ENVIRONMENTAL IMPACT ASSESSMENT REPORT AND ENVIRONMENTAL MANAGEMENT PLAN

KANGALA COAL MINE

UNIVERSAL COAL (PTY) LTD

MP 30/5/2/2/4929 MR

NOVEMBER 2009

DRAFT FOR PUBLIC REVIEW

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Your Comment on this Draft Environmental Impact Assessment Report and Environmental Management Plan

In accordance to the National Environmental Management Act, Act No.107 of 1998 (NEMA), Constitutional principles and the Promotion of Administrative Justice Act, Act No.3 of 2000 (PAJA), Interested and Affected Parties (I&AP) must be given an opportunity to comment on proposed projects which may impact on their environmental rights. In terms of the Mineral and Petroleum Resource Development Act, Act No. 28 of 2002 (MPRDA)Universal Coal (Pty) Ltd has submitted a Mining Right Application on portion 1 and the remaining extent (RE) of portion 2 the farm Wolvenfontein 244 IR in the Delmas area of the Mpumalanga Province of South Africa. Digby Wells and Associates (Pty) Ltd (DWA) are the appointed independent consultants responsible for completing the necessary environmental documentation in support of the Mining Right Application.

The purpose of the public review process of this draft Environmental Impact Assessment Report and Environmental Management Plan (EIAR EMP) is to allow I&AP's to review the document before completion and submission of the final document to the competent authorities and to ensure that comments raised during the public participation process have been recorded and form part of the findings. It also affords I&AP's an opportunity to issue additional comments and concerns for incorporation into the final document. Please note that there may be sections contained in this draft EIAR EMP which are not yet finalised due to time constraints or unforseen delays. The outstanding information will be included in the final report which will be made available for review in December 2009.

This draft EIAR EMP is available for public review at the following locations:

Place	Contact Person	Telephone Number
Delmas Library	Librarian	013 665 2425
Digby Wells & Associates	Helen Knight	011 789 9495

This draft report will be available electronically at www.digbywells.co.za

DUE DATE FOR COMMENT: 11 DECEMBER 2009

You may comment on this draft report by: post; email and/or fax.

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EXECUTIVE SUMMARY

Universal Coal (Pty) Ltd has submitted a Mining Right Application to mine coal on portion 1 and the remaining extent of portion 2 the farm Wolvenfontein 244 IR in the Delmas area of the Mpumalanga Province. The proposed project is known as the Kangala Coal Mine.

Universal Coal proposes to undertake opencast truck and shovel roll over mining of the No 2 and No 4 Coal seam of the Witbank Coal field. The extracted Run of Mine coal will be beneficiated on site yielding an export coal product and a secondary product suitable for the inland power generation market.

An estimated 295ha will be disturbed which equates to 31% of the total project area which is in line with the available coal reserve on the proposed project site. The total estimated Run of Mine reserve is 14.5Mt which will be mined over the 10 year Life of Mine.

All coal will be sold to a coal trading company which will transport the coal 10km via haul truck to the Leeuwpan rail siding.

Digby Wells and Associates (Pty) Ltd have conducted necessary social and environmental studies in order assess the impacts on the physical, biological and social environments within the proposed mining area. The impacts that mining is expected to have on these different environments have been assessed using a detailed quantitative impact assessment methodology. From the impact assessment it was determined that the most significant impacts will be on the following environmental aspects:

- Topography
- Soil
- Surface Water
- Wetlands
- Air Quality
- Air Blasting and Ground Vibration
- Traffic and Safety

(Groundwater investigations are currently not complete but will be finalised for inclusion into the final EAR EMP)

The potential impacts that the proposed project will have on the above environmental aspects will have a **medium-high** significance prior to the implementation of management measures. Taking into consideration the position of the proposed mining area within the catchment, it is recommended that direct impacts to the wetland areas be restricted to the proposed opencast areas only and mining activities adhere to the 1:100 year floodlines and described buffer zones. Additionally, the functioning of the wetland areas which will be lost and should be artificially

created so as to ensure the survival of the remaining wetland areas and larger system as a whole, ensuring water quality provision and enhancement services continue.

Universal Coal will need to implement the management plan included within this document as well as additional operating procedures and management plans in order to ensure that the potential impacts are controlled, monitored and prevented if possible. It needs to be ensured that the management plan is communicated to all levels of employees including contractors that will be working on the mine. The environmental management plan needs to be implemented pre-construction through the life of mine. Annual performance assessments of Kangala Coal Mine to their environmental management plan must be undertaken to access compliance.

From the information gathered during the EIA process it can be concluded that the proposed mine's overall impact on the natural environment will be of a medium significance. If all the mitigation measures, management and monitoring procedures recommended in this report are adhered to, the impacts will significantly be reduced.

Digby Wells and Associates entrusts that this EIAR EMP will provide adequate information for an informed decision to be made on the approval of the Mining Right.

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ABBREVIATIONS

Acronym	Description
ABA	Acid-base accounting
AIA	Archaeological Impact Assessment
AMD	Acid mine drainage
BIDs	Background Information Documents
BPG	Best Practice Guidelines
Ca	Calcium
CBOs	Community Based Organisations
dBA	A-weighted decibels
DME	Department of Minerals and Energy
DTM	Digital Terrain Model
DWA	Digby Wells & Associates
DWAF	Department of Water Affairs and Forestry
EAP	Environmental Assessment Practitioner
ECA	Environmental Conservation Act, Act No 73 of 1989
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMP	Environmental Management Programme
GG	Government Gazette
GN	Government Notice
GIS	Geographic Information System
g/t	grams per tonne
ha	hectare
I&APs	Interested and Affected Parties
K	Potassium
ktpm	kilo tonnes per month
kV	kilo Volts
l/s	Litres per second
LoM	Life of Mine
m^3/d	Meters cubed per day
Mm^3	Million cubic meters

Acronym	Description
m.a.m.s.l.	meters above mean sea level
MAP	Mean Annual Precipitation
MDALA	Mpumalanga Department of Agriculture and Land Administration
mbgl	Meters below ground level
Mg	Magnesium
Ml	Mega litres
MPRDA	Minerals and Petroleum Resources Development Act, No. 28 of 2002
MRA	Mining Right Application
mS/m	millisiemens per meter
Mt	Mega tonnes
NEMA	National Environmental Management Act, No.107 of 1998
NEMAQA	National Environmental Management Air Quality Act, No39 of 2004
NEMBA	National Environmental Management Biodiversity Act, No 10 of 2004
NGOs	Non-Governmental Organisations
NHRA	National Heritage Resources Act, No. 25 of 1999
NWA	National Water Act, Act No 36 of 1998
PPP	Public Participation Process
RBDM	Risk Based Decision Making
ROM	Run of Mine
SAWS	South African Weather Service
SLP	Social and Labour Plan
WRC	Water Research Commission

1 INTRODUCTION

Universal Coal (Pty) Ltd (Universal Coal) has submitted a Mining Right Application (MRA) to mine coal on portion 1 and the remaining extent (RE) of portion 2 the farm Wolvenfontein 244 IR in the Delmas area of the Mpumalanga Province. The proposed project is known as the Kangala Coal Mine. Through exploration and feasibility studies, together with the demand for coal within both the internal and international market, Universal Coal has found it feasible to undertake the proposed Kangala Coal Mine project.

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

Universal Coal proposes to undertake open cast mining of the No 2 and No 4 Coal seam of the Witbank Coal field. The extracted Run of Mine (ROM) coal will be beneficiated on site yielding an export coal product and a secondary product suitable for the inland power generation market.

In order to comply with the requirements of the Minerals and Petroleum Resource Development Act, No 28 of 202 (MPRDA) this Environmental Impact Assessment Report (EIAR) and Environmental Management Plan (EMP) has been compiled in support of the submitted MRA.

The Environmental Scoping Report that has been completed was used as a guide for the completion of this EIAR EMP. Once the EIAR has been compiled and the all impacts identified that require management measures, it is used to develop the EMP for the proposed project. This EIAR EMP provides details of the proposed project, the methodology which was used for conducting the EIA, the current state of the environment, the various environmental impacts that are likely to occur during all phases of the project and the mitigation measures that are proposed for implementation.

2 METHODOLOGY AND OBJECTIVES

2.1 Scoping

The investigations that were undertaken during the scoping phase included aspects such as the physical, biological and social environment. A general evaluation of the status of the pre-mining environment was also undertaken. The information in the Scoping Report was compiled from various sources, including the client, site visits, interviews and meetings with authorities and Interested and Affected Parties (I&APs), and literature reviews..

Both the positive and negative potential impacts that the proposed mining operations will have on the environment were identified and discussed.

The Public Participation Process (PPP) is central to the investigation of environmental impacts as it is important that stakeholders who are potentially affected by the project are given an opportunity to identify issues relevant to them and to ensure that local knowledge, needs and values are understood and utilised. The views of stakeholders were included in the Scoping Report and were used to either validate the appropriateness of the specialist studies that were commissioned or to indicate where additional specialist studies were required to ensure that issues are addressed.

Issues and impacts identified in the Scoping Report are described in detail and assessed in the EIA and mitigation methods are discussed in the EMP, which also deals with the implementation and monitoring of these mitigation measures.

The objective of the Scoping Phase was to:

- Initiate investigations into the current receiving environment.
- Develop a project description that is adequate in detail to provide sufficient information.
- To identify and initiate consultation with stakeholders.
- Identify possible impacts that may occur as a result of the proposed project.
- To formulate a plan of study for the EIA, this included the terms of reference for the identified required specialist investigations.

2.2 Environmental Impact Assessment

The EIA uses a rigorous, numerical environmental significance rating process which is based on the accepted impacts assessment methodology that uses the probability of an event occurring and the severity of the impact, should an event occur, as factors to determine the significance of a particular environmental risk.

In order to determine the severity of any potential environmental impact, the criteria taken into consideration are the spatial extent of the impact, the duration of the impact and the severity of the impact. The probability of an impact occurring is determined by the frequency at which the activity takes place and by how often the type of impact in question has taken place or takes place in similar circumstances. The values assigned to these factors (weighting) are discussed as part of the EIA.

In order to clarify the purpose and limitations of the impact assessment methodology, it is necessary to address the issue of subjectivity in the assessment of the significance of environmental impacts. Even though DWA, and the majority of environmental impact assessment practitioners, propose a numerical methodology for impact assessment, one has to accept that the process of environmental significance determination is inherently subjective. The weight assigned to each factor of a potential impact, and also the design of the rating process itself, is based on the values and perception of risk of members of the assessment team, as well as that of the I&APs and authorities who provide input into the process.

Whereas the determination of the spatial scale and the duration of impacts are to some extent amenable to scientific enquiry, the severity value assigned to impacts is highly dependent upon the perceptions and values of all involved. It is for this reason that it is crucial that all Environmental Impact Assessments make reference to the environmental and socio-economic context of the proposed activity in order to reach an acceptable rating of the significance of impacts. Similarly, the perception of the probability of an impact occurring is dependent upon perceptions, aversion to risk and availability of information.

It has to be stressed that the purpose of the EIA process is not to provide an incontrovertible rating of the significance of various aspects, but rather to provide a structured, traceable and defendable methodology of rating the relative significance of impacts in a specific context.

The EIA assesses environmental and social impacts according to different stages of the proposed project, namely: the construction, operational, decommissioning and post-closure phases. Impact and benefit significance are assessed before and after the application of any mitigation or enhancement measures and refer to effects on both the ecological and social environment.

Lastly, the cumulative impacts of the proposed operation on the environment, with reference to similar operations and activities in the area are discussed.

The main objective of the EIA Phase is to:

- Determine the sensitivity and ecological status quo of the receiving environment through specialist investigations;
- To identify the activities involved in all phases of the proposed project that may result in a detrimental impact to the receiving environment;
- To determine the significance of identified impacts;
- To relay findings of the EIA phase to all stakeholders.

2.3 Environmental Management Plan

The EMP is aimed at addressing all environmental impacts that have been identified in the EIA phase and providing achievable mitigation measures to reduce the possible impacts on the environment.

As the EIA indicates the relative significance of the various environmental impacts associated with mining activities, it serves to focus the allocation of resources on environmental aspects and specific impacts requiring mitigation. The aim of the mitigation measures is to minimise the negative impacts and enhance the positive aspects of the project, as well as to inform and involve the local communities through the process.

The main objective of the EMP is to:

- Provide information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified including cumulative impacts;
- Provide detailed description of the aspects of the activity that is covered by the EMP;
- Identification of required monitoring programmes;
- Determine associated costs required for rehabilitation and / mitigation.

The EMP section is divided into the setting of objectives and the planning of management measures. The monitoring and performance assessment section of the EMP details the monitoring and audits that will be implemented to ensure the effectiveness of mitigation measures. The EMP section will aim to provide all necessary information in terms of Section 39 (1) of the MPRDA and schedule 34 of GN R385 in terms of NEMA.

2.4 Submission of Information

The following is a summary of documentation submitted to the Department of Minerals (DM) in support of the Mining Right Application for the proposed Kangala Coal Mine Project on portion 1 and RE of portion 2 the farm Wolvenfontein 244 IR.

Documents Submitted	Date
Mining Right Application	14 May 2009
Environmental Scoping Report	17 July 2009
EIAR EMP	Will be submitted on or before 17 December 2009

3 LEGAL FRAMEWORK

The following section briefly introduces the principle legislation in terms of which the proposed project must be authorised before any mining activities may commence.

3.1 Mineral and Petroleum Resource Development Act, Act No28 of 2002

Universal Coal must be in possession of an approved Mining Right for the mining of coal on portions 1 and the RE of portion 2 of Wolvenfontein 244 IR before mining operations may commence. In terms of the MPRDA various supporting documentation is required for the proposed project as part of the application for a Mining Right.

3.2 National Environmental Management Act, Act No. 107 of 1998

The National Environmental Management Act, Environmental Impact Assessment Regulations, GN R385 ("NEMA EIA Regulations") were published on 21 April 2006 and

came into operation on 1 July 2006. Together with the NEMA EIA Regulations, the Minister also published the following two Regulations in terms of sections 24 and 24D of the National Environmental Management Act:

- Regulation GN R386 which sets out a list of identified activities which may not commence without environmental authorisation from the competent authority and which must follow the basic assessment procedure as provided for in regulations 22 to 26 of the NEMA EIA Regulations;

- Regulation GN R387 which sets out a list of identified activities which may not commence without environmental authorisation from the competent authority and which must follow the scoping and EIA procedure as provided for in regulations 27 to 36 of the NEMA EIA Regulations.

This EIAR EMP has been compiled in accordance to NEMA. Universal Coal has not submitted an application for environmental authorisation the Mpumalanga Department of Agriculture and Land Administration for listed activities in terms of GN R386 and GN R387. It is expected that this will be undertaken in the upcoming months.

3.3 National Water Act, Act No 36 of 1998

In accordance with Section 21 and 40 of the NWA a water use licence application will be submitted to the DWEA. Investigations have to be undertaken in order to determine what activities will take place, as well as the impacts thereof. It is likely a license will be required for the following uses:

- Section 21 a – Abstraction of water for water from a pipeline or groundwater;
- Section 21 b – Storage of water for both raw and potable water use;
- Section 21 f – Discharging waste or water containing waste into a water resource through a pipe or canal for the disposal of sewage works effluent (if constructed) and the disposal of sludge at the water purification plant (if constructed);
- Section 21 g – Disposing waste or water containing waste in a manner which may detrimentally impact on a water resource for the pollution control dams, overburden dumps, coal stockpiles and discard dumps;
- Section 21 j – Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity for the safety of the people for the dewatering of the mining pits to facilitate mining and to provide a safe mining environment.

DWA are in the process of compiling an Integrated Water Use Licence Application (IWULA) for Universal Coal. The results of the groundwater and surface water investigations will be incorporated, and the public will be informed of the submission of the IWULA.

Government Notice (GN) R. 704

Regulation 4 of this government notice states that no residue deposit, reservoir or dam may be located within the 1:100 year flood line, or less than a horizontal distance of 100m from the nearest watercourse. Furthermore, person(s) may not dispose of any substance that may cause water pollution.

Regulation 5 states that no person(s) may use substances for the construction of a dam or impoundment if that substance will cause water pollution. Regulation 6 is concerned with the capacity requirements of clean and dirty water systems, while Regulation 7 details the requirements necessary for the protection of water resources.

Where any of GN 704 regulations are contravened, the user should apply for an exemption of regulations 4 and 5 from the Minister. A meeting with a representative from DWEA is being organised in order to discuss the IWULA and regulation 704 for the Kangala Coal Mine.

3.4 Other Legislation

The EIA study is not only subject to the terms and regulations of the MPRDA, but must also comply with other applicable statutory requirements and guideline documents relevant to the project. The following includes a non-exhaustive list of legislation and guidelines that were considered during the scoping phase of the project:

- National Legislation and associated Regulations:
- Atmospheric Pollution Prevention Act, Act No. 45 of 1965;
- Constitution of the Republic of South Africa Act, Act No. 108 of 1996;
- Environment Conservation Act, Act No.73 of 1989;
- Hazardous Substances Act, Act No. 15 of 1973;
- National Heritage Resources Act, Act No. 25 of 1999;
- National Environmental Management: Air Quality Act, Act No 39 of 2004;
- National Environment Management: Biodiversity Act, Act No. 10 of 2004;
- National Forest Act, Act No. 84 of 1998;
- National Water Act, Act No. 36 of 1998; and
- Promotion of Access to Information Act, Act No. 2 of 2000.
- Guideline Documents include:
- DEAT Air Quality Guidelines;
- SANS 10103:2004 The Measurement and Rating of Environmental Noise with Respect to Land Use, Health, Annoyance and to Speech Communication;
- SANS 10286: Mine Residue Disposal, 1998 1st Edition;
- SANS 1929:2005 Edition 1.1 – Ambient Air Quality Limits for Common Pollutants;
- DWAF: Best Practice Guideline G1: Storm Water Management;

- DWAF: Best Practice Guideline G2: Water and Salt Balances; August 2006;
- DWAF: Best Practice Guideline A4: Pollution Control Dams (PCD's);
- DWAF: Best Practice Guideline GH: Water Reuse and Reclamation, June 2006;
- DWAF: Minimum Requirements Guideline for the Handling, Classification and Disposal of Hazardous Waste, 1998;
- DWAF: Minimum Requirements Guideline for Waste Disposal by Landfill, 1998;
- DWAF: Minimum Requirements Guideline for the Water Monitoring at Waste Management Facilities;
- Department of Water Affairs and Forestry, 1996. South African Water Quality Guidelines. Volume 7: Aquatic Ecosystems;
- Department of Water Affairs and Forestry, 1996. South African Water Quality Guidelines (second edition). Volume 4: Agricultural Use: Irrigation; and
- Department of Water Affairs and Forestry, 1996. South African Water Quality Guidelines (second edition). Volume 5: Agricultural Use: Livestock Watering.

3.5 Summary of Environmental authorisation

In terms of the MPRDA no mining activities can commence until such date that Universal Coal is in possession of an approved Mining Right issued by the DM. Various authorisation will also be required from Department of Water and Environmental Affairs (DWEA).

4 EXPERTISE OF THE ENVIROMENTAL ASSESSMENT PRACTITONER

DWA is an independent environmental solutions provider with extensive experience within the mining industry. The personnel of DWA are qualified and competent within their field of expertise and where required junior consultants are guided and mentored by senior and experienced personnel. Suitably qualified sub-contractors are used, where necessary, in order to ensure that all requirements of the establishment of baseline environmental information are reported on. Louise Nicolai, as the Environmental assessment Practioner (EAP) has a postgraduate qualification in Environmental Management and three years working and project management experience in the completion of various environmental authorisation documentation. Louise is currently completing the registration process in order to become a certified EAP.

For the purpose of this project the following DWA consultants were involved:

Project management Liz Hilton Gray

Project team

- Steve Horak – *Project Sponsor*
- Helen Knight – *Public Consultation*
- Andrew Husted – *Wetland & Aquatic Specialist*
- Rudi Greffrath – *Biodiversity Specialist*
- Bradly Thornton – *Geology, Visual, Topography and GIS Specialist*

- Jacques Groenawald – *Geohydrologist*
- Andries Wilke - *Geohydrologist*
- Marike Fourie – *Archaeological & Heritage, Socio-economic Specialist*
- Lukas Sadler – *Noise and Air Quality*
- Philip Lourens – *Surface Water Quality Specialis*t
- Hendrik Smith – *Soil Specialist*
- Grant Beringer – *Mine Closure*

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Sub- contractors were used for the completion of the archaeological and heritage field survey, and blasting and vibration studies. Curriculum Vita's of the EAP and specialists are attached in Appendix A.

5 PROJECT DESCRIPTION

5.1 Project Introduction

The proposed Kangala Coal Mine project is to be located on portion 1 and RE of portion 2 of the farm Wolvenfontein 244IR in the Delmas area of the Mpumalanga Province. The proposed project area is 951 hectares in extent.

The mineral deposit is bituminous coal from the No. 2 and No. 4 seams of the Witbank Coalfield. The mining method that will be undertaken is conventional opencast truck and shovel roll over method. An estimated 295ha will be disturbed which equates to 31% of the total project area which is in line with the available coal reserve on the proposed project site. The total estimated Run of Mine (ROM) reserve is 14.5Mt which will be mined over the 10 year Life of Mine (LoM).

The ROM coal will be beneficiated (washed) on site to produce a C-grade export coal and a D-grade coal for the local power generation market. The beneficiated coal will then be transported to rail siding in the area for further transportation.

5.2 Project Applicant

The full particulars of the applicant are as follows:

Full name:	Universal Coal Development 1(Proprietary) Limited
Registration No.:	2007/032600/07
Contact person:	Mike Seeger/ Tony Weber/ Jaco Malan
Telephone No.:	(012) 460 0805
Facsimile No.:	(012) 460 2417
Physical address:	Universal Coal Head Office 467 Fehrsen Str Brooklyn PRETORIA 0181
Postal address:	P O Box 2423 Brooklyn Square 0075

The Kangala Coal Mine is a venture of Universal Coal Development 1 (Pty) Ltd. The company is 70.5% owned by Universal Coal and Energy (Pty) Ltd and 29.5% by Mountain Rush (Pty) Ltd, a BEE company. Universal Coal and Energy (Pty) Ltd is a 100% subsidiary of Universal Coal Plc, which is listed on the Alternative Investment Market (AIM) in London. The legal agreements have been concluded, and the relevant board approvals have been obtained. Both shareholders of the Kangala Coal Mine are of sound financial state.

Universal Coal and Energy (Pty) Ltd will be funded via Universal Coal Plc, through capital raising campaigns on AIM. In addition, financial institutions will be approached for funding of the Project. The feasibility study that is being conducted has given the relevant shareholders the comfort that the business case is sound. The soundness of the business case will also give the financial institutions an increased level of comfort.

5.3 Project Motivation

Coal is one of the major primary energy sources in the world principally because it is affordable to mine and there are large resources available. In South Africa, our most abundant source of energy used for electricity generation is coal. Eskom, South Africa's electricity utility, generates, transmits and distributes electricity to industrial, mining, commercial, agricultural and residential customers and redistributors (www.eskom.co.za).

Eskom relies on coal fired power stations to produce approximately 95% of its electricity used in South Africa. Eskom uses over 90 million tons of coal per annum, and is therefore totally dependent on the South African coal mining industry to supply it with coal. Coal mining in South Africa is relatively cheap compared to the rest of the world. These low costs have had an important effect on the nation's prosperity and potential for development (www.eskom.co.za).

The Future of the Industry

Coal will have a major role in meeting the future energy needs. Demand for coal and its vital role in the world's energy system is set to continue. Over the next 30 years it is estimated that global energy demand will increase by almost 60%. Two thirds of the increase will come from third world countries, and by 2030 they would account for almost half of the total energy demand (www.bp.com).

The changes in the global market are placing Eskom under increasing risk in terms of securing future supplies from the local market, in which the production capacity has not kept pace with increases in both local and international demand. It is critical that local production be facilitated to ensure long term security of supply for electricity production. Additional power stations and major power lines are being built to meet rising electricity demand in South Africa (Eskom Annual Report, 2008). Until such time as alternative sources of energy are successfully implemented, coal will remain the primary source in South Africa.

The Kangala Coal Mine has a gross in situ resource of 20.21 Mt (in situ before losses) that can be classified as multi-product coal that would yield a significant portion of export steam coal. The planned life-of-mine is 10 years. The life of mine may be extended, as more mineable reserves become available through a further drilling campaign of the adjacent resources.

The benefits of the Kanagla Coal Mine project are as follows:

- Coal will be directly supplied to Eskom where it will be burnt to generate electricity which is distributed throughout Southern Africa. Due to increased development and demand for electricity, there is an ever increasing need for coal mines to continue to produce coal for supply to Eskom;
- Training will be provided to employees resulting in an improvement of the local skills base;
- The mine will invest in social capital by undertaking a Social and Labour Plan, and promote sustainable local economic development in the surrounding areas;
- Support will be given to the local and national economy by the purchase of goods and services;
- The export of coal will contribute towards:
- South Africa's foreign revenue;
- The generation of export income.

5.4 Regional Setting

The Kangala Coal Mine project is located within the Witbank Coal Field, 60km due east as the crow flies and 80km by road of the centre of Johannesburg in Delmas, Mpumalanga Province. The proposed project area is in close proximity to the operating Exxaro coal mine Leeuwpan. The location of the project area can be seen on **Error! Reference source not**

ound.. The proposed project area is accessible via the R42 and from the R555. The Kangala Coal Mine falls within the Delmas Local Municipality which is part of the greater Nkangala District Municipality.

5.5 Land Tenure

The proposed mining activities of the Kangala Coal Mine will be undertaken on portion 1 and RE of portion 2 of the farm Wolvenfontein 244IR. The tables below provide the landowner information of the mining right area and the adjacent landowners. The location of all farms and landowners mentioned below can be seen on Plan 2.

Table 5-1: Landowner details of the mining right area.

Farm Name	Portion	Landowner
Wolvenfontein 244IR	1	Kallie Madel Trust
Wolvenfontein 244IR	RE of Ptn 2	Kallie Madel Trust

Table 5-2: Adjacent Landowners of the Kangala Coal Mine.

Farm Name	Portion	Landowner
Wolvenfontein 244IR	RE	Kallie Madel Trust
Wolvenfontein 244IR	5	Willem Oosterhuis Boerdery
Wolvenfontein 244IR	4	Mariwija Boerdery
Wolvenfontein 244IR	6 of Ptn 2	Petrus Haefele
Strydpan 243IR	16	Eloff Mining Company
Strydpan 243IR	20	Eloff Mining Company
Strydpan 243IR	24	Eloff Mining Company
Strydpan 243IR	33	Hendrik Schoeman Weilaagte
Strydpan 243IR	44	Hendrik Schoeman Weilaagte
Middelbult 235IR	39	Eloff Landgoed
Middelbult 235IR	40	VV2 Eiendomme
Witklip 232IR	2	Hendrik Schoeman & Seuns
Witklip 232IR	18	Hendrik Schoeman & Seuns

There is no knowledge of the lodgement of land claims on the proposed project area.

Plan 1: Regional Locality

Plan 2: Land Tenure

5.6 Coal Deposit

The mineral deposit is bituminous coal from the No. 2 and No. 4 seams of the Witbank Coalfield. The No. 4 Seam consists of a mixture of bright and dull coal with occasional shale coal intra-seam partings. The No. 2 Seam consists of alternating coal and carbonaceous shale layers.

The Kangala Coal Mine property hosts a gross in situ resource of 20.21 Mt (in situ before losses) that can be classified as multi-product coal that would yield a significant portion of export steam coal.

Table 5-3 summarises the estimated coal resources of the propose Kangala Coal Mine project.

Table 5-3: Kangala Coal Mine Resource

Kangala Project Resource/Reserve Summary				
Seam	**Gross In-Situ Tonnes ('000 tonnes) (Indicated)**	**Mineable In-Situ Tonnes ('000tonnes) (Probable)**	**Saleable Tonnes ('000tonnes)**	
			Export	Eskom
No. 4 Seam	1,850	1,332	527	180
No. 2 Seam	18,360	13,219	5,235	1,785
Grand Total	**20,210**	**14,551**	**5,762**	**1,965**

All of the mineable coal at Wolvenfontein is accessible by open pit mining at an average stripping ratio of 2.5:1 (m^3 waste to ton coal).

Table 5-4 summarises the raw and washed qualities of the mineable coal at Kangala Coal Mine.

Table 5-4: Raw and Washed Coal Qualities

Raw and Washed Coal Qualities within the Mining Area							
	Moisture %	**Ash %**	**Volatiles %**	**Fixed Carbon %**	**Sulphur %**	**CV (MJ/kg)**	**Yield %**
Raw Coal	4.82	31.33	20.51	43.33	1.27	19.30	100
Washed Coal at RD 1.55	5.42	15.70	23.57	55.31	0.76	25.40	44.32

The total estimated ROM reserve is 14.5Mt which will be mined at 1.5 Mt per annum over the 10 year LoM.

5.7 Mining Methods

The mining method that will be undertaken in order to remove the coal reserve will be opencast truck and shovel roll over method at an average strip ration of 2.5:1. Roll over mining or strip mining is undertaken by creating an initial cut or strip which is mined out. When mining moves forward the second strip, the overburden from the second strip is backfilled into the initial cut. The overburden from the initial cut is used to backfill the final cut (Figure 5-1). An estimated 295ha will be disturbed which equates to approximately 31% of the total project area. Plan 3 provides a conceptual mine plan which indicates the location of the opencast pit and the direction of the proposed strip mining. From the mine plan one can see that mining of the coal will be initiated in the middle of the pit area which will allow for two faces that will advance. As these two faces advance backfilling will still occur. Once initial backfilling occurs, the mining operation will look like two small pits that are advancing in opposite directions. Figure 5-2 shows the sequence that mining will occur through the LoM.

In accordance Regulation 704, mining must stay outside of the 100 year flood lines of the intermittent stream that runs through the project area and outside of a 100m buffer zone from the stream or delineated wetland area, the area which is greater will be adhered to. In the event that Universal Coal plans to mine with in this area, exemption from Regulation 704 will need to be applied for before mining commences.

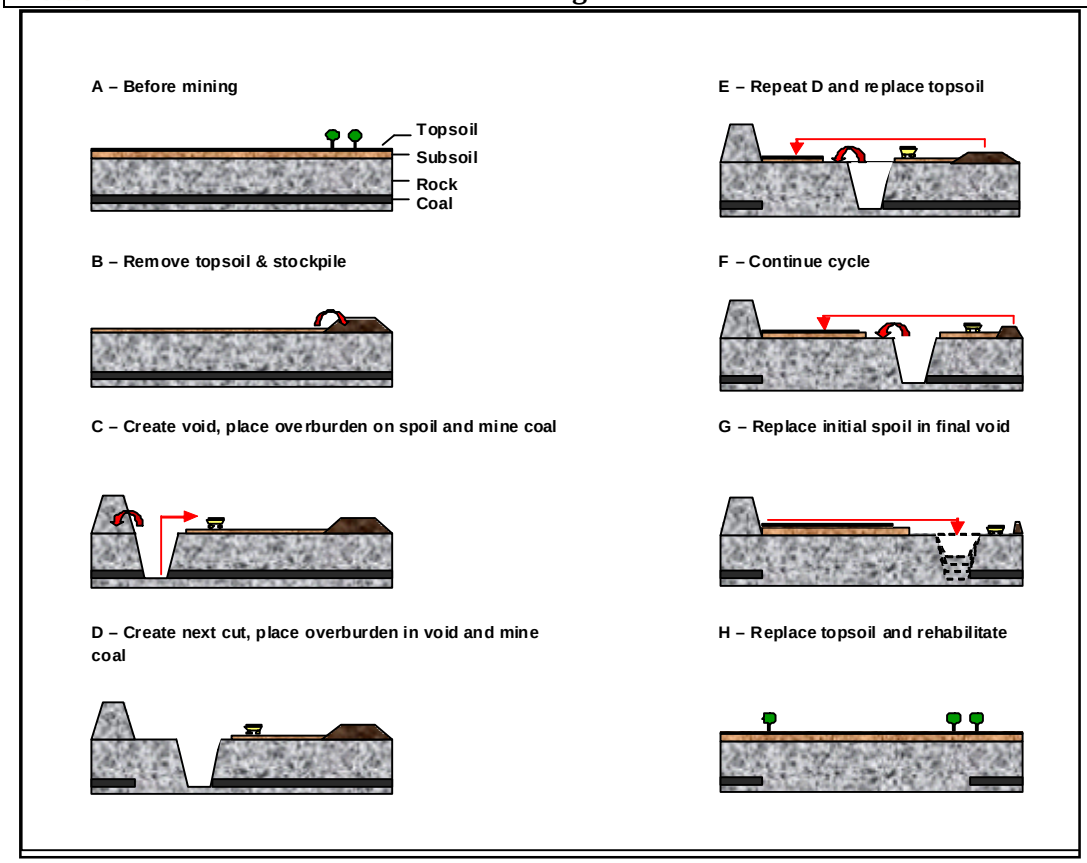


Figure 5-1: Illustration of strip mining.

5.8 Coal Processing

The extracted coal from the open pit will require further beneficiation. The mineable coal at Kangala lends itself (both the No. 4 and No. 2 Seams) to double washing, yielding a 5700-5900 kcal/kg (net CV on an "as received" basis) export coal and a secondary product suitable for local power generation with overall yields on a weighted average basis of approximately 60%.

Kangala Coal Mine is a multiproduct mine, producing a minus 50 mm C-grade steam coal for export through the Phase 5 expansion of Richards Bay Coal Terminal and a minus 50mm D grade coal for Eskom.

The plant is been designed to produce this multigrade product. Processing of the coal will involve washing the entire ROM product at a high relative density of 1.8-1.9, so as to scalp all possible saleable coal. This would give a discard of 40% and a product yield of 60%. Then, in a second stage wash, at a relative density of 1.5, Eskom grade coal (15% yield) would be separated from Export quality coal (45% yield).

A discard will be produced from the washing process. This discard will result in a permanent discard dump facility. The location of the discard dump facility can be seen on Plan 3.

Plan 3: Conceptual Mine Plan

5.9 Coal Market

The Kangala Coal Mine will produce a C grade steam coal for export purposes and a D grade coal for Eskom. Traditional power generators issue annual enquiries for one-year supply contracts. Contracts will be negotiated one year before the mine becomes operational. No long-term off-take agreements have therefore been negotiated for Kangala Coal Mine. The marketing surveys show that there is a strong demand for C-grade coal on the international market. Universal Coal will sell its coal free on truck to coal trading houses, who in turn will use their export allocation in the allocations as well as Eskom supply contracts to feed the coal to the current markets

Table 5-5: Typical quality specifications for Kangala coal is as follows:

Product	C-grade coal	Eskom coal
Density	1.55	1.9
Yield	44%	15%
CV (MJ/kg)	25.4	21.6
Volatiles	23.6	21.3
Ash	15.7	25.4
Sulphur	0.76	0.8

5.10 Duration, Sequence and Timing of Mining Activities

The following timeframe has been anticipated the proposed Kangala Coal Mine assuming the mining right is awarded and the other required licensing is obtained.

- Exploration: Q2-Q4 2009
- Feasibility: Q2 2009 – Q2 2010
- Development: Q2 2010 – Q3 2010
- Construction & commission: Q3 – Q4 2010
- Production: Q1 2011

The coal will be mined over a 10 year LoM. The figure below shows the mining sequence for each year once Kangala Coal Mine is operational.

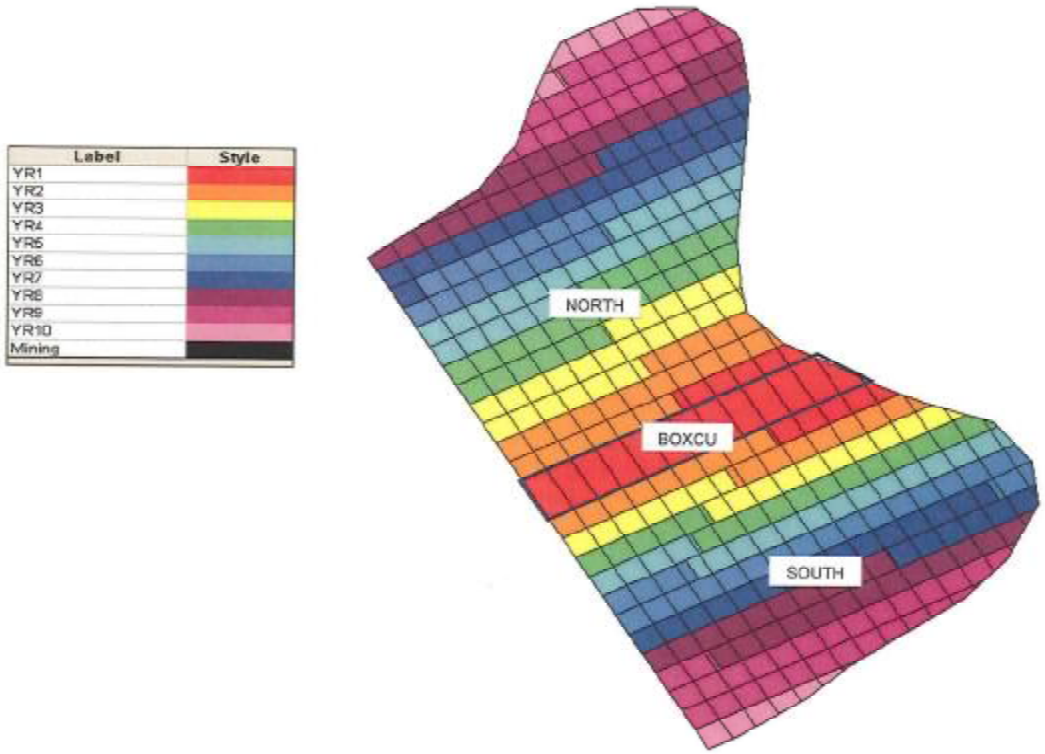


Figure 5-2: Kangala Coal Mine mining sequence.

5.11 Mine Infrastructure and servitudes

There will be various supporting infrastructure that will be built on site for the operation of Kangala Coal Mine. The following infrastructure will be built on the proposed project area and the location of the main infrastructure can be seen on Plan 3:

- Processing plant;
- Offices and control room;
- Workshops with an aboveground storage tank for diesel storage;
- Change houses and ablution facilities;
- Pollution control dams;
- A discard dump;
- A sewage purification plant;
- Overburden, topsoil and coal stockpiles;
- Water diversion berms;
- Electrical substation (5MVA 22/11kV);
- Explosive magazine;
- Temporary storage of hazardous waste, and ;
- Access roads.

5.12 Employment Figures

Kangala Coal Mine will employ 34 permanent employees and 166 contracted employees. The labour sending district will be kept local within the Delmas Municipality and no accommodation will be provided for mine workers on site. The mine once operational will implement and Employment Equity Plan in compliance with the Mining Charter where at least 40% of management personal will be HDSA on the appointment of the senior staff and 10% of the workforce across the board especially those involved in core mining activities will be composed of women within 12 months of the granting of the mining right. Kangala Mine will be operating 24 hours a day over 6 days a week with two 10 hour shifts.

5.13 Project Activities and Phase Description

This section provides a preliminary description of the actions, activities and processes that are proposed for the Kangala Coal Mining operation. Each activity can be linked to the various mining, mineral processing, waste management and any other associated activities that constitute the various collieries' operations. These activities act as driving forces that exert pressure on the natural environment, ultimately resulting in impacts on the biophysical, social and cultural environments.

As shown in Table 5-6, each activity can be categorised into the different phases of mining, namely the construction, operation, decommissioning and post-closure phases. A short description of each activity has been provided. The impacts of these activities have been assessed in detail.

Table 5-6: Proposed Project Activities for Kangala Mining

Activity	Description
Construction Phase	
Activity 1:	Recruitment, procurement and employment
Activity 2:	Transport of construction material
Activity 3:	Storage of fuel, lubricant and explosives
Activity 4:	Site clearing and topsoil removal
Activity 5:	Construction of surface infrastructure
Activity 6:	Establishment of initial boxcut and access ramps
Activity 7:	Temporary waste and sewage handling and treatment
Operational phase	
Activity 8:	Employment
Activity 9:	Storage of fuel, lubricant and explosives
Activity 10:	Topsoil and overburden removal and stockpiling
Activity 11:	Drilling and blasting of hard overburden
Activity 12:	Coal removal
Activity 13:	Vehicular activity on haul roads
Activity 14:	Water use around site
Activity 15:	Screening and washing

Activity	Description
Activity 16:	Discard dumps
Activity 17:	Pollution control dams
Activity 18:	Waste and sewage generation and disposal
Activity 19:	Concurrent replacement of overburden and topsoil and revegetation
Decommissioning phase	
Activity 20:	Retrenchment
Activity 21:	Demolition of infrastructure no longer required
Activity 22:	Final replacement of overburden and topsoil and revegetation
Activity 23:	Waste and sewage handling
Post-closure phase	
Activity 24:	Post-closure monitoring and rehabilitation

5.13.1 Construction Phase

The construction phase consists of activities performed in preparation of mining, coal beneficiation and waste disposal, as well as the construction of supporting infrastructure. The following activities are part of the construction phase:

- *Activity 1: Recruitment, procurement and employment*
  Recruitment and employment of construction workers, as well as the procurement of engineers and construction contractors, materials and other required services.
- *Activity 2: Transport of construction material*
  Large trucks are used to transport construction material to the construction site via national, provincial and local roads.
- *Activity 3: Storage of fuel, lubricant and explosives*
  Construction equipment utilise large amounts of fuel and lubricants. In addition, explosives are used for excavation of boxcuts. These substances are stored in temporary storage facilities for the duration of the construction phase. These substances are classified as hazardous in terms of the Hazardous Substances Act 15 of 1973.
- *Activity 4: Site clearance and topsoil removal*
  Vegetation is cleared from construction areas prior to the commencement of physical construction activities. Topsoil is removed from construction areas using excavators and dump trucks, prior to the commencement of physical construction activities.
- *Activity 5: Construction of surface infrastructure*
  Earthmoving activities include the excavation of borrow pits for road construction material, the establishment of boxcuts, cut-and-fill activities and the levelling of surface areas for infrastructure construction. Surface infrastructure includes; office buildings, workshops, haul roads, beneficiation plants, and pollution control dams.
- *Activity 6: Establishment of initial boxcut and access ramps*
  Establishment of initial boxcuts and access ramps to new opencast strip mining areas.
- *Activity 7: Temporary waste and sewage handling and treatment*

Temporary sewage handling and/or treatment facilities are required at the construction site.

5.13.2 Operational Phase

The operational phase is the commencement of mining activities. All related colliery operations, including coal beneficiation, waste generation and disposal, as well as concurrent rehabilitation forms part of this phase. The following activities are part of the operational phase:

- *Activity 8: Employment*
  The operation of the mine, plants, waste management facilities and other support infrastructure require numerous skilled and unskilled employees.
- *Activity 9: Storage of fuel, lubricant and explosives*
  Mining equipment and vehicles require large amounts of fuel and lubricants, which are classified as hazardous material and must be stored in bunded areas. Dangerous explosives are used during opencast and underground mining and also require special storage.
- *Activity 10: Topsoil and overburden removal and stockpiling*
  Topsoil is removed from opencast areas using excavators and dump trucks, prior to the commencement of strip mining at that location. The topsoil is stored on topsoil stockpiles located near the opencast areas, for use during rehabilitation. Following the removal of topsoil from opencast areas, soft overburden is excavated and stored on overburden stockpiles. Once mining of an opencast strip is completed, the soft overburden is replaced.
- *Activity 11: Drilling and blasting of hard overburden*
  Hard overburden consists of solid rock which is not easily excavated. This requires drilling and blasting to break up the rock for easy removal by excavators and dump trucks.
- *Activity 12: Coal removal*
  Once the coal seam is exposed by opencast strip mining, the coal is removed with shovels and transported with trucks to the plants.
- *Activity 13: Vehicular activity on haul roads*
  Mining equipment utilise haul roads to access opencast areas, plants and waste management facilities, or to transport coal from the mining areas to the plants. Smaller passenger vehicles also utilise haul roads to transport staff around the mining site.
- *Activity 14: Water use around site*
  During operations 35m3/hr volume of water will be required in order to run the mine and process the coal, as well as for domestic use. Water provision is likely to be supplied through either municipal water, boreholes or a dam.
- *Activity 15: Screening and washing*
  Screening involves the separation of the crushed run-of-mine coal fragments into coarse and fine particles, as well as the removal of coarse waste rock particles. The coal is then washed to remove further impurities.
- *Activity 16: Discard dumps*

Coal discard from the coal beneficiation process, consisting of coarse discard is transported to the coal discard dumps for disposal.

- *Activity 17: Pollution control dams*
  Water that comes into contact with sulphuric material in the opencast and underground mining areas, beneficiation plants, overburden stockpiles, or discard dumps, must be separated from clean water. The polluted water is therefore diverted or pumped to a pollution control dam for storage.
- *Activity 18: Waste and sewage generation and disposal*
  Large quantities of domestic, industrial and hazardous waste is produced during the mining and beneficiation process. This includes waste cans, plastics, used tyres or oil, all of which must be disposed of in an appropriate manner. Sewage produced from the residential villages, office buildings and ablutions at the collieries is treated at sewage plants, septic tanks or in French drain systems.
- *Activity 19: Concurrent replacement of overburden and topsoil and revegetation*
  Once mining of an opencast strip is completed, the strip is filled with overburden and compacted. This is followed by the replacement of stockpiled topsoil for the purpose of revegetation. Following the filling of opencast strips and replacement of topsoil, the disturbed area is revegetated. This is done on a continuous basis throughout the operational phase.

5.13.3 Decommissioning Phase

The decommissioning phase involves the cessation of mining and coal beneficiation activities. During this phase, all disturbed areas are rehabilitated. The following activities are defined as part of the decommissioning phase:

- *Activity 20: Retrenchment*
  The cessation of mining and coal beneficiation activities result in retrenchment of staff. Only staff involved in the demolition of infrastructure or rehabilitation remains.
- *Activity 21: Demolition of infrastructure*
  Infrastructure that cannot be used after decommissioning is demolished and removed. This includes the beneficiation plants, pollution control dams and mine infrastructure.
- *Activity 22: Final replacement of overburden and topsoil and revegetation*
  Once mining of the final opencast strip has been completed, the strip is filled with overburden, levelled and topsoil replaced. Areas disturbed by surface infrastructure and opencast strip mining are revegetated.
- *Activity 23: Waste and sewage handling*
  Large quantities of waste, including scrap metal and used oil, are produced during the demolition of infrastructure and the operation of equipment used during decommissioning.

5.13.4 Post-closure Phase

The post-closure phase is the final phase and continues long after mining and decommissioning activities have ceased.

- *Activity 24: Post-closure monitoring and rehabilitation*

Environmental monitoring is done post-closure in order to determine the level of success of rehabilitation, as well as to identify any additional measures that have to be undertaken to ensure that the mining area is restored to an adequate state. This includes monitoring of the groundwater seepage plume, soil fertility and erosion scars, natural vegetation and alien invasive species, as well as dust generation from coal discard dumps.

5.14 Waste Management

5.14.1 General waste

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

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

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

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

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

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

(i) a by-product is not considered waste; and

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

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

(a) domestic waste;

(b) building and demolition waste;

(c) business waste; and

(d) inert waste.

General waste will be disposed of at a licensed general waste site. General waste will be stored in waste disposal skips that will be placed on a concrete surface and will be covered while awaiting removal.

5.14.2 Hazardous waste

The definition of hazardous waste in accordance with NEMWA refers to any waste that contains organic or inorganic elements or compounds that may owing to the inherent physical, chemical or toxicological characteristics of that waste have a detrimental impact on health and the environment. Examples of hazardous waste include certain solvents, grease

and oil. All hazardous waste will need to be disposed of at Holfontein Hazardous Waste Site. All hazardous waste will be stored in appropriate containers in a bunded area while awaiting removal off site for final disposal.

5.14.3 Mine waste

Benificiation of coal will be occurring on site at Kangala Coal Mine, by-products and/or fines will be generated from the operation. The coal spillages that do occur on site during loading will be collected and placed on the trucks transporting ROM coal. The ROM stockpile and the coal washing plant will be placed on a concrete surface to allow for easy clean up of spillages.

5.14.4 Sewage Effluent

A sufficient number of chemical toilets will be provided on site during the construction phase. Once the change house facilities are completed septic tanks will be installed for the management of sewage effluent. The septic tanks will be emptied when necessary by a reputable contractor.

5.15 Water Use and Resources

Universal coal are currently investigating alternative sources of water such as groundwater (boreholes) municipal water (from Delmas or a water pipeline to be constructed close to the site) and or making use of existing dams in the region. There is also an option of constructing a new dam if required. Negotiations and further investigations still need to take place. A meeting with DWEA is being set up to discuss this further.

Regarding water use, new technologies, as well as best practise guidelines will be used to ensure water use is minimal and where possible water is reused and recycled. The most water intensive activity on site is the wash plant, thereafter the mining and also potable water for washing. Current predicted water volumes required for the mine are $35m^3$/hr for the entire operation. This equated to $840m^3$/day and 25 $200m^3$ per month.

5.16 Storm Water Management

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

5.17 Transport

Kangala Coal Mine will provide a bus service that will transport the mine workers from the surrounding areas to the mine. No accommodation will be provided for the mine workers on the site.

All coal will be sold to a coal trading company which will transport the coal 10km via haul truck to the Leeuwpan rail siding (Plan 4). From the Leeuwpan siding coal will be loaded using front end loaders and transported by COALlink to the Richard Bay Coal Terminal or to a selected Eskom power station which is likely to be Kendal Power Station. The transport of coal will have an impact on the R555 and the R50 as 198 haul trucks will be leaving the site daily to deliver coal to the Leeuwpan siding. Universal Coal will need to be committed to ensuring the safety of road users and therefore investigations into required road intersections must be undertaken before the mine is operational.

6 PROJECT ALTERNATIVES

Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives help identify the most appropriate method of developing the project, taking into account location or site alternatives, activity alternatives, process or technology alternatives, or the no-go alternative. Alternatives also help identify the activity with the least environmental impact.

6.1 Mining Alternatives

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

The depth to coal does not allow underground mining to take place. The tonnage of the resource and the life of mine will indicate the optimal mining rate; this in turn will inform the mining method. Drag line operations due to the depth and scale of the operation which makes it not economically feasible to use such an operation..

6.2 Land Use Alternatives

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

Plan 4: Proposed Transport Route

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

In the project area, present land uses includes agriculture (crop and grazing), residential, business and recreational. In terms of the Kangala Coal Mine project area, the current land use is commercial crop farming. Alternatively the land may be returned to its natural status which may hold possible eco-tourism benefits, however due to the adjacent land predominantly being used for agricultural purposes eco-tourism in the area is an unlikely option.

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

The Delmas area is of high agricultural potential and agriculture in the form of commercial crop farming and broiler farming. Agriculture has been occurring over generations and have been employing labours through the time. Agriculture provides a food source for both the local and export market. Agriculture can also negatively impact the environment t some degree.

Mining activities are governed by the resource, which determines the duration of the operation. During this time the mine will employ a limited number of permanent employees and the remaining will be contracted. Mining has a significant negative impact on the environment and after closure the land will be returned to grazing potential. However, currently the majority of the population in the area is employed in the agricultural sector and not in mining activities

6.3 Transport Alternatives

The final product coal will be transported to Leeuwpan siding 10km from the mining site. The coal will then be transported by rail to its final destinations. By making use of the siding and rail transport it eliminated that use of national roads to transport coal to its final destination and therefore not increasing the number of coal trucks on the already stressed road network. The 12km to the rail siding is a short distance in which a small section will be used of the R555 and the R50. The alternative to transporting the coal to the siding vial haul truck is to construct a conveyer belt, the use of a conveyer belt for the transport of coal to the siding will drastically reduce haul trucks on the road and the safety risk associated with road haulage. A conveyer bels system is usually not a favourable option for such a small mine with such a short LoM as it is costly to build and maintain, therefore the focus will need to be given by reducing the number of vehicles that travel to the siding by possible using higher tonnage haul trucks.

6.4 Mining Development and Infrastructure Alternatives

Universal Coal has aimed to reduce the size of the proposed mining activities footprint as far as possible to reduce the loss of agricultural potential land. Consideration of the findings of the environmental investigations has been considered to ensure the placement of infrastructure will not significantly impact the receiving environment. The footprint of the mining operations has decreased since the initial planning in the scoping phase. In terms of the beneficiation of coal on site there is the alternative of undertaking beneficiation at Exxaro Leeuwpan Colliery 10km from the site. Beneficiating the coal off site will reduce the need for the discard dump and therefore the environmental impact on the receiving environment will be reduced. Negotiations with Exxaro are ongoing depending on the outcomes of these negations the preferred option will be implemented.

6.5 No-mining Option

The current land use is one of agriculture, where land is planted to crops. The no-mining option will result in the continuation of such land use. Although economically viable, the continuation of agriculture may not provide the level of short-term economic growth to the area that mining would offer, such as increased employment of residents in the area, greater economic input into the area allowing better development of the towns and surrounding areas, and greater socio-economic stability in the area. Agriculture does, however, provide food for the nation which is an important resource.

After mine closure and rehabilitation of mined areas, the land capability may be return to a lower state of land capability than pre-mining. The mine will also promote sustainable local economic development, to give communities the skills required to remain economically viable and successful after mine closure.

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

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

7 DESCRIPTION OF THE ENVIRONMENT

The objective of this section is to provide a description of the current biophysical, socio-economic and cultural heritage environment of the proposed Kangala Coal Mine project area that has been established though various environmental investigations. The description will serve as a baseline according to which the potential impacts of the proposed mining activity will be compared and evaluated.

7.1 Climate

The project area falls within the Highveld climatic zone which is characterised by moderate summers, cold winters and summer rainfall.

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

Climate data from the SAWS was obtained for the station of Delmas Witklip (station number 0477309A6). The Delmas Weather Station is located within the study area. The data time series of this station for rainfall consists of a 30 year record, which stretches from 1979 to 2009. The data time series of this station for temperature consists of a 24 year record, which stretches from 1984 to 2009. Volume I of the WRC documents was used as a reference to assist in describing the climate of the local area.

7.1.1 Mean monthly rainfall

According to the rainfall data from the Delmas Weather Station between 1979 and 2009 the mean annual precipitation is 681mm.

Precipitation occurs as showers and thunderstorms and falls mainly from October to March with the maximum falls occurring in November, December and January. Rainstorms are often violent (up to 242 mm can occur in one day) with severe lightning and strong winds, sometimes accompanied by hail. The winter months are dry with the combined rainfall in June, July and August making up only 3.1 % of the annual total according to the data obtained from the weather station (Figure 7-1).

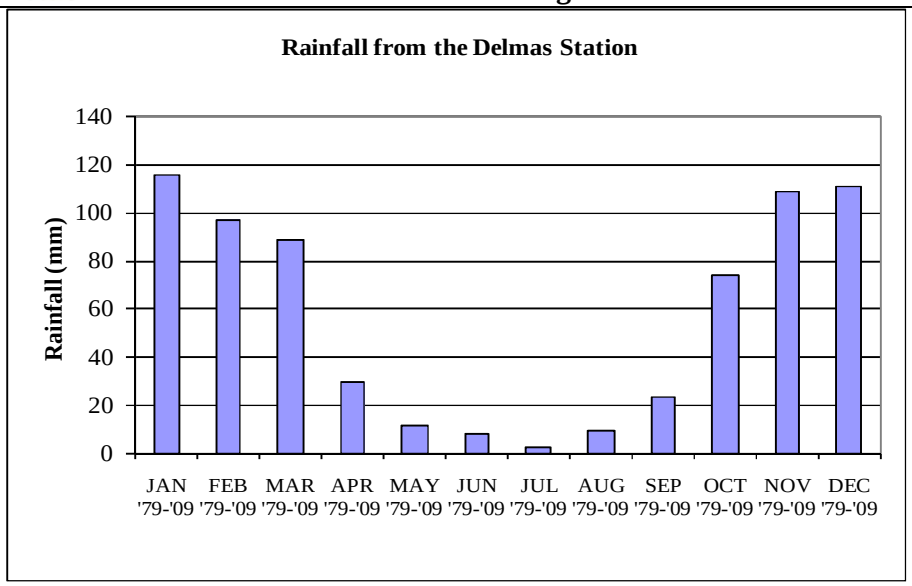


Figure 7-1: Total annual rainfall recorded between 1979 and 2008/2009

7.1.2 Mean monthly temperatures

According to the Delmas Weather Station the average daily maximum temperature in January (the hottest month) is 27.6 °C and in July (the coldest month) is 18.4 °C. The mean daily minimum in February is 14.5 °C and July 1 °C but extremes of -2 °C have occurred (Figure 7-2).

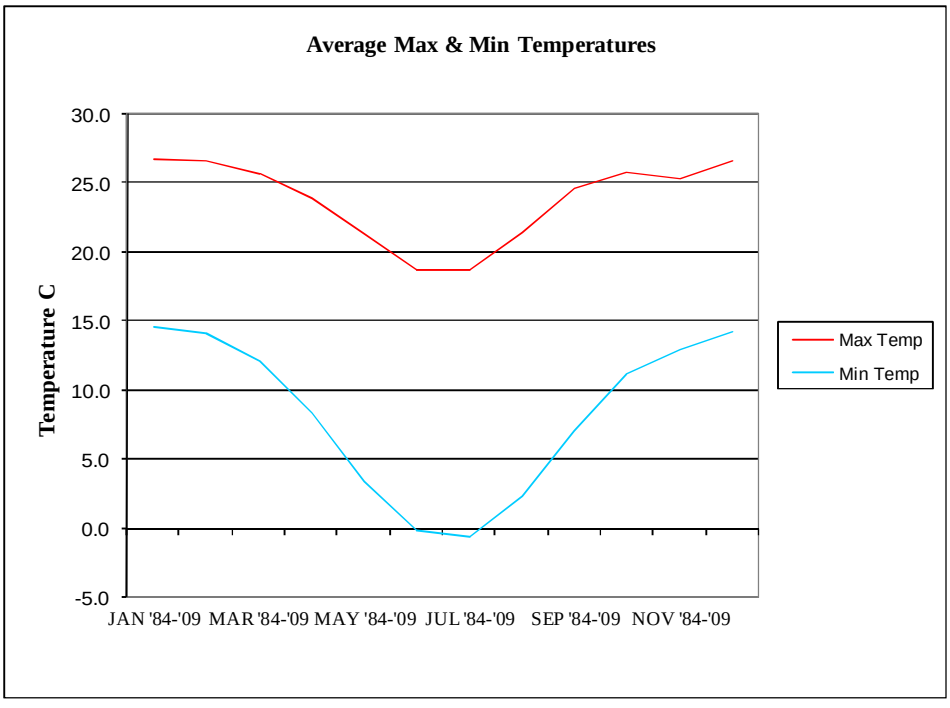


Figure 7-2: Average minimum and maximum temperatures recorded between 1984 and 2008/2009.

7.1.3 Mean monthly wind direction and speed

Data for 2001 to 2008/2009 from the Springs weather station was used. This stations data was used as it is the nearest to Delmas and thus depicts the closest wind patterns experienced at Delmas. Wind speeds, averaged over a one hour period, ranged from 0m/s to 8.7m/s with a period average wind speed of between 0.5 and 3.5 m/s having been recorded. The wind speeds fluctuate from season to season with the strongest winds during the months of September to November. The predominant wind direction is South-East, East to East-South-East.

Figure 7-3 represents the wind direction compared with the wind speed. The results were gathered over an 8 year period between 2001 and 2008/2009 from the climate station located in Springs approximately 30km to the north east of the site.

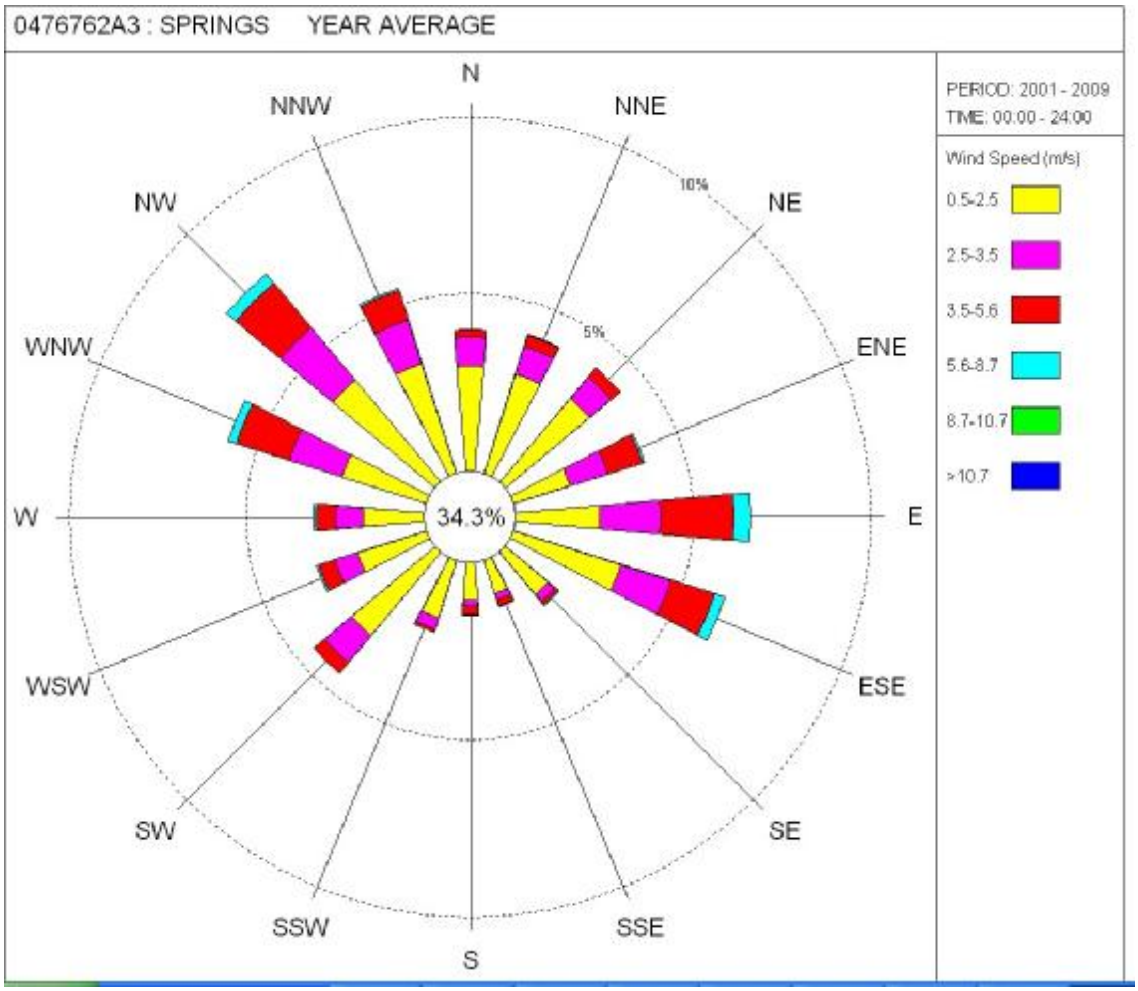


Figure 7-3: Wind Rose Diagram depicting the Average Wind Speed and Direction as measured from the period 2001-2008/2009

7.2 Topography

Topography is defined as the study of the earth's surface features and involves predominantly the relief of the surface, vegetation cover and human activities. The topography has a strong relationship with the underlying geology and climate; thus there is a strong link between topography and the science of geomorphology. One of the objectives of topography is to describe spatial relationships in terms of relative position, both horizontally and vertically.

The site is located at 28˚40' 25,76"E ; 26˚ 12' 16,643"S which falls within the Delmas Local Municipality within the Mpumalanga Province. Vegetation on site is dominated by the eastern Highveld grasslands. The general landscape typical of the Highveld grasslands is that of a gently undulating topography, with dispersed valley bottom wetlands and perennial/non perennial pans.

The project site covers 951ha which is characterised by topography very similar to that of the entire Highveld grassland area.

depicts the topography of the site.

As can be seen in

there are five non perennial pans, located in the central and north western portions of project MRA site, adjoining these pans are hill slope seepage wetlands. Three perennial streams flow in a northerly direction through the site, with associated valley bottom wetland systems.

Elevation on site is lowest in the valley bottom wetland along the eastern boundary of the project site at 1560 meters above sea level. The highest elevation is located on a spur on the western boundary of the site located very close to a trigonometric beacon at 1595 meters above sea level. This equates to a range of 35 meters between the highest and lowest points of elevation on the site. The low difference in elevation between these sites gives rise to a project site that is reasonably flat with an average slope percentage of < 2 percent. Slope percentage is steepest, increasing to 5 percent along the perennial stream that runs through the central portion of the site.

7.3 Geology

The geological information was abstracted from Universal Coal geological report. The proposed Kangala Coal Mine project is situated in the Witbank Coalfield (Plan 6). The Witbank Coalfield is currently the most important coalfield in South Africa, supplying more than 50% of South Africa's sale of coal. It produces both metallurgical coal and A-grade to D-grade steam coal for the export and local markets and hosts most of the major coal-fired power stations in South Africa to which it supplies low grade coal.

Plan 5: Topography

In the Witbank Coalfield proper five coal seams are contained within a 70m thick succession of Vryheid Formation sediments. The seams, from the base upwards, include:

No. 1 Seam:

The No. 1 seam is best developed in the northern part of the Witbank Coalfield, where it is approximately 1.5m to 2m thick. Elsewhere it is patchily developed and variable in thickness. The seam typically consists of high quality lustrous to dull coal with local shaly sandstone partings. The seam is a source of A-grade steam coal and low phosphorus metallurgical coal.

No. 2 Seam:

Approximately 69% of the coal resources in the Witbank Coalfield are attributed to the No 2 Seam, which also contains some of the best quality coal. The seam averages 6.5m in thickness in the main-central part of the coalfield and thins to approximately 3m towards the west and east. The seam generally displays well-defined zoning, with up to five zones of coal of differing quality. The basal three zones are generally being mined for production of low-ash metallurgical coal and steam coal for the export market.

No. 3 Seam:

The No. 3 seam is thin (usually less than 0.5m thick) and is generally uneconomic. It is locally of high quality and where it attains a thickness of approximately 0.8m, it could represent an important opencast resource.

No. 4 Seam:

Approximately 26% of the coal resources in the Witbank Coalfield are attributed to the No 4 Seam, which varies in thickness from approximately 2.5m in the central Witbank area to 6.5m elsewhere. In the Delmas area it attains a thickness of approximately 4m. The seam is divided into the 4 Lower, 4 Upper and 4 A zones, separated by sandstone and shale partings. The seam usually contains dull to dull lustrous coal and the mining horizon is generally restricted to the 4 Lower Seam because of the poor quality to the 4 Upper Seam. The coal is most suitable as a power station feedstock.

No. 5 Seam:

The No. 5 seam has extensively being eroded over large areas and has an average thickness of between 0.5m and 2m. The seam consists of mixed, mainly bright, banded coal with thin shale partings in a few localities. The seam is generally of high quality and is a source of both high-swell and low-swell blending coking coal.

Mining in the Witbank Coalfield started in 1889. The coal seams in the Delmas area were historically exploited at the now defunct Largo Colliery approximately 25 km southwest of Delmas. Currently a number of Collieries are present in the Delmas area, including Exxaro's Leeuwpan Mine and Stuart Colliery, both situated within a radius of approximately 5-10 km from the Kangala Project. Additionally, a number of junior coal miners, including Keaton

Energy (JSE listed) and Homeland Energy (TSE listed) are actively exploring coal assets in the area.

The coal in general is a high ash, low moisture and low volatile bituminous coal without further upgrading ideally suited for power generation or synthetic liquid fuel production.

7.3.1 Local Geology

The Kangala Coal Project lies at the western extent of the Witbank Coal Field towards the northern edge of the main Karoo sedimentary basin. The area is underlain by sedimentary sequences (predominantly sandstone, shale and coal) of the Vryheid Formation deposited on tillite of the Dwyka Formation or directly on the glaciated basement topography (mostly Malmani dolomites).

Dolerite intrusives (dykes and sills) are extensively developed south of the project area, with minor occurrences within the area of interest.

The Vryheid Formation locally hosts up to four flat lying coal seams. The economically important No. 4 and No. 2 Seams are the best developed in the area, whereas the No. 1 and 3 Seams occurs sporadically and/or joined to the No. 2 Seam. The No. 4 Seam and No. 2 Seam are of economic interest to Universal Coal.

The No. 4 Seam consists of a mixture of bright and dull coal with occasional shaly coal intra-seam partings. The No. 2 Seam consists of alternating coal and carbonaceous shale layers. The Kangala Project represents the eastern and western extension of the Greater Elof Coal Project. The typical stratigraphic succession of the coal bearing strata of the Vryheid Formation on Wolvenfontein is illustrated in Figure 7-4 and can be described from the bottom to the top as follows:

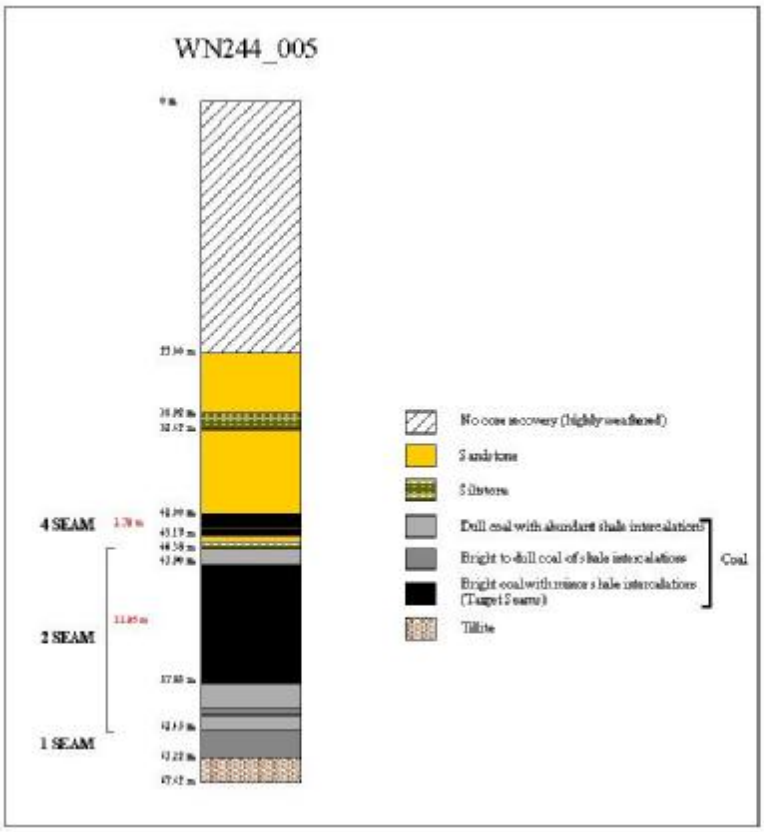


Figure 7-4: Typical stratigraphic succession of the local geology

The 2.77 m thick No. 1 Seam overlies tillite of the Dwyka Formation. The No. 1 Seam coal is generally dull to bright with intercalated carbonaceous shale layers. A carbonaceous shale parting sometimes occurs between the base of the No. 1 Seam and the Dwyka tillites.

A carbonaceous shale parting typically separates the No 1 Seam from the overlying No. 2 Seam. The parting averages 0.50 m in thickness, but can be absent.

The No. 2 Seam, as illustrated in the figure presented, is 19.07 m thick and generally consists of alternating dull and bright coal zones with varying amounts of carbonaceous shale intercalations. The bright coal zone within the No. 2 Seam is 11.95 m thick, occurs close to the top of the seam and is of economic value.

The parting between the No. 2 Seam and the overlying No. 4 Seam is 1.15 m thick and consists of laminated siltstone grading upwards into a fine-grained sandstone.

The No. 4 Seam is 2.17 m thick and consists of two coal bands separated by a siltstone parting (0.38 m). The upper coal band (1.17 m) consists of bright, finely banded coal of high quality. The lower coal band (0.62 m) consists of dull to lustrous coal. Both coal bands are of economic interest. Pyrite stringers and nodules are common within the Top seam.

Plan 6: Regional Geology

The No. 4 Seam is overlain by fine-to medium grained sandstone with minor and thin siltstone intercalations. The sandstone attains a maximum thickness of 41 m in the western part of Wolvenfontein.

The topsoil is between 4 to 10 m thick and consists of an upper 0.6 m of dark-brown sandy soil and an underlying yellow to brown clayey soil. Intense weathering occurs to a depth of 25 m and averages approximately 20 m over the entire property.

It is noted that there are various Karst systems in the area, dolerites have been intersected during drilling in the area of the proposed open cast pit. This will have implications for the groundwater study.

7.4 Land Attributes

A soil survey was undertaken for the proposed project area and the complete specialist report is attached in Appendix B

7.4.1 Soils

The topography at the farm Wolvenfontein is relatively flat. Some areas of the property consist of shallow crest like shapes followed by mid, foot slope and valley bottom terrain units. The higher lying area is occupied by deep well aerated red soil representing the Oakleaf soil form. Depressions in the landscape are occupied by pans containing shallow Katspruit soils.

The valley bottom positions are occupied by wetlands. The wetland area dividing the farm from east to west, contains similar to the pans, also Katspruit soils. The main wetland next to the National road to Nigel, contains mainly Valsrivier and Arcadia soils. The occurrence of these soils in the main wetland area indicates that the wetland drains relatively quickly (water runs off) and the soils are not waterlogged for long periods. Opposed to this the pans do not have quick water runoff and drainage so these stay waterlogged for longer periods.

Table 7-1 contains the soil types and areas occupied by the various soil types while Plan 7 indicates the various soil groups found on the farm Wolvenfontein. It is evident from Table 7-1 that 70 % of the farm is dominated by high potential Oakleaf and Tukulu soils. 26 % of the property is occupied by wetlands and pans of which at least 10 % is cultivated.

The topography at the farm Wolvenfontein is relatively flat with gentle slopes of 1 – 2 % in the cultivated areas followed by steeper slopes of 2 – 6 % towards the wetland area. Some areas of the property consist of shallow crest like shapes followed by mid, foot slopes and valley bottoms. The higher lying area is occupied by deep well aerated red soil representing the Oakleaf soil form.

Table 7-1: Soil types occurring on the farm Wolvenfontein

Soil Types	Area (ha)	Area (%)	Average depth (m)
Oakleaf	285.6	32.3	1.4
Tukulu	340.8	38.6	0.8
Cultivated wetland areas (Katspruit)	87.8	9.9	0.35
Uncultivated wetland areas (Katspruit, Valsrivier, Arcadia)	140.3	15.9	0.35
Cultivated shallow soil (Dresden)	4	0.5	0.3
Uncultivated shallow soil (Mispah)	24.6	2.8	< 0.3
Total	**883.1**	**100**	

The valley bottom positions are occupied by wetlands. The wetland area, which has similar soils to the pans (Katspruit soils) divides the farm from east to west. The main wetland next to the National road to Nigel, contains mainly Valsrivier and Arcadia soils. The occurrence of these soils in the main wetland area indicates that the wetland drains relatively quickly (water runs off) and the soils are not waterlogged for long periods.

The mid and foot slope positions between the higher landscape positions and the valley bottom positions are dominated by similar red, well aerated soils. These soils, however, show indications of wetness in the subsoil. The presence of permanent wet subsoil changes the classification from an Oakleaf soil form to a Tukulu soil form. The wet area is present just above the parent material which is impervious to water therefore providing the conditions for the soil to stay wet for long periods. The B horizon is still a neocutanic subsoil horizon. The only difference is the presence of the wet zone at the bottom of the B horizon. Generally the Tukulu soil form is shallower than the Oakleaf soil form.

Small areas on the farm Wolvenfontein are very shallow containing Glenrosa and Mispah soil forms. These soils contain an orthic A horizon underlain by weathered or hard rock respectively. The shallow stony areas are left uncultivated due to the challenge stones pose to farming equipment (see Plan 7). One area next to the east/west wetland contains the Westleigh/Dresden soil forms. These soil forms are characterized by orthic A horizons underlain by soft or hard plinthite respectively.

The physical and chemical properties of the soil are discussed further in the Soil Survey Report attached in Appendix B

Plan 7: Soil Type

7.4.2 Pre-mining land capability

Land capability is determined by a combination of soil, terrain and climate features. Land capability is defined as the potential intensive long term use of land under rain-fed conditions. At the same time an indication is given about the permanent limitations associated with the different land use classes.

The land capability of the farm Wolvenfontein is classified as mainly arable, high potential farm land (see Plan 8). 71 % of the total area consists of arable high potential soil. 29 % of the farm is occupied by low potential agricultural soil due to mainly depth restrictions on the one hand and imperfect drainage on the other hand. The exceptions to arable farm land being the shallow soil in the pan and wetland areas. A small portion, namely 10 %, of the total area comprising of pan and wetland areas, is cultivated. These areas will present the farmer with challenging problems especially during wet seasons due to the shallow soil and underlying waterlogged G horizon. Crops yields in the waterlogged areas will be low and using farm machinery on wet Katspruit soil is difficult.

The agricultural potential of the soil in the survey area is determined by a combination of soil depth and favourable (high rainfall) climatic conditions. The high rainfall in combination with deep soil results in high arable agricultural potential. Some of the cultivated areas however form part of the wetland areas, see Plan 8. The soils in the wetland areas are shallow and exhibit signs of waterlogging. Shallow waterlogged soil has a low agricultural potential.

The dominant agricultural potential of the farm Wolvenfontein is classified as high potential farm land. There are, however, some areas of low agricultural potential present on the farm. High and low agricultural potential are indicated on Plan 8. The agricultural potential is low because soil depth is very limited in addition to poor drainage and high clay content. Smaller areas of shallow soil containing rocks are also part of the low agricultural potential as shown on Plan 8. Shallow rocky soils cannot be easily cultivated using normal agricultural equipment.

The agricultural potential of the soil in the survey area is determined by the combination of soil depth and favourable (high rainfall) climatic conditions. The soil occurring in the potential opencast mining site, however, contains high clay content, is waterlogged and shallow.

Plan 8: Land Capability

7.4.3 Land use

The predominant present land use in the wider area is arable agriculture. The farm Wolvenfontein is no exception and land use is dominated by arable crop production due to the dominant high potential soil. Plan 9 contains the land use information. Current land use is estimated at 81 % of the available land being used for arable farming. 19 % of the total available farmland is un-used due to shallow soils and wetland areas. The area is well serviced by tar roads as well as farm roads.

Arable crop farming activities dominate at the farm Wolvenfontein. During the time of the field survey the fields were cultivated but unplanted in anticipation of the rainy season. Only the wetland areas contain perennial vegetation potentially available for grazing. The wetland areas at Wolvenfontein are however not fenced off and are not used for grazing. The wetland areas were burnt during the winter thereby limiting potential grazing opportunities.

7.4.4 Concluding statement

The dominant soils found on the property represent the Oakleaf and Tukulu soil forms. The Oakleaf soils are deeper than their Tukulu counterparts. Lower lying pans and wetland areas contain the high clay content Katspruit soil form. The potential opencast area is dominated by the occurrence of Tukulu and Katspruit soil forms.

The dominant land capability of the potential opencast mining area on the farm Wolvenfontein is arable crop farming. Present land use is commercial crop production. The agricultural potential is high on the Tukulu soil but low on the shallow waterlogged Katspruit soil.

Considering the cumulative negative impacts of opencast coal mining on loss of land capability in general in Mpumalanga, then it must be emphasized that soil rehabilitation at Wolvenfontein post mining should strive to proportionally emulate pre-mining land capability and land use. The well drained high potential agricultural soils should be put back in the higher landscape positions while the low agricultural potential wetland and pan area soil should be put back in lower landscape positions.

It is recommended that land should be rehabilitated to pre-mining crop and wetland land capabilities on the planned opencast area. The heavy clay topsoil and subsoil material should not be mixed with the Tukulu topsoil and subsoil material, either during stockpiling or reclamation. The heavy clay soil contains high clay content and should be used to rehabilitate lower lying areas rather than higher in the topography.

Compaction by vehicle traffic should be avoided when reclamation takes place. Soil physical problems are of real concern because impacts on reclaimed vegetation are severe due to restricted root growth, low water penetration and low water holding capacity. Compacted shallow soils are commonly found after opencast rehabilitation resulting in poor vegetation establishment and growth. The rehabilitation budget should include costs to cover intensive deep ripping, using custom-built, dozer-drawn ripping equipment.

Plan 9: Current Land Use

Soil fertility and acidity status should be established through representative soil sampling and analyses to ensure optimal post reclamation vegetative growth and crop production. Any nutritional or acidity problems should be corrected prior to any vegetation establishment on reclaimed soil

7.5 Surface Water

A complete Surface Water Report is attached in Appendix C.

7.5.1 Surface Water Quantity

Included in the surface water quantity section below are findings on specific sub-catchment areas, flood volume flows and flood line locations. Mean annual run-off and average dry flow values are also presented.

7.5.1.1 Catchment Boundaries

The proposed mine project falls within quaternary catchment B20A and lies on one of the upper tributaries of the Bronkhorsspruit river . The sub-catchment within which the proposed mining area falls is 151 km2. The study area was sub-divided into 15 sub-catchments for the purpose of the calculation of 1:100 year flood peaks, and delineation of flood lines for streams in the proposed mining area.

For the purpose of calculating the 1:100 year flood peaks and delineating the corresponding floodplains and flood lines as required by the national water legislation, the sub-catchments were grouped as follows from East to West:-

1. Stream running through the south-eastern corner of the project site (Catchment: C13). This stream has a relatively big catchment area upstream of the south-eastern part of the project site. The stream has three upstream tributaries and a number of sub-tributaries. Catchments for the tributaries are C6, C9, and C12. Catchments for the sub-tributaries are C8, C7, C10, and C11
2. Stream draining the southern part of the project site with two upstream tributaries (Catchment: C4). Catchments for the tributaries are C1 and C2 (Plan 4);
3. Stream that draining the central part of the project site with a relatively significant runoff contribution from an area upstream of this part of the project site (Catchment: C3 – Plan 4);
4. Stream draining some of the north-western part of the project site. This stream flows past the project site on the north-west, but has a small area of the project site draining into it

7.5.1.2 Mean Annual Runoff

The Mean Annual Runoff (MAR) of B20A is 38 mm (21.7 Mm3). The Mean Annual Precipitation (MAP) for B20A is 661 mm and the ratio of the MAR to MAP is 5.7%. The Mean Annual Evaporation (MAE) is 1650 mm.

7.5.1.3 Normal Dry Weather Flow Volume

During normal dry weather seasons, the flow volume per year of the quaternary catchment area is 10.22 x 106m3 (DWAF, 2005).

7.5.1.4 Flood Flows

The peak flows for the various sub-catchments delineated were assessed utilising a combination of the following Rainfall-Runoff methods (Table 2):

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

Rational Method

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

Alternative Rational Method

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

Standard Design Flood

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

Soil Conservation Services Method

The United States Department of Agriculture's soil based technique (SCS) for the estimation of design flood volume and peak discharge from small catchments (i.e. < 30 km²) were originally adapted for use in Southern Africa by Schulze and Arnold in 1979. Based on extensive research and extended databases an updated version of this method was developed further for Southern Africa by Schmidt, Schulze and Dent (1987).

The flood peaks (1: 100 year return period) results (Table 7-2) obtained by using all four methods for all the sub-catchments were found to be quite close to one another. The SCS method has an added advantage over the other three methods as it allows for soil properties to

be included in the flood quantities (1:100 year) estimation. Thus the SCS method results were selected for the determination of the surface water profiles and floodlines.

Table 7-2: Flood peaks - 1:100 year return period

Sub-Catchment	Rational (m^3/s)	Alternative Rational (m^3/s)	SDF (m^3/s)	SCS (m^3/s)
C1	95.7	99.4	91.3	101
C2	93.6	96.8	88.9	93.6
C3	144	153	151	147
C4	80.4	83.3	93.2	92.9
C5	75.1	77.9	86.2	84.0
C6	45.2	46.2	43.0	45.4
C7	79.4	81.9	72.6	72.9
C8	73.7	75.9	67.0	74.3
C9	75.8	78.6	75.8	80.3
C10	74.4	76.6	67.8	69.0
C11	92.2	95.2	83.6	85.4
C12	121	128	131	130
C13	81.9	85.5	93.3	92.5
C14	111	115	110	105
C15	55.4	57.1	55.2	57.6

7.5.1.5 Flood Lines

The floodlines, the 100 m buffer zone around the streams, and the exclusion zone for mining or mine infrastructure placement were delineated using the Geographic Information System (GIS) Software ArcGIS 9 (Plan 10). No mining is to take place within the buffer zone.

Plan 10: Floodlines

7.5.2 Surface Water Quality

The surface water field survey which was undertaken from the 2nd to the 4th of March 2009 included the following farm portions (Plan 5):

- Portion 6 of Weilaagte Farm, 271 IR
- Portion 3 of Stompiesfontein Farm, 273 IR
- Portion 33 of Strydpan Farm, 243 IR
- Portion 20 of Strydpan Farm, 243 IR
- Portion 1 of Wolvenfontein Farm, 244 IR
- Portion 6 of Wolvenfontein Farm, 244 IR
- Portion R of Wolvenfontein Farm, 244 IR
- Portion 3 of Wolvenfontein Farm, 244 IR
- Portion R of Witklip Farm, 229 IR

The location of all the points from which surface water resources (rivers, streams and pans) were sampled were recorded with a hand-held Global Positioning System (GPS) for the purpose of spatial orientation and are indicated in Plan 5. The collected samples were submitted to an accredited water quality analysis laboratory for the analysis of the chemical constituents.

7.5.2.1 Field Investigation

Hydrocensus Nomenclature

A total of 10 surface water sources (river, streams and pans) were sampled in the area (Plan 11). A number of chemical constituents in the surface water hydrocensus samples were analysed at Regen Waters laboratory, in Witbank, Mpumalanga. The results were then benchmarked against the SANS 241 (2005) drinking water quality standards as presented in Table 7-3.

Table 7-3: Chemical results from the surface water samples taken in March 2009

Sample ID		Total Dissolved Solids	Nitrate NO_3 as N	Chlorides as Cl	Total Alkalinity as $CaCO_3$	Sulphate as SO_4	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Iron as Fe	Manganese as Mn	Conductivity at 25° C in mS/m	pH-Value at 25° C	Aluminium as Al	Free and Saline Ammonia as N
Class 0	(Ideal)	<450	<6.0	<100	N/S	<200	<80	<30	<100	<25	<0.01	<0.05	<70	6.0-9.0	<0.15	N/S
Class I	(Acceptable)	450-1000	6.0-10.0	100-200	N/S	200-400	80-150	30-70	100-200	25-50	0.01-0.2	0.05-0.1	70-150	5-6 or 9.0-9.5	0.15-0.3	N/S
Class II	(Max. Allowable)	1000-2400	>10-20	>200-600	N/S	>400-600	>150-300	>70-100	200-400	50-100	>0.2-2	>0.1-1	>150-370	4-5 or 9.5-10	>0.3-0.58	N/S
Class III	(Exceeding)	>2400	>20	>600	N/S	>600	>300	>100	>400	>100	>2	>1	>370	<4 or >10	>0.58	N/S
INJ1	II	162	<0.10	13.0	109	15.6	12.1	9.93	22.4	6.75	0.16	0.20	24.7	7.29	0.26	0.78
INJ2	I	170	<0.10	30.0	71.0	23.9	13.7	8.68	22.2	8.65	0.02	0.07	27.4	6.95	0.12	0.39
INJ3	I	62.0	<0.10	3.00	38.0	8.80	6.55	3.91	2.59	5.89	<0.01	0.06	9.27	6.60	0.13	0.48
INJ4	II	54.0	<0.10	3.00	32.0	6.10	7.53	1.95	2.69	5.81	0.38	0.05	7.65	6.62	0.12	0.55
INJ5	I	250	<0.10	25.0	171	7.40	25.3	15.2	20.8	19.0	0.14	0.06	39.5	7.00	0.12	0.86
INJ6	0	162	<0.10	11.0	117	9.00	15.9	11.4	18.8	8.24	<0.01	0.04	26.9	7.10	0.13	0.75
INJ7	II	330	<0.10	14.0	153	14.8	18.0	14.7	29.1	5.58	1.21	0.04	34.0	7.23	0.12	<0.20
INJ8	0	190	<0.10	11.0	146	13.8	18.6	15.6	20.1	3.87	<0.01	0.02	30.6	7.66	0.12	<0.20
INJ9	0	250	<0.10	12.0	192	10.0	24.3	19.0	26.0	6.52	<0.01	0.03	39.3	7.85	0.12	<0.20
INJ10	0	202	<0.10	13.0	157	8.60	20.5	14.7	22.3	7.16	<0.01	0.04	32.6	7.28	0.13	0.89

The results are colour coded according to the SANS 241 class in which they fall (Table 7-3), more especially in the cases where the Class 0 (ideal) guidelines were exceeded. The following was deduced from the results for each point that was sampled:

- INJ1: Most of the chemical constituents measured at this sampling point were found to be within the ideal limit (Class 0). Fe and Al concentration levels were found to be within the acceptable limit (Class I) while Mn concentration fell within the maximum allowable limit (Class II). Considering that the highest limit or class under which one of the constituents fell was Class II, the overall water quality of this sampling point is therefore considered to be of a Class II SANS 241 drinking water quality standard.
- INJ2: Most of the chemical constituents measured at this sampling point were found to be within the ideal limit (Class 0). Fe and Mn concentration levels were found to be within the acceptable limit (Class I). In view of the fact two of the constituents fell within Class I, the overall water quality of this sampling point is therefore considered to be of a Class I SANS 241 drinking water quality standard and thus suitable for human consumption;
- INJ3: Most of the chemical constituents measured at this sampling point were found to be within the ideal limit (Class 0). The highest concentration level measured was that of Mn, which fell within the acceptable limit (Class I). Thus the overall water quality at this point is characterised as Class I and is suitable for human consumption.
- INJ4: Most of the chemical constituents measured at this sampling point were found to be within the ideal limit (Class 0). Mn and Fe concentration levels were found to be within the acceptable limit (Class I), and the maximum allowable limits (Class II), respectively. The overall water quality of this sampling point is therefore considered to be of a Class II SANS 241 drinking water quality standard and was at the time of sampling suitable for human consumption.
- INJ5: Most of the chemical constituents measured at this sampling point were found to be within the ideal limit (Class 0). The concentration levels of Mn and Fe were found to be within the acceptable limit (Class I). The overall water quality of this sampling point is therefore considered to be of a Class I SANS 241 drinking water quality standard;
- INJ6: All of the chemical constituents measured at this sampling point were found to be within the ideal limit (Class 0). The overall water quality of this sampling point is therefore considered to be of a very good quality i.e. Class 0 SANS 241 drinking water quality standard;
- INJ7: All of the chemical constituents measured at this sampling point except Fe were found to be within the ideal limit (Class 0. Fe concentration level was found to be within the maximum allowable limit (Class II). The overall water quality of this sampling point is therefore considered to be of a Class II SANS 241 drinking water quality standard;
- INJ8: All of the chemical constituents measured at this sampling point were found to be within the ideal limit (Class 0). The overall water quality of this sampling point is therefore considered to be of a very good quality i.e. Class 0 SANS 241 drinking water quality standard;

- INJ9: All of the chemical constituents measured at this sampling point were found to be within the ideal limit (Class 0). The overall water quality of this sampling point is therefore considered to be of a very good quality i.e. Class 0 SANS 241 drinking water quality standard; and
- INJ10: All of the chemical constituents measured at this sampling point were found to be within the ideal limit (Class 0). The overall water quality of this sampling point is therefore considered to be of a very good quality i.e. Class 0 SANS 241 drinking water quality standard;

In general, the water quality in the area was at the time of sampling was suitable for human consumption ranking within Class 1 and 2 of the SANS 241 standards. However, the metal concentration levels (Fe, Mn and Al) had a higher concentration level at a number of sampling points . This was attributed to the fact that most of the water samples were collected from stagnant water as the area is characterised by a high number of pans and small streams with very slow flows. Furthermore, the evaporation of water from the pan sites can contribute to the higher metal concentrations and more total dissolved solids. Although the national standards (SANS 241) for drinking water quality are the acceptable standard for water quality analysis, there are DWAF guidelines which govern other water users such as aquatic life and agricultural use.

It is important to note that the main use of water in the quaternary catchment of the proposed project area is agriculture (WARMS, 2008). Based on the DWAF guidelines for such use, the water quality of the sampled sites was within the ideal/acceptable limits. In light of this , it is crucial to ensure that the mining operation will not negatively impact on the surface water resources so as to deteriorate the quality at the sampled points. Proper management measures will ensure that the downstream water users continue to receive the same quality of water during and post mining.

7.5.3 Surface Water Use

The main use of surface water in B20A is irrigation and livestock watering (Plan 6). Total number of registered surface water users in B20A is 78. Most of the users abstract water from the Koffiespruit and Bronkhorstspruit rivers and their tributaries. The annual water volumes abstracted by the users as per the DWAF database range from 365 to 640 000 m3/a. Three of these users are close to the proposed mining area. One user is located on the south-eastern corner of the farm to be affected by the proposed mining project. Another user is located 1.5 kilometres south-east of the first one while the third user is 3.5 kilometres downstream of the affected farm (Plan 6).

7.5.4 Water Authority

The Department of Water Affairs and Forestry (DWAF) has the overall mandate for the management of the Olifants WMA.

Plan 11: Hydrocensus

Plan 12: Registered Water Users

7.6 Groundwater

DWA is in the process of completing a hydrogeological investigation on the proposed Kangala Coal Mine project area. Five new boreholes were drilled from ground geophysical anomalies and successful boreholes aquifer tested to gain the necessary aquifer parameters so that groundwater flow can be quantified. Background water chemistry will also be deduced. Due to unforseen delays, the results from the geohydrological study are not available in time to include in this draft report. The final hydrogeological report which will include all the work completed to date has therefore not been completed for inclusion in this Draft EIA EMP. It will be included in the final EIA EMP for submission to DM, but will also be made available to I&AP's. The results of the study will be presented at the I&AP feedback meeting on the 24th November, where additional concerns and comments will be noted.

Please notify DWA if you would like to receive a copy of the Geohydrological Report once completed.

The information presented in this section is therefore conceptual and desktop level.

7.6.1 Conceptual hydrogeology

The area is underlain by sedimentary sequences (predominantly sandstone, shale and coal) of the Vryheid Formation deposited on tillite of the Dwyka Formation or directly on the glaciated basement topography (mostly Malmani dolomites).

The hydrogeological significant units are foremost the karstified sections within the Malmani dolomites to the north, while the upper weathered Ecca aquifer, the fractured aquifer within the competent Ecca sediments and the aquifer below the Ecca sediments make up the larger portion of the project area.

According to the lithological information supplied by Universal Coal PLC (Malan, 2008) the Ecca sediments are weathered to depths between 0 – 25 m below surface throughout the area. The upper aquifer is associated with this weathered zone and water is often found a few meters below the surface. Rainfall that infiltrates into the weathered rock reaches impermeable layers of sediment below the weathered zone, where it accumulates and groundwater flow is in a lateral direction following the surface slope. Water reappears as seeps at the wetland areas. The aquifer in the weathered zone is generally low yielding and ranges between 0.1 – 0.5 L/s as a result of lower conductivity.

The solution aquifers within the Malmani dolomites are normally very good aquifers with high storativity and conductivity and in general yields of higher than 5 L/s for this area (Hydrogeology map, DWEA, 1999) can be expected.

Pores within the Ecca sediments, comprising the lower aquifer, are too well cemented to allow any significant groundwater flow. All groundwater flow occurs along secondary structures, such as fractures and joints in the sediments. Structures are better developed in

the Sandstones, but it should be emphasized that not all fractures are water bearing. Of all the unweathered sediments in the Ecca, the coal seams often have the highest hydraulic conductivity.

Water quality in general is good with total dissolved solids between 193 and 814 mg/L and pH between 7 and 8.5 (DWEA, NGA data).

7.6.2 Groundwater recharge

This aquifer is recharged by rainfall and the percentage recharge is estimated to be between 1 and 3 % of the annual precipitation of between 600 and 800 mm/a (Hydrogeology map, DWEA, 1999).

7.6.3 Groundwater levels and flow

The available data from the National Groundwater Archive (NGA, DWAF) indicates that water levels in the project and surrounding area is in the range of 1 to 91 mbgl, measured over a period of 22 years. There is limited information regarding water strike depths of the boreholes in the proposed mining area and therefore it is not possible to perform any interpretation on aquifer geometry. As no elevation data above datum exists for the NGA data, very little interpretation can be deduced from the flow of groundwater in the area. Positional accuracy of this data is also questionable but at least yields some basic hydrogeological information of the area. Taking this fact into account we can use a 20 m digital terrain model (DTM) to assign an elevation (above datum) to the boreholes and derive very course piezometric contours for the project area (Plan 6). This at least presents an idea of the hydraulic gradient and some idea of the flow direction of groundwater in the area, which to some extent follows the surface topography. However unless more accurate data and new water level surveys are conducted this should not be seen as a conclusive tool for interpretation. Two scenarios might be of significance here:

- Groundwater could either be drawn from the Malmani dolomites when dewatering is performed for opencast mining; or
- A significant contamination risk could exist due to flow of groundwater towards the Malmani dolomites, especially after cessation of mining.

It is therefore vital to improve the groundwater data for this area.

7.6.4 Borehole yields

The 1:500 000 hydrogeological map (DWEA, 1999) indicate yields that range between 0.1 and more than 5 L/s.

7.6.5 Groundwater use

The boreholes in the proposed mining area are mainly utilised for domestic purposes, irrigation and livestock watering. Some large scale abstraction for the town water supply is

also evident from the groundwater data for the larger area. The volume of water derived from boreholes is yet to be established by the hydrocensus.

7.6.6 Groundwater quality

Data available from the DWEA, NGA database indicate that the quality of groundwater is good with an average EC value of 70.2 mS/m, an average pH of 8.07 and an average TDS of 503 mg/L. The concentration of all the cations, chloride, sulphate and heavy metals are well within the recommended acceptable limits (SANS 241:2005) for domestic and agricultural use. This is based on data available until 2004 in a 5 km radius around the project area.

Interpretation from displaying data on tri-linear diagrams such as the Piper and Extended Durov diagrams (Figure 7-5 and Figure 7-6 respectively) produces different groundwater classes. The Piper diagram indicates a groundwater classed as a calcium-magnesium-sodium-potassium type as well as a dominant group classed as a sodium-potassium type. Using the Extended Durov diagram for further refinement indicates a group that can be classed as a magnesium-calcium-bicarbonate type which is typical of groundwater interactions with dolomite while another group can be classed as a sodium-chloride type water which could be due to dissolution of certain minerals.

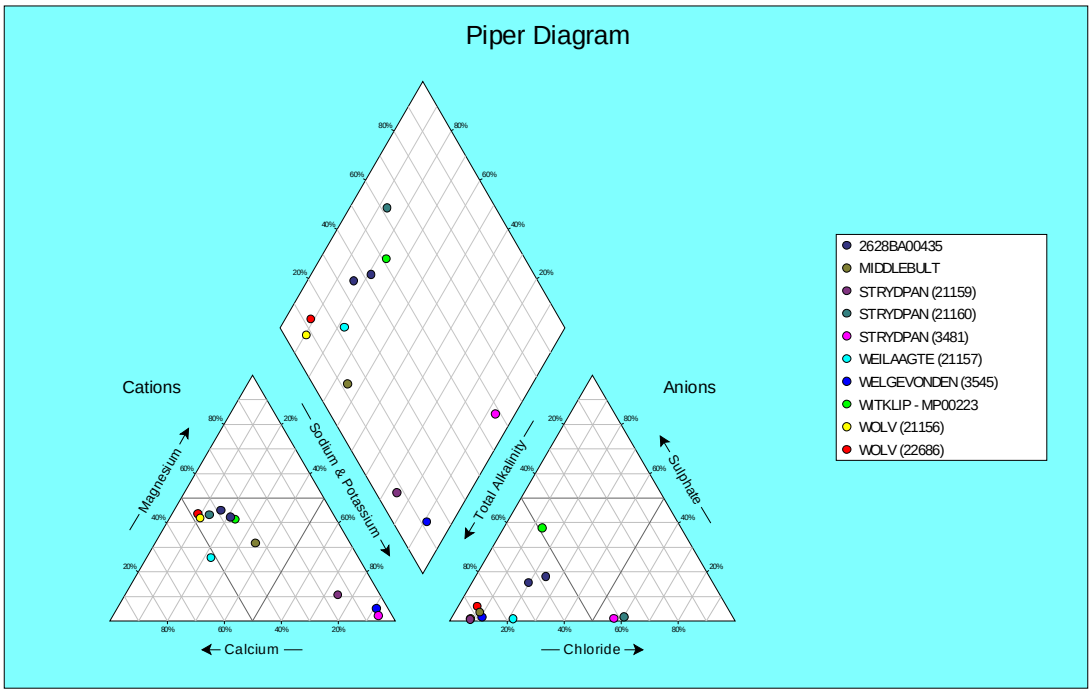


Figure 7-5: Piper diagram displaying the major cations and anions of the groundwater in the project area

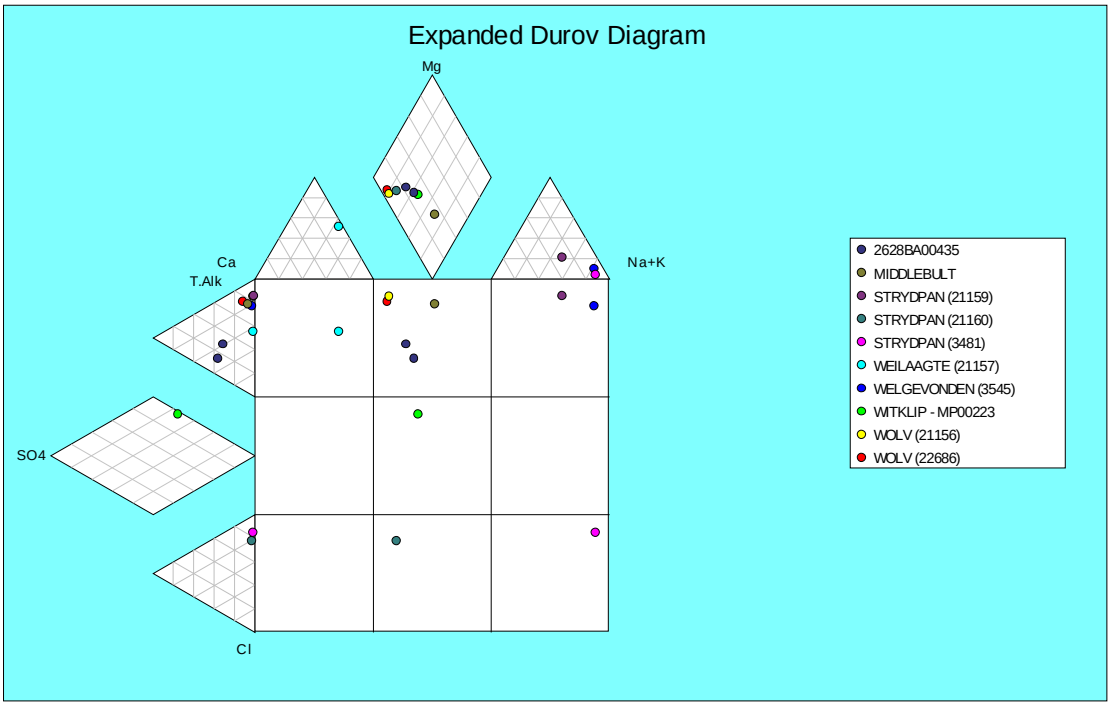


Figure 7-6: Extended Durov diagram displaying the major cations and anions of the groundwater in the project area.

7.7 Air quality

Subcontractors to DWA, Margot Saner & Associates, completed the Air Quality Assessment for the proposed Kangala Coal Mine project, attached in Appendix E

7.7.1 Highveld priority area

A 31,000 square kilometre area extending across eastern Gauteng and western Mpumalanga has been declared an air pollution hot spot by the minister of environmental affairs and tourism. The “Highveld Priority Area” is home to 3.6-million people and includes Witbank, Middelburg, Secunda, Standerton, Edenvale, Boksburg, Benoni and Balfour.

Sources of air pollution include power stations, timber industries, metal smelters, petrochemical plants, brick and stone works, mines (primarily coal mines), fertiliser and chemical producers, explosives producers and charcoal producers.

In declaring the Highveld Priority Area, the minister is satisfied that a situation exists within the area which is causing, or may cause, a significant negative impact on air quality and that the area requires specific air quality management action to rectify the situation, said a DEAT

spokesperson. DEAT and the affected provincial and municipal departments now have two years to develop an air quality management plan for the area.

The Highveld is the second priority area to be declared under the National Environmental Management: Air Quality Act 2004. The first was the Vaal Triangle Air-Shed Priority Area, declared in April 2006

The figure below shows the area that has been declared the Highveld Priority Area.

Figure 7-7: Highveld priority area

Based on the above, the proposed Kangala Coal Mine near Delmas falls within the Highveld Priority Area.

7.7.2 Source emissions quantification

In order to establish an emissions inventory for the modelling of the expected process contribution at the proposed site, fugitive sources of particulate emissions from the proposed

Kangala Coal Mine were quantified (more details are available in Appendix E). These are summarised in Table 7-4 below accounting for each of the individual mining operations.

Table 7-4: Emissions inventory

Source	PM_{10}	TSP
Loading Truck with Overburden	21.25	45.00
Loading Truck by shovel or FEL	21.00	43.50
Bulldozing Coal	284.70	893.52
Bulldozer on Overburden	35.04	148.92
Truck Unloading Overburden	6.45	18.00
Truck Unloading Coal	6.30	15.00
Drilling	6.19	11.78
Blasting	12.86	24.73
Dust generated from Unpaved Roads	120.00	310.40
Crushing	0.50	1.11
Screening	2.04	3.34
Miscellaneous Transfer and Conveying	0.30	0.59
Wind erosion from Active Stockpiles	54.75	109.50
Total:	**571.38**	**1625.40**

7.7.3 Survey results and dispersion model

For the purposes of this study it was assumed that the one month sampling period was representative of baseline conditions throughout the lifetime of the proposed mine.

No baseline ambient PM10 monitoring data was available at the time of this assessment. The Air Quality standards for PM10 used in the assessment were therefore applied solely to the modelled process contribution from the proposed Kangala Coal Mine.

Table 7-5: Baseline Dust deposition mg/m2/day at Receptor Level

Discrete Receptor	Average Dust deposition*
UN 1	287
UN 2	596
UN 3	697
UN 4	622
UN 5	765
UN 6	404
UN 7	503
UN 8	628
UN 9	470

* One month sampling average, August 2009

The aim of this Air Quality Impact Assessment was to determine, through computational techniques, the potential impacts to the environment (in the form of dust deposition and ambient PM10 concentrations) that would result from activities performed on proposed Kangala Coal Mine, near Delmas, Mpumalanga.

Baseline dust fall-out conditions were assessed using data acquired during a one month dust deposition study conducted by DWA in August 2009 (Plan 13). The results of this study are detailed in Table 7. No baseline data exists for ambient PM10 conditions.

According to the Department of Water and Environmental Affairs (DWEA), dust deposition can be classified as follows:

- SLIGHT : less than 250 mg/m2/day
- MODERATE : 250 to 500 mg/m2/day
- HEAVY : 500 to 1200 mg/m2/day
- VERY HEAVY: more than 1200 mg/m2/day

Investigation of the current baseline conditions revealed that the area is characterised by fallout dust in the MODERATE to HEAVY range. It is further noted that the averaged results obtained by the DWA study fall into Band 2 of the SANS 1929:2005 Four-Band.

Figure 7-8 – Figure 7-14 illustrate the predicted dispersion of PM10 contribution from the project and dust fall out. The dispersion model takes into account all the components of the dust generation for the calculation, including dust generation from blasting. Included is the change in dispersion if mitigation is undertaken. In terms of mitigation, fictitious scenarios of 0%, 50% and 90% effectiveness in dust suppression are presented.

Plan 13: Dust Fallout Sampling Points

The specific means of mitigation are not discussed as it is up to the mine to decide which mitigation methods they will employ and at what level. However, should mitigation be undertaken at an effectiveness of 50%-90% range, which is very reasonable, the scenarios created are perfectly feasible and representative. Please note the following figures are not to scale and scaled illustrations can be found in the complete specialist report attached in Appendix E.

Isopleths shown are the relevant PM10 reference standard concentrations, as predicted by the atmospheric dispersion model. The illustrated values are 30 µg/m3, 40 µg/m3 and 60 µg/m3 – i.e. the SANS 1929:2005 Target, SANS 1929:2005 Limit and NEMAQA reference standards for long term, Annual (yearly average exposure) for PM10 respectively

Depicted isopleths illustrate the relevant fallout dust reference standard concentrations, as predicted by the atmospheric dispersion model. The illustrated values are 100 µg/m3, 300 µg/m3 600 µg/m3, 1200 µg/m3 and 2400 mg/m2/day – i.e. the SANS 1929:2005 Target, Action and Alert thresholds for dust deposition respectively.

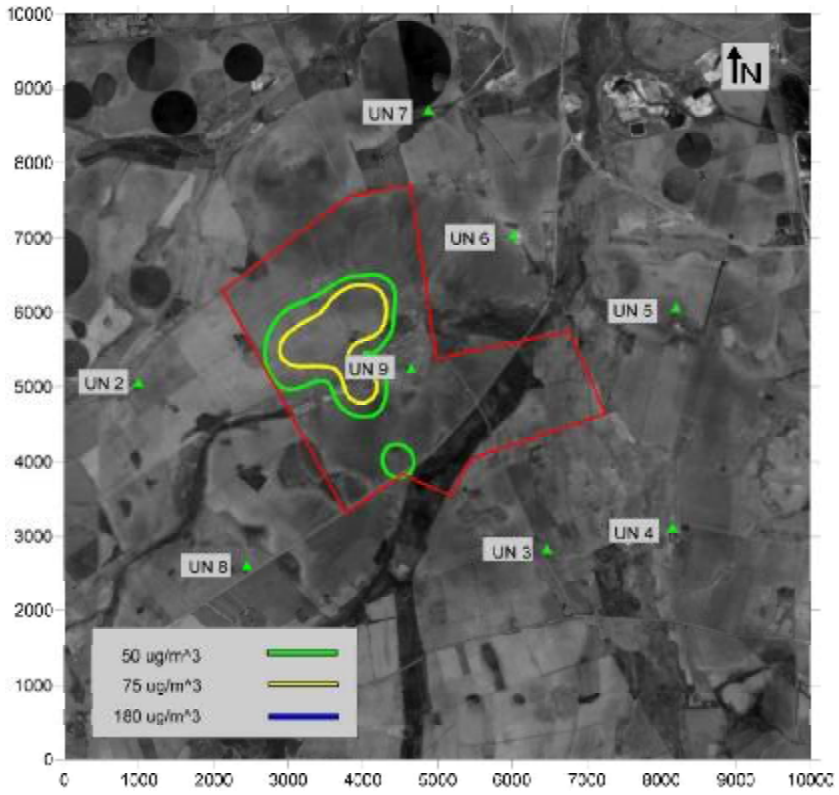


Figure 7-8: Predicted Process Contribution PM10 24 Hour Exposure (0% mitigation)

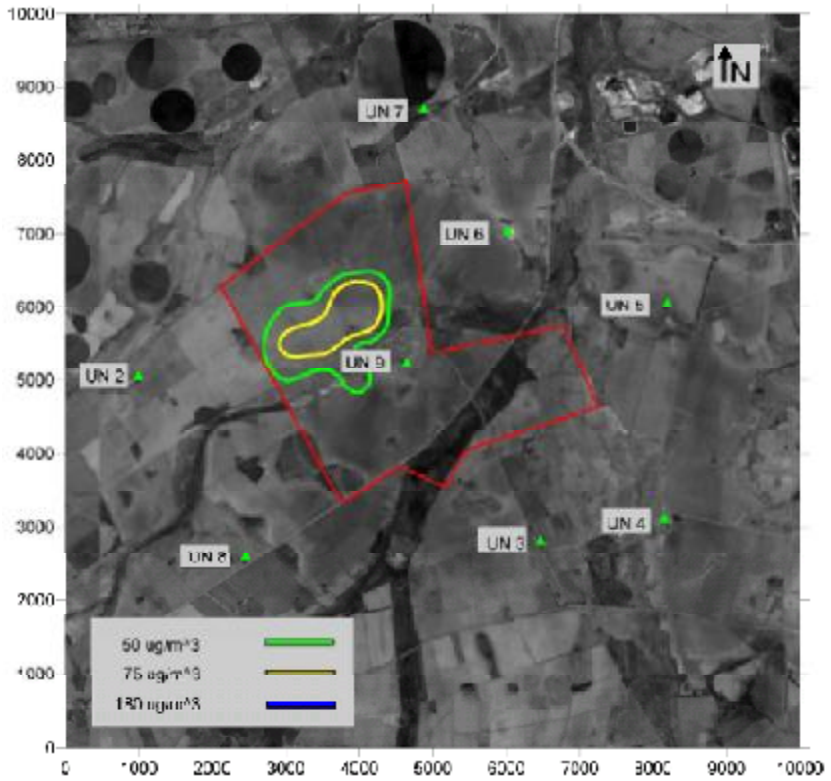


Figure 7-9: Predicted Process Contribution PM10 24 Hour Exposure (50% mitigation)

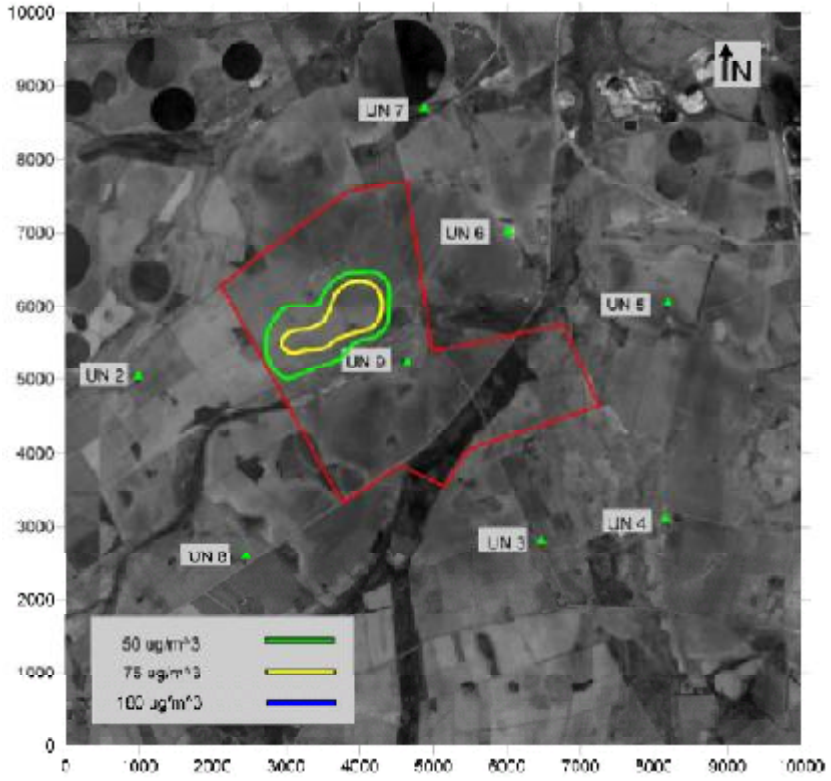


Figure 7-10: Predicted Process Contribution PM10 24 Hour Exposure (90% mitigation)

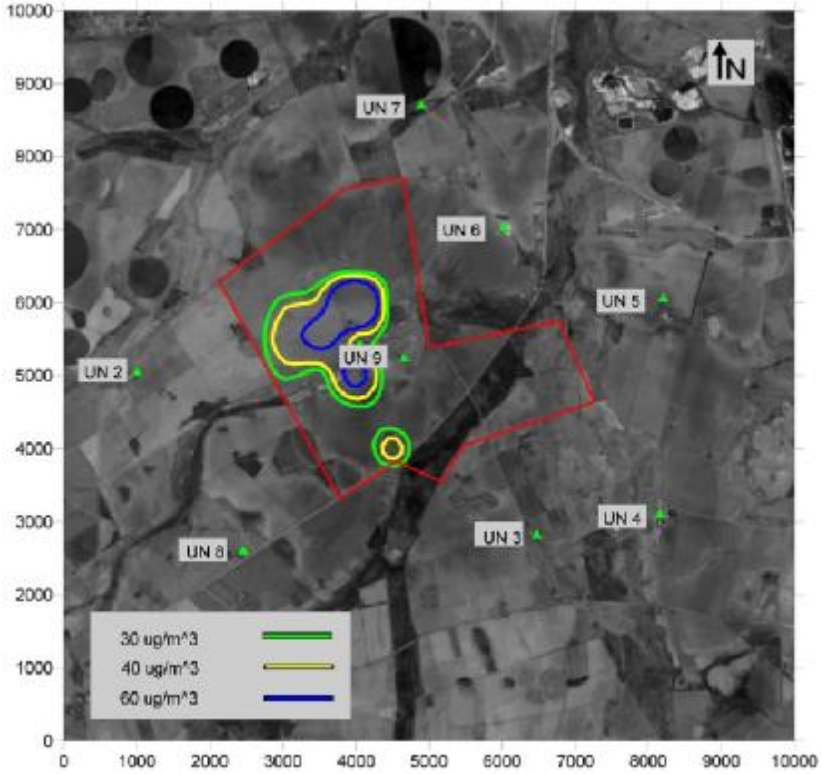


Figure 7-11: Predicted Process Contribution PM10 Annual Exposure (0% mitigation)

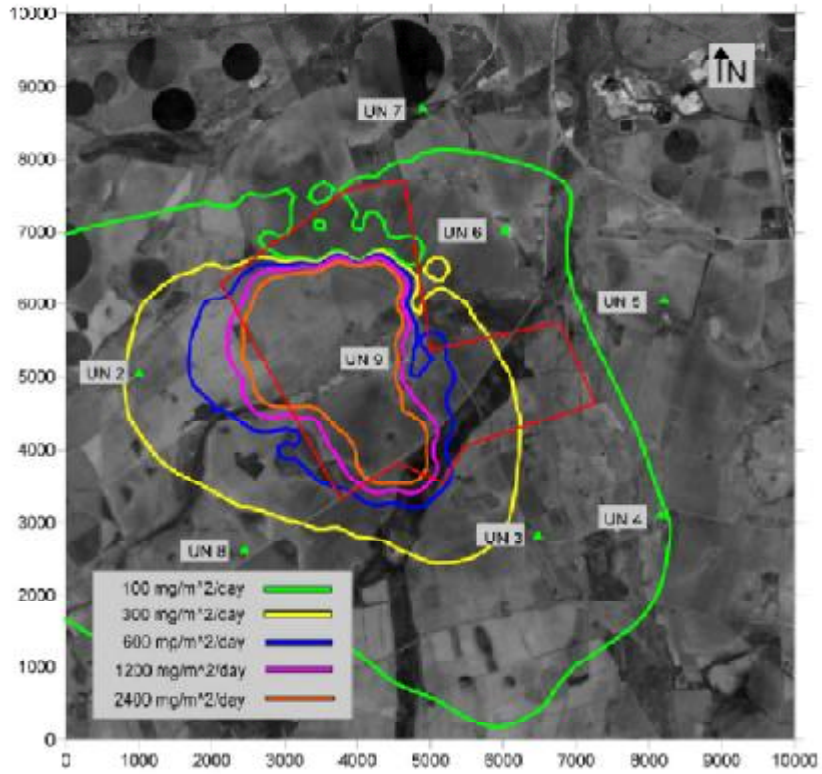


Figure 7-12: Predicted Process Contribution fallout dust Annual Exposure (0% mitigation)

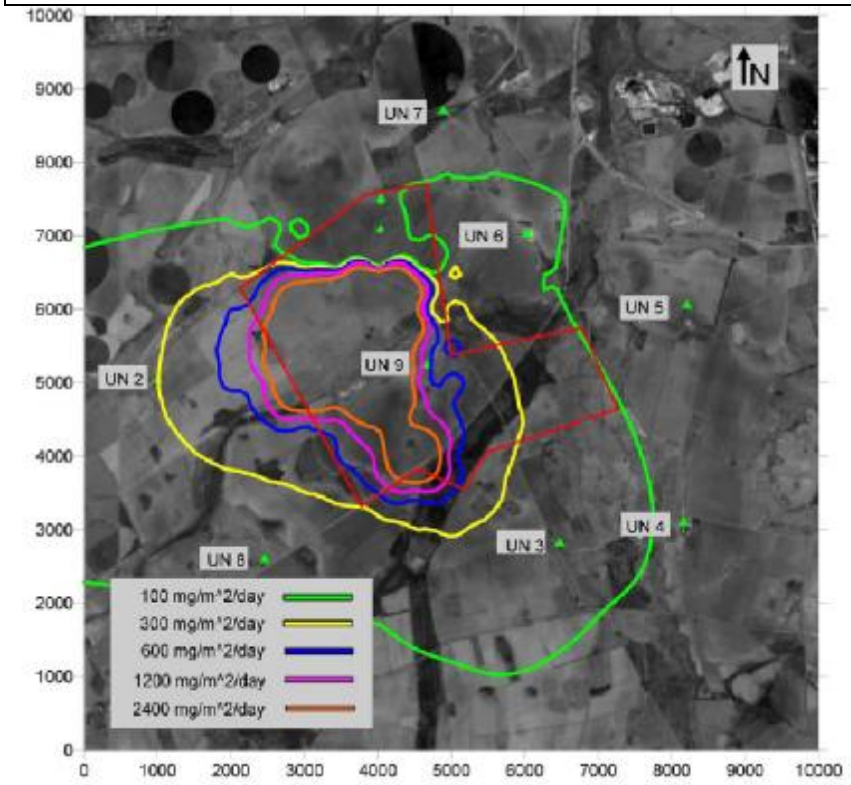


Figure 7-13: Predicted Process Contribution fallout dust Annual Exposure (50% mitigation)

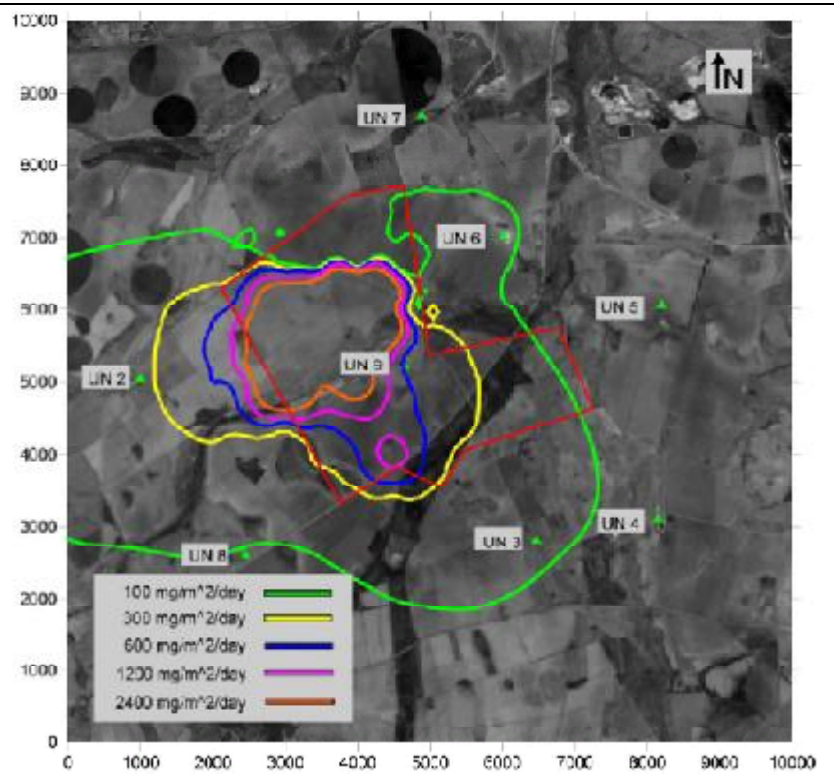


Figure 7-14: Predicted Process Contribution fallout dust Annual Exposure (90% mitigation)

7.8 Noise

A noise assessment was undertaken for the area surrounding the proposed project site. The Noise Survey Report that includes the methodology and standards used together with the results of the assessment is attached in Appendix F.

7.8.1 Baseline noise assessment

Baseline noise measurements were taken at various farmsteads, within a radius of two kilometres from the proposed mining activities. The two kilometre buffer zone has been selected in accordance to the Concawe method (SANS 10357) of calculating noise propagation.

According to the SANS 10103:2008 guidelines, 'daytime' is defined as anytime between 06:00 to 22:00, and 'night time' between 22:00 to 06:00. As a result of these guidelines, measurements were taken once during the daytime and once during night time at each identified noise receptor. Monitoring was taken at a measurement of 1.5 meters above ground level, and for a minimum period of 30 minutes (SANS 10103:2008).

A Quest (Model 1900), Type 1, impulse and precision integrating sound level meter (calibration certificates are available on request) was used for the measurements. The instrument was field calibrated with a Quest QC-10, sound level calibrator. Meteorological conditions at the time of the measurements were measured with a Kestrel 3500 pocket weather meter. Certificates of calibration for these instruments are available on request.

A list of identified receptors, within the 2km range where noise measurements were recorded, is presented in Table 7-6. The location of the identified receptors in which noise measurement were taken can be seen on Plan 14.

Table 7-6: Identified receptors

Code	Farm	Portion	Receptor type	Owner
UN1	Middelbult 235 IR	39	Homestead	Josua Boerdery
UN2	Strydpan 243 IR	15	Homestead	Eloff Mining Co pty ltd
UN3	Weilaagte 271 IR	9	Homestead	Adriaan Bruwer
UN4	Weilaagte 271 IR	4	Homestead	Koos Uys
UN5	Wolwenfontein 244 IR	5	Homestead	Willem Ooterhuis
UN6	Wolwenfontein 244 IR	R	Stores	Kallie Madel Trust
UN7	Witklip 232 IR	28	Homestead	Hendrik Schoeman en Seuns
UN8	Strydpan 243 IR	31	Homestead	Eloff Mining Co pty ltd
UN9	Wolwenfontein 244 IR	1	Homestead	Kallie Madel Trust

Plan 14: Noise Measurement Points.

7.8.2 Results

Results obtained from the noise survey will be addressed per sample point. The results from the noise meter recordings for all the sampled points as well as the SANS rating limits are presented in Table 4. Additionally this table also presents the recorded date, time and meteorological conditions.

Receptor UN1:

The measurement was taken at the residence of Mr. and Mrs. du Plessis who reside on portion 39 of the farm Middelbult 235 IR. The daytime Leq level measured 43.3 dB which is below the daytime rating limit for rural districts range. The night time Leq level measurement was 32.7 dB which is below the night time rating limit for rural districts.

Receptor UN2:

The measurement was taken at the residence of Mrs Teresa du Plessis who resides on portion 15 of the farm Strydpan 243 IR. The daytime Leq level measurement was 44.1 dB which is below the daytime rating limit for rural districts. The night time Leq level measurement was 33.3 dB which is below the night time rating limit for rural districts.

Receptor UN3:

The measurement was taken at the residence of Mr. Gerhard Opperman who resides on portion 9 of the farm Weilaagte 271 IR. The daytime Leq level measured 50.1 which is slightly above the daytime limit of 45 dB for rural districts. The cause of the high level may have been attributed to occasional barking of dogs on the farm.

The night time Leq level measured 32.9 dB which is below the night time noise limit for rural districts.

Receptor UN4:

The measurement was taken at the residence of Mr Uys, who resides on portion 4 of the farm Weilaagte 271 IR. The daytime Leq level measured 44.3 dB which is below the daytime limit for rural districts. The night time Leq level measured 32.9 dB which is below the night time limit for rural districts.

Receptor UN5:

The measurement was taken at the residence of Mr Jaco Oosterhuis, who resides on portion 5 of the farm Wolwenfontein 244 IR. The daytime Leq level measured 50.4 dB which is above the daytime limit for rural districts. The cause of the high level may be attributed to a tractor that was idling approximately 30 meters from the noise meter for the entire measurement period.

The night time Leq level measured 40.2 dB which is above the night time limit for rural districts. The high night time level was caused by the noise emanating from the existing

mining activities at Exxaro's Leeupan Colliery that is located approximately 1.5 km to the north.

Receptor UN6:

The measurement was taken at the Stores of Schoeman Boerdery on the remaining extent of the farm Wolwenfontein 244 IR. The daytime Leq level measured 37.3 dB which is below the daytime limit for rural districts. The night time Leq level measured 34.5 dB which is below the night time limit for rural districts.

Receptor UN7:

The measurement was taken at the residence of Mr Kallie Schoeman, who resides on portion 28 of the farm Witklip 232 IR. The daytime Leq level measured 42.7 dB which is below the daytime limit for rural districts. The night time Leq level measured 34.4 dB which is below the night time limit for rural districts.

Receptor UN8:

The measurement was taken at the residence on portion 32 of the farm Strydpan 243 IR. The daytime Leq level measured 46.1 dB which is slightly above the daytime limit for rural districts. The high noise level was caused by the vehicular traffic on the R42 that is running 50 meters south of the residence.

The night time Leq level measured 45 dB which is above the night time limit for rural districts. The high night time noise level was caused by the vehicular traffic on the R42 as well as the occasional barking of the dogs on the property.

Receptor UN9:

The measurement was taken at the residence on portion 1 of the farm Wolwenfontein 244 IR. The daytime Leq level measured 52.3 dB which is above the daytime limit for rural districts. The high level was caused by birdsong. The night time Leq level measured 32.5 dB which is below the night time limit for rural districts.

7.8.3 Concluding statement

With regards to the baseline assessment, the day and night time noise levels are primarily what is to be expected from a rural area. Most of the results are below or slightly above the SANS 10103:2008 guidelines. The few noise levels that were slightly above were due to noise associated with vehicular activity as well as the Leeufontein Colliery influencing the night time noise levels at receptor UN5.

It is expected that during the operational phase the noise levels generated by the mining activities will impact on the ambient noise level at receptors UN1, UN2, UN6, UN7 and UN9 during the night time.

It is expected that the blasting activities will impact on receptors UN1, UN2, UN6, UN7 and UN9. The identified mining activities throughout the decommissioning phase will have a low significance of impact on most of the receptors.

Table 7-7: Results from baseline noise measurements

Sample ID	SANS rating limit			Measurement details			
	Type of district	Period	Acceptable rating level dBA	LAreq,T	Maximum/ Minimum dBA	Date/Time	Meteorological conditions
UN1	Rural	Daytime	45	43.3	51.3 / 35.5	26/08/2009 : 09:00	Temp: 21.6°C-Wind: West @ 1.3 m/s -Humidity: 29.8%
		Night time	35	32.7	47.6 / 23.9	26/08/2009 :22:00	Temp: 8.1°C-Wind: West @ 0.3 m/s-Humidity: 50.6%
UN2	Rural	Daytime	45	44.1	63 / 37.3	26/08/2009 : 10:40	Temp: 21.6°C-Wind: West @ 1.3 m/s-Humidity: 31.2%
		Night time	35	33.3	52.2 / 30.5	26/08/2009 : 22:30	Temp: 8.1°C -Wind: West @ 0.3 m/s-Humidity: 50.6%
UN3	Rural	Daytime	45	50.1	60.9 / 35.5	25/08/2009 : 17:20	Temp: 16°C-Wind: West @ 0.5 m/s-Humidity: 39.7%
		Night time	35	32.9	52.2 / 28.4	25/08/2009 : 23:30	Temp: 8.6°C-Wind: West @ 0.9 m/s-Humidity: 52%
UN4	Rural	Daytime	45	44.3	54.6 / 31.9	25/08/2009: 16:00	Temp: 21.4°C-Wind: West @ 0.7 m/s-Humidity: 30%
		Night time	35	32.9	47.5 / 29.7	26/08/2009 :00:00	Temp: 8.6°C-Wind: West @ 0.9 m/s-Humidity: 52%
UN5	Rural	Daytime	45	50.4	66.6 / 44.1	26/08/2009 : 14:00	Temp: 25.5°C-Wind: West @ 1.9 m/s-Humidity: 19%
		Night time	35	40.2	49.5 / 36.1	27/08/2009 : 00:00	Temp: 8.1°C-Wind: West @ 0.3 m/s-Humidity: 50.6%
UN6	Rural	Daytime	45	37.7	54.2 / 29.4	26/08/2009 : 13:15	Temp: 25.2°C-Wind: West @ 1.3 m/s-Humidity: 17.7%
		Night time	35	34.5	50.8 / 28.7	26/08/2009 :23:25	Temp: 8.6°C-Wind: West @ 0.9 m/s-Humidity: 52%
UN7	Rural	Daytime	45	42.7	58.2 / 32.6	26/08/2009 : 12:00	Temp: 22.2°C-Wind: West north west@ 1.4 m/s-Humidity: 23.1%
		Night time	35	34.4	49.4 / 29.4	26/08/2009 : 23:00	Temp: 8.1°C-Wind: West @ 0.3 m/s-Humidity: 50.6%
UN8	Rural	Daytime	45	46.1	67.5 / 29.6	25/08/2009 : 13:00	Temp: 22.9°C-Wind: West @ 0.8 m/s-Humidity: 28.5%
		Night time	35	45	73.2 / 42	25/08/2009 :22:00	Temp: 9.3°C-Wind: West @ 0.3 m/s-Humidity: 57.1%
UN9	Rural	Daytime	45	52.3	78.8 / 30.7	25/08/2009 : 14:15	Temp: 22.9°C-Wind: West @ 0.8 m/s-Humidity: 28.5%
		Night time	35	32.5	55 / 27.7	25/08/2009 :22:45	Temp: 6.3°C-Wind: no wind-Humidity: 63.3%
	Indicates LAeq,T levels above either the daytime rating limit or the night time rating limit						

7.9 Air Blasting and Ground Vibration

Blast Management and Consulting sub-consultants contracted by DWA to undertake a Ground Vibration ad Air Blast study for the proposed Kangala Coal mine. The complete report is attached in Appendix G.

7.9.1 Ground vibration and prediction

Explosives are used to break rock through the shock waves and gasses yielded from the explosion. Ground vibration is a natural result from blasting activities. The far field vibrations are inevitable, but un-desirable by products of blasting operations may occur (such as damage to structures). The shock wave energy that travels beyond the zone of rock breakage is wasted and could cause damage and annoyance. The level or intensity of these far field vibration is however dependant on various factors. Some of these factors can be controlled to yield desired levels of ground vibration and still produce enough rock breakage energy. Factors influencing ground vibration are the charge mass per blast , distance from the blast, the delay period and the geometry of the blast. These factors are controlled by planned design and proper blast preparation.

- The larger the charge mass per blast - not the total mass of the blast, the greater the vibration energy yielded. Blasts are timed to produce effective relief and rock movement for successful breakage of the rock. A certain quantity of holes will detonate within the same time frame or delay and it is the maximum total explosive mass per such delay that will have the greatest influence. All calculations are based on the maximum charge detonating on a specific delay.
- Secondly is the distance between the blast and the point of interest / concern. Ground vibrations attenuate over distance at a rate determined by the mass per delay, timing and geology. Each geological interface a shock wave encounters will reduce the vibration energy due to reflections of the shock wave. Closer to the blast will yield high levels and further from the blast will yield lower levels.
- Thirdly the geology of the blast medium and surroundings also has an influence. High density materials have high shock wave transferability where low density materials have low transferability of the shock waves. Solid rock i.e. norite will yield higher levels of ground vibration than sand for the same distance and charge mass. The precise geology in the path of a shock wave cannot be observed easily, but can be tested for if necessary in typical signature trace studies - which are discussed shortly below.

Normally, in order to determine effective control measures, it will be required to do signature hole trace study. This process consists of charging and blasting test holes that are measured for ground vibration and air blast at various distances. Signature trace data can then be used to determine site specific constants for prediction of ground vibration and assist in determining timing of blasts in order to minimize the effect of vibration.

Possible effects of blasting operations are presented here. Review of the area surrounding the Kangala Mine showed various structures and installations that were identified and taken into consideration. Expected ground vibration and air blast levels were calculated for each of these structure locations surrounding the mining area. Ground vibration and air blast was calculated from the boundary of the mining area. This means that calculations were done from the edge as if it would be the closest place where drilling and blasting will be done to the various structures. The pit area was considered with charge masses applied are according to the blast designs done. The minimum and maximum charge mass was used. Ground vibration and air blast was calculated, then plotted and overlaid with current mining plans to observe possible influences at structures identified. Structures for consideration are also plotted in each model.

Ground vibration predictions were done considering distances ranging from 50 to 4500 m around the opencast mining area. The expected levels for each of the identified structures, possible influence and concern is also considered and presented in a table prior to modelling graphic. The opencast pit was reviewed for expected ground vibration. Table 7-8 shows the ground vibration predictions for minimum charge and the possible concern for human tolerances and structure response. Table 7-9 shows the ground vibration predictions for maximum charge and the possible concern for human tolerances and structure response. Ground vibration predictions were done considering distances ranging from 50 to 4500 m around the opencast mining area. A Minimum charge of 265 kg and maximum charge of 1925 kg was modelled.

Table 7-8: Expected Ground Vibration Levels for Minimum Charge at the Various Private Structures

No.	Structure	Direction from Pit Position	Shortest Distance (m)	Predicted PPV (mm/s) Min	Human Tolerance @ 30Hz	Structure Response @ 10Hz	Structure Response @ 30Hz
1	Road	N	242	13.3	Unpleasant	Acceptable	Acceptable
2	DamWall2	E	600	3.0	Perceptible	Acceptable	Acceptable
3	DamWall1	W	759	2.0	Perceptible	Acceptable	Acceptable
4	Water Ponds	E	828	1.7	Perceptible	Acceptable	Acceptable
5	Struct~4	E	1053	1.2	Perceptible	Acceptable	Acceptable
6	Struct~1	W	1467	0.7	Low	Acceptable	Acceptable
7	R42Road	SE	1625	0.6	Low	Acceptable	Acceptable
8	Struct~2	W	1803	0.5	Low	Acceptable	Acceptable
9	DamWall3	E	1812	0.5	Low	Acceptable	Acceptable
10	Chicken1	W	1813	0.5	Low	Acceptable	Acceptable
11	Struct~8	NE	1829	0.5	Low	Acceptable	Acceptable
12	Struct~5	E	2022	0.4	Low	Acceptable	Acceptable
13	DamWall4	E	2086	0.4	Low	Acceptable	Acceptable
14	DamWall5	E	2289	0.3	Low	Acceptable	Acceptable
15	Struct~7	N	2504	0.3	Low	Acceptable	Acceptable
16	Struct~3	S	2792	0.2	Low	Acceptable	Acceptable
17	Informal	E	2829	0.2	Low	Acceptable	Acceptable
18	Struct~6	NW	2912	0.2	Low	Acceptable	Acceptable
19	Chicken2	W	3225	0.2	Low	Acceptable	Acceptable
20	Power lines	N	242	13.3	Unpleasant	Acceptable	Acceptable
21	New Chicken Pen	N	547	3.5	Perceptible	Acceptable	Acceptable

Table 7-9: Expected Ground Vibration Levels for Maximum Charge at the Various Private Structures

No.	Structure	Direction from Pit Position	Shortest Distance (m)	Predicted PPV (mm/s) Min	Human Tolerance @ 30Hz	Structure Response @ 10Hz	Structure Response @ 30Hz
1	Road	N	242	68.3	Intolerable	Acceptable	Acceptable
2	DamWall2	E	600	15.3	Unpleasant	Acceptable	Acceptable
3	DamWall1	W	759	10.4	Unpleasant	Acceptable	Acceptable
4	Water Ponds	E	828	9.0	Unpleasant	Acceptable	Acceptable
5	Struct~4	E	1053	6.0	Unpleasant	Acceptable	Acceptable
6	Struct~1	W	1467	3.5	Perceptible	Acceptable	Acceptable
7	R42Road	SE	1625	2.9	Perceptible	Acceptable	Acceptable
8	Struct~2	W	1803	2.5	Perceptible	Acceptable	Acceptable
9	DamWall3	E	1812	2.5	Perceptible	Acceptable	Acceptable
10	Chicken1	W	1813	2.5	Perceptible	Acceptable	Acceptable
11	Struct~8	NE	1859	2.4	Perceptible	Acceptable	Acceptable
12	Struct~5	E	2022	2.1	Perceptible	Acceptable	Acceptable
13	DamWall4	E	2086	2.0	Perceptible	Acceptable	Acceptable
14	DamWall5	E	2289	1.7	Perceptible	Acceptable	Acceptable
15	Struct~7	N	2504	1.4	Perceptible	Acceptable	Acceptable
16	Struct~3	S	2792	1.2	Perceptible	Acceptable	Acceptable
17	Informal	E	2829	1.2	Perceptible	Acceptable	Acceptable
18	Struct~6	NW	2912	1.1	Perceptible	Acceptable	Acceptable
19	Chicken2	W	3025	1.0	Perceptible	Acceptable	Acceptable
20	Power lines	N	242	68.3	Intolerable	Acceptable	Acceptable
21	New Chicken Pen	N	547	17.8	Unpleasant	Acceptable	Acceptable

Evaluation of expected ground vibration levels surrounding the pit area showed levels relatively acceptable at all the structures identified. Review of data for the maximum charge showed levels for private structures to be within acceptable limits. The data showed that maximum charge levels could be problematic for the mine structures. These acceptable limits for specific areas of concern still need to be finalised. These concerns are based on distances from the pit boundary and will certainly be different at different blast block locations inside the pit area. Levels observed at private structures are indicated as levels ranging between perceptible and unpleasant for humans but are well within the safe boundaries for structures. Structures at further distances are even less influenced than by the blasting operations as modelled for this study.

7.9.2 Air blasting

The effect of air blast, if not controlled properly, can be a factor that could be problematic. Air blast normally generates rattling of roofs and windows which could be easily misjudged by house owners as ground vibration. These levels do not need to be excessively high in order to upset the owners. Levels of air blast required to induce damage are in the order of 130 dB and greater. In some areas the levels could be perceptible but possible damage to the

nearest structures is low and is not expected to be problematic. However considering the human perception the air blast was remodelled using the smallest charge mass per delay and is presented here. Review of expected data for the various charge masses was evaluated and presented in this section.

The opencast pit was reviewed for expected air blast. Table 7-10 shows the air blast predictions for minimum charge and the possible concern for human tolerances and structure response. Table 7-11 shows the air blast predictions for maximum charge and the possible concern for human tolerances and structure response. Air blast predictions were done considering distances ranging from 50 to 4500 m around the opencast mining area. A Minimum charge of 265 kg and maximum charge of 1925 kg was modelled..

Table 7-10: Expected Air Blast Levels for Minimum Charge at the Various Private Structures

No.	Structure	Direction from Pit Position	Shortest Distance (m)	Predicted Air Blast (dB) Min Charge	Possible Concern?
1	Road	N	242	127.2	Complaint
2	DamWall2	E	600	117.7	Acceptable
3	DamWall1	W	759	115.3	Acceptable
4	Water Ponds	E	828	114.4	Acceptable
5	Struct~4	E	1053	111.8	Acceptable
6	Struct~1	W	1467	108.4	Acceptable
7	R42Road	SE	1625	107.3	Acceptable
8	Struct~2	W	1803	106.2	Acceptable
9	DamWall3	E	1812	106.2	Acceptable
10	Chicken1	W	1813	106.2	Acceptable
11	Struct~8	NE	1859	105.9	Acceptable
12	Struct~5	E	2022	105.0	Acceptable
13	DamWall4	E	2086	104.7	Acceptable
14	DamWall5	E	2289	103.8	Acceptable
15	Struct~7	N	2504	102.8	Acceptable
16	Struct~3	S	2792	101.7	Acceptable
17	Informal	E	2829	101.5	Acceptable
18	Struct~6	NW	2912	101.2	Acceptable
19	Chicken2	W	3225	100.2	Acceptable
20	Power lines	N	242	127.2	Complaint
21	New Chicken	N	547	118.7	Acceptable

Table 7-11: Expected Air Blast Levels for Maximum Charge at the Various Private Structures

No.	Structure	Direction from Pit Position	Shortest Distance (m)	Predicted Air Blast (dB) Min Charge	Possible Concern?
1	Road	N	242	134.1	N/A
2	DamWall2	E	600	124.6	N/A
3	DamWall1	W	759	122.1	Complaint If People Present
4	Water Ponds	E	828	121.2	Complaint If People Present
5	Struct-4	E	1053	118.7	Acceptable
6	Struct~1	W	1467	115.3	Acceptable
7	R42Road	SE	1625	114.2	N/A
8	Struct-2	W	1803	113.1	Acceptable
9	DamWall3	E	1812	113.1	N/A
10	Chicken1	W	1813	113.1	Acceptable
11	Struct~8	NE	1859	112.8	Acceptable
12	Struct-5	E	2022	111.9	Acceptable
13	DamWall4	E	2086	111.6	N/A
14	DamWall5	E	2289	110.6	N/A
15	Struct~7	N	2504	109.7	Acceptable
16	Struct-3	S	2792	108.6	Acceptable
17	Informal	E	2829	108.4	Acceptable
18	Struct~6	NW	2912	108.1	Acceptable
19	Chicken2	W	3225	107.1	Acceptable
20	Power lines	N	242	134.1	N/A
21	New Chicken Pen	N	547	125.6	Complaint

Evaluation of expected air blast levels surrounding the pit area showed levels relatively acceptable at all the structures identified. Review of data for the maximum charge showed levels for private and mine structures to be within acceptable limits. These concerns are based on distances from the pit boundary and will certainly be different at different blast block locations inside the pit area. Levels observed at private structures observed are indicated as levels ranging between acceptable and the possibility for complaints.

Plan 15: Ground Vibration and Air Blasting

7.9.3 Air blast and ground vibration baseline study

A baseline study was done in order to determine what typical levels of ground vibration and air blast is present around the Kangala Coal area. In the location of the mine are public structures and various installations. The process followed for the baseline study is one of placing monitors at specific points for a time period and monitoring levels of ground vibration and air blast continuously. Monitors are normally placed at positions of specific interest for periods ranging from 24 hrs extending to days, pending the specific requirement. Recording done on ground vibration utilises the tri-axial geophone sensors and air blast is recorded on the pressure microphone of the seismograph. Ground vibrations levels between 0 and 254 mm/s and air blast between 88 and 148 dB can be recorded. Recording of data is done on a continuous basis with variable sampling rates i.e. 2, 5 or 15 seconds or 1, 5 or 15 minutes pending the detail and length of time for information required. The quantity of data recorded is governed by the storage memory for the system. Data recorded is presented on a histogram format. Further to this the equipment is setup to record specific events of ground vibration and air blast when a specific threshold is reached. Meaning that whilst histogram recording is done the system will record specific events as well. The specific event can then be matched to actual levels recorded as these will normally also show on the histogram at higher peaks. Confirmation can then be obtained of the type of event that generated the levels observed.

Monitors are checked frequently to ensure that memory is not exceeded. Ground vibration and air blast sensors are setup pointing in a northerly direction in the absence of a probable source of ground vibration or air blast.

Results were effectively recorded at all points monitored. Two sets of data are presented for the histogram data. The systems were downloaded at approximately 10h00 to ensure that system memory is not exceeded and data lost due to this.

Figure 7-15: Location of the Various Monitoring Positions

Both histogram data as well as individual events were recorded during the baseline monitoring period. Individual events were mainly recorded at points 1, 2, and 4. Ten events were recorded at all three monitoring points. Most of these events registered are due to system sensitivity when system is approached for download or stop monitoring actions. Points 3 did not show any individual events. Table 7-12 shows summary table with start and end dates and times, maximums recorded, date and time of maximums and notes.

Table 7-12: Summary table of baseline results

Point	Start Date time	End Date Time	Date Time Max VPPV	Max VPPV	Date Time Max dB	Max dB	Avg. VS	Avg. dB	Max PPV	Max MicL Pa
Point 01	Oct 20 /09 11:58:54	Oct 22 /09 09:06:43	Oct 21 /09 12:57:13	7.99	Oct 21 /09 14:46:09	139.9	0.3	86.2	5.97	198.50
Point 02	Oct 19 /09 08.26.32	Oct 22 /09 09.15.32	Oct 20 /09 11.08.07	4.84	Oct 20 /09 12.57.55	147.9	0.3	83.7	3.56	500.25
Point 03	Oct 19 /09 08:53:34	Oct 22 /09 09:39:17	Oct 21 /09 18:27:09	1.28	Oct 19 /09 08:53:52	121.3	0.2	85.4	0.89	23.25
Point 04	Oct 19 /09 11.28.58	Oct 22 /09 08.46.56	Oct 19 /09 18.08.56	9.08	Oct 19 /09 18.08.56	140.9	0.3	83.8	7.11	223.00

Explanation of Headings:
Point: Seismograph position where placed
Start Date time: Start date and Time of Histogram
End Date Time: End date and Time of Histogram
Date Time Max VPPV: Date and Time of Maximum Vector sum of Vibration Recorded (mm/s)
Max VPPV: Maximum Vibration Vector Sum in peak particle velocities (mm/s)
Date Time Max dB: Date and Time of Maximum Air blast Recorded (mm/s)
Max dB: Maximum Air blast (dB)
Avg. VS: Average Vector Sum for Vibration calculated from the channels:
Longitudinal, Transverse & Vertical in peak particle velocities (mm/s)
Avg. dB: Average Air blast (dB)
Max PPV: Maximum Vibration of any of the channels: Longitudinal, Transverse &
Vertical peak particle velocities (mm/s)
Max MicL Pa: Maximum Air blast (Pa)

Data recorded showed some areas more active than others. Air blast was more active on direct view of results. Thirty individual events were recorded at all the positions monitored; none of them were blast related. Review of the events showed data to be erroneous and no effects that are directly related to ground vibration or air blast due to blasting operations on surface or underground. Ground vibration levels were generally very low and of no significant value. Most of the ground vibration results observed is due to effect on system when approached for data downloading or stopping or people approaching the systems.

Various individual events were recorded as well. These events were analysed and found to be related to wind influence with no specific data that is related to possible effects on structures. The level values may look high but with no real value. Individual events recorded showed events that are associated with disturbance of the monitor in recording mode. Histogram ground vibration recorded showed vector sum levels ranging between 1.28 and 9.08 mm/s. The average vector sum of all the data are between 0.2 and 0.3 mm/s. Air blast recorded

ranged between 121.3 and 147.9 dB (L). The data is linear pressure data with no weighing. The highest air blast levels were recorded at Point 2 and the highest ground vibration at Point 03. None of the points monitored showed actual ground vibration or air blast results. The maximum results recorded are that can be associated with activities around the systems. The results for the spikes observed are attributed to human action. The baseline clearly indicates no definite ground vibration or air blast that's active in the area surrounding the mine in the village area. This means that any additional influence to the area will be over and above the results recorded.

7.9.4 Concluding statement

The expected ground vibration and air blast levels from blasting operations required at the Kangala Coal, Wolvenfontein 244 IR, Portion 1and R/E of Portion 2 was calculated and considered in relation to the surrounding structures and installations. Some concerns were identified from review of the expected ground vibration and air blast levels. These concerns are however manageable and in no way such that blasting should be prohibited. The main concerns are related to distance between the mining area and the nearest structures. Expected levels of ground vibration and air blast are within the allowed limits but levels are such that it could be perceptible. This in turn may lead to complains and subsequent investigations. Considering the reduced charge modelled, this will have a decreased ground vibration effect and reduce the risk significantly. This is within the general safety limit of 25 mm/s. All the structures / installations were well within limits with no significant effect. Mitigation in reducing the maximum charge mass per delay and design of blasts in the area will assist to control the ground vibration.

Air blast levels reviewed showed no direct concern with regards to damage to structures, but did indicate that mitigation of the ground vibration will also bring about reduced air blast levels. The air blast is within accepted norm of 134dB when people are considered. The levels observed for some of the broilers may be problematic and will certainly require mitigation. Strict controls will need to be imposed as well on surface initiation of any explosive as this will immediately induce undesirable effects into the surroundings. Reduced charges and control on stemming will be assisting in reducing the possibilities of complaints from home owners.

It is concluded that blasting will be possible but careful consideration should also be given to the recommendations made.

7.10 Biodiversity

The complete Fauna and Flora Report is attached in Appendix H.

7.10.1 Vegetation

Both a wet and dry season vegetation field survey was undertaken for the proposed Kangala Coal Mine project.

7.10.1.1 Plant species recorded during the wet season survey

During the wet season survey, 88 plant species were recorded. These species included two tree, nine shrub, one reed, six sedge, 33 grass and 35 herb species. From a grass perspective twelve Decreaser grasses were observed in the area. Seven grasses are Increaser I species, with 16 climax grasses occurring in the project area, these are known to occur in underutilised veld (van Oudtshoorn, 1999). Furthermore, seven Increaser II grasses were recorded in the area, these species are abundant in over utilised veld and therefore increase with excessive grazing. There were two Increaser III grasses species observed in the area. Five grasses recorded in the area were exotics, weed or alien invasive.

The dry season survey resulted in 11 plant species being recorded. This included one shrub, eight grasses and two herb species. One Decreaser grass was observed in the area. Six Increaser II grasses were recorded in the area. Increaser II grasses are abundant in overgrazed veld and include pioneer and subclimax species which will establish quickly on exposed ground (van Oudtshoorn, 1999). One of the grasses recorded in the area was exotic (Paspalum dilatatum or Dallis grass).

7.10.1.2 Red Data Plant Species

Three species listed as officially protected were recorded, namely Gladiolus crassifolius, Kniphofia brachystachya and Gladiolus dalenii (Table 7-13). According to Mpumalanga Nature Conservation Act, Act No. 10 (1998) Section (69) 1 (a) and (b), the species in Table 7-13 are protected from destruction or removal, without proper consent in the form of permits from the department.

Table 7-13: Red Data plant species that were recorded during both surveys.

Scientific Name	Common Name	Ecological Status	Form, Site found
Gladiolus crassifolius	Thick-leaved Gladiolus	MPB Protected	Shrub, 1
Gladiolus dalenii	Natal lilly	MPB Protected	Shrub, 6,19
Kniphofia brachystachya	Poker	MPB Protected	Shrub, 5, 11

7.10.1.3 Exotic and Invasive Plant Species

The Conservation of Agricultural Resources Act regards weeds as alien plants, with no known useful economic purpose that should be eradicated. Invader plants, also considered by the Act, are also of alien origin but may serve useful purposes as ornamentals, as sources of timber, or may have other benefits. These plants need to be managed and prevented from spreading.

A total of 18 alien invasive species were observed during the wet season survey and 3 species were observed during the dry season (Table 7-14). Alien invasive species tend to out compete the indigenous vegetation, this is due to the fact that they are vigorous growers that are adaptable and able to invade a wide range of ecological niches (Bromilow, 1995). They are tough, can withstand unfavourable conditions and are easily spread. This is indicative of early stages of succession and although these species are invasive their use in aid of the prevention of erosion, cannot be denied.

Table 7-14: Alien invasive and Weed species recorded

Scientific Name	Common Name	Ecological Status	Form
Amaranthus hybridus	Pigweed	Alien Invasive	Herb
Bidens pilosa	Common Black-jack	Alien Invasive	Herb
Cirsium vulgare	Scotch Thistle	Alien Invasive MPB alien cat. 1	Herb
Conyza albida	Tall fleabane	Alien Invasive	Shrub
Conyza bonariensis	Flax-leaf fleabane	Alien Invasive	Herb
Cortaderia selloana	Pampas grass	Alien Invasive MPB alien cat. 1	Grass
Cosmos bipinnatus	Cosmos	Alien Invasive	Shrub
Cyperus esculentus	Yellow Nut Sedge	Medicinal/Edible/Alien Invasive	Sedge
Eucalyptus camaldulensis	Red River Gum	Alien Invasive MPB alien cat. 2	Tree
Gomphocarpus fruticosus	Milkweed	Alien Invasive	Herb
Modiola caroliniana	-	Alien invasive	Herb
Oxalis latifolia	Pink Garden Sorrel	Alien invasive	Herb
Paspalum dilatatum	Dallis Grass	Exotic MPB alien	Grass
Paspalum urvillei	Vasey Grass	Sub climax Exotic	Grass
Persicaria lapathifolia	Spotted Knotweed	Alien Invasive	Herb
Persicaria serrulata	Knotweed/Snake Root	Alien Medicinal	Herb
Salix babylonica	Weeping Willow	Alien Invasive MPB alien	Tree
Solanum panduriforme	Yellow Bitter-apple	Medicinal Weed	Shrub
Tragus berteronianus	Carrot-seed Grass	Weed Increaser 2 - Pioneer	Grass
Typha capensis	Bulrush	Weed Alien Medicinal	Reed
Urochloa mosambicensis	Bushveld Signal Grass	Weed Increaser 2 - Pioneer to subclimax	Grass
Verbena bonariensis	Tall Verbena	Alien invasive MPB alien	Shrub

7.10.1.4 Medicinal Plant Species

Medicinal plants are important to many people and are an important part of the South African cultural heritage (Van Wyk et al, 1997). Plants have been used traditionally for centuries to cure many ailments, as well as for cultural uses such as building material and for spiritual uses such as charms.

During the wet and dry season, 15 medicinal plants (Table 7-15) were observed during field surveys. *Scabiosa columbaria* (Wild scabiosa) is used in traditional medicine to treat sterility, colic and sore eyes, and *Berkheya setifera* (Buffalo-tongue Berkheya) is traditionally used as a pot herb and in traditional medicine to treat stomach complaints (Pooley 1998).

Table 7-15: Medicinal plant species recorded.

Scientific Name	Common Name	Ecological Status	Form
Anemone caffra	Anemone	Medicinal	Herb
Aponogeton junceus	-	Medicinal	Aquatic herb
Becium obovatum	Cat's Whiskers	Medicinal	Herb
Berkheya setifera	Buffalo-tongue Berkheya	Medicinal	Herb
Berkheya speciosa	-	Medicinal	Herb
Haplocarpha scaposa	False Gerbera	Medicinal	Herb
Helichrysum aureonitens	Golden everlasting	Medicinal	Herb
Hibiscus trionum	Bladder Hibiscus	Medicinal	Herb
Hypoxis hemerocallidea	Star-flower	Medicinal	Herb
Polygala virgata	Purple broom	Medicinal	Shrub
Pycreus macranthus	-	Medicinal	Sedge
Scabiosa columbaria	Wild scabiosa	Medicinal	Herb
Senecio inornatus	-	Medicinal	Herb
Tephrosia purpurea	Silver Tephrosia	Medicinal	Herb
Solanum panduriforme	Yellow Bitter-apple	Medicinal Weed	Shrub
Cyperus esculentus	Yellow Nut Sedge	Medicinal/Edible/Alien Invasive	Sedge

7.10.1.5 Plant communities

The plant communities described in this section occur within the boundaries of the areas of concern as a result of differentiating landscape features. These landscape features include altitude, degree of slope, rockyness, presence of moisture and soil type, and all affect the number and type of vegetation present. Vegetation assemblages can be viewed as plant species that thrive under similar habitat conditions (as described above), it therefore stands to reason that grouping these plant assemblages contributes to the understanding of the driving forces present. Furthermore, the understanding of such driving forces aids in the formulation and implementation of habitat management plans. During field investigations one main community and two sub-communities were encountered which are shown in Figure 7-16 below.

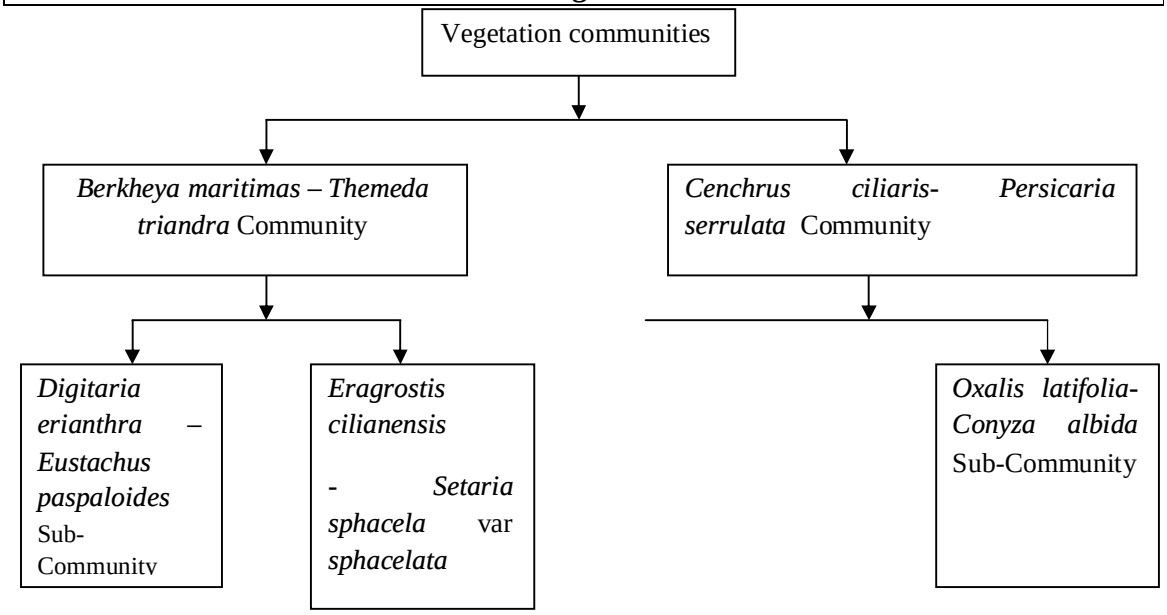


Figure 7-16: Dendrogram of plan communities

7.10.2 Animal Life

7.10.2.1 Mammals observed and recorded in the area

Actual sightings, spoor, calls, dung and nesting sites were used to establish the presence of animals on the proposed project site. The evidence of dung and spoor suggests that animals were present in the area although very few were recorded during the surveys. Traps were placed close to fresh burrows in an attempt to identify smaller mammals in the area. Table 7-16 lists all mammals observed during wet and dry season surveys, by both DWA specialists and resident farmers. During the course of personal consultation with landowners, Mr Chris Rossouw Senior indicated that Serval (*Leptailurus serval*) is present in the area, as he has observed one.

Table 7-16: Mammals known to occur on the Kangala Mine site

Genus	Species	English name	Status	Observation Method	Sample plot observed
Sylvicapra	*Grimmia*	Common duiker*	Least concern	Visual	2, 23
Cynictis	*penicillata*	Yellow mongoose*	Least concern	Visual	25, 8
Pedetes	*Capensis*	Springhare*	Least concern	Visual	15, 23
Canis	*mesomelas*	Black-backed Jackal#	Least concern	-	-
Hystrix	*africeaustralis*	Porcupine# *	Least concern	Visual	11
Leptailurus	*Serval*	Serval#	Near Threatened	-	-
Raphicerus	*campestris*	Steenbok#	Least concern	-	-

Note: (#) denotes observed by farmers in the area

(*) denotes observed by DWA specialists

The Serval (Leptailurus serval) is a Red Data Status mammal considered to be Near Threatened. The preferred habitat of the Serval is dense vegetation, particularly reeds, grass and thickets bordering streams and rivers. They are rarely found far from water. Their diet consists of guinea fowl and other game birds, rodents, hares and even fish and small reptiles. Vlei Rats are a favourite food source and these are found in grasslands and wetland areas such as marshes and swamps. The decline of grasslands and wetlands over time has been detrimental to the survival of the species and management is needed to conserve non-fragmented prime habitat.

Apart from the threat that human beings and mining activities will place on the Serval population, the reduction in suitable habitat is of concern. Should their suitable habitat and food source be removed, these animals will move away from the site in search of safety, shelter and food. The wetland areas are of particular importance as a source of food and for shelter. If these habitats are destroyed during the proposed mining operation the availability of other suitable wetlands in the surrounding areas needs to be investigated to be sure that successful relocation is appropriate. In order for these animals to return to the area once mining is complete and rehabilitation has taken place it is imperative that these areas are rehabilitated to a state equally good, if not better, than prior to mining. For these apex predators to return to the area the food chain on which they rely must first be restored

7.10.2.2 Birds observed and recorded in the area

A total of 30 bird species were identified during the wet season survey (Table 7-17). Most of these birds were observed in the vicinity of less disturbed areas, tall trees such as Red River Gum (*Eucalyptus camaldulensis*) and Weeping Willow (*Salix babylonic*) occur. Many were also identified close to the dam on the southern corner of the project area, with birds regularly seen feeding on dried maize kernels on the edges of maize fields.

No rare or endangered species were observed during the wet and dry season's survey. This does not mean that none occur here, but merely that none were recorded during this survey.

Table 7-17: Bird species recorded during the wet season survey

Scientific	English Name	Residency	Rareness	SA Red Data Status	IUCN Status
Phalacrocorax lucidus	Whitebreasted Cormorant	Resident	Common	Not threatened	
Anhinga rufa	Darter	Resident	Common	Not threatened	Least Concern
Chlidonias hybrida	Whiskered Tern	Resident	Locally common	Not threatened	Least Concern
Egretta alba	Great White Egret	Resident	Common	Not threatened	
Egretta garzetta	Little Egret	Resident	Common	Not threatened	Least Concern
Bubulcus ibis	Cattle Egret	Resident	Common	Not threatened	Least Concern
Ardea melanocephala	Blackheaded Heron	Resident	Common	Not threatened	Least Concern

Ardea cinerea	Grey Heron	Resident	Common	Not threatened	Least Concern
Scopus umbretta	Hamerkop	Resident	Common	Not threatened	Least Concern
Bostrychia hagedash	Hadeda Ibis	Resident	Common	Not threatened	Least Concern
Dendrocygna viduata	Whitefaced Duck	Resident	Common	Not threatened	Least Concern
Thalassornis leuconotus	Whitebacked Duck	Resident	Uncommon	Not threatened	Least Concern
Anas undulata	Yellowbilled Duck	Resident	Common	Not threatened	Least Concern
Fulica cristata	Redknobbed Coot	Resident	Common	Not threatened	Least Concern
Gallinula chloropus	Commen Moorhen	Resident	Common	Not threatened	Least Concern
Vanellus armatus	Blacksmith Plover	Resident	Very Common	Not threatened	Least Concern
Burhinus capensis	Spotted Dikkop	Resident	Common	Not threatened	Least Concern
Coturnix coturnix	Common Quail	Resident//Non-breeding migrant/Breeding migrant	Common	Not threatened	Least Concern
Pternistis swainsonii	Swainson's Francolin	Near Endemic	Common	Not threatened	
Numida meleagris	Helmeted Guineafowl	Resident	Very Common	Not threatened	Least Concern
Elanus caeruleus	Blackshouldered Kite	Resident	Common	Not threatened	Least Concern
Buteo vulpinus	Steppe Buzzard	Non-breeding migrant	Common	Not threatened	
Streptopelia senegalensis	Laughing Dove	Resident	Very Common	Not threatened	Least Concern
Streptopelia capicola	Cape Turtle Dove	Resident	Very Common	Not threatened	Least Concern
Urocolius indicus	Redfaced Mousebird	Resident	Common	Not threatened	Least Concern
Passer melanurus	Cape Sparrow	Near Endemic	Very Common	Not threatened	Least Concern
Ploceus velatus	Masked Weaver	Resident	Common	Not threatened	Least Concern
Euplectes orix	Red Bishop	Resident	Common	Not threatened	Least Concern
Euplectes afer	Golden Bishop	Resident	Locally common	Not threatened	Least Concern
Euplectes ardens	Redcollared Widow	Resident	Locally common	Not threatened	Least Concern

7.10.2.3 Reptiles

No reptile species was observed during the wet season or dry season surveys.

7.10.2.4 Amphibians

During the wet season studies the following amphibian species were encountered in the study area, these species were found in the vicinity of permanent water bodies (Table 7-18).

Table7-18: Amphibian species encountered

Family	Genus	species	Common name	IUCN Status	Habitat	Breeding sites
Ranidae	*Strongylopus*	*fasciatus*	Striped Stream Frog	Least Concern	Savanna Grassland Fynbos	Streams Pans Dams Seepage areas Grassy margined waters
Bufonidae (Toads)	*Bufo*	*gutturalis*	Guttural toad	Least Concern	Savanna Grassland	Semi-permanent water Open pools Dams Streams Pans
Bufonidae (Toads)	*Bufo*	*rangeri*	Raucous Toad	Least Concern	Fynbos Grassland Woodland	Semi-permanent water Permanent water Rivers Streams Ponds
Pipidae	*Xenopus*	*laevis*	Common Platanna	Least Concern	Savanna Grassland Fynbos Semi-desert Desert	Permanent water

7.10.2.5 Terrestrial Invertebrates

With the good representation in the area of interest being maize fields and valley bottom grasslands containing wetland areas, a high volume of green foliage is available as food for insects, therefore one can expect a fair representation of terrestrial invertebrates.

The Reduviidae family had the highest species richness followed by the Meloidae family, during the wet season sampling. In Table 7-19 the insects collected from grasslands and their abundances is shown.

Table 7-19: Total number of families found at Kangala during the wet season

	Families	Total Abundance
1	Acanthosomatidae	1
2	Acrididae	25
3	Alydidae	8
4	Asilidae	6
5	Carabidae	1
6	Ceratopogonidae	1
7	Chironomidae	12
8	Chrysomelidae	26
9	Chrysopidae	4
10	Cicadellidae	1
11	Coccinellidae	29
12	Coenagrionidae	1
13	Coreidae	5
14	Curculionidae	1
15	Drosophiliidae	4
16	Eumenidae	16
17	Formicidae	4
18	Mantidae	2
19	Meloidae	36
20	Muscidae	12
21	Noctuidae	1
22	Pentatomidae	10
23	Phycitidae	4
24	Reduviidae	76
25	Scutelleridae	2
26	Sepsidae	1
27	Sphecidae	7
28	Syrphidae	3
29	Tenebrionidae	18
30	Tingidae	2
31	Tipulidae	1

7.10.3 Concluding Statement

The land capability of any area should be seen as very important when a change in land use is proposed. An area might have high agricultural potential or/and high potential to sustain natural habitats, if these land uses are not already taking place. During the planning phase and the changing of land use, land capability must be kept in mind as this could bring about considerable cost saving later on in a project, most notably during closure and rehabilitation phase.

By protecting designated areas within a mining concession area from the negative effects of mining, the land capability of these areas could be used to facilitate rehabilitation. These designated areas could hold great potential from a natural fauna and flora perspective by creating refuge for plant and animal species thereby creating a source within an area that is

seen as a sink. With adequate conservation planning and implementation, these protected natural areas could be linked to form corridors of natural habitat whereby sources and sinks will be linked to form a larger area of conservation. With the creation of these corridors the ecological functioning of areas previously disturbed could be restored, once such an area is linked to a suitable source population. Natural corridors exist throughout the Kangala project area, these are the low lying wetland and hillslope areas that are unsuitable for agricultural purposes.

During the field investigations it was found that these valley bottom and hillslope areas were not managed to exploit their full potential. These areas were also the only areas where natural vegetation was found, suitable to sustain small fauna species.

The destruction of the remnant grassland has resulted in habitat destruction impacting negatively on fauna and this is the case on the site in question and the surrounding areas. During the survey it was found that small scale fragmentation has already occurred within the site and in the surrounding area, mainly due to human intervention either in the form of livestock grazing or agricultural activities.

The fauna and flora survey suggests that parts the area has been misused in the past, and this is reflected in the vegetation found on site. The overall impact of the proposed development will be negative however the mitigation measures suggested will minimise these impacts.

7.11 Sites of Archaeological and Cultural Interest

The Archaeology Impact Assessment Report is attached in Appendix I.

7.11.1 Summary of findings

During the archaeological survey in the proposed project area, the following archaeological and heritage sites were identified within the mining application area. The location of Significant Archaeological and Heritage Sites can be seen on Plan 16.

Table 7-20: List of archaeological and heritage sites identified by PGS

SITE	DESCRIPTION
Site 1: Cemetery	A small informal, unfenced cemetery with approximately 150 graves was identified at this location. The graves are situated in a ploughed field.
Site 2: Historical Structures	The dilapidated remains of an old farm house and its outbuildings and other structures were identified at this location.
Site 3: Cemetery	A cluster of three graves was identified at this location.
Site 4: Cemetery	Nine graves and demolished remains (building rubble) structures were identified at this site.

During the survey a total of four archaeological and heritage sites were found. According to the current mine plan, none of these will be directly affected by proposed mining activities. It is recommended that the cemetery located within the mining area (site 1) be fenced and a buffer zone of 20 m left around the site and adequate access must be provided for the family to visit the graves in terms of the NHRA (25 of 1999). The historical structure (site 2) currently falls within the footprint area of proposed disturbance. It is currently unclear if this structure is older than 60 years, this will be need to be clarified by a historical architect before development commences. In the event that the structure is older than 60 years a permit for the demolition of the structure will be required form NHRA. If any additional archaeological or heritage finds are made during the construction, operational or decommissioning phases, an accredited archaeologist must be contacted to assess and document the find. For more discussion on the findings of the Archaeological Impact Assessment please refer to Appendix I.

Plan 16: Archaeological Sites

7.12 Wetland Delineation

A Wetland Delineation Assessment was completed for the proposed Kangala Coal Mine project area. The complete report is attached in Appendix J.

7.12.1 Wetland delineation results

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

- Pans;
- Hillslope seepage wetlands connected to a pan;
- Valley bottom wetland without a channel; and
- Hillslope seepage wetland connected to a watercourse.

The distribution of the various HGM types of wetland occurring in the study area are presented on Plan 17. Photographs of the various wetland units are presented in Figure 7-17. The area (ha) of the different wetland types assessed and the percentage in relation to the study area as well as a description based on their setting in the landscape and hydrologic components are given in Table 7-21 and Table 7-22 respectively.

Table 7-21: Area of the different HGM wetland types within the study area.

Wetland type	Area of wetland assessed	
	Hectares (ha)	Percentage (%)
Pans	16.1	6.5
Hillslope seepage wetland connected to a pan	22.2	8.9
Hillslope seepage wetland connected to a watercourse	179.0	72.0
Unchannelled valley bottom wetland	31.3	12.6
Total	248.6	100.0

The total size of the study area is approximately 950 ha with approximately 25% (248.6 ha) of the study area being comprised of wetland areas. The hillslope seepage wetlands comprise approximately three quarters (179 ha) of the total wetland area. The unchannelled valley bottom wetlands comprise approximately one third (31.3 ha) of all wetland areas. The hillslope seepage wetlands connected to the pans comprise approximately 20 ha of the total wetland area. The smallest wetland unit within the study area are the pans comprising approximately 16 ha (6.5%).

Table 7-22: The definition of the different HGM wetland types occurring in the study area.

Pans	**TOPOGRAPHIC SETTING**	**DESCRIPTION**	
	In depressions and basins, often at drainage divides on top of the hills	A basin shaped area with a closed elevation contour that allows for the non-permanent (seasonal or temporary) accumulation of surface water. An outlet is usually absent.	
	HYDROLOGIC COMPONENTS		
	Inputs	**Throughputs**	**Outputs**
	Runoff from the surrounding catchment area and lateral seepage from adjacent hillslope seepage wetlands.	None.	Evapo-transpiration and groundwater discharge from leakage.
Hillslope seepage wetlands connected to pans	**TOPOGRAPHIC SETTING**	**DESCRIPTION**	
	Along the slopes of pan basins	Occur adjacent to pans on the concave or convex slopes associated with the pan basin and are characterized by the colluvial (transported by gravity) movement of materials. Generally always associated with sandy soil forms.	
	HYDROLOGIC COMPONENTS		
	Inputs	**Throughputs**	**Outputs**
	Predominantly groundwater from perched aquifers and interflow.	Interflow and diffuse surface flow.	Variable but predominantly restricted to interflow and diffuse surface flow
Valley bottom wetlands without channels	**TOPOGRAPHIC SETTING**	**DESCRIPTION**	
	Occur in the shallow valleys that drain the slopes.	Valley bottom areas without a stream channel. Are gently or steep sloped and characterized by the alluvial transport and deposition of material by water.	
	HYDROLOGIC COMPONENTS		
	Inputs	**Throughputs**	**Outputs**
	Receive water inputs from adjacent slopes via runoff and interflow. May also receive inputs from a channelled system. Interflow may be from adjacent slopes, adjacent hillslope seepage wetlands if these are present, or may occur longitudinally along the valley bottom.	Surface flow and interflow.	Variable but predominantly stream flow.
Hillslope seepage wetlands connected to watercourses	**TOPOGRAPHIC SETTING**	**DESCRIPTION**	
	Hillslopes	Occur on concave or convex slopes immediately adjacent to, or at the head of watercourses including other wetlands. Characterized by the colluvial (transported by gravity) movement of materials. Generally always associated with sandy soil forms.	
	HYDROLOGIC COMPONENTS		
	Inputs	**Throughputs**	**Outputs**
	Predominantly groundwater from perched aquifers and interflow.	Interflow and diffuse surface flow.	Variable including interflow, diffuse surface flow and stream flow.

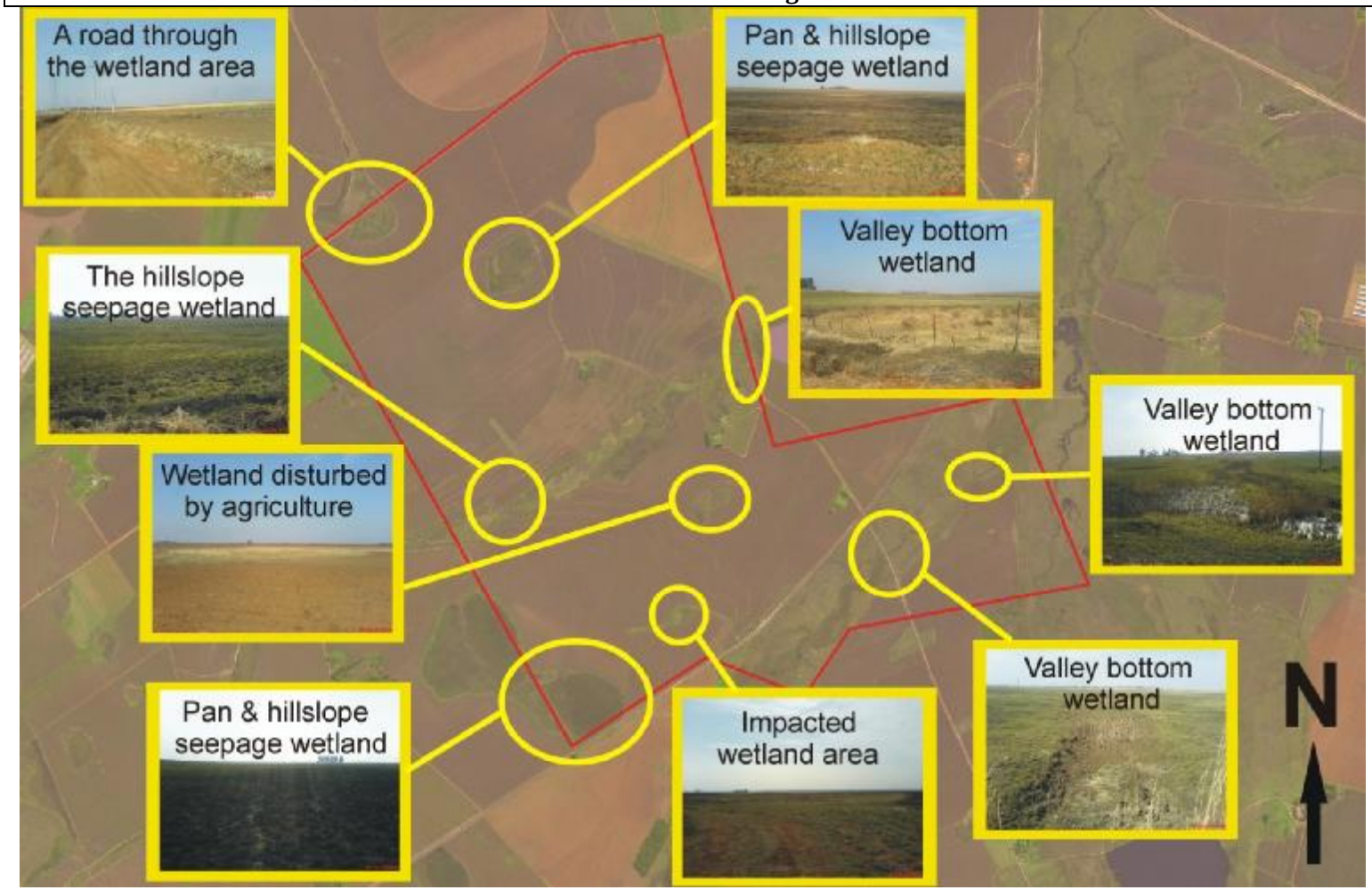


Figure 7-17: Photographs of the identified and delineated wetland units within the study area.

Plan 17: Wetland Delineation

7.12.2 Ecological functioning of the wetlands

7.12.2.1 WET-EcoServices Functional Assessment of on Site Wetlands

The general features of the wetland unit were assessed in terms of functioning and the overall importance of the hydro-geomorphic unit was then determined at a landscape level. The results from the "WET-EcoServices" tool for the respective wetland units are presented in the Wetland Assessment Report attached in Appendix J.

The most important ecological services provided for by all the assessed wetland units are associated with water quality enhancement. These services consist of sediment and phosphate trapping as well as nitrate and toxicant removal. These services in particular were determined to be of intermediate importance for the pans and the associated hillslope seepage wetlands. The exception is that nitrate removal and the maintenance of biodiversity were determined to be of moderately high ecological importance for the pan. The similar services associated with water quality enhancement were determined to be of moderately high ecological importance for the unchannelled valley bottom wetland and associated hillslope seepage wetlands. The unchannelled valley bottom wetland had the most ecological services assigned a moderately high importance and this is to be expected due to the diffuse nature of the system. This will provide important services such as flood attenuation, streamflow regulation, sediment trapping and erosion control. The services associated with water quality enhancement are important to consider when taking into consideration the surrounding land uses (agricultural practices) and the impacts to water quality as a result. Agricultural fields are encroaching into the various wetland units increasing the potential for erosion, loss of habitat and impacts to biodiversity. The unchannelled valley bottom wetland provides a variety of ecological services which should be protected to maintain these services. The lower scores for the remaining wetland units associated with water quality enhancement services may be as a result of agricultural practices impacting on these systems and reducing the ability of these systems to provide effective services.

7.12.2.2 The Present Ecological Status

All of the wetlands within the study area have been modified to some extent. The wetlands within the study area were determined to be largely natural or critically modified. The percentage relating to the PES is as follows (ratings from section 6.3):

- 12.7% are largely natural (with a PES of B);
- 82.9% are moderately modified (with a PES of C);
- 0.4% are largely modified (with a PES of D); and
- 4.0% are critically modified (with a PES of E).

The present state of the wetlands in the study area is, therefore, modified to some extent when compared with what would be expected for reference conditions. Wetland units which have been critically modified are a result of agricultural practices and informal roads causing a loss of seepage area for these units. Additional impacts to the wetland units resulting from

agricultural practices include increased sediment loads, water quality modifications, indigenous vegetation removal and invasive plant encroachment. There are a series of dams and culverts upstream and downstream of the study area, as well as within the site boundary itself. These dams and culverts impact on the units by altering flow dynamics and permanently inundate areas. The unchannelled valley bottom wetland was determined to be largely natural due to the limited direct impacts to the system as well as the ability of the system to provide habitat, food and water for biodiversity as well as the importance of the system to enhance water quality.

7.12.2.3 Ecological Importance and Sensitivity

No rare or endangered species were identified for any wetland unit. Due to the nature of the current land uses and the encroachment of agricultural activities on the wetland units, the impact on biodiversity would be considerable as a result of habitat loss, human disturbances and competition for food in a reduced area. The EIS of the remaining wetland units was determined to vary from largely modified (D) to critically modified (E) with these systems providing little importance to the maintenance of ecological diversity and functioning on local and wider scales. These systems would also have a largely reduced ability to resist disturbance and provide capability to recover from disturbance once it has occurred. The percentage relating to the EIS is as follows:

- 72.3% are moderately modified (with a EIS of C);
- 24.9% are largely modified (with a EIS of D); and
- 2.8% are critically modified (with a EIS of E).

7.12.3 Concluding statement

Four different types of wetland units were identified within the study area. The health of the units varied from largely natural to critically modified. Additionally, the EIS of these wetlands units varied from moderately modified to critically modified. No sensitive or Red Data species were recorded for any wetland unit. Impacts to the wetland units are as a result of the agricultural practices on the periphery of the wetlands, resulting in water quality impairment, loss of habitat, increased sediment loads, erosion and loss of biodiversity.

A 100m buffer zone was described for selected wetland units and it is strongly recommended that no activities take place within these zones. Additionally, wetland units which were determined to be critically modified are recommended to be lost to the proposed mining operation, this will allow for healthier units to be preserved. Where agriculture has impacted on wetland units selected to be conserved, it is recommended that the disturbed areas be rehabilitated to compensate for the wetland areas recommended to be lost to mining. The ability and importance of the wetland units to be conserved to not only provide water but to also enhance water quality is ecologically important and must be protected.

7.13 Visual Aspects

Within a Geographical Information System (GIS), a Digital Terrain Model (DTM) was created from contour information to digitally display the relief of the topography (Plan 2) surrounding the proposed Mine. This DTM was then used to create a theoretical Viewshed model which is the total area that theoretically has a direct visual connection with the Project based on topographical features. Hills and valleys have an impact on the line-of-sight of a receptor and can mask out various activities; this is explained in Figure 3

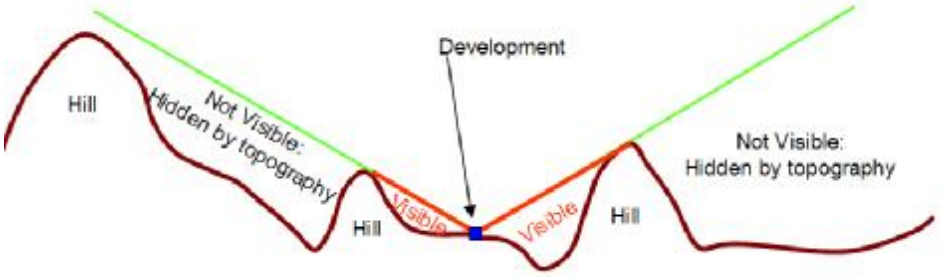


Figure 7-18: Theoretical background to Viewshed Modelling

The theoretical Viewshed model does not take into account aspects such as vegetation and atmospheric conditions such as haze or fog. From experience, it has been found in heavily vegetated areas, that the theoretical Viewshed model is not always a good representation of what is visible in reality (practical Viewshed). It was thus necessary to conduct a field visit to assess the nature of the vegetation.

The site visit revealed that there are not many tall trees or thick vegetation on the site and surrounding areas, this indicates that the theoretical Viewshed model will give a realistic representation of the Project's visibility to the surrounding areas

When looking at the Viewshed model (Plan 18) it can be seen that the highest visual disturbance will be located directly East to North East of the site. Further visual disturbances are envisaged to areas lying North West of the project site. The total area of disturbance is approximately 295km², this is due to the prominent position of the site within the surrounding landscape. The additional height of the proposed infrastructure, discard dumps and stock piles and transport of coal in large trucks further contribute to this large visual disturbance. The main receptors in the area will be persons located on the farms mentioned in the above findings.

The Viewshed model predicted that the mines visual disturbance will extend as far as the out skirts of the town of Delmas, thus possibly affecting residents of the town, it is believed that infrastructure in around the town should provide enough screening to reduce the disturbance.

Plan 18: Viewshed Model

Areas directly surrounding the project site have agricultural land uses with the exception of two main roads passing in close vicinity of the site. Motorists along the R42 main road which joins to the N17 highway will be visually impacted by the mine as this main road passes 1.5kms south of the site. Due to site being surrounded by maize farms, it is expected that during the growing season the visual impact of the mine will be greatly reduced as the maize will provide a visual screen, however once the crops in the area have been harvested so the visual impact will once again become significant.

It was found that the potential theoretical Viewshed of the proposed Kangala Coal Mine amounts to 177km².

7.14 Traffic and Safety

The R42 between Delmas and Nigel runs through the Wolvenfontein farm with the remainder of the farms being accessed via dirt roads that form boundaries between farms. There are farms vehicles which make use of the dirt roads, the extent of the traffic varies depending on the agricultural season, with harvesting and planting resulting in higher activities of farm vehicles. This also impacts on higher dust levels which have an indirect effect on the visibility on the roads, which impacts on safety.

Currently traffic on the R42 is fairly constant and made up of motorists, trucks and farmers. The mining activities are currently taking place on the North-West portion of the farm which is not likely to impact significantly on the R42 traffic.

The coal will be transported form Kangala Coal Mine to the Leeuwpan railway siding which is approximately 10 km from the site. The transport of coal will have an impact on the R555 and the R50 by substantially increasing traffic on the roads as a 70 haul trucks will be leaving the site daily to deliver coal to the Leeuwpan siding (Plan 4). Universal Coal will need to be committed to ensuring the safety of road users and therefore investigations into required road intersections must be undertaken before the mine is operational.

The maintenance and management of the roads used for the transport of the coal will be negotiated with the local municipality in order to form collaboration between Universal Coal and the local municipality. However Universal Coal will be solely responsible for the construction of required road intersection.

7.15 Regional Socio-Economic Structure

Information of the socio-economic environment of the proposed study area has been taken from the Delmas Local Municipality Integrated Development Plan and the Nkangala District Municipality website (www.nkangaladm.org.za).

Nkangala District Municipality is made up of the following local municipalities: Delmas, Dr J.S. Moroka, Emalahleni, Emakhazeni, Steve Tshwete, and Thembisile. It is also responsible for the Mdala District Management Area.

7.15.1 Local Municipality

The centre of economic activity in the municipality is Delmas (www.delmasmunic.co.za). The economy of Delmas Local Municipality (LM) contributes 3,2 % to the economy of the District. Between 1996 and 2001 the economy grew at a rate of 2,9 %. The local economy is relatively diversified. In terms of output and proportional contribution to the local economy, the largest sector is trade, followed by agriculture and mining sectors. The total output of the agricultural sector experienced significant levels of growth while the mining and minerals sector declined. The sectors which experienced expansion in terms of output were agriculture, manufacturing, trade, transport and finance. Electricity, construction and community services sectors are the smallest sectors in the local economy. The employment in the municipality has been decreasing albeit at a slower rate. However, the comparisons between 1998-2001 and 2001-2004 show that mining, manufacturing and finance have been growing, with agriculture shredding employment. The rate of loss of number of employment opportunities lost is stabilising (www.delmasmunic.co.za).

7.15.2 Population

The population within the Delmas LM is estimated at 56 207 people (Figure 7-19).

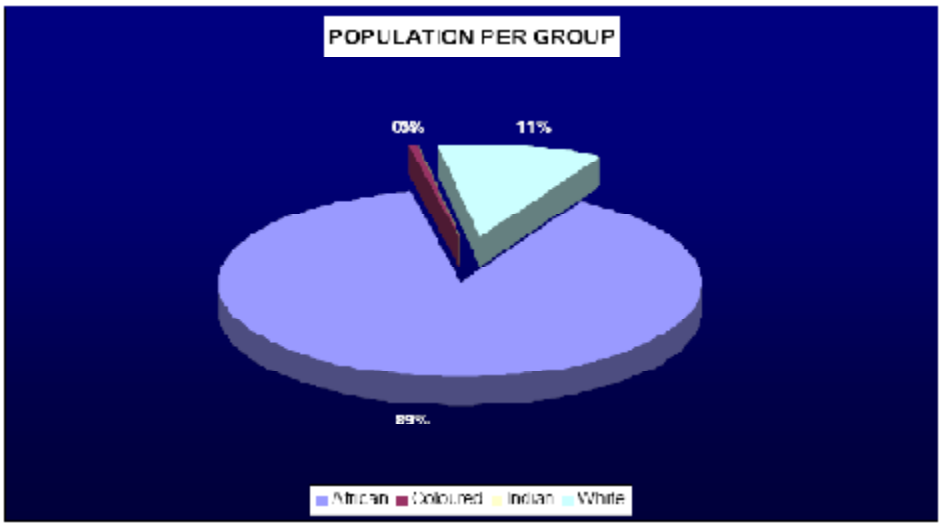


Figure 7-19: Population per Group

Of the total population size of 56 207 people, 27, 665 (49%) people are male and 28 542 (50%) people are female (www.delmasmunic.co.za).

The population statistics show that the largest language group is IsiNdebele (33.5%) followed by IsiZulu (32.5%) and Afrikaans (10.7%).

The local economy is relatively diversified, with the largest sector being the trade sector, which is followed by the agriculture sector and then the mining sector. The labour force consists of 23 019 people, of which 13 236 are employed, bringing the unemployment figure to near to 42%. Figure 7-20 illustrates what the employment figures are per each industry.

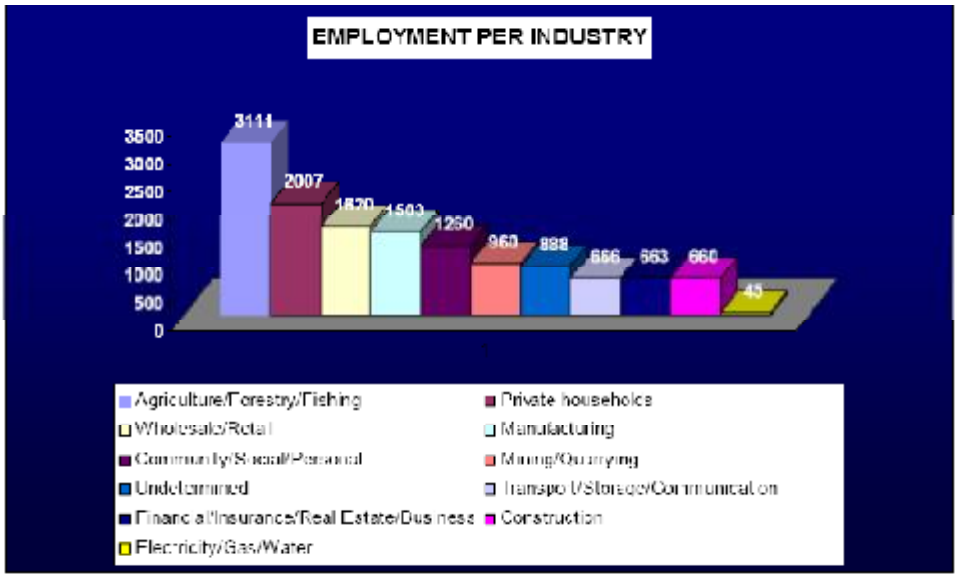


Figure 7-20: Employment Figures per Industry

Of those people employed in the Delmas local community economy, 4 416 are employed at an elementary level, 2 400 are plant/machine operators and only 411 are professionals (www.delmasmunic.co.za).

7.15.3 Housing

The present status of housing types in the Delmas Municipality area is reflected in the table below (Table 7-23**):**

Table 7-23: Housing Type

Households	**Total**
Formal	8 304
Informal	3 885
Traditional	1 161
Other	39
Total Households	13 389

Of the 13 389 households in the Delmas Local Municipality 8,304 households or 62% of households live in formal houses. These figures translate to a housing backlog of at least 5 085 households. As this backlog has been calculated based on figures from the 2001 census, the municipal council has initiated a project on the compilation of a socio-economic profile of the urban community in the municipality. The results are not yet available, but when available will assist with accurately planning the development of housing. The anticipated development of the townships known as Botleng Extension 5 and 6 where approximately 7 500 residential stands are to be developed, will in all probability address the backlog (www.delmasmunic.co.za).

7.15.4 Public Health

The public hospital in Delmas is in the process of being upgraded and renovated. The hospital caters for 40 beds. It has seven doctors of which three are community doctors and 21 nursing staff. The hospital treats about 120 patients per month. The hospital is currently being renovated and upgraded to include an outpatient and casualty unit, a pharmacy, a maternity and paediatric unit, additional wards, living quarters for doctors and nursing staff.

Medical services currently being rendered at the hospital include: occupational therapy, physiotherapy, psychology, dietary care, issuing of anti-retroviral drugs, optometry, psychiatry and speech therapy.

In the municipality there are three public health clinics. Each of these clinics has three professional nurses on duty and they are supported by at least three community health workers, clerks and cleaners. Each clinic attends to approximately 1 600 patients per month. Services rendered at the clinics include: immunization, ante- and post natal care, family planning, TB treatments, HIV/AIDS counselling and testing and prevention of mother-to-child transfer, malnutrition care, treatment of communicable diseases, treatment of sexually transmitted diseases, cancer screening, house visits and health education and training.

Besides the three public health clinics there are also three mobile clinics that are dispatched into the rural area of the municipality to take care of health matters where it is difficult for people to get to other clinics. These mobile clinics have one professional nurse and one community health worker. Each mobile clinic attends to about 200 people per month.

There are 14 non-governmental organizations operating in the public health sector and attend from HIV/AIDS counselling to home based care. There are 10 trained volunteer HIV/AIDS counsellors, four who operate from the hospital and two from each one of the public health clinics.

In the private health service there is a Medicross Health Centre, six medical doctors in private practice, two dentists, an optometrist, a dietician, a physiotherapist, and a psychologist (www.delmasmunic.co.za).

7.15.5 Social Welfare

The Delmas Local Municipal Council in involved in poverty alleviation through the implementation and application of its Indigent policy. Of the 13 426 municipal accounts, 2 476 (18.4 %) are registered on the indigent register. All residential consumers receive free basic water of 6 kilolitres per month. At as 01 July 2007, all residential consumers received free basic electricity. Figure 7-21 reflects the relative individual monthly income (www.delmasmunic.co.za).

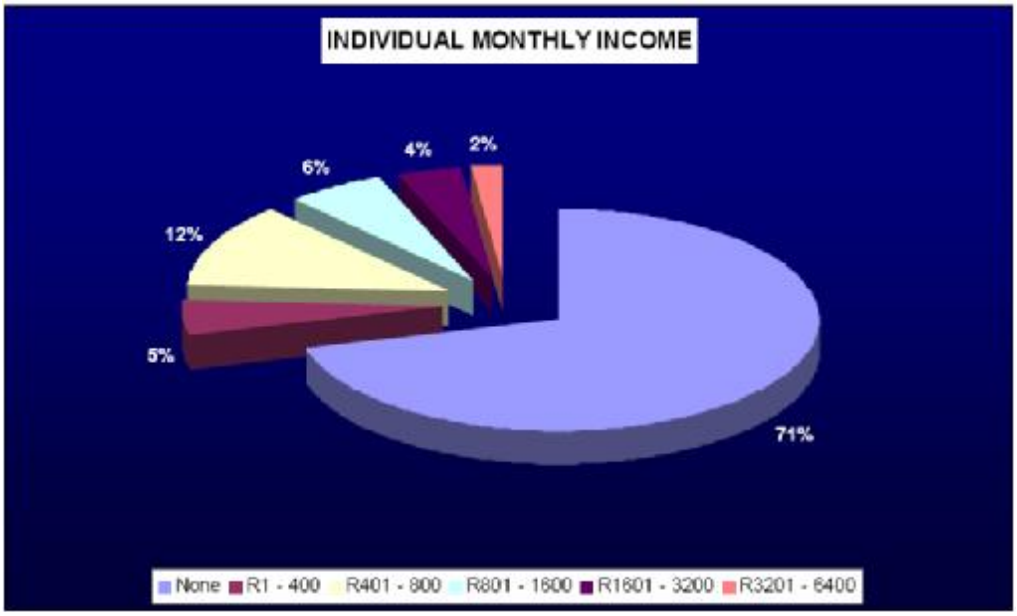


Figure 7-21: Relative Individual Monthly Income

7.15.6 Water Service

The bulk provision of water in the urban area of the Delmas LM is accessed from two sources: subterranean water via a number of boreholes and Rand Water. Of the 13 389 households in the Delmas LM 9 462 households (71%) have piped potable water on their stands.

7.15.7 Sanitation Service

All stands in the Delmas LM, excluding Eloff and Sundra areas, with piped potable water are also connected to a water-borne sanitation system.

7.15.8 Electricity Service

The one key feature of the Delmas LM is that the municipal council and Eskom act as service providers in the municipality.

Of the 13 389 households in the Delmas LM, 8 688 households (65%) use electricity for lighting purposes).

8 PUBLIC PARTICIPATION

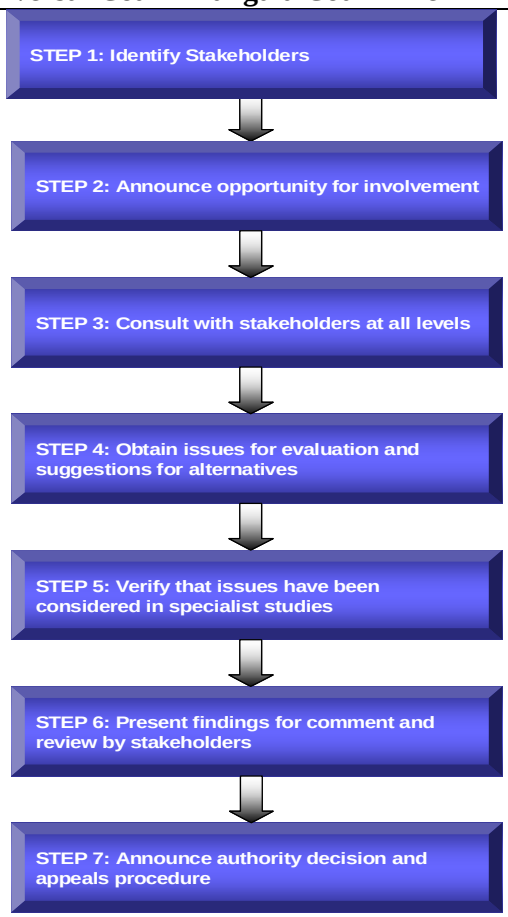
The complete Public Participation Report is attached in Appendix K. Please refer to this report regarding the consultation process that was undertaken for the Kangala Coal Mine project as well as for all copies of documentation that has been distributed to I&APs during the project.

8.1 Aims of public participation

Public participation is a key component of any EIA. It involves those interested in or affected by the proposed development. Interested and Affected Parties (I&APs) are given an opportunity to highlight issues of concern and assist the project designers to take account of locally relevant conditions as opposed to imposing a socially and environmentally insensitive design onto the environment. Fulfilling the basic requirements of public participation is a legislative requirement, and failure to address this aspect creates significant risks to project development.

8.2 Approach

In approaching the development of a PPP strategy for this project the consultant team has aimed for a rigorous and methodical process that will stand up to scrutiny, thereby limiting project risks based on procedural grounds. The process will also encourage active engagement by I&APs so that suggestions can be incorporated into the project design and so that concerns and conflicts can be openly addressed. Public participation ensures that adequate and timely information is provided to all stakeholders and that these groups are given sufficient opportunity to voice their opinions, concerns and issues. The PPP undertaken has followed the steps indicated below.



For further details on each of the above steps please refer to the Public Participation Report attached in Appendix K.

8.3 Summary of consultation

The following table is a summary of the consultation with I&APs that has been undertaken to date.

Date	Type of Consultation/ Documentation	By Means Of	Stakeholder Group
Scoping phase			
29 June to 8 July 2009	Micro-consultation - BID, letter of invitation and registration form	Email, fax or post	Authorities, general public and farmers
3 July 2009	Advertisement	Streeksnuus newspaper	General public
8 July 2009	Micro – consultation BID, letter of invitation and registration form	Hand	Farmers
13 July 2009	Public meeting	Delmas Country Lodge	Authorities, general public and farmers
16 July 2009	Minutes from	Email, fax, post and	Authorities, general

Date	Type of Consultation/ Documentation	By Means Of	Stakeholder Group
	Information Sharing Meetings and notification of Scoping Report	SMS	public and farmers
17 July 2009	Site Notices	Poster	Directly affected landowners, land users and the general public
17 July to 17 August 2009	Scoping report for public review	Delmas public library; The DWA website www.digbywells.co.za	Authorities, general public, farmers, landowners and land users
EIA Phase			
2 September 2009, 18 September 2009 and 8 October 2009.	Micro consultation	In person	On request from certain farm owners
18 and 19 September 2009.	Micro consultation	In person	Adjacent farm labourers
27 to 28 October 2009	Invitation to Feedback meeting and notification of EIA Report	Email, fax, post	Authorities, general public, farmers, landowners and land users
24 November 2009	Public feedback meeting	Delmas Country Lodge	Authorities, general public, farmers, landowners and land users
Early December 2009	Minutes from Public feedback Meeting and notification of EIA EMP availability	Email, fax or post	
16 November to 11 December 2009	Draft EIA EMP Report for public comment	Delmas public library; The DWA website www.digbywells.co.za	Authorities, general public, farmers, landowners and land users
15 December 2009	Final EIA Report submission to DM	Courier	Regulatory authorities
Once ROD is received from Regulatory authority	ROD	Email, fax, post	General public, farmers, landowners and land users

8.4 Main issues raised during consultation

The most significant issues below are formed from the perceptions of stakeholders. These concerns were raised at the micro consultation meetings and the public meetings held. A more comprehensive breakdown of issues raised is included in Appendix K.

Table 8-1: Summary of significant issues raised by I&APs

Issue Raised	Response
Employment	
What sub-contractors will be required and what employment skills base would the mine require?	The mine will require a number of sub-contractors and supporting services. Universal Coal is a listed company on the London Stock Exchange and has to adhere to certain guidelines set by the investors. Sub-contractors will have to be reputable companies with a proven track record in mining. Less technical contracts could be awarded to local contractors.
Will Universal Coal train people in the necessary skills they require for employment on the mine?	Commitments for training of local people are outlined in the Social and Labour Plan.
The thirty five permanent jobs are not sufficient to benefit the local community.	It is important that people do not have high expectations for employment. The mine of this size can only employ thirty five people permanently. There is also always the possibility that the project could not go into operation. Depending on the outcome of the EIA.
Safety and Security	
Influx of people will create an increase in crime and theft and security systems will need to be improved. There will be an increase in theft due to people trespassing on farms to gain access to the mine.	The mine will secure its property and supply security for the mining area which could also improve security in the area.
Rehabilitation and Closure	
How will topsoil stockpiles be protected against contamination? Previous experience proves that no monitoring mechanisms, enforcement laws and penalties are given when mines do not comply with their EMP guidelines. Who will be responsible for the rehabilitation should Universal be declared bankrupt? How will rehabilitation be guaranteed?	Topsoil and overburden stockpiles will be kept separately. There will be a rehabilitation plan in place and the mine will adhere to international best practice guidelines and norms. There will be an independent fund which will ensure that there are sufficient funds for rehabilitation.
Water will become contaminated, how will water be treated during operations and after mine closure?	Dirty and clean water will be kept separate from clean water through the use of berms and trenches. There will also be a pollution control dam.
The soil in this area has a very high agricultural potential and the soil and the land can never be restored back to its original state. The mine infrastructure will	Coal is often situated in areas where the land is of high agricultural potential. It all depends on the exploration drilling results. The

Issue Raised	Response
still be there after rehabilitation and will destroy the surrounding land. Is there no possible way to minimise the amount of land being utilised for mining?	mine plan will look at ways in which the mine can be sited with as little impact on soil and water as possible. Once rehabilitation has been completed, the only mine infrastructure that will remain is the waste rock dump and pollution control dams. All of the other infrastructure will be demolished and removed.
What measures will be taken to avoid incidents of children falling into sink holes or pits once mines have closed?	Universal Coal will follow the correct decommissioning procedures and will ensure that the mine area is safe once the mine is closed.
How will topsoil stockpiles be protected against contamination?	Topsoil and overburden stockpiles will be kept separately.
Air Quality	
The mine could change the climate of the surrounding areas. What impact will there be on air quality with regards to blasting?	Blasting and mining will generate dust and PM10. This impact will be significant at the mine site, but will decrease in severity the further away from the site one is. Cumulative dust deposition impacts will not exceed the Industrial Action level (1200 mg/m2/day) at any off-site receptor locations. Dust levels off-site will increase and mitigation measures proposed in the EMP will apply. See sections 11.3.5, 12.2 and 14.2.
There are chicken farmers in the area and blasting could impact negatively on chickens. Noise will increase and become unpleasant to people living in the area	The existing chicken farms in the area will be within acceptable limits of the blasting and vibrations. A concern to be considered is the possible effect on the proposed new chicken broiler that Mr. Schoeman intends to construct north east of the mining area. The predicted air blast levels for his structure range's between 118 and 126 dB between the used minimum and maximum charge. Levels of greater than 120dB and sudden load bangs could be problematic. The problem with chickens is that they are frightened by sudden loud bangs and then tend to trample each other as they ran into a corner of the broiler. The construction of this broiler will certainly have influence on the permissible levels of air blast from blasting operations. Mitigation is difficult and negotiations between mine management and Mr Schoeman should take place.
Coal dust from the mine will negatively impact the photosynthesis process of mealies and health.	Similar studies undertaken to prove the hypothesis, are the studies undertaken to prove the hypothesis that coal dust adversely effects the photosynthetic performance of *Avicennia marina* the dominant mangrove species in the Richards Bay harbour. The results of the study indicated that the coal dust significantly reduced carbon dioxide exchange of upper and lower leaf surfaces. The reduction in carbon dioxide exchange by coal dust was higher at the high elevation site that supported isolated dwarfed trees. The chlorophyll fluorescence data supported the gas exchange

Issue Raised	Response
	measurements and are consistent with reduced photosynthetic performance of leaves coated with coal dust. Richards Bay Coal Terminal (RBCT) is one of the largest export coal terminals in the world. Opened in 1976 with an original capacity of 12 million tons per annum, it has grown into an advanced 24-hour operation with a design capacity of 76 million tons per annum. Loading and exporting at RBCT happens at an annual rate of 149.17 million tons per annum therefore one can justify a study of this nature. With regards to the coal dust impacting on the growth rate and health of the maize crops in the area of the proposed Kangala mine, the proposed mining rate will be at 1.5 million tons per annum which is a lot less then the coal that is moved and stockpiled at RBCT. The RBCT has also been operating for +-33 years, where the life of mine for the proposed Kangala is 10 years. According to the predicted dispersion of the dust from the Air Quality assessment with 90% mitigation, the heavy dust fallout levels will only impact on the cropfields bordering the proposed site on the western side but most of the heavy dust levels will be restricted to the proposed site
How will air quality measurements be undertaken?	Multi directional dust buckets will be set up to show the direction of where the majority of dust is generated from. There will also be dust monitoring during the operation of the mine.
Surface and Ground Water	
There are a number of boreholes near Delmas town, has a census been taken of all the boreholes in the area and the flow rates determined? How will they be affected by the mining activities? What water sources and monitoring will be used? Wetlands will become contaminated and disappear completely.	A hydro-census of the ground water will be undertaken to test water levels, volumes and quality. The same procedures will take place for surface water. DWA will use both DWAF and SANS water quality standards in the analysing of the water quality.. Current water source options include groundwater or water from a proposed Randwater Pipeline. These negotiations and licenses will be the subject of a Water Use License and the chosen option will be communicated to IAPs. The monitoring plan is listed in Chapter 15. Impacts associated with the agricultural practices have affected the ecological state of the wetlands, but there has been no evidence of any of these impacts seriously affecting the underlying hydrology supporting the wetlands. A buffer zone has been described for selected wetland areas. It is suggested that no mining activities take place within the selected wetland areas and associated buffer areas. Additionally, it is recommended that any agricultural activities encroaching into the wetland units cease and these areas be rehabilitated to

Issue Raised	Response
	improve the integrity of these impacted areas as well as restore ecological functioning. A conservation plan aimed at improving the integrity of the wetland areas and the associated ecological functioning to improve water quality and biodiversity maintenance should therefore be directed at managing the land use practices in the area and the direct use and conversion of the wetland resources.
Is there a way to mitigate the impacts on wetlands?	A buffer zone has been described for selected wetland areas. It is suggested that no mining activities take place within the selected wetland areas and associated buffer areas. Additionally, it is recommended that any agricultural activities encroaching into the wetland units cease and these areas be rehabilitated to improve the integrity of these impacted areas as well as restore ecological functioning. A conservation plan aimed at improving the integrity of the wetland areas and the associated ecological functioning to improve water quality and biodiversity maintenance should therefore be directed at managing the land use practices in the area and the direct use and conversion of the wetland resources. Refer to Chapter 14 in the EIA for the management plan for wetlands and Chapter 15 for monitoring plans.
Sinkholes could result from the dewatering of the underlying dolomite aquifers. Farmers' water is obtained from the underlying aquifers. If you mine the coal it will cause the water levels to drop, resulting in further loss of agricultural production.	The impact of the mining on the dolomite and groundwater will be determined through the groundwater investigations that are still been undertaken.
Blasting may cause damage to the dam wall on my property. What can be done to ensure this does not happen? The dam is eighty years old, concerned about the distance between the boundary and his property and damage to the dam wall.	The blast and vibration report indicates that thee levels at the dam wall are of acceptable limits, however a monitoring point will be placed at the dam wall to the south east of the site in order to monitoring blasting and vibration. In the event of damage being linked to blasting, compensation will be negotiated.
Will the pans on the southern boundary of the proposed mining area be affected?	Drilling has shown that there is no viable coal in this area will be excluded from the mine plan and therefore these pans will not be affected.
The catchment is already in a bad state and will require close monitoring. The grassy pans are very important ecologically and need to be studied thoroughly. Is drainage from the site in a northerly direction?	The mining area falls within the Bronkhorstspruit catchment which drains north to the Bronkhorstspruit dam. The mining area falls within the B20A catchment area. The drainage on site is in a south east direction towards the small stream in the south. A wetland assessment has been conducted, the results of which are included in the EIA. The pans are of various ecological status and sensitivity and management plans are required

Issue Raised	Response
	in order to preserve the pans and wetlands.
Cumulative Impacts	
Farming operations could be adversely affected due to the cumulative impacts if a farm is situated between two mines, Mining will have negative impacts on highly potential agricultural land.	Mining will affect certain portions of the agricultural land, impacting on the soil, but these impacts are for the life of mine (10 years) after which the rehabilitation plan in Chapter 20 will apply. It is possible that the soils will lose some of its agricultural potential over the life of mine, but this is very dependant on how the soils is treated prior to and during mining. Farming will be able to continue around the mining operations present, albeit in a modified manner.
Is mining more sustainable than agriculture?	Chapter 9 of the EIA discusses sustainability. Existing agricultural production in the proposed project area can be classified as 'sustainable' and is confirmed by local farming initiatives. Based on the finite and non-renewable nature of coal resources, coal mining is not considered 'sustainable'. Once the coal is removed and utilised it cannot be returned or reused. Based on its ability to contribute towards to the economy and socio-economic environment; however, it can lead to a more sustainable mining industry. Although minerals are non renewable, the mining industry may find measures to support alternative and more sustainable industries such as agricultural. This could be achieved by using the "High cost – Low impact" approach, which means that the mine is willing to invest a percentage of its profits (high cost) towards environmental, social and economic management and monitoring to ensure a low impact on the environment (low impact). Many environmentalists consider non-sustainable mining developments a threat to the agricultural industry; however, through an integrated high cost, low impact approach may provide greater sustainability for the mining industry.
Compensation	
If land owners property is on located on a non-viable coal deposit will it still be purchased?	No
There will be a potential loss of grazing land.	The total loss of grazing land from the proposed mine is 950 ha.
There is air craft runway; it is located close to the proposed project area, which we will not be permitted to use. Where will air craft land if the mine is opened?	Should the mine go ahead, negotiations with the Civil Aviation Authority will take place in order to establish a safe flight path and if necessary, an alternative landing strip. If this is the case, compensation may be required.
Who will be liable for any damage caused by blasting activities or houses cracking? Will it be Universal coal or the contractors?	In general, it is the mining company that is held liable for any damages caused by blasting. During mining activities blasting will be monited and all complaints will be noted, and any damage that is claimed must be proved to be a result of blasting. Compensation will then apply.

Issue Raised	Response
Is Universal Coal going to purchase Portion 2 or only utilise Portion 1?	Universal coal will only purchase the land portions which are going to be mined and where infrastructure will be placed.
Operations	
What opencast mining process is proposed?	The rollover strip mining method will be used.
What is the minimum blasting distance between a mine and a built up area and the cubic metres per blast? Will the size of the blasts and the intensity of the blasts be included in the EIA/EMP?	A blasting and vibration assessment has been undertaken and the results included in the EIA. The impacts on the surrounding receptors are discussed, as well as the modelling of the blasts and vibrations.
What measures will be in place to prevent spontaneous combustion of coal stockpiles?	The roll over methods will be used for strip mining which will help reduce the potential for spontaneous combustion by cladding and covering exposed areas as soon as possible to prevent air ingress. Open pits will be monitored regularly for signs of combustion and where required, wind breaks will be constructed to minimise strong winds. Measures can be used such as: • Sealing agents (inhibit oxidation) • Dozing over (closing off areas with sand) • Cladding (replace overburden & level off) • Quick turn-around of coal stockpiles
Is the 10 year life of mine from commissioning to closure?	There will be a one year construction period and the mine will be operational for ten years.
Where will the mine labour to be housed?	No labour will be housed on the mine. It will most likely be housed in Delmas, located within a 6 km distance from the mine.
Will Universal Coal Development 1 or Universal Coal PLC be directly responsible for the mine?	Universal Coal Development 1 will be directly responsible for the mine. Universal Coal PLC will also take responsibility for any liabilities.

8.5 Way forward

The Kangala Coal Mine project is currently in the EIA phase, therefore the following will be undertaken before submission of the final EIA EMP to the DM:

1. Public review of the Draft EIA EMP Report:

   The EIA report will be made available for comment at the following venues;

   - Delmas public library;
   - The DWA website www.digbywells.co.za and
   - A Compact Disc (CD) of the report will be made available on request.

   The draft EIA Report will be made available to all I&APs for review to ensure that the report is publicly accessible. I&APs will be informed of the availability of the EIA, PPP reports by E-mail, Fax, Post and SMS. This will give I&APs a further opportunity

to give inputs into the process, and will give the opportunity to ensure that their issues, comments and concerns have been included and addressed in the issues trail.

2. Public feedback meeting:

Invitations have been distributed to identified and registered stakeholders on the database inviting I&APs to a public feedback meeting on the 24th November 2009. The aim of the public feedback meeting will be to inform I&APs of further developments regarding the proposed mine, and to receive further inputs regarding the project. The minutes from this meeting will be incorporated into the EIA report and any further issues and concerns raised by I&AP's will be addressed in the specialist sections of the EIA report

3. Notification of the record of decision

Once a record of Decision has been issued by the relevant authority all registered I&APs will be notified of the decision and appeal procedure.

8.6 Concluding Statement

A thorough public participation process has been initiated for this project in the scoping phase of the project . This continued throughout the environmental authorisation process and presented I&APs with relevant and accessible project information as it became available. Open and transparent communication is central to the development of trust between all parties interested and or affected by this project. The public participation process strove to contribute to the facilitation of a project whose design and implementation, if approved, will be acceptable, to stakeholders involved.

Farmers in the area of the proposed Kangala Mine were not in favour of the proposed mine as the mine will be situated on prime agricultural land. According to farmers prime agricultural land is scarce and it cannot be rehabilitated back to its original state once the mine is decommissioned. The farmers are not against development, and would have been more amenable if the proposed mine was an underground mine.

The general perceptions from the farm workers and communities in the area is that there will be employment opportunities, unfortunately this is not the case, as very few people will be employed permanently.

Public consultation was ongoing throughout the environmental authorisation process and should be continued during the life of the mine. A consultation strategy should be developed to keep all stakeholders informed about the project. This will allow Kangala to address issues as they arise before they become significant

9 SUSTAINABILITY

A Sustainability Chapter has been completed for the proposed Kangala Coal Mine project and is attached in Appendix L.

9.1 Sustainability Overview

According to the Department of Minerals and Energy (Swart, 2007), the mining sector in South Africa aims to promote its vision of 'sustainable development' by enabling South Africans to make balanced and informed decisions regarding the extraction and utilisation of mineral resource, by measuring and assessing progress towards sustainable development objectives and by minimising negative impacts and optimising environmental management in the mining sector.

Large scale developments such as coal mining in an area with high agricultural potential may create a complex relationship between industries; and although the mineral sector is actively attempting to achieve its sustainable development goals and objectives in the Mpumalanga Province, farmers in the Delmas region have already raised concerns regarding the potential impacts of mining on the local and regional agricultural industry. The impacts identified by farmers include water availability and contamination, soil disturbances and ineffective rehabilitation, amongst others.

As a key aspect of their corporate philosophy, Universal Coal embraces the sustainable approach towards the development of the Kangala Coal Mine. Universal Coal strives to achieve the sustainable development objectives by minimising negative impacts and optimising environmental management. The biggest challenge for this sustainability approach is to create a balance between the main economic activities in this area, mining and agriculture.

The overall objective of the sustainable baseline assessment for the proposed Kangala Coal Mine is to ultimately ensure that the local farming sector is not adversely affected by potential impacts caused by mining activities. The challenge is to determine how mining activities can continue without affecting the agricultural sustainability of the area by implementing the high cost – low impact approach. The aim of this assessment is to identify existing and potential sustainable land uses within the proposed project area and ultimately promote the sustainable use of social, economic and environmental resources in the area.

9.2 Limitations

The sustainability chapter only includes baseline information regarding the current status of the socio-economic and agricultural environments. The main elements of sustainability, Environmental integrity, Social justice and Economic efficiency, have therefore only been broadly described. Detailed assessments of social issues and economic analysis of markets and businesses have therefore not been included in this study. The local socio-economic conditions have been assessed through a number of key informant interviews with the nearby

settlement and potentially affected farmers only. By reason of the fluctuation of markets and variation of input costs of individual farmers, the exact market values have not been financially calculated (ZAR) for this study. If more detailed studies are required for the analysis of the socio-economic or agricultural economic status of the proposed Kangala Project area, a Social Impact Assessment and or a comprehensive Agricultural Economic Impact Assessment study should be undertaken.

9.3 Discussion

According to specialist result outlined in the EIA/EMP report, mining activities evidently has various negative impacts on environmental resources such as soil, water and air, which are the bare essential resources that the agricultural industry dependents on. Increased impacts on these elements will therefore have a secondary negative impact on the agricultural industry.

Cumulative impacts of alternative industries such as mining and tourism on social, economic and environmental elements are also described in more detail in the EIA/EMP report. Besides mining, there are also other elements that may affect the sustainability of the agricultural industry such as political instability, fuel price escalations, electricity tariff increases, diseases, natural disasters and climate change.

The sustainability of the agricultural industry in the Delmas area is evidently vulnerable to a variety of external and internal impacts resulting from tangible and intangible changes to the environment such as industrial developments, mining projects, political changes and economic fluctuations, amongst others. It is therefore important to consider the cumulative impacts on broader scale and implement a high cost low impact approach in mining developments and identify strategies to contribute to the local agricultural industry, e.g. building roads, subsidising electricity or fuel costs.

As recommended in the EIA/EMP report, impacts resulting from the mining activities should still be managed and monitored according to the legislative requirements. These impacts can further be mitigated in the context of the high cost low impact approach to ensure overall sustainability of the agricultural industry. This implies that coal mines such as Kangala Coal Mine may add value to the Delmas area by operating more effectively and responsible and attain to achieve a sustainable balance between social justice, environmental integrity and economic efficiency. This balance can only be attained if the recommendations outlined in the EIA/EMP are effectively implemented through the integration of agricultural concerns and needs, and continuous monitoring of environmental resources.

Mines such as Kangala Coal Mine have the financial capacity to ensure the agricultural industry is not adversely affected by the impacts associated with mining activities. The high cost low impact approach is therefore not a once off solution to the sustainability debate, but a continuous process of environmental planning, management and monitoring.

9.4 Recommendations

The three most important aspects of sustainable development, social justice, environmental integrity and economic efficiency were discussed in this chapter in the context of the proposed project area. Based on the finite and non-renewable nature of coal resources, coal mining is not considered sustainable. Once the coal resource is removed and utilised it cannot be returned or reused; however it provides electricity for generations and contribute towards the economy.

Many environmentalists consider non-sustainable mining developments a threat to the agricultural industry and environment, but through an integrated high cost, low impact approach may provide greater sustainability for the mining industry. The mining industry may be able to provide support to the existing agricultural industry. Support from the mining industry may be provided though capital input (construction of roads and electricity infrastructure) through research and development (diseases and scientific awareness) and through effective environmental monitoring and management. In addition, surplus land not occupied by infrastructure or otherwise (especially after completion of construction) could be leased back to farmers for utilization of agricultural production.

The sustainability chapter was therefore compiled to promote the optimisation of project benefits associated with the Kangala Coal Mine and minimisations of negative impacts associated with proposed mining activities; and ultimately encourage the sustainable use of social, economic and environmental resources in the area. In essence, sustainable development is a shared responsibility and not an outcome that Universal Coal can deliver in isolation. Society, industry and government must all contribute and work together to ensure the responsible use of social, economic and environmental resources, as well as the long term conservation of agricultural sustainability.