rehabilitated landscape. Such a technique has however not yet been applied in South Africa and it is uncertain whether it would be feasible. Treat decanting mine water to acceptable water quality levels (in consultation with DWA) by the installation of a treatment plant, typically an RO plant (reverse osmosis). Treated water should at least meet the standards for use for livestock watering and irrigation. Financial and logistical provision should be made for prolonged maintenance and operation. Timing, location and volume of decant expected should be determined to allow more detailed decisions regarding possible mitigation and management measures.	8	5	5	5	90	-	H	Only water meeting the requirements of the DWA standards should be allowed to decant or be discharged into any water course.	During closure and decommissioning phase	Environmental control officer
Acidification and salinization of surface water as a result of decant/AMD will have a negative impact on especially biota intolerant to water quality alterations, but depending on the severity may be detrimental to the entire aquatic ecosystem.	Block OI	Residual impact post-closure	8	5	3	4	64	-	H	See mitigation for Wetlands. It is important that the environmental monitoring should continue during and past the decommissioning phase, and adequate budget should therefore be provided for this.	8	5	5	5	90	-	H	Should monitoring (biomonitoring, groundwater or surface water monitoring or environmental audits detect any signs of acid mine drainage, it should be addressed and rectified and an auditable record kept of actions taken. An Acid-Base: Accounting, Technique and Evaluation (ABATE) should be undertaken (Usher et al., 2003).0	During closure and decommissioning phase	Environmental control officer
Issues related to SURFACE WATER																				
Contamination of surface water due to groundwater seepage	OJ, OL	Groundwater seepage	10	5	4	4	76	-	H	The mine residue should be dumped below the water table and compacted so little or no leach exists. Pending the decant quality various treatment options could be considered. These include pH adjustment and controlled release or containment. Collection of decant into a purposely dedicated pollution control dam which may require lining pending the expected water quality.	2	5	4	3	33	-	M	The return of waste with a net acid-producing potential (i.e. coal waste and coal-bearing shale), should only occur in areas that will later be covered by water to prevent the oxidation of sulphides in this material. If necessary, some of the clay overburden will be used to isolate this filling even further	During closure and decommissioning phase	Environmental control officer
Erosion control over rehabilitated areas	OJ, OL	Erosion	8	5	2	4	60	-	M	Contouring of rehabilitated areas in order to control run-off direction, speed and velocity. Maintenance and control of vegetation cover over the rehabilitated areas.	4	4	2	2	20	-	L	The return of waste with a net acid-producing potential (i.e. coal waste and coal-bearing shale), should only occur in areas that will later be covered by water to prevent the oxidation of sulphides in this material. If necessary, some of the clay overburden will be used to isolate this filling even further	During closure and decommissioning phase	Environmental control officer

POTENTIAL ENVIRONMENTAL IMPACT	MINING AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 3: RESIDUAL IMPACTS POST CLOSURE																				
Contribution of rainfall and run-off to the expected volume and quality of the decant	OJ, OL	Ingress of water	6	4	2	3	36	-	M	Sloping of areas as to allow maximum run-off of clean water and minimise ingress of water to the workings which could significantly contribute to the expected volume of decant. Prevention of ponding. Frequent maintenance and inspections.	4	5	2	2	22	-	L	The return of waste with a net acid-producing potential (i.e. coal waste and coal-bearing shale), should only occur in areas that will later be covered by water to prevent the oxidation of sulphides in this material. If necessary, some of the clay overburden will be used to isolate this filling even further	During closure and decommissioning phase	Environmental control officer
Issues related to GROUNDWATER																				
Contamination of groundwater due to the strong potential for the coal and carbonaceous material at Leeuwpan to produce acid effluent that would be loaded with potential toxic heavy metals.	OD, OH, OM, OL, OJ	AMD	10	5	3	4	72	-	H	A proper integrated water management scheme that would significantly remediate, and reduce, the generation of acid mine drainage should be developed. Such an integrated water management plan should form the basis of the rehabilitation operation guideline and closure plan for Leeuwpan Coal Mine.	6	5	3	4	56	-	M	Groundwater quality must be monitored on a quarterly basis. Water samples must be taken from all the monitoring boreholes by using approved sampling techniques and adhering to recognised sampling procedures. Samples should be analysed for both organic as well as inorganic pollutants, as mining activity often lead to hydrocarbon spills in the form of diesel and oil. At least the following water quality parameters should be analysed for: Total Petroleum Hydrocarbons (TPH), pH, electrical conductivity (EC), Ca, K, Mg, Na, SO_4, NO_3, Cl, F, B, total alkalinity, and Fe (total). As toxic heavy metals are also suspected to be a contaminant, this should be included at a less frequent interval.	During closure and decommissioning phase	Environmental control officer
ARD and pollution of surface water drainage channels.	OD, OH, OM, OL, OJ	Residual Impacts Post Closure	8	5	3	4	64	-	H	Proper backfilling will ensure less recharge of oxygen rich water and less ARD produced.	6	5	3	4	56	-	M	Groundwater quality must be monitored on a quarterly basis. Water samples must be taken from all the monitoring boreholes by using approved sampling techniques and adhering to recognised sampling procedures. Samples should be analysed for both organic as well as inorganic pollutants, as mining activity often lead to hydrocarbon spills in the form of diesel and oil. At least the following water quality parameters should be analysed for: Total Petroleum Hydrocarbons (TPH), pH, electrical conductivity (EC), Ca, K, Mg, Na, SO_4, NO_3, Cl, F, B, total alkalinity, and Fe (total). As toxic heavy metals are also suspected to be a contaminant, this should be included at a less frequent interval.	During closure and decommissioning phase	Environmental control officer
Issues related to SOIL, LAND USE AND LAND CAPABILITY																				
			6	4	1	3	33	+	M						0	-	L			
Issues related to AIR QUALITY																				
No impacts anticipated	N/A	N/A	0	0	0	0	0	N	L	No mitigation measures necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to NOISE																				

POTENTIAL ENVIRONMENTAL IMPACT	MINING AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 3: RESIDUAL IMPACTS POST CLOSURE																				
No impacts anticipated	N/A	N/A	0	0	0	0	0	N	L	No mitigation measures necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to CULTURE & HERITAGE																				
No impacts anticipated	N/A	N/A	0	0	0	0	0	N	L	No mitigation measures necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to VISUAL																				
No impacts anticipated	N/A	N/A	0	0	0	0	0	N	L	No mitigation measures necessary	0	0	0	0	0	N	L	N/A	N/A	N/A
Issues related to TRAFFIC																				
Retrenchment		Block OI	0	2	2	4	16	-	L	No recommendations	0	2	2	4	16	-	L	Construct road and surfacing	Once plus maintenance	Mine management
Issues related to SOCIAL																				
Standard of living		Economic Processes	4	3	2	2	18	-	L	To increase the standard of living locally, the contractors employed should aim to ensure that local or surrounding people are employed where possible	6	3	2	3	33	-	M	The employment of local residents during operation (as far as practically possible) would increase the standard of living, since they would have a higher disposable income and less transportation costs.		
Conversion and diversification of land use		Geographic processes	6	4	3	4	52	-	M	Educate landowners in terms of their rights and responsibilities prior to the project going ahead and develop clear communication lines when consulting with affected landowners and their employees.	4	4	3	4	44	-	M	Take into account surrounding land uses and design post-mining land use options to support and enhance long-term development options.		
Transport and accessibility		Geographic processes	6	4	3	4	52	-	M	• The applicant should, in liaison with the relevant Roads and Traffic Department, identify problem areas and assist with the regular maintenance of the roads frequently used by construction and mine traffic;	4	4	3	4	44	-	M	Speed limits on the local roads surrounding the mining site should be enforced and appropriate traffic management measures should be planned for and implemented. The recommendations made by the TIA should be employed.	Ongoing	Environmental Control Officer
Functioning of government agencies		Institutional and Legal Processes	4	5	3	3	36	-	M	Assist the LM with the diversification of the local economy and emphasise the use of local service providers and SMMEs and focus on the development of LED programmes.	2	4	2	2	16	-	L	Institute a joint municipal coordinating and implementing committee to support the municipality's local economic and social develop needs and requirements, where feasible.	Ongoing	Environmental Control Officer
Impact equity		Institutional and Legal Processes	8	4	1	3	39	-	M	Negative impacts on the local property owners should be limited as far as possible such as intrusion impacts (dust, noise, and air pollution). Mitigation measures from the specialist studies dealing with these issues should thus be strictly implemented. Furthermore it is critical that safety and security measures are critical to avoid any increase in criminal activities within the local study area.	6	3	1	2	20	-	L	Skills training and development should be maximised to benefit as many local employees as possible and the use of local labour must be maximised as far as possible.	Ongoing	Environmental Control Officer

POTENTIAL ENVIRONMENTAL IMPACT	MINING AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 3: RESIDUAL IMPACTS POST CLOSURE																				
Capacity building and skills transfer		Empowerment Process	4	2	3	3	27	-	L	Where possible, recruit and train local residents to supply unskilled labour during the mine expansion; Stakeholders should be mutually accountable for increased opportunities regarding skills and competency development (general education and technical training); Training should be concentrated on skills that can be readily transferred to other employment opportunities in the local area to avoid persons with trained skills leaving the area for work elsewhere;	6	2	3	4	44	-	M	It is recommended that a comprehensive program for recruiting, hiring, training, orienting and counselling be established, in line with the SLP. The nature of the training provided does not need to be limited to specific project related tasks and can include financial planning, bookkeeping, general arithmetic etc. Furthermore the implementation of the SLP should be monitored on an annual basis.	Ongoing	Environmental Control Officer
Actual health and fertility		Socio-cultural processes	6	4	2	4	48	-	M	HIV / Aids awareness campaigns should be initiated by Exxaro and provided to all its mine employees on a regular basis; Exxaro should investigate how they could assist in implementing a community health awareness programme in liaison with the LM; The necessary safety precautions should be taken and first aid supplies should be made available on site; All mine employees (including contractors) should undergo health and safety training on a regular basis; The general health of employees should be monitored on an on-going basis and employees should be given free access to clinic services; The required safety equipment should be provided to employees as well as on site and should be in a good working order.	4	4	2	3	30	-	M	It is advised that Exxaro, through consultation with the LM investigate ways in which their LED programmes and infrastructure development component of their SLP can assist in improving the overall health services within the communities	Ongoing	Environmental Control Officer
Adequacy and access to social infrastructure		Socio-cultural processes	6	3	2	2	22	-	L	In consultation with the municipality and other mines operating in the area, ensure that the necessary planning for upgrades of social infrastructure, where lacking due to the proposed mine expansion, take place.	4	3	2	2	18	-	L	Involvement in upliftment programmes should be done according to the priority needs and projects identified as part of the LMs IDP, as well as in consultation with other stakeholders such as the local community representatives, ward committees and youth organisations;	Ongoing	Environmental Control Officer
Personal safety and hazard exposure		Socio-cultural processes	6	4	2	4	48	-	M	A Health and Safety Plan should be implemented and it must be ensured that all managers are trained in First Aid and other relevant safety courses. Furthermore, the implementation of safety measures to limit fire hazards and implementation of fire breaks is necessary.	4	3	2	3	27	-	L	A Fire/Emergency Management Plan should be developed and implemented. It is important that this management plan and associated communication channels are developed at the outset of the project. It would be important to regularly review the functionality and efficiency of such a plan in conjunction with the local emergency teams, mine	Ongoing	Environmental Control Officer

POTENTIAL ENVIRONMENTAL IMPACT	MINING AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 3: RESIDUAL IMPACTS POST CLOSURE																				
																		management and neighbouring landowners;		
Crime and violence		Socio-cultural processes	4	4	2	3	30	-	M	Local, unemployed labour should be employed as far as possible; Mine workers should be clearly identifiable by ensuring they wear uniforms and identification cards that should be exhibited in a visible place on their body.	2	3	1	2	12	-	L	The AgriSA protocol for access to farms should be followed in all instances where access to farmers' land is required.	Ongoing	Environmental Control Officer
Loss of natural and cultural heritage		Socio-cultural processes	8	5	1	3	42	-	M	The recommendations of the HIA should be implemented.	8	2	1	1	11	-	L	Local residents and farmers should be consulted to determine any possible heritage sites not identified by the HIA	Ongoing	Environmental Control Officer

7.5 Cumulative Impacts

Section 2 of the NEMA requires the consideration of cumulative impacts as part of any environmental assessment process. Furthermore this is carried forward into Regulation 385 which requires assessment of cumulative impacts in an EIA Report. EIAs have traditionally, however, failed to come to terms with such impacts, largely as a result of the following considerations:

- Cumulative effects may be local, regional or global in scale and dealing with such impacts requires co-ordinated institutional arrangements; and
- EIAs are typically carried out on specific developments, whereas cumulative impacts result from broader biophysical, social and economic considerations, which typically cannot be addressed at the project level.

A cumulative impact can be defined as an impact on the environment which results from the incremental impact of an action (i.e. mining) when added to other past, present and reasonably foreseeable future actions, regardless of who (i.e. private individual, government agency, industrial business, agricultural business, etc) undertakes such actions.

Cumulative impacts associated with this type of mining development could lead to initial, incremental or augmentation of existing types of environmental degradation, due to existing activities such as farming, including impacts on the air, soil and water present within available habitat. Pollution of these elements might not always be immediately visible or readily quantifiable, but incremental or fractional increases might rise to levels where biological attributes could be affected adversely on a local or regional scale. In most cases are these effects are not bound and is dispersed, or diluted over an area that is much larger than the actual footprint of the causal factor. Similarly, developments in untransformed and pristine areas are usually not characterised by visibly significant environmental degradation and these impacts are usually most prevalent in areas where continuous and long-term impacts have been experienced.

The nature of the development is such that pollution and degradation of the surrounding areas are expected to some extent, but this is incredibly difficult to quantify initially and will require monitoring and management throughout the life of the mine. Cumulative impacts are, for this very reason, assessed over the entire lifespan of the project operation. Since the cumulative impacts can occur at any point within any of the identified phases it is preferable to present them separately in order to understand what aspects will require monitoring and management throughout the life of the project as well as after successful closure and decommissioning of the Backfill Plant (i.e. such as when the area is operated as another functional entity like agricultural practises).

Cummulative Impacts will be finalised upon completion of the final specialist studies due to the update of these studies regarding new infrastructure localities.

8 MONITORING AND AUDITING

This chapter of the reports fulfills the requirements of section 50 (h) and 51 (b) of the MPRDA Regulation R527, as listed under the EMP template:

REGULATION 50 (h):

- *(Section 1- 15): Arrangements for monitoring and management of environmental impacts:*
  - *(Section 1 - 15.1): List of identified impacts which will require monitoring programmes;*
  - *(Section 1 - 15.2): Functional requirements for the said monitoring programmes; and*
  - *(Section 1 - 15.3): Roles and responsibilities for the execution of the monitoring programmes;*
  - (Section 1 - 15.4): Time frames for monitoring and reporting.

REGULATION 51 (b):

- *(Section 2 – 8): Planned monitoring and environmental management programme performance assessment:*
  - *(Section 2 - 8.1): Description of planned monitoring of the aspects of the environment which may be impacted upon. (Include all the items referred to in the concomitant section of the guideline posted on the official website of the Department);*
  - *(Section 2 - 8.2): Provide a description as to how the implementation of the action plans contemplated in regulation 51 (b) (ii) as described will be monitored as described in paragraph 6 of the EMP will be monitored;*
  - *(Section 2 - 8.3): Frequency of proposed reporting for assessment purposes.*

Furthermore, Regulation 55 (1) (2) of the MPRDA Regulations, R527 require that the holder of a mining right conduct monitoring on a continuous basis.
The key to the success of an EMP lies in its effective implementation. Compliance monitoring is therefore crucial. Monitoring ensures that the environmental requirements stipulated in the EMP are being complied with. It also allows for ongoing impacts to be tracked so that the effectiveness of the mitigation can be measured. Refer to Table 8.1 for a summary of all current and new monitoring components for Leeuwpan Coal.

Table 8.1 Summary of Components to be Monitored for Leeuwpan

Aspect	Component	Frequency of data collection
Surface water	Surface water quality	Monthly
	Water consumption levels	Daily
Groundwater	Groundwater quality	Quarterly
Biomonitoring	Biological integrity of aquatic habitats	Biannually
Air quality	Dust fallout	Quarterly
Rehabilitation	Soil	Quarterly
	Vegetation	Periodically
	Animal life	Annually
Noise	Noise levels	Monthly
Topography	Surface movement (subsidence)	Quarterly
Integrated Management System	Identification of deviations from standards	Periodically
Performance assessment	Assessment of adequacy of EMP commitments	Biennially

8.1 Water Monitoring Program

8.1.1 Water Quality

The objective of the water monitoring programme currently in place at Leeuwpan Coal is to assess and quantify the impacts of the existing Leeuwpan on the aquatic ecosystems and receiving waters.

Sampling is performed according to recognised legal procedures (minimum requirements for water monitoring at waste management facilities, Department of Water Affairs and Forestry (DWAF), 1998) and follows approved laboratory analysis techniques.

The NWA sets out a framework for the management of water resources in South Africa. This framework provides for the establishment of water management institutions, made up of role-players in each catchment. It is therefore of utmost importance that the requirements of down-stream users be determined pro-actively.

The target water quality guidelines are defined as those values or concentrations where no impact is expected on the specific user group. These values and concentrations are used to evaluate the water qualities at Leeuwpan Coal and are presented in Table 8.2.

Table 8.2 Target Water Quality Guideline

Variable	Dom[1]	Aqua[2]	Live[3]
pH	6.0 -9.0	-	-
Electrical Conductivity (mS/m)	70		500
Sulphate (mg/l SO_4)	< 200	-	< 1 000
Nitrate (mg/l NO_3)	< 6	-	< 100
Chloride (mg/l Cl)	< 100	-	< 3 000
Fluoride (mg/l F)	< 1	< 0.75	< 2
Ammonia (mg/l NH_3)	2 max	< 0.007	-
Calcium (mg/l Ca)	< 32	-	< 1 000
Magnesium (mg/l Mg)	< 30	-	< 500
Aluminium (mg/l Al)	< 0.15	< 0.005	< 5
Manganese (mg/l Mn)	< 0.05	< 0.18	< 10

8.1.2 Objectives of Monitoring Programme

The objectives and targets for water monitoring systems at Leeuwpan Coal are:

- The water monitoring system will be maintained, reviewed and improved (if and when required) to ensure compliance with changes to policy and regulatory requirements as well as to provide for the needs of the mine,
- Reduce frequency of spills or leakages by implementing accurate monitoring measures as well as developing and implementation of contingency measures, and
- The latest policy of the DWAF as contained in the relevant draft Best Practise Guideline, which is currently being finalised for publication, will be reflected in the regular review and audit of the water monitoring system.

8.1.3 Monitoring Frequency

8.1.3.1 Surface Water

Monthly monitoring of the various surface water monitoring points is conducted, as well as from the Bronkhorstspruit localities, which are up- and downstream from potential impact points that may originate from Leeuwpan. Results generated at these localities are used to characterise and identify potential pollution sources on the mine, and for early detection of acid mine water formation. Surface water samples are analysed according to the following variables: Turbidity, electrical conductivity, pH, fluoride, nitrate, chloride, sulphate, sodium, calcium, potassium, magnesium, manganese, iron, aluminium, total hardness, total dissolved salts and alkalinity.

Samples are also taken on a monthly basis from each of the monitoring localities for drinking water. A sample is taken in a sterile container and this water is analysed for bacterial species richness and diversity. Drinking water samples are analysed according to the following variables: electrical conductivity, pH, fluoride, nitrate, chloride, sulphate, sodium, calcium, potassium, magnesium, manganese, iron, aluminium, total hardness, total dissolved salts, heterotrophic count, faecal coliforms and total coliforms.

Hydrocarbon monitoring is also undertaken at several of the process water monitoring localities. Samples are analysed for soap, oil and grease concentrations.

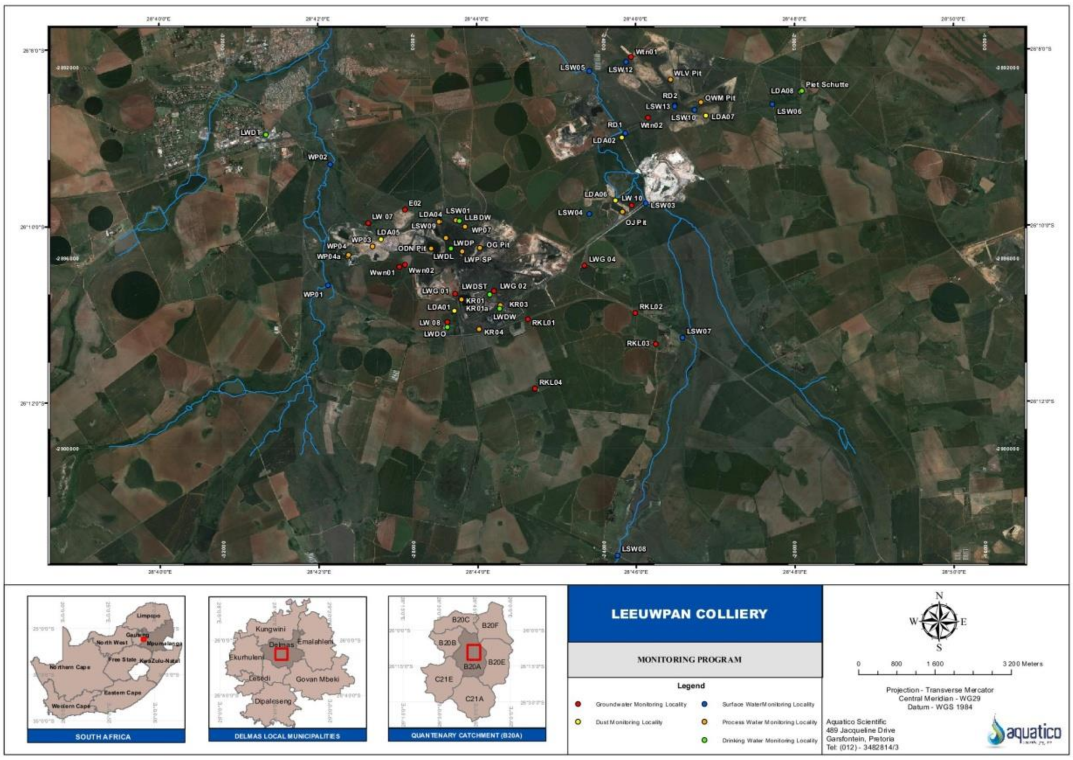
8.1.3.2 Groundwater

Groundwater monitoring localities were selected to characterise, and identify any deterioration in groundwater quality within the vicinity of the existing mine. These localities were selected based on the direction of groundwater flow. Monitoring is conducted on a quarterly basis with sampling conducted at a standard depth of 5 m below the water level. Groundwater samples are analysed according to the following variables: Turbidity, electrical conductivity, pH, fluoride, nitrate, chloride, sulphate, sodium, calcium, potassium, magnesium, manganese, iron, aluminium, total hardness, total dissolved salts and alkalinity.

Groundwater levels are monitored on a quarterly basis and visual observations are recorded in a monthly data sheet developed for Leeuwpan Coal.

8.1.4 Sample Locality

Figure 8.1 and Table 8.2 shows the locality of the current monitoring programme for surface and grondwater water.



[Figure not to scale – refer to A3 map in appendix A]

Figure 8.1: Monitoring locations

Table 8.3 Water Monitoring Locations and Descriptions

LOCALITY	DESCRIPTION	COORDINATES	
		LATITUDE	LONGITUDE
Drinking water and final sewerage effluent			
LW DT	Drinking Water In Town at Garage or KFC	S-25.7886	E28.2934
LWDO	Drinking Water At Mining Offices	S-25.7886	E28.2934
LWDP	Drinking water at plant	S-25.7886	E28.2934
LW DW	Drinking water at workshop	S-25.7886	E28.2934
LDWST	Drinking Water Supply Tank	S-25.7886	E28.2934
LLBDW	Loadout Bay Offices Drinking Water	S-261659	E28.7299
LWDL	Drinking water at Laboratory	S-25.7886	E28.2934
Piet Scutte	Drinking Water on Piet Schuttes Farm	S-26.1415	E28.8017
LWP SP P	Final Effluent From Septic Tanks at Plant	S-25.7886	E28.2934
LWP SP W	Final Effluent at Sewage Plant behind workshop	S-26.1812	E28.7396
LWP SP W DS	Sewage discharge flow into valley - Behind Workshop	S-26.1811	E28.7396

LOCALITY	DESCRIPTION	COORDINATES	
		LATITUDE	LONGITUDE
Surface water and receiving environment			
WP01	Bronkhorstspruit, upstream	S-25.7885	E28.2933
WP02	Bronkhorstspruit, downstream	S-26.1551	E28.7026
LSW03	Koffie Spruit at Delmas Silica - Downstream	S-25.7886	E28.2934
LSW04	Koffie Spruit downstream	S-25.7886	E28.2934
LSW05	Weltevreden Spruit downstream	S-261375	E28.757
LSW06	Weltevreden Spruit at Farm - Upstream	S-26.1439	E28.7955
LSW07	Rietkuil Tributary Downstream of LSW08	S-25.7884	E28.2934
LSW08	Rietkuil Tributary upstream of Block UI	S-25.7886	E28.2935
LSW10	Upstream Of RD2 - Part Of River Diversion	S-25.7884	E28.2934
LSW12	Wetland In River Diversion 2, Between RD2 And LSW05	S-26.1358	E28.7647
LSW13	Stormwater flowing into Riverdiversion 2	S-26.144	E28.775
Mine water-Process water			
RD1	River Diversion no 1	S26.1493	E28.7645
RD2	River Diversion no2	S-26.1442	E28.775
LSWO1	Load-out Bay Drainage Canal	S-26.1659	E28.7295
LSWO9	Pollution Control Dam	S-25.7885	E28.2934
KRO1	Kenbar open pit	S-25.7886	E28.2934
KRO1A	Kenbar Return Water Dam	S-25.7886	E28.2934
KRO3	Workshop oil separator sump	S-25.7885	E28.2934
KRO4	Marsh area next to workshop road	S-25.7885	E28.2934
WPO4	New Witklip Return Water Dam	S-25.7885	E28.2933
WPO4A	Seepage From Witklip Return Water Dam	S-25.7885	E28.2933
WPO7	Channel next to Load Out Bay	S-26.1669	E28.7308
0G	Pit 0G Pit Water	S-25.7894	E28.2935
0G Pit	0G Pit Water	S-253894	E28.2935
OJ Pit	OJ Pit Water	5-25.7886	E28.2935
OWM Pit	OWM Pit Water	S-25.7894	E28.2935
ODN Pit	OD Pit North	S-25.7886	E28.2934
WLV Pit	Weltevreden Pit	S-25.7886	E28.2934

The monitoring programme will be updated after the completion of the Hydrogeological assessment for Leeuwpan. New groundwater monitoring points will be added to the water monitoring programme.

8.2 Wetlands and Aquatic Ecology (Biomonitoring)

The proposed new activities should be included within the Leeuwpan Coal Mine surface water quality and biomonitoring monitoring plan. As a minimum the points as indicated in Figure 8.2 should be included in the plan, ***though if existing monitoring points occupy a similar location and are considered suitable, the existing monitoring points should be retained***. The following should be monitored (as far as possible):

- Water quality (pH, EC, TDS, SO4 as well as standard anions and cations) – monthly;
- Aquatic macro-invertebrates (SASS) – biannually (start and end of wet season); and
- Diatoms – bi-annually (start and end of wet season)

Figure 8.2 Suggested Wetland and Biomonitoring points

It is recommended that monitoring at three (3) points commences as soon as possible and at the latest at the onset of construction activities. Commencing monitoring immediately will allow for the baseline conditions to be accurately established prior to any impacts materializing.

8.3 Air Quality and Dust Monitoring

Leeuwpan Coal currently implements a dust monitoring programme in accordance with the Standard Practice Instruction titled “Fall out dust monitoring”, dated 9 June 2009. A monthly report is sent to Leeuwpan Coal, providing the results of the dust samples for that month as well as any irregularities or suggestions regarding the production of fall out dust. A report of dust fall out is submitted to the DMR on a quarterly basis.

Based on the predicted impacts on the surrounding environment it is recommended that ambient PM10 monitoring be done and that the existing dust fallout monitoring network is extended to include single dust buckets at the proposed sites for the new operations.

The existing dust fallout monitoring network should be extended to include 7 single dust buckets at specified locations on the site boundary (Figure 8.2). It is recommended that dust deposition monitoring be confined to sites within and in close proximity (< 2 km) to the mine operations. As episodic high values of PM10 are expected, continuous PM10 monitoring is recommended at two specified locations on the site boundary (closest to Delmas). This will not only confirm the modelled values, but will also provide a record of the success or otherwise of implemented management measures. It must however be recognised that passive samplers are essentially averaging devices that have lower detection limits. At low ambient concentrations, fairly long sampling times (days to weeks) may be required to obtain meaningful results.

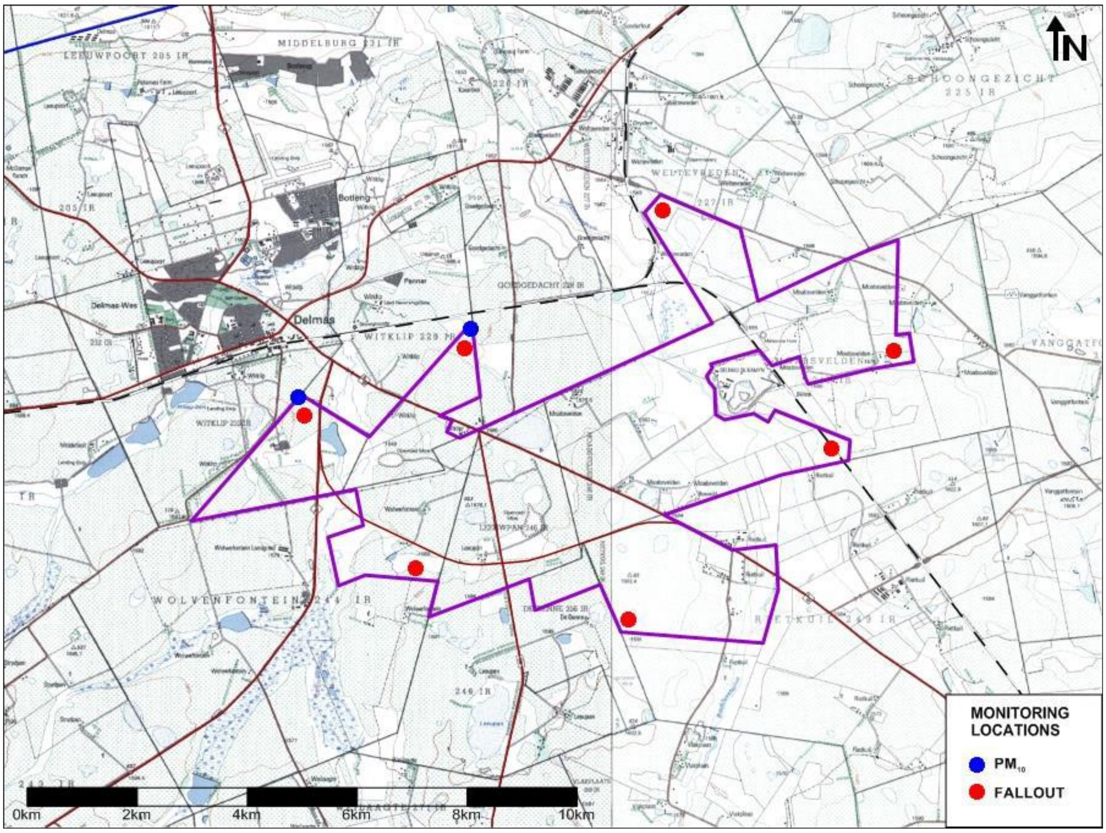


Figure 8.3 Suggested PM10 and Dust monitoring locations

8.4 Soil Monitoring

Annual monitoring of soil conditions on site is recommended. Monitoring should be conducted downwind and downstream (or down gradient) from mine facilities such as waste rock piles and tailings storage facilities (TSF) and upwind and upstream from these facilities. The analyses parameters for the soil monitoring programme include:

- Soil chemistry:
    - pH;
    - Anion exchange capacity;
    - Electrical conductivity;
    - Metals (full complex using ICP scan);
    - Petroleum hydrocarbons;
- Soil structure:
    - Relative fractions of sand, silt and clay;
    - Particle size distribution;
    - Water retention;
    - Permeability

Sampling frequency and parameters analysed must be reassessed based on results from air quality and surface water monitoring to determine whether there is a possibility of a sudden increase in pollutants that will result in more frequent sampling, especially during the rainy season.

Apart from the parameters indicated above, each monitoring round should include a physical observation and reporting of the following:

- Evidence of erosion or land degradation;
- Condition of access roads;
- Condition of cleared areas;
- Condition of perimeter drains (if installed) and associated settlement ponds (if installed);
- Compliance with applicable regulatory and corporate requirements.

8.5 Performance Assessment/Audit

Performance assessment audits are required in terms of Regulation 55(1) of the MPRDA Regulations, R527. In order to comply with this regulation, the following will be undertaken:

- Monitoring which will be conducted on an ongoing basis;
- Performance assessments of the environmental management programme annually, with an external performance assessment audit every two (2) years or as agreed by the Minister in writing. The annual performance assessment will be undertaken by a suitably qualified person, while the audit will be undertaken by an external, independent third party; and
- Submission of a performance assessment report to the Director of the DMR in Mpumalanga.

9 ENVIRONMENTAL AWARENESS AND EMERGENCY RESPONSE PLAN

This chapter fulfils the requirements as per Regulation 51 (b) (iii) of the MPRDA Regulation R527 and headings 7 and 10 of the EMP Template.

<u>REGULATION 51 (B)</u> *– Outline of the implementation programme.*

- (*Section 7) Procedures for environmentally related emergencies and remediation (An environmental emergency plan that includes all the items referred to in the concomitant section of the guideline posted on the official website of the Department)*
- *(Section 10): Environmental Awareness Plan (Section 39 (3) (c)) (Include all the items referred to in the concomitant section of the guideline posted on the official website of the Department).*

The environmental awareness plan is required in terms of Section 39 (3) (c) of the MPRDA:
"An applicant who prepares an environmental management programme or an environmental management plan must –

(a) develop an environmental awareness plan describing the manner in which the applicant intends to inform his or her employees of any environmental risks which may result from their work and the manner in which the risks must be dealt with in order to avoid pollution or the degradation of the environment".

The purpose of this chapter of the EMP is to set out procedures to be followed during and after various types of incidents and accidents. It also sets out the procedure for inducting employees and informing all mine employees and contractors of the various risks which may results from the various activities on site and all required management and mitigation measures which are in place and that must be complied with in order to avoid environmental pollution and degradation.

The Environmental Awareness and Emergency Response Procedures as developed by Exxaro for Leeuwpan is attached under Appendix E.

10 FINANCIAL PROVISION FOR CLOSURE

This chapter of the report fulfills the requirements as per section 41 and 45 of the MPRDA and Regulation 53 and 54 of the MPRDA Regulation R527 and heading 9 of the EMP Template.

EMP Template:

- *(Section 2 – 9): Financial provision in relation to the execution of the environmental management programme:-*
    - *(Section 2 - 9.1): Plan showing the location and aerial extent of the aforesaid main mining actions, activities, or processes anticipated. (Include all the items referred to in the concomitant section of the guideline posted on the official website of the Department)*
    - *(Section 2 - 9.2): Annual forecasted financial provision calculation (Refer to the concomitant section of the EIA and EMP guideline);*
    - *(Section 2 - 9.3): Confirmation of the amount that will be provided should the right be granted;*
    - *(Section (2 - 9.4): The method of providing financial provision contemplated in Regulation 53.*

The closure cost estimate is undertaken in accordance with the Guideline Document for the Evaluation of the Quantum of Closure Related Financial Provision Provided by a Mine, by the DMR (January, 2005).

10.1 Overview of Legal Requirements

Section 41 and 45 of MPRDA:

- Section 41(1): Requires that an applicant must before the Minister approves the EMP in terms of section 39(4) make the prescribed “financial provision” for the rehabilitation or management of negative environmental impacts.
- Section 41(2): If a holder of a mining right fails to rehabilitate / manage, is unable to undertake such rehabilitation or to manage any negative impact on the environment, the Minister may upon written notice to such holder, use all or part of the financial provision to rehabilitate or manage the negative environmental impact in question.
- Section 41(3): Require the holder to undertake an annual assessment of his or her environmental liability and increase his or her financial provision to the satisfaction of the Minister.
- Section 45: Allows the Minister to recover cost in the event of urgent remedial measures.

Regulation 53 and 54 of the MPRDA Regulation R527:

- Regulation 53 sets out the methods for providing the financial provision required, i.e. trust fund, financial guarantee by a bank or other financial institution, or direct deposit into a bank account stipulated by the DMR Director General;
- Regulation 54: Requires that the quantum of financial provision to be approved by the Minister must be based on the requirements of the approved EMP and shall include detailed itemization of all actual costs required for premature closure regarding:
  - The rehabilitation of the surface of the area;
  - The prevention and management of pollution of the atmosphere;
  - The prevention and management of pollution of water and the soil; and
  - The prevention of leakage of water and minerals between subsurface formations and the surface.
  - Decommissioning and final closure of the operation; and
  - Post closure management or residual latent environmental impacts.

10.2 Closure Goal

The overall closure goal for the proposed Leeuwpan mine area is to return the disturbed areas to a state that is as close as possible to the natural conditions. Leeuwpan aims to progressively re-instate an area that is safe, stable, and non-polluting to be integrated into the current land uses (cattle and game farming).

10.3 Summary of Closure Cost

The detailed financial provision is provided in the Closure Cost tables attached under Appendix F.

The costs is calculated for the current Leeuwpan Coal Mine and for immediate closure, based on the current mine plan (Refer to the project description under Chapter 2 and the proposed surface layout under Figure 2.2) are:

Table 10.1 Closure Cost Summary

SubTotal 1		**R 275 742 024.02**
SPECIALIST STUDIES 5%	1%	R 2 757 420.24
CONSULTANTS FEES 0%	0%	R 0.00
CONTINGENCY (DMR Requirement)	10%	R 27 574 202.40
P&G'S 6 % (DMR Requirement if Sub-Total 1 > than R100,000,000)	6%	R 16 544 521.44
Engineering and Project management 0%	0%	
Management & Personel 0%	0%	
Monitoring 1%	1%	R 2 757 420.24
I&AP Processes 1%	1%	R 2 757 420.24
GRAND TOTAL		**R 328 133 008.59**

Please note that the financial provision for Leeuwpan will be updated in the final EIA/EMP Report to reflect additional rehabilitation costs associated with the addition of the OI Expansion Project.

11 ENVIRONMENTAL REHABILITATION PLAN

This chapter fulfills the requirement of Regulation 39 (4) (a) (iii) of the MPRDA Regulations R527 and Chapter 13 of the EMP Template:

- *Section (2- 13): SECTION 39 (4) (a) (iii), Capacity to manage and rehabilitate the environment (Include all the items referred to in the concomitant section of the guideline posted on the official website of the Department)*

Due to the fact that several of the specialist investigations require updating due to infrastructure location changes, the rehabilitation plan has not been completed. Please note that the final Rehabilitation Plan for Leeuwpan will be submitted with the final submission of the EIA/EMP Report to the Competent Authorities.

12 INFORMATION GAPS AND FURTHER WORK REQUIRED

REGULATION 50 (g):

- *(Section 14): The appropriate mitigatory measures for each significant impact of the proposed mining operation.*
    - *(Section 14.1): Adequacy of predictive methods utilized:*
    - *(Section 14.2): Adequacy of underlying assumptions:*
    - *(Section 14.3): Uncertainties in the information provided.*

Due to the fact that several of the specialist investigations require updating due to infrastructure location changes, the information gaps and the adequacy of the information cannot be fully assessed at present and the section will be completed upon completion of the final specialist studies.

Please note that the section will be updated and submitted with the final submission of rht ethe EIA/EMP Report to the Competent Authorities.

13 LIST OF SPECIALIST REPORTS

This chapter provides a list of the specialist reports which are appended to this EIA/EMP as required by section 2 – 11 and 2 – 16 of the DMR EIA/EMP Template:

- *Section 2 -11): Attachment of specialist reports, technical and supporting information. (Provide a List)*

REGULATION 50 (i):

- *(Section 2 – 16): Technical and supporting information. (Include all the items to be included in the list referred to in the concomitant section of the guideline posted on the official website of the Department)*

The following Specialist studies were undertaken during July 2012 and January 2013. The specialist studies were recommissioned after a change in planning and the locality of key infrastructure, these amendments to initial studies commenced in December 2013 and will be complete in January 2014.

These reports are attached as appendices to this EIA/EMP report:

- Soils, Land Use and Land Capability Assessment, attached in Appendix C-1;
- Draft Biodiversity Assessment including both Flora and Fauna Assessments for the attached in Appendix C-2, final will be submitted with the final EIA/EMP;
- Draft Hydrology Report attached in Appendix C-3, please note that the Final Hydrology report with updated water balance and Stormwater Management Plan will be submitted with the final EIA/EMP;
- Hydrogeology Assessment still ongoing and the final Hydrogeology Study will be submitted with the final EIA/EMP Appendix C-4;
- Draft Wetlands Assessment is attached in Appendix C-5, the updated wetland assessment will be submitted with the final EIA/EMP;
- Draft Air Quality Assessment is attached in Appendix C-6, the updated and final air quality assessment will be submitted in final EIA/EMP;
- Historical Assessment attached in Appendix C-7;
- Noise Assessment attached in Appendix C-8;
- Blasting Assessment attached in Appendix C-9;

- Social Impact Assessment attached in Appendix C-10; and
- Traffic Assessment is attached in Appendix C-11.

14 UNDERTAKING

This chapter of the report complies with Section 13 of the EMP Template:

- *(Section 1 - 13.1): The Environmental Management Programme will, should it comply with the provisions of section 39 (4) (a) of the Act and the right be granted, be approved and become an obligation in terms of the right issued. As part of the proposed Environmental Management Programme, the applicant is required to provide an undertaking that it will be executed as approved and that the provisions of the Act and regulations thereto will be complied with.*

The signed undertaking is provided on the next page.

UNDERTAKING

(to be completed upon the final submission)

I, ____. , the undersigned and duly authorised thereto by Exxaro Leeuwpan Coal, have studied and understand the contents of this Environmental Management Programme (EMP) and duly undertake to adhere to the conditions as set out therein, unless specifically or otherwise agreed to.

Signed at ____________________________________, on this ______, day of ______________ 201__

____

Signature of Applicant

I, ____, the undersigned and duly authorised thereto by the DEPARTMENT OF MINERAL RESOURCES, have studied and approved the contents of this Environmental Management Programme (EMP).

Signed at ____________________________________, on this ______, day of ______________ 201__

____

Signature of Director

15 CONCLUSION

Project Description

In terms of Section 102 of the MPRDA Leeuwpan requires authorisation for the proposed activities in the form of an amendment to the existing Environmental Management Programme (EMP), which must be approved by the DMR in Mpumalanga, before construction may begin. The DMR, however, requested Exxaro to consolidate all the previous EMPR's (refer to 1.1.1 to 1.1.6) for the existing operations. The consolidation of EMPR's was requested in addition to the proposed mining of Block OI in order to have one EMP for the entire operations. The MPRDA process will thus address the entire operations as a whole including all activities regarding the proposed Block OI expansion.

Leeuwpan is planning the development of an additional opencast pit (Block OI) which will be located on portions of the farm Moabsvelden and Rietkuil. The mineral rights belong to Exxaro, however the certain portions of these farms are privately owned and utilised for agricultural practices.

Environmental Authorization Processes

The environmental processes involved with the project will be undertaken in three (3) parallel processes namely the NEMA process for all the associated listed activities, the MPRDA process to develop a consolidated EIA/EMP for the DMR, and the NWA process regarding the water uses that will be associated with the proposed development.

The following documents will be submitted to the indicated competent authorities:

- Consolidated EIA/EMP under MPRDA: Department of Mineral Resources (hereinafter referred to as "*DMR*"), in Mpumalanga;
- EIA/EMP under NEMA: Mpumalanga Department of Economic Development, Environment and Tourism (hereinafter referred to as "*MDEDET*"); and
- IWULA and Integrated Waste and Water Management Plan (IWWMP) under NWA: Department of Water Affairs (hereinafter referred to as "*DWA*").

Public Participation

The Public Participation Process (PPP) has been initiated as part of the requirements of the NEMA; MPRDA; and NWA. A Background Information Document (BID) was sent to all stakeholders and Interested and Affected Parties (IAPs) on the existing Leeuwpan database and the identified stakeholders as per the requirements of the NEMA and MPRDA. The database is being updated continuously as new stakeholders and/or IAPs register for the project.

Advertisements regarding the project background and the assessment process being followed were placed in the following newspapers:

- The Citizen on 9th of November 2012; and
- Streeknuus on 16th of November 2012.

Site notices regarding the project background and the assessment process being followed were also put up around the project site.

Please note that this process is still ongoing and will be completed upon the final submission of the EIA/EMP to the competent authority.

Specialist Studies conducted

- Soils, Land Use and Land Capability Assessment;
- Draft Biodiversity Assessment including both Flora and Fauna Assessments;
- Draft Hydrology Report, please note that the Final Hydrology report with updated water balance and Stormwater Management Plan will be submitted with the final EIA/EMP;
- Hydrogeology Assessment still ongoing and the final Hydrogeology Study will be submitted with the final EIA/EMP;
- Draft Wetlands Assessment, the updated wetland assessment will be submitted with the final EIA/EMP;
- Draft Air Quality Assessment, the updated and final air quality assessment will be submitted in final EIA/EMP;
- Historical Assessment;
- Noise Assessment;
- Blasting Assessment;
- Social Impact Assessment; and
- Traffic Assessment is attached in Appendix C-11

Please note: Due to infrastructural changes specialist studies are in the process to be updated and completed to take all the related changes into consideration with regards to their environmental impacts on the area.

Environmental Impacts and Mitigation:

The main activities which will create impacts during the different phases of the mine life cycle were assessed during the EIA and mitigation and management measures developed thereto (Refer to Chapter 7 of this document). The main activities are:

Construction

- Land clearing
- Soil stripping and stockpiling
- Infrastructure establishment
- Boxcut establishment (earthworks only)
- Waste handling

Operational

- Opencast mining of existing and new blocks
- Operation of existing and new plants
- Operation and maintenance of linear infrastructure (haul road, powerlines and conveyors)
- Storage of dangerous goods (diesel and explosives)
- Operation and maintenance of dirty water containment dams
- Operation of stockpiles (topsoil, product, including coal mixing bed)
- Maintenance of river diversion

Decommissioning and Closure

- Removal of infrastructure
- Active rehabilitation
- Post closure aftercare and monitoring

Monitoring of Programme

Aspect	Component	Frequency of data collection
Surface water	Surface water quality	Monthly
	Water consumption levels	Daily
Groundwater	Groundwater quality	Quarterly
Biomonitoring	Biological integrity of aquatic habitats	Biannually
Air quality	Dust fallout	Quarterly

Aspect	Component	Frequency of data collection
Rehabilitation	Soil	Quarterly
	Vegetation	Periodically
	Animal life	Annually
Noise	Noise levels	Monthly
Topography	Surface movement (subsidence)	Quarterly
Integrated Management System	Identification of deviations from standards	Periodically
Performance assessment	Assessment of adequacy of EMP commitments	Biennially

Motivation for the Project

The proposed project will result in the expansion of the life of mine with an additional 18 years. The additional coal resources will supply Eskom with coal for power generation.

The mine has an approved Social and Labour Plan which is set out on injecting capital, skills and services into the district municipality. Should this project be approved, and the life of mine increased, the district municipality will continue to benefit from the mining operations.

However, as with many coal opencast mines', especially in the Mpumalanga Province, there are the unavoidable environmental and social impacts. Should the project be approved the project will necessitate the permanent removal of disturbed wetlands. The project may also have a cumulative impact on water resources in the area and the loss of flora and fauna.

Exxaro is however committed to ensure that all the necessary specialist studies are undertaken to identify the potential impacts and also the significance of these. Based on this detailed management programmes will be established for soil management, ecological management, surface water and wetland management, groundwater management, air quality management, visual and noise management and any other management programme deemed necessary to reduce or eliminate potential negative impacts and enhance the positive impacts associated with the project. Exxaro is committed to investigate options for long term sustainable wetland management programmes and also possibly the potential for establishing off-set areas.

If the ‘No Project’ alternative were implemented, all possible positive impacts resulting from the proposed development would be lost and in terms of the life of mine, closure of the facility will be required within three (3) years. The mine currently employs approximately 500 permanent staff and 400 contractor staff who will be impacted significantly in this event. The overall contribution to the chronic unemployment levels on a national scale, in addition to the required for coal for electricity generation makes the ‘No Project’ option strongly unadvisable. For the above-mentioned reasons, the implementation of the 'No Project' option is not advisable.

16 REFERENCES

Air Quality

APCD 1995. Colorado State Implementation Plan for Particulate Matter (PM10) - Denver Metropolitan Non-attainment Area Element, jointly prepared by Regional Air Quality Council and Colorado Department of Health, Air Pollution Control Division, signed into law on May 31 1995.

BOTHA B. W. 2008. Management of the Mineral Resource Risk associated with Near-Density Material in the Beneficiation Plant at Leeuwpan Coal Mine. MSc dissertation, Faculty of Natural and Agricultural Science, University of Pretoria.

CEPA/FPAC WORKING GROUP 1998. National Ambient Air Quality Objectives for Particulate Matter. Part 1. Science Assessment Document, A Report by the Canadian Environmental Protection Agency (CEPA) Federal-Provincial Advisory Committee (FPAC) on Air Quality Objectives and Guidelines.

CERC 2004. ADMS Urban Training. Version 2. Unit A.

DEPARTMENT OF ENVIRONMENTAL AFFAIRS 2012Draft HPA AQMP Baseline Assessment - March 2010.

DEPARTMENT OF ENVIRONMENTAL AFFAIRS.2011. Draft HPA AQMP Baseline Assessment - April 2011.

DEPARTMENT OF ENVIRONMENTAL AFFAIRS 2011. State of Air Quality Governance Report.

DOCKERY D. W.& POPE C. A. 1994. Acute Respiratory Effects of Particulate Air Pollution, Annual Review of Public Health, 15, 107-132.

NATIONAL POLLUTANT INVENTORY (NPi).2012. Emissions Estimation Technique Manual for Mining, Version 3.2.

PIKETH S. J.1994. Generation, transportation and characterisation of suspended particles in the eastern Transvaal. Masters Thesis, University of the Witwatersrand, Johannesburg, South Africa.

SCHULZE B. R.1986. Climate of South Africa. Part 8. General Survey, WB 28, Weather Bureau, Department of Transport, Pretoria, 330 pp.

TIWARY, A., & COLLS, J. 2010. Air pollution: measurement, monitoring and mitigation (3rd Edition ed.). Oxon: Routledge.

US EPA. 1998. AP42 5th Edition Volume 1.

WHO 2005. WHO Air Quality Guidelines Global Update, World Health Organisation, October 2005, Germany.

Biodiversity Assessment

Environmental/ landscape overview and vegetation assessment

BARBOUR, M.G.BURK, J.H. & PITTS, W.D. 1980. Terrestrial Plant Ecology. Benjamin/Cummings Publishing Company, California.

BOTHMA, J du P. 1995. Wildsplaasbestuur Nuwe uitgebreide uitgawe. 2de Uit. Struik Uitgewers

COWAN, G.I. (ed) 1995. Wetlands of South Africa. Department of Environmental Affairs and Tourism, Pretoria

DE FREY, W.H. 1999. Phytosociology Of Southeastern Mpumalanga High Altitude Grasslands. MSc Thesis, University of Pretoria

DWAF. 2005. A practical field procedure for identification and delineation of wetlands and riparian areas. Edition 1. Department of Water Affairs and Forestry, Pretoria

EWART-SMITH, J., OLLIS, D., DAY, J & MALAN, H 2006. NATIONAL WETLAND INVENTORY: Development of a Wetland Classification System for South Africa. The Water Research Commission (WRC)

FEY, M. 2010. Soils of South Africa. Cambridge

FORMAN, R.T.T., SPERLING, D., BISSONETTE, J.A., CLEVENGER, A.P., CUTSHALL, C.D., DALE, V.H., FAHRIG, L., FRANCE, R., GOLDMAN, C.R., HEANUE, K., JONES, J.A., SWANSON, F.J., TURRENTINE, T., WINTER, T.C. 2003. ROAD ECOLOGY Science and Solutions. Island Press

GERMISHUIZEN, G & MEYER, N.L. (eds) 2003. Plants of southern Africa: an annotated checklist. Strelitzia 14. National Botanical Institute, Pretoria.

GIBBS RUSSELL, G.E., WATSON, L., KOEKEMOER, M., SMOOK, L. BARKER, N.P., ANDERSON, H.M. & DALWITZ, M.J. 1990. GRASSES OF SOUTHERN AFRICA. National Botanical Gardents, South Africa

GOLDING, J (Ed.s), 2002. Southern African Plant Red Data Lists. Sabonet Report no. 14.SouthernAfrican Botanical Diversity Network. Pretoria

HILTY, J.A., LIDICKER JR., W.Z. & MERENLENDER, A.M. 2006. CORRIDOR ECOLOGY The Science and Practice of Linking Landscapes for Biodiversity Conservation. Island Press

JOHNSON, M.R., ANHAEUSSER, C.R. & THOMAS, R.J. (Eds) 2006. The Geology of South Africa. Geological Society of South Africa, Johannesburg/ Council of Geoscience, Pretoria, 691 pp

KEDDY P. 2005. Putting the Plants Back into Plant Ecology: Six Pragmatic Models for Understanding and Conserving Plant Diversity. Annals of Botany 96: 177 - 189

KENT, M. & COKER, P. 1992. Vegetation Description and Analysis: A practical Approach. John Wiley & Sons, Chichester.

LE ROUX, J. 2002. THE BIODIVERSITY OF SOUTH AFRICA 2002 Indicators, Trends and Human Impacts. Endangered Wildlife Trust, Struik Publishers

LEISTNER, O.A. (ed) 2000. Seed plants of southern Africa: families and genera. Strelitzia 10. National Botanical Institute, Pretoria

LINDENMAYER, D.B. & FISCHER, J. 2006. Habitat Fragmentation And Landscape Change An Ecological And Conservation Synthesis. Island Press, USA

MC MURTY, D., GROBLER, L, GROBLER, J. & BURNS, S. 2008. Field Guide to the ORCHIDS of Northern South Africa and Swaziland. Umdaus Press, Hatfield

MUCINA, L. & RUTHERFORD, M.C. (eds) 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

NEL, J., MAREE, G., ROUX, D., MOOLMAN, J., KLEYNHANS, N., SILBERBAUER, M. & DRIVER, A. 2004. South African National Spatial Biodiversity Assessment 2004: Technical Report. Volume 2: River Component. CSIR Report Number ENV-S-I-2004-063. Council for Scientific and Industrial Research, Stellenbosch.

READ, H.H. & WATSON, J. 1983. Introduction to Geology Volume 1 PRINCIPLES. Macmillan Press Ltd, Hong Kong

RETIEF, E. & HERMAN, P.P.J. 1997. Plants of the northern provinces of South Africa: keys and diagnostic characters. Strelitzia 6: 1 – 681.

ROUGET, M., REYERS, B., JONAS, Z., DESMET, P., DRIVER, A., MAZE, K., EGOH, B. & COWLING, R.M. 2004. South African National Spatial Biodiversity Assessment 2004: Technical Report. Volume 1: Terrestrial Component. Pretoria: South African National Biodiversity Institute.

SOIL CLASSIFICATION WORKGROUP 1991. Soil classification a taxonomic system for South Africa.Memiors oor die Natuurlike Landbouhulpbronne van Suid-Afrika Nr. 15.

STRAHLER, A.N. & STRAHLER, A.H. 1987. Modern Physical Geography Third Edition. Wiley & Sons, New York

TAINTON, N. 1999. Veld Management in South Africa. University of Natal Press

TURNER, M.G., GARDNER, R.H., & O'NEILL, R.V. 2001. Landscape Ecology In Theory And Practice Pattern And Process. Springer, USA

VAN ANDEL, J & ARONSON, J (Eds). 2006. RESTORATION ECOLOGY - The New Frontier. Blackwell Publishing

VAN OUDTSHOORN, F.P. 1991. Gids tot grasse van Suid-Afrika. Briza Publikasies Bk. Arcadia.

VAN WYK, B. & MALAN, S. 1988. Veldgids tot die veldblomme van die Witwatersrand-&Pretoria-gebied. Struik Uitgewers, Kaapstad.

VAN WYK, B-E, VAN OUDTSHOORN, B. & GERICKE, N. 2000. MEDICINAL PLANTS OF SOUTH AFRICA. BRIZA, Pretoria.

WHITE, R.E. 1987. Introduction to the Principles and Practice of Soil Science. Blackwell Scientific Publications, Australia

WIENS, J.A., MOSS, M.R., TURNER, M.G. & MLADENOFF, D.J. 2006. Foundation Papers In Landscape Ecology. Columbia University Press, New York

Avifauna and invertebrate ecological assessment

BARNES, K.N. 1998. The Important Bird Areas of southern Africa. BirdLife South Africa, Johannesburg.

BARNES, K.N. 2000. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. BirdLife South Africa, Johannesburg.

BUCKLAND, S.T., ANDERSON, D.R., BURNHAM, K.P., LAAKE, J.L. 1993. Distance Sampling: Estimating abundance of biological populations. Chapman and Hall, London.

CLARKE, K.R. & WARWICK, R.M. 1994. Changes in marine communities: An approach to statistical analysis and interpretation. Natural Environmental Research Council, United Kingdom.

DAVIS, A.L.V., FROLOV, A.V. & SCHOLTZ, C.H. 2008. The African dung beetle genera. Protea Book House, Pretoria.

DEL HOYO, J., ELLIOTT, A. & CHRISTIE, D.A. eds. (1992-2011). Handbook of the Birds of the World. Vol 1-16. Lynx Edicions, Barcelona.

FEINSINGER, P. 2001. Designing field studies for biodiversity conservation. The Nature Conservancy. Island Press.

GILL, F. & DONSKER, D. eds. 2012. IOC World Bird Names (v. 2.11).

HALFFTER, G., FAVILA, M. & HALFFTER, V. 1992. A comparative study of the structure of the scarab guild in Mexican tropical rain forests and derived ecosystems. Folia Entomologica Mexicana 84: 131-156.

HANSKI, I. & CAMBEFORD, Y. 1991. Dung beetle ecology. Princeton University Press, Princeton.

HARRISON, J.A., ALLAN, D.G., UNDERHILL, L.G., HERREMANS, M., TREE, A.J., PARKER, V. & BROWN, C.J. (eds.). 1997. The Atlas of Southern African Birds. Vol. 1 & 2. BirdLife South Africa, Johannesburg.

HENNING, G.A., TERBLANCHE, R.F. & BALL, J.B. (eds.) 2009. South African Red Data Book: butteflies. SANBI Biodiversity Series 13. South African National Biodiversity Institute, Pretoria.

HOCKEY, P.A.R., DEAN, W.R.J. & RYAN, P.G. (eds.) 2005. Roberts – Birds of Southern Africa, VIIth ed. The Trustees of the John Voelker Bird Book Fund, Cape Town.

NEW T.R. 1997. Butterfly conservation. Second edition. Oxford University Press, Melbourne, Australia.

IUCN Red List of Threatened Species. Version 2012. http://www.iucnredlist.org/.

KRELL F-T. 1998. Preliminary key to the South African (and Namibian) genera of coprophagous Scarabaeidae. Unpublished report.

MUCINA L. & RUTHERFORD M.C. (eds) 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

NEW T.R. 1997. Butterfly Conservation. Oxford University Press.

SCHOLTZ C.H. DAVIS L.V. & KRYGER U. 2009. Evolutionary biology and conservation of dung beetles. Pensoft Publishers, Bulgaria.

SIBLEY C.G. & AHLQUIST J.E. 1990. Phylogeny and classification of birds. Yale University Press, New Haven.

SUTHERLAND W.J. 2006. Ecological census techniques. A handbook. 2nd Edn. Cambridge University Press.

SUTHERLAND W.J., NEWTON, I. & GREEN, R.E. 2004. Bird Ecology and Conservation. A handbook of techniques. Oxford University Press,

TARBOTON W. 2001. A guide to the Nests & Eggs of Southern African Birds. Struik Publishers, Cape Town.

WOODHALL S. 2005. Field guide to the butterflies of South Africa. Struik Publishers, Cape Town.

www.sabap2.adu.org.za

ZILIHONA I. & NUMMELIN M. 2001. Coleopteran diversity and abundance in different habitats near Kihansi waterfall, in the Udzungwa Mountains, Tanzania. Biodiversity and Conservation 10: 769–777.

Herpetofauna ecological assessment

BRANCH, W.R. ed. 1988. South African red data book – Reptiles and amphibians. NMB Printers, Port Elizabeth.

BRANCH, W.R. 1998. Field guide to snakes and other reptiles of southern Africa. Struik, Cape Town.

CORN, P.S. & BURY, B.R. 1990. Sampling methods for terrestrial amphibians and reptiles. In: Wildlife-Habitat Relationships: Sampling Procedures for Pacific Northwest Vertebrates. Andrew B. Carey and Leonard F. Ruggiero, Technical Editors.

CROSSWHITE, D.L., FOX, S.F. & THILL, R.E. 1999. Comparison of Methods for Monitoring Reptiles and Amphibians in Upland Forests of the Ouachita Mountains. Proc. Okla. Acad. Sci. 79:45-50

DU PREEZ, L. & CARTUTHERS, V. 2009. A complete guide to the frogs of southern Africa. Struik, Cape Town.

MASTERSON, G.P.R., MARITZ, B., MACKAY, D. & ALEXANDER, G.J. 2009. The impacts of past cultivation on the reptiles in a South African grassland. African Journal of Herpetology 58(2): 71-84

NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT. 2004 (act 10 of 2004): Publication of lists of critically endangered, endangered, vulnerable and protected species.

WWW.IUCNREDLIST.ORG. 2010. The IUCN red data list website.

http://vmus.adu.org.za/. 2010. The Southern African Reptile Conservation Assessment (SARCA) and the Southern African Frog Atlas Project (SAFAP) website.

Mammal ecological assessment

SKINNER J.D.& CHIMIMBA C.T. 2007. The Mammals of the Southern African Subregion (New Edition). Cambridge University Press. South Africa.

ENDANGERED WILDLIFE TRUST. 2004. Red Data Book of the Mammals of South Africa: A Conservation Assessment. CBSG Southern Africa, Parkview, South Africa.

LIEBENBERG L. 2005. A Field Guide to the Animal Tracks of Southern Africa. David Phillips Publishers. South Africa.

SCHMIDT-NIELSEN K. 1995. Animal physiology, fourth edition. Cambridge University Press.

STUART C.& STUART T. 1998. A Field Guide to the Tracks and Signs of Southern and East Africa. Southern Book Publishers. South Africa.

IUCN LIST OF THREATENED SPECIES. 2010. U. R. L. www.iucnredlist.org

Groundwater

CLEANSTREAM ENVIRONMENTAL SERVICES (2007). Leeuwpan Coal: Extension of Block OD and UI, Draft EIA. Ref No: ERL/LC/03/2007.

Heritage Impact Assessment Report

Archaetnos database.

BERGH J.S. (ed.). 1999. Geskiedenisatlas van Suid-Afrika. Die vier noordelike

provinsies. Pretoria: J.L. van Schaik.

COERTZE P.J. & COERTZE, R.D. 1996. Verklarende vakwoordeboek vir Antropologie en Argeologie. Pretoria: R.D. Coertze.

HUFFMAN T.N. 2007. Handbook to the Iron Age: The Archaeology of Pre-Colonial Farming Societies in Southern Africa. Scottsville: University of KwaZulu-Natal Press.

KNUDSON, S.J. 1978. Culture_in retrospect. Chicago: Rand McNally College Publishing Company.

KORSMAN S.A. & MEYER A. 1999. Die Steentydperk en rotskuns. Bergh, J.S. (red.).

Geskiedenisatlas van Suid-Afrika. Die vier noordelike provinsies. Pretoria: J.L. van Schaik.

PISTORIUS J.C.C. 2007. A phase 1 heritage impact assessment (HIA) STUDY FOR Moabsvelden 248, Rietkuil 249 and Wolvenfontein 244 near Delmas in the Mpumalanga Province of South Africa. (Unpublished report, Pretoria).

REPUBLIC OF SOUTH AFRICA. 1980. Ordinance on Excavations (Ordinance no. 12 of 1980). The Government Printer: Pretoria.

REPUBLIC OF SOUTH AFRICA. 1983. Human Tissue Act (Act 65 of 1983). The Government Printer: Pretoria.

REPUBLIC OF SOUTH AFRICA. 1999. National Heritage Resources Act (No 25 of 1999). Pretoria: the Government Printer.

REBUPLIC OF SOUTH AFRICA. 1998. National Environmental Management Act (no 107 of 1998). Pretoria: The Government Printer.

SAHRA database.

VAN DER RYST M.M. & MEYER A. 1999. Die Ystertydperk. Bergh, J.S. (red.).

Geskiedenisatlas van Suid-Afrika. Die vier noordelike provinsies. Pretoria: J.L. van Schaik.

VAN SCHALKWYK J.A., 2006. Cultural Heritage Scoping report for the proposed Leeuwpan mining development, Delmas district, Mpumalanga. (Unpublished report, National Cultural History Museum. Pretoria).

Social Impact Assessment

Quantec Research (Pty) Ltd

http://www.delmasmunic.co.za/

http://en.wikipedia.org/wiki/Mpumalanga_Province

http://en.wikipedia.org/wiki/Nkangala_District_Municipality

http://en.wikipedia.org/wiki/Delmas_Local_Municipality

Socio-Economic

DELMAS LOCAL MUNICIPALITY 2009. Integrated Development Plan 2008-2009

DEPARTMENT OF ECONOMIC DEVELOPMENT AND PLANNING , MPUMALANGA PROVINCE 2008. Mpumalanga Economic Profile.

DEPARTMENT OF COOPERATIVE GOVERNANCE AND TRADITIONAL AFFAIRS 2005. Mpumalanga Province Project Consolidate.

NKANGALA DISTRICT MUNICIPALITY(UNDATED). Economic Profile of the Nkangala District Municipality. Available online at: http://www.nkangaladm.org.za/

WWF (2011). Coal and Water Futures in South Africa: A case for conserving headwaters in the Ekangala grasslands.

Wetland Assessment

BRINSON M. M. 1993. A hydrogeomorphic classification for wetlands. Wetlands Research Program Technical Report WRP-DE-4. U. S. Army Corps of Engineers, Waterway Experiment Station. Vicksburg, MS: Bridgham and Richardson.

CEMAGREF.1982. Etude des méthodes biologiques quantitatives d'appréciation de la qualité des eaux. Rapport Division Qualité des Eaux Lyon - Agence Financiére de Bassin Rhône-Méditerranée- Corse. Pierre-Benite

DEPARTMENT OF WATER AFFAIRS AND FORESTRY. 1999a. Resource Directed Measures for Protection of Water Resources. Volume 4. Wetland Ecosystems Version 1.0, Pretoria.

DEPARTMENT OF WATER AFFAIRS AND FORESTRY. 1999b. Resource Directed Measures for Protection of Water Resources. Volume 1. River Ecosystems Version 1.0, Pretoria.

DEPARTMENT OF WATER AFFAIRS AND FORESTRY, 2005. A practical field procedure for identification and delineation of wetland and riparian areas. DWAF, Pretoria.

KLEYNHANS C.J. 1996. A qualitative procedure for the assessment of the habitat integrity status of the Luvuvhu River. Journal of Aquatic Ecosystem Health 5: 41 - 54.

KLEYNHANS C.J. 1999. A procedure for the determination of the ecological reserve for the purposes of the national water balance model for South African Rivers. Institute for Water Quality Studies. Department of Water Affairs and Forestry, Pretoria.

KOTZE D.C, MARNEWECK G.C., BATCHELOR A.L., LINDLEY D. and COLLINS N. 2004. Wetland Assess: A rapid assessment procedure for describing wetland benefits. Mondi Wetland Project, Unpublished report.

LENOIR A. and COSTE M. 1996. Development of a practical diatom index of overall water quality applicable to the French National Water Board network. In: Whitton B.A and E. Rott (eds) Use of Algae for Monitoring Rivers 11. lnstitut für Botanik. Universität lnnsbruck: 29-43.

MARNEWECK G.C. and BATCHELOR A. 2002. Wetland inventory and classification. In: Ecological and economic evaluation of wetlands in the upper Olifants River catchment. (Palmer, R.W., Turpie, J., Marneweck, G.C and Batchelor (eds.). Water Research Commission Report No. 1162/1/02.

McCARTNEY, M.P. 2000. The water budget of a headwater catchment containing a dambo. Institute of Hydrology, Crowmarsh Gifford, Wallingford, Oxon, OX10 8BB, UK

PARSONS, R. 2004. Surface Water: Groundwater Interaction in a South African Context. Water Research Commission. WRC TT 218/03

PRYGIEL J.& Coste.M 2000. Guide méthodologique pour la mise en oeuvre de l'Indice Biologique Diatomées. NF T 90-354. Agence de l'eau Artois Picardie, Douai.

REPPERT R.T. SIGLEO W. SRACHKHIV E. MESSMAN L & MEYERS C. 1979. Wetland values: concepts and methods for wetlands evaluation. IWR Research Report 79-R-1, U.S. Army Corps Engineers, Fort Belvoir, VA.

TAYLOR J.C. HARDING W.R. & ARCHIBALD C.G.M 2007. A methods manual for the collection, preparation and analysis of diatom samples. Water Research Commission Report TT281/07. Water Research Commission. Pretoria.

WALKER L.R. 1999. Ecosystems of Disturbed Ground. In: Ecosystems of the World. Elsevier

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