

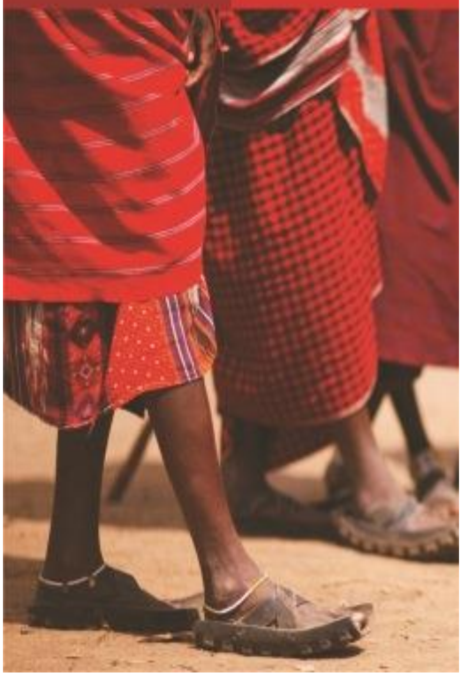

DIGBY WELLS
ENVIRONMENTAL

Environmental Impact Assessment and Environmental Management Programme Report (Updated) for Kangala Coal Mine – Mpumalanga Province

EIA and EMP Report

DMR Reference Number:

MP 30/5/2/2/ 429MR

Project Number:

UCD3160

Prepared for:

Universal Coal Development I (Pty) Ltd

December 2014

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Report Type:	**EIA and EMP Report**
Project Name:	**Environmental Impact Assessment and Environmental Management Programme Report (Updated) for Kangala Coal Mine - Mpumalanga Province**
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Name	**Responsibility**	**Signature**	**Date**
Kasantha Moodley	Report Updating		November 2014
Andries Wilke	Reviewer		December 2014

EXECUTIVE SUMMARY

Universal Coal Development 1 (Pty) Ltd (Universal Coal holds a Mining Right 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 project is known as the Kangala Coal Mine (Kangala).

The Environmental Impact Assessment and Environmental Management Programme Report was submitted to the Department of Minerals and Energy (now Department of Mineral Resources) in December 2009 (Draft) and in June 2010 (Final). A Mining Right was granted to Universal Coal in May 2012.

This updated report serves to provide the project information in the new template as required by the Department of Mineral Resources. It also serves to update the EIA/EMP with the following changes at the Kangala Coal Mine:

- Re-positioning of stockpiles (i.e. hards, softs and topsoils);
- A lined clean water storage dam with a capacity of 1000 m^3;
- Two new Run of Mine stockpiles adjacent to the existing ROM stockpile;
- One new product stockpile within the plant area;
- A new overland conveyor belt, 309 m long within the plant area;
- An additional contractors camp, including an office, workshop, storage and a wash bay;
- Installation of a new laundry; and
- A weighbridge.

It should also be noted that Universal Coal wish to extend the footprint of the discard dump. This proposed activity however will only be undertaken within the next two years. The current footprint of the discard dump is 16.5 ha. The proposed extension will be 4.14 ha with a final discard footprint of 20.6 ha. The footprint of the discard area as approved in the original EMP is approximately 32 ha in extent.

Currently, at Kangala, the opencast truck and shovel roll over mining method is used on the No. 2 and No. 4 Coal seam of the Witbank Coal field. The extracted Run of Mine coal is crushed, screened and washed on site yielding an export coal product and a secondary product suitable for the inland power generation market.

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

Kangala has an agreement with Eskom to supply the Kusile Power Station, but due to the delays in the completion of the Kusile Power Station, 100 000 t/m is currently supplied to

Kriel Power Station, 40 000 t/m to Kendal Power Station and 6 000 t/m to Leewpan siding for export.

Digby Wells and Associates (Pty) Ltd have conducted necessary social and environmental studies to assess the impacts on the physical, biological and social environments within the mining area as part of the 2010 EIA/EMP. 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 are on the following environmental aspects:

- Topography;
- Soil;
- Surface water;
- Groundwater;
- Wetlands;
- Air Quality;
- Blasting and vibration; and
- Traffic and safety.

The potential impacts that the project has on the above environmental aspects have a medium-high significance prior to the implementation of management measures. Taking into consideration the position of the mining area within the catchment, it is recommended that direct impacts to the wetland areas be restricted to the 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 should be artificially recreated so as to ensure the survival of the remaining wetland areas and larger system as a whole, ensuring water quality provision and enhancement services continue.

In addition, the new activities that have been planned at the Kangala Coal Mine are not considered to have a significant impact on the bio-physical or socio-economic environments as the infrastructure has been or will be placed within the existing footprint of the mine area which has been developed with the necessary pollution control systems. Potential impacts that have been considered are the visual impact associated with the re-positioning of the overburden and topsoil dumps along the south-western boundary which cannot be mitigated. The potential impact on topography and air quality associated with the proposed extension of the discard dump was also considered. Mitigation for these impacts has been proposed.

Universal Coal is currently implementing the management plan included within this document as well as current operating procedures and management plans to ensure that the potential impacts are controlled, monitored and prevented if possible. The management plan must be communicated to all levels of employees including contractors that are currently working on the mine. Kangala undertakes annual performance assessments against the management plan to determine compliance.

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

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SECTION A:
ENVIRONMENTAL IMPACT ASSESSMENT

1 The baseline environment (REGULATION (50A))

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 project area is in close proximity to the operating Exxaro coal mine Leeuwpan. The location of the project area can be seen on Plan 1. 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.

The proposed mining activities of the Kangala Coal Mine have been 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 1-1: 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 1-2: Adjacent landowners

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

Farm Name	Portion	Landowner
Middelbult 235IR	40	VV2 Eiendomme
Witklip 232IR	2	Hendrik Schoeman & Seuns
Witklip 232IR	18	Hendrik Schoeman & Seuns

In 2010, there was no knowledge of the lodgement of land claims on the proposed project area.

The Kangala Coal Mine is an operational opencast mine with supporting infrastructure. Please refer to Plan 3 and Plan 3A for an overview of the current mine activities as well as the new infrastructure that is covered under this EIA/EMP report update.

1.1 Description of the current 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 through various environmental investigations. The description serves as a baseline according to which the potential impacts of the proposed mining activity have been compared to and evaluated. The baseline described is the pre-mining baseline from 2009 and 2010.

1.1.1 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.

1.1.1.1 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 1-1).

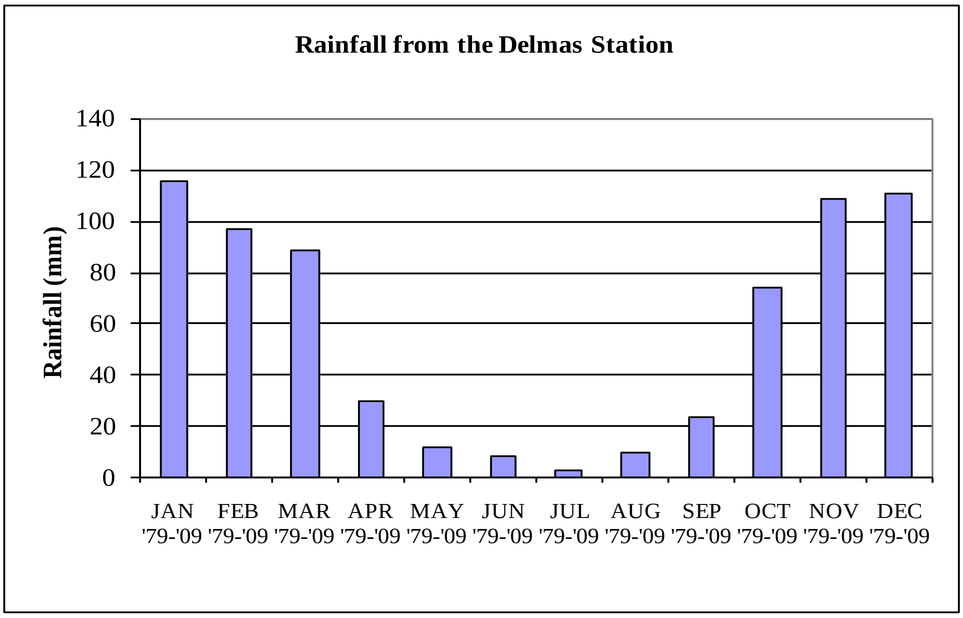

Figure 1-1: Total annual rainfall recorded between 1979 and 2008/2009

1.1.1.2 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 1-2).

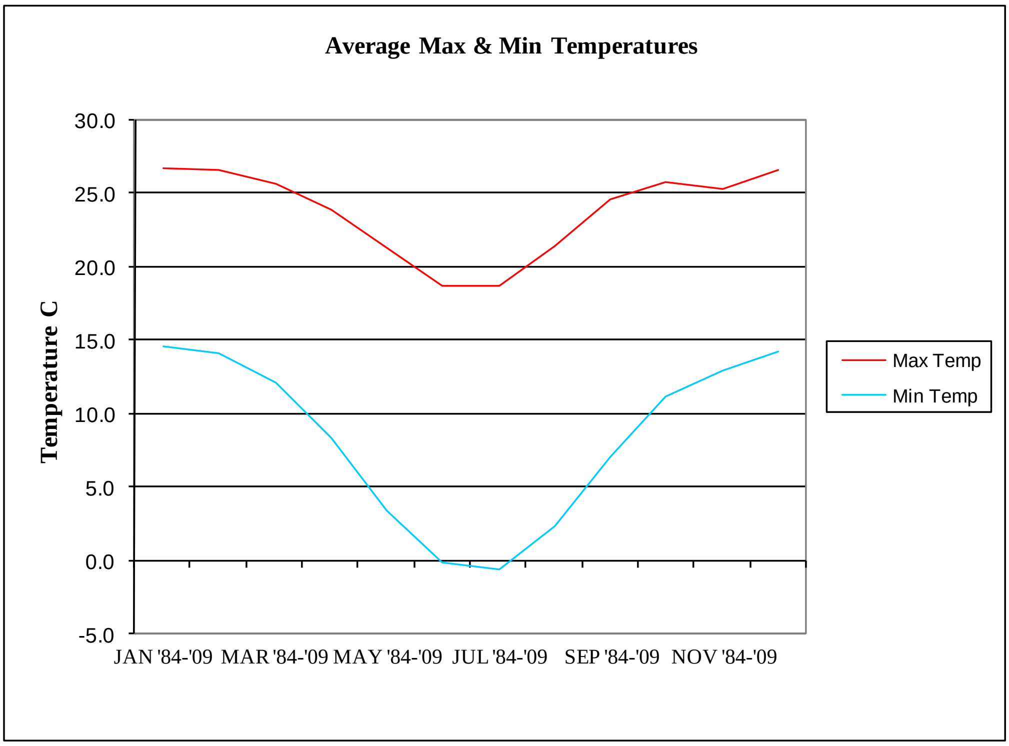

Figure 1-2: Average minimum and maximum temperatures recorded between 1984 and 2008/2009

1.1.1.3 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 1-3 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.

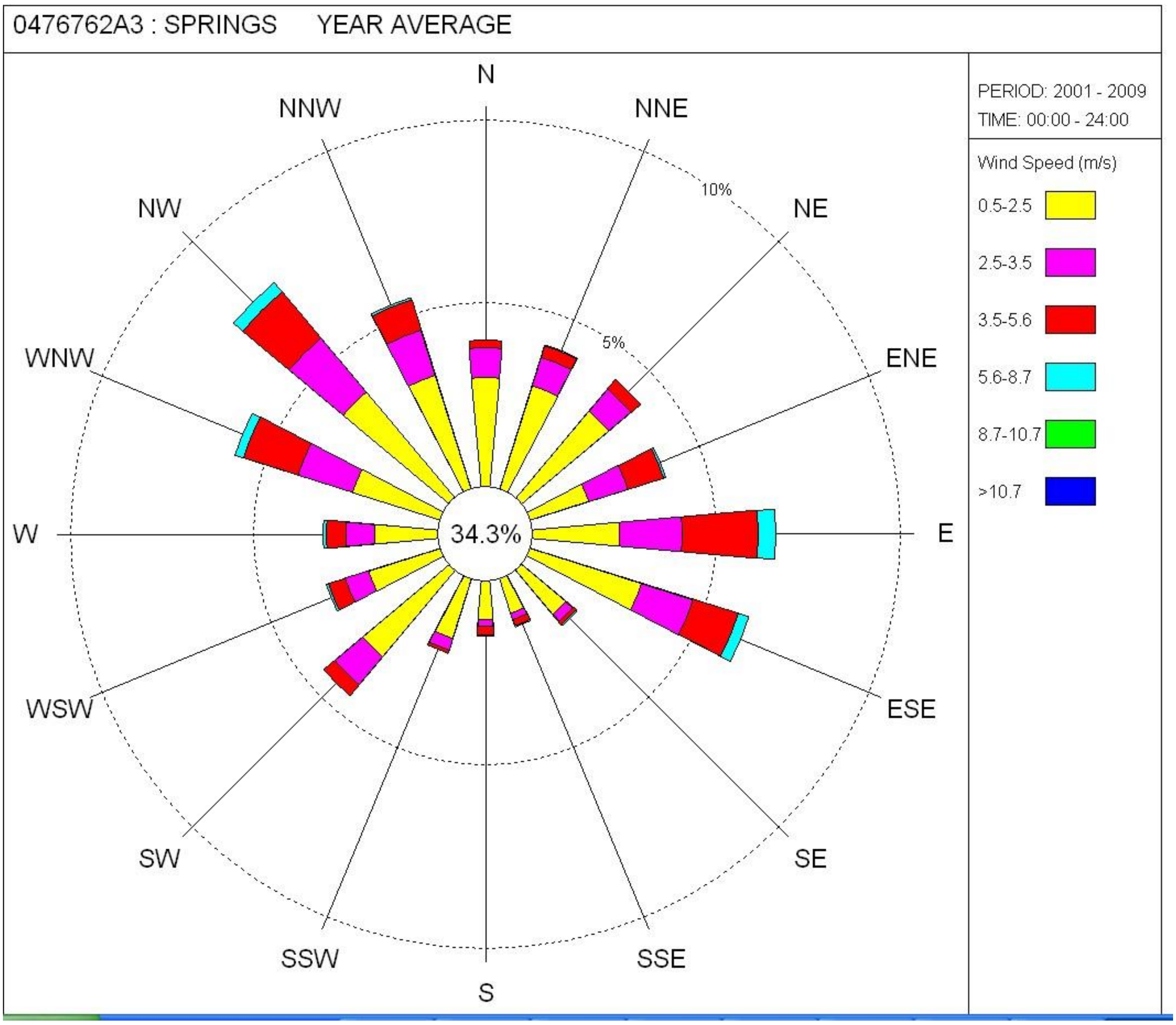

Figure 1-3: Wind Rose Diagram depicting the Average Wind Speed and Direction as measured from the period 2001-2008/2009

1.1.2 Topography

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

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

Plan 4 depicts the topography of the site. As can be seen in Plan 4, 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.

1.1.3 Geology

The geological information was abstracted from Universal Coal geological report. The proposed Kangala Coal Mine project is situated in the Witbank Coalfield (Plan 5). 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. 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:

1.1.3.1 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 shale sandstone partings. The seam is a source of A-grade steam coal and low phosphorus metallurgical coal.

1.1.3.2 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.

1.1.3.3 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.

1.1.3.4 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.

1.1.3.5 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.

1.1.3.6 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 occur 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 1-4 and can be described from the bottom to the top as follows:

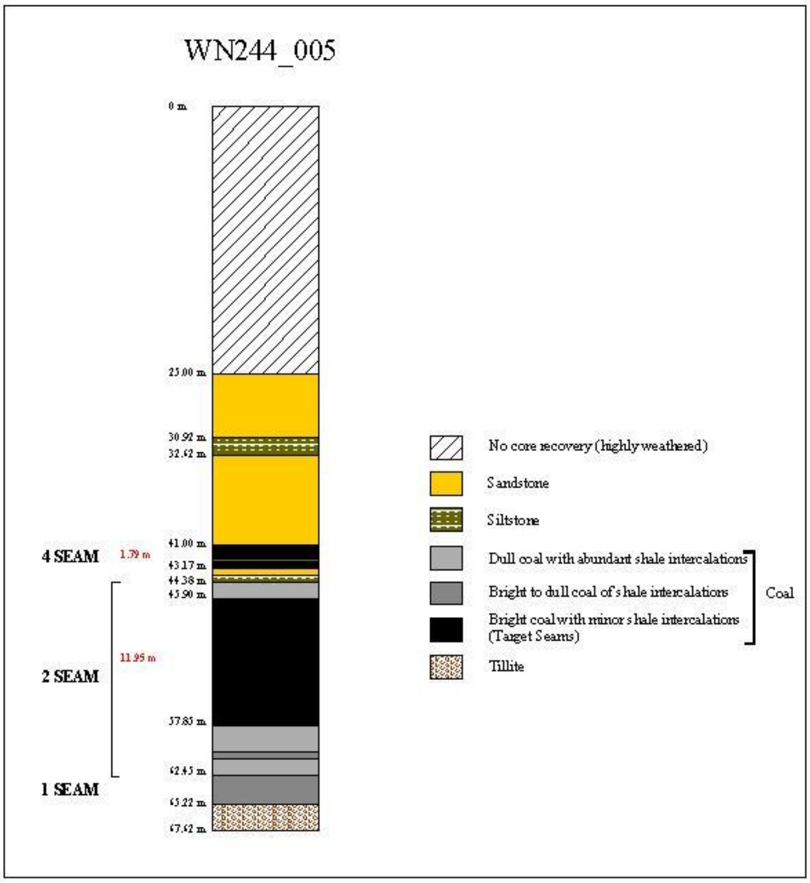

Figure 1-4: Typical stratigraphic succession of the local geology

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.

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.

1.1.4 Land attributes

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

1.1.4.1 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 1-3 contains the soil types and areas occupied by the various soil types while Plan 6 indicates the various soil groups found on the farm Wolvenfontein. It is evident from the table below 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 1-3: 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 6). 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.

1.1.4.2 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 7). 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 7. 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 7. 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 7. 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.

1.1.4.3 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 8 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.

1.1.5 Surface water

A complete Surface Water Report is attached in Appendix C.

1.1.5.1 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.

1.1.5.1.1 Catchment boundaries

The proposed mine project falls within quaternary catchment B20A and lies on one of the upper tributaries of the Bronkhorstspruit 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:-

- 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
- Stream draining the southern part of the project site with two upstream tributaries (Catchment: C4). Catchments for the tributaries are C1 and C2 (Plan 9);
- 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 9); and
- 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.

1.1.5.1.2 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.

1.1.5.1.3 Normal dry weather flow volume

During normal dry weather seasons, the flow volume per year of the quaternary catchment area is 10.22 x 106m^3 (DWAF, 2005).

1.1.5.1.4 Flood flows

The peak flows for the various sub-catchments delineated were assessed utilising a combination of the following Rainfall-Runoff methods (Table 1-4):

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

1.1.5.1.4.1 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.

1.1.5.1.4.2 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.

1.1.5.1.4.3 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.

1.1.5.1.4.4 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 1-4) 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 1-4: 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

Sub-Catchment	Rational (m^3/s)	Alternative Rational (m^3/s)	SDF (m^3/s)	SCS (m^3/s)
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

1.1.5.1.5 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.

1.1.5.2 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:

- 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; and
- 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 11. Plan 12 indicates all the registered water users in the area. The collected samples were submitted to an accredited water quality analysis laboratory for the analysis of the chemical constituents.

1.1.5.2.1 Field investigation

1.1.5.2.1.1 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 1-5.

Table 1-5: 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 1-5), 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.

1.1.6 Groundwater

A complete Hydrogeological Report has been completed for the proposed Kangala Coal Mine as is attached in Appendix D. This report addresses the hydrogeological issues and expected impacts of the Kangala development. During the investigation it was observed that the planned mining area is currently used for agricultural activities which include large scale maize production under irrigation from surface and groundwater resources. The groundwater is of good quality and the samples fall within the SANS 241 drinking water guidelines.

The karstified Malmani dolomites present in and adjacent to the area should not be at risk if careful mine planning and operations are performed, however this will have to be carefully monitored for the life of mine and beyond.

1.1.6.1 Geophysical survey

A geophysical survey was conducted during the week of the 1st to the 4th of September 2009. The project area is mostly covered with worked agricultural land with very little surface outcrops visible, geophysics is a method used to characterise the subsurface physical conditions without the use of extensive intrusive drilling programmes. Due to the lithology present at the project area, possibly being karstified carbonate terrain, the use of the gravity method was essential to delineate possible voids in the subsurface. A magnetic and electromagnetic line was also surveyed to establish weathered zones for background monitoring boreholes.

The results from the gravity survey after the data was reduced yielded several low density anomalies as can be seen on Plan 13. After removing the regional fields and presenting the line data on a 2D graph these anomalies were targeted for the drilling programme. The low density anomalies could represent cavities or voids within the carbonate rocks and is normally drilled to explore tertiary aquifer systems within the dolomitic terrain and to ensure that all possible impacts are defined. It must be noted however that not all favourable anomalies could be drilled due to interference of the drilling equipment with the cultivated agricultural lands in the project area. Three of the boreholes were moved adjacent to coincide with the local road network and it is therefore unknown if any karstification has developed below the original target areas, however using extrapolation the new targets were also positioned at low density areas.

Bouguer anomaly values were filtered and the residual Bouguer values graphed. The ground geophysical data is appended in Appendix D. The drilling targets for the establishment of the monitoring boreholes can be seen on these. All five boreholes were drilled and only KAM01 intercepted a weathered zone in the dolomite which can probably be attributed to the weathered zone between the contact with the Karoo strata and the Malmani dolomite. The rest of the boreholes either stopped short of the dolomites (deeper than proposed mining depths) or did not intercept any major weathered zones and definitely no cavities or voids. The possibility of deeper lying cavities is very good as borehole G37018 indicated such a zone at 187 m (water strike in excess of 40 L/s) on the farm Wolvenfontein (eastern project area).

The results from the magnetic and electromagnetic survey indicated possible weathered zones along magnetic anomalies. The magnetic data used in the graph has been filtered and the regional magnetic field removed using a third degree polynomial. Due to budgetary constraints only five boreholes were drilled and it was decided for now not to drill any of these anomalies. The line was surveyed to delineate possible weathered zones in order to establish a background monitoring borehole up-gradient of the project area. Borehole KAM04 was drilled in this area and would for the time being suffice as a background monitoring borehole.

Intrusive studies via drilling and aquifer testing where undertaken in order to obtain more information on the hydrogeology of the area. For more information on these phases please refer to the Hydrogeology Report in Appendix D.

1.1.6.2 Conceptual hydrogeological model

The conceptual hydrogeology model was derived from the data obtained from drilling and aquifer testing as well as the exploration geological logs obtained from Universal Coal.

A conceptual model is a representation of probable geometry of an aquifer system hosted within a defined lithological area. Due to the diversity of the geology more than one aquifer system could exist within a vertical slice of layers. Groundwater flow direction and hydraulic conductivity is important to visualise the movement of groundwater due to gravity and pressure / hydraulic gradients.

Figure 1-5 is a graphical rendition of the geology and hydrogeology at the project site in order to conceptualise the groundwater occurrence and movement in the subsurface. Rainfall that infiltrates into the weathered rock soon reaches the layer of shale underneath the weathered zone. The movement of groundwater on top of this retarding shale layer is lateral and in the direction of the surface slope. The water reappears on surface at the wetland areas.

Groundwater not influenced by evapotranspiration, which in this area will be a minimum due to the cultivated open land, will infiltrate weathered and fractured zones within the weathered shale / siltstone layer flowing vertically down into the coal seams from where it will move horizontally through the layer but also along the Dwyka contact towards the topographical lows eastwards and towards the wetland stream area. The area north east to east of the project has outcropping dolomites. The Dwyka clayey zone will most likely act as a retarding aquitard layer when still intact. The k6 or dolomite layer will most probably have regional flow associated with it on the contact weathered zone between the Dwyka and Malmani dolomite as well as in the effectively connected karst zones deeper within the dolomites. This will flow towards the northern to eastern outcropping dolomites.

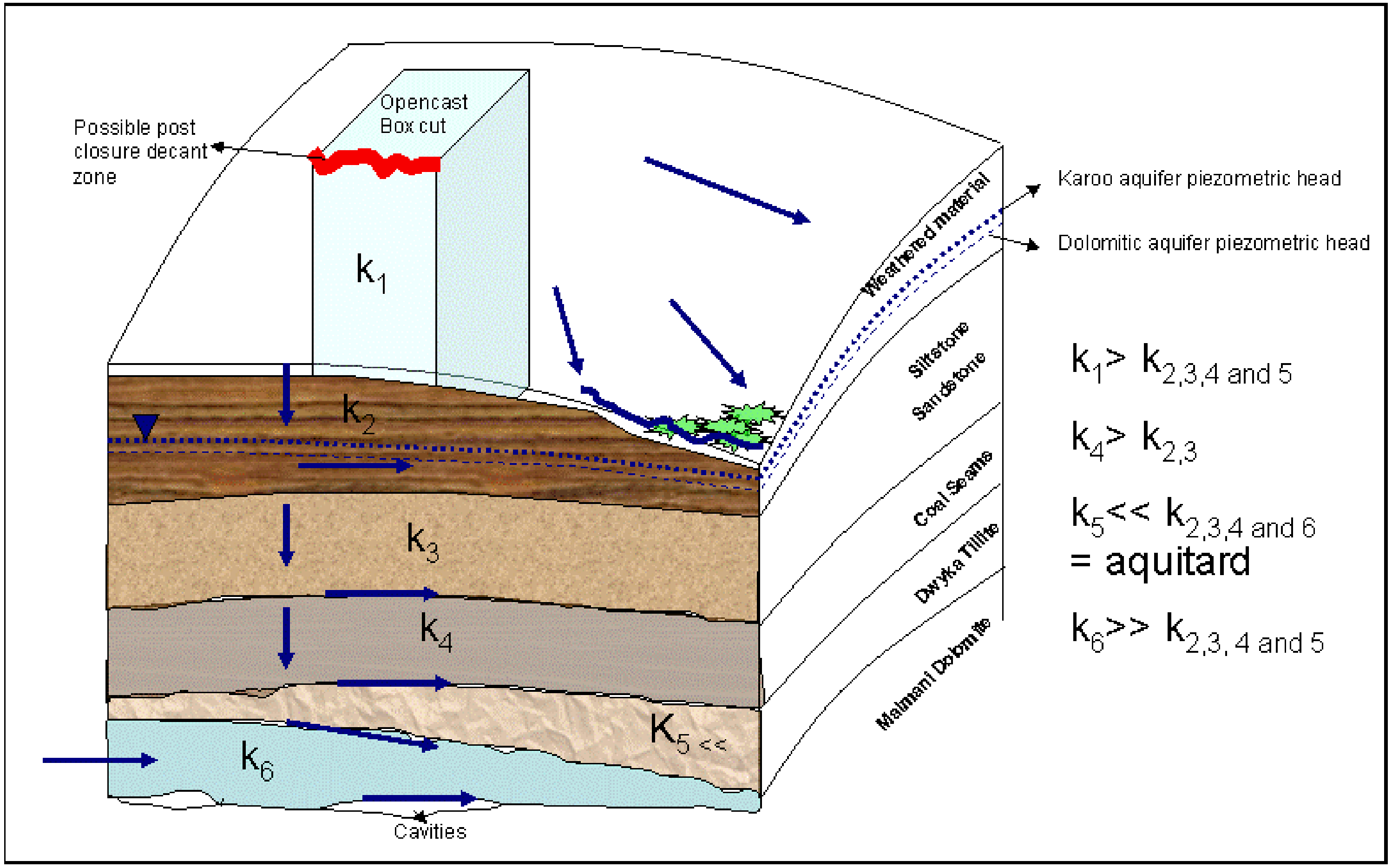

Figure 1-5: Hydrogeological conceptual model for the Kangala Coal Mine project area

Two possible water levels will exist, the phreatic water table within the weathered zone k2 and piezometric water level from the semi-confined Karoo aquifer and the confined dolomitic aquifer. These levels are fairly close to each other.

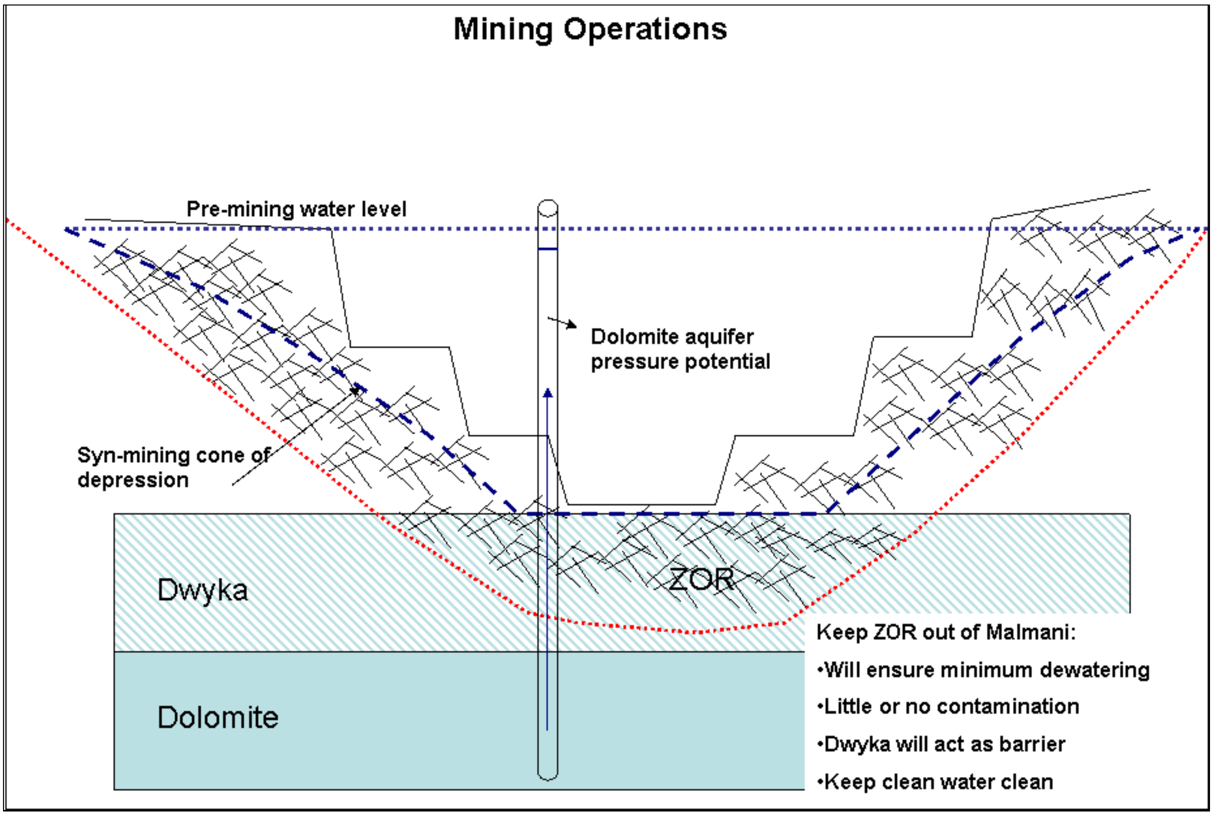

Figure 1-6: Mining conceptual model for the Kangala Coal Mine area

Hydraulic conductivites in the dolomites and open pit areas will be the highest with the Dwyka aquitard being the lowest. The weathered zone will have slightly higher conductivities than the Karoo different layers.

This will be significant as flow within the Karoo will be governed mainly by fractured and weathered zones, which will impede the movement of possible contaminants away from the mine infrastructure towards the lower lying wetland area.

The vertical flow regime will also be significant as the Dwyka aquitard should in theory impede flow towards the dolomites and specifically the karstified zones in the deeper sections of the dolomite.

However if the Zone of Relaxation (ZOR) usually created by opencast mining operations such as blasting and removal of material, would puncture the Dwyka layer the potential pressure within the dolomitic aquifer could cause severe dewatering issues and possible post mining decant along the red zone indicated in Plan 14 and Figure 1-5.

Cognisance will therefore need to be taken of this hydrodynamic system to ensure that minimum impacts will be caused by mining and that monitoring will have to be conducted to ensure management of the system.

The conceptual model of mining in a profile view (Figure 1-6) for the area and in relation to the most important layers, indicates the importance of the dolomitic aquifer pressure potential and the retarding Dwyka layer that needs to be kept intact during mining operations. It also again reiterates the possible hydraulic potential of the dolomitic aquifer.

1.1.6.3 Groundwater levels and flow

A general restriction applies when groundwater flow directions are defined using the normal approach of measuring static water levels in boreholes drilled for characterisation. The concept of a potentiometric surface is only valid for horizontal flow in horizontal aquifers. Obviously this is not the case in natural systems. Further it is possible to confuse a petentiometric surface with the water table in areas where both confined and semi-confined aquifers exist (Freeze *et al*, 1979). There should be at least three boreholes penetrating a specific aquifer, to ensure accurate flow direction measurements as well as gradients can be made from a specific potentiometric level. However in practise that is almost impossible due to costs etc. A general water level surface which is an average approximation of the potentiometric surface as well as semi-confined to unconfined water table values is therefore used for defining the groundwater flow in an area and is generally referred to as a potentiometric or piezometric contour map.

Plan 13 is a false colour (RGB) potentiometric surface contour map indicating the groundwater flow in the project area. There is a good correlation with the regional contour map, representing data obtained from the DWA National Groundwater Archive (NGA) performed during the scoping phase (DWA, 2009) and onsite data from the five newly drilled boreholes (Table 1-6).

The flow is in an easterly to north-easterly direction towards the topographical low lying areas. This in general is towards the dolomitic outcropping area.

Table 1-6: Static water level data and surface data above datum for newly drilled boreholes at Kangala.

Borehole no.	Borehole collar elevation (mamsl)	Static water level (mamsl)
KAM02	1611.49	1600.29
KAM01	1591.98	1580.39
KAM03	1602.99	1591.99
KAM04	1613.88	1609.15

Borehole no.	Borehole collar elevation (mamsl)	Static water level (mamsl)
KAM05	1616.14	1606.86

The Bayesian correlation method below describes the relationship of flow and natural surface gradient:

1.1.6.3.1 Bayesian correlation

The five boreholes with accurate collar elevations were used to establish the relationship of groundwater elevation with regards to surface topography. A scatter diagram of surface topography plotted against groundwater elevation above datum is used to analyse the relationship and is referred to as a Bayesian correlation for a specific aquifer system. Figure 1-7 depicts the relationship for the aquifer system / s in the project area. There seems to be a reasonable correlation apart from borehole KAM04 which was the dry borehole with no water strike and only a seepage static water level later on.

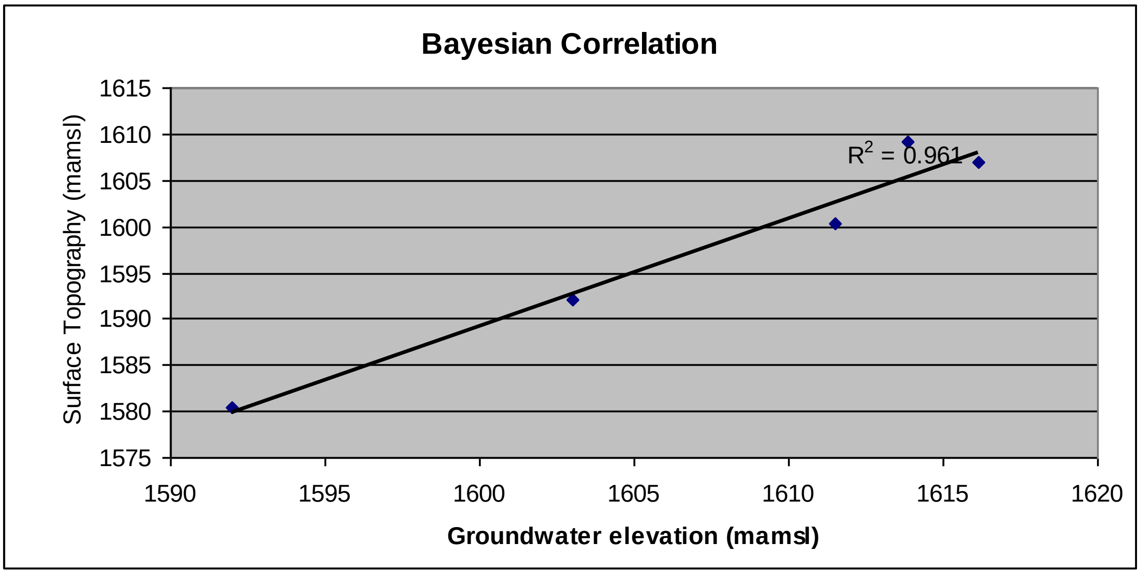

Figure 1-7: Bayesian correlation

1.1.6.3.2 Dewatering and re-watering of mining areas

1.1.6.3.2.1 Dewatering in the opencast mining areas

Dewatering in the area surrounding the opencast areas will occur as a result of groundwater flow under the influence of gravity to the bottom of the pit. Dewatering of the pit is currently being undertaken. The radius of influence from the pit areas calculated as a function of the hydraulic conductivity can only be achieved if confident Storativity (S) values are known through aquifer testing with monitoring boreholes. This will be achieved during the groundwater model update to be performed in January 2015, incorporating all the infrastructure design and operational phase.

1.1.6.3.2.2 Post mine ingress into the back filled areas

Although it is imperative to calculate the post mine ingress volumes after rehabilitation is completed during the closure phase, the same restriction as in section 5.4.2 holds for these calculations. A more reliable figure also needs to be derived for groundwater recharge in order to make informed calculations on post flooding scenarios of back filled pits. Flooding of this backfilled material should minimise the chances of acid generation normally associated with high sulphide mineral content, but fluctuating levels should be minimised (DWAF Guideline G4, 2008).

The coal seam elevations were obtained from the exploration drilling data completed at Kangala. To understand the current mining and post mining hydrogeological conditions, cross sections were completed indicating the relation between the No. 2 coal seam and the surface topography as well as the difference between the two which is a measure of what volume of material will be removed for mining and where the two levels could coincide, which can be related to direct decant if values are zero. Surface and coal seam elevations indicate two possible decant zones from the two profile sections depicted on Plan 14.

1.1.6.4 Groundwater quality

It is crucial to establish baseline quality conditions prior to any mining activities in a project area. This ensures that no degradation of the groundwater resources will occur and at best that improvement results. This also establishes the nature and degree of existing contamination practices and will help quantify cumulative impacts. Groundwater quality also helps establish the origin of the water and how to best manage impacts that could arrive.

The five newly drilled characterisation boreholes were sampled for water quality. These were boreholes KAM 01, 02, 03, 4 and 05. Table 1-8 summarises the quality of the groundwater and is a comparative analysis with the SANS 241:2005 Drinking Water Standards.

The sampling protocol used conformed to the DWEA (Weaver *et al*. 2007) as well as the SANS 241:2005 protocols. Purging of the boreholes was performed removing at least one and a half time the volume of each sampled borehole to ensure a representative sample. Inter hole decontamination of sampling equipment was also performed, while calibration of instruments was performed during sampling.

Graphical methods are employed to present the data in a convenient manner for visual inspection. The major ion compositions as a percentage of the total equivalents (milliequivalents per liter) are displayed using the tri-linear diagrams known as Piper and Extended Durov diagrams. The diagrams are useful to describe the differences in major ion chemistry in groundwater flow systems. The Stiff diagram facilitates rapid comparison as a result of distinct graphical shapes or signatures. The major ion constituents from the five samples collected is presented in these different diagrams and interpreted below:

The tri-linear Piper diagram (Figure 1-8) indicates that the groundwater is a bicarbonate-calcium-magnesium type water and very typical of dolomitic terrain. There is a slight sodium-chloride presence and could indicate mixing from the Karoo aquifer (probably due to the coal layer influence). KAM01 also indicates some elevated sulphate values which can be contributed to the coal horizon intercepted during the drilling and possible mixing.

The Expanded Durov diagram uses similar ratio techniques as the piper diagram to plot the concentrations of the major ions, however six triangular diagrams are used, three for the anions and the other for the cations (Figure 1-9). The expanded Durov is divided into 9 areas, each corresponding to a water type; a brief description of each area is given below in Table 1-7. In each instance the dominant anions and or cations are presented. In certain instances there is no dominance by any particular constituents (area 5) or only dominant anions (area 8).

Table 1-7: Expanded Durov legend

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

The majority of the samples fall within the second field represented by a bicarbonate-magnesium or calcium-magnesium dominant water. Sample KAM01 again falls within field five indicating no dominant water type or mixing waters.

The Stiff diagrams (Figure 1-10) indicate an underlying dolomitic signature with prominent alkalinity and magnesium-calcium ratios. There is a definite addition of sodium and chloride as well as sulphate to these signatures again confirming mixing water.

The water quality in general for all five samples falls within class one water according to SANS 241 (acceptable) with only elevated iron and manganese values which falls within the maximum allowable limit. High nitrate values could be due to agricultural activities as these boreholes were all drilled next to cultivated lands.

The Total dissolved solids ranges between 88 to 344 mg/L and the Electrical Conductivity (EC) between 15.2 and 54.3 mS/m which is classed as fresh water. The Piper display also indicates freshly recharged water in general with little residence time.

The pH ranges between 6.89 and 7.75 which is slightly acidic but more towards the basic side of the scale. This again is typical of alkaline dolomitic waters.

A hydrosensus of surrounding boreholes was also completed. The results of the hydrosensus are included in the hydrogeological Report attached in Appendix D.

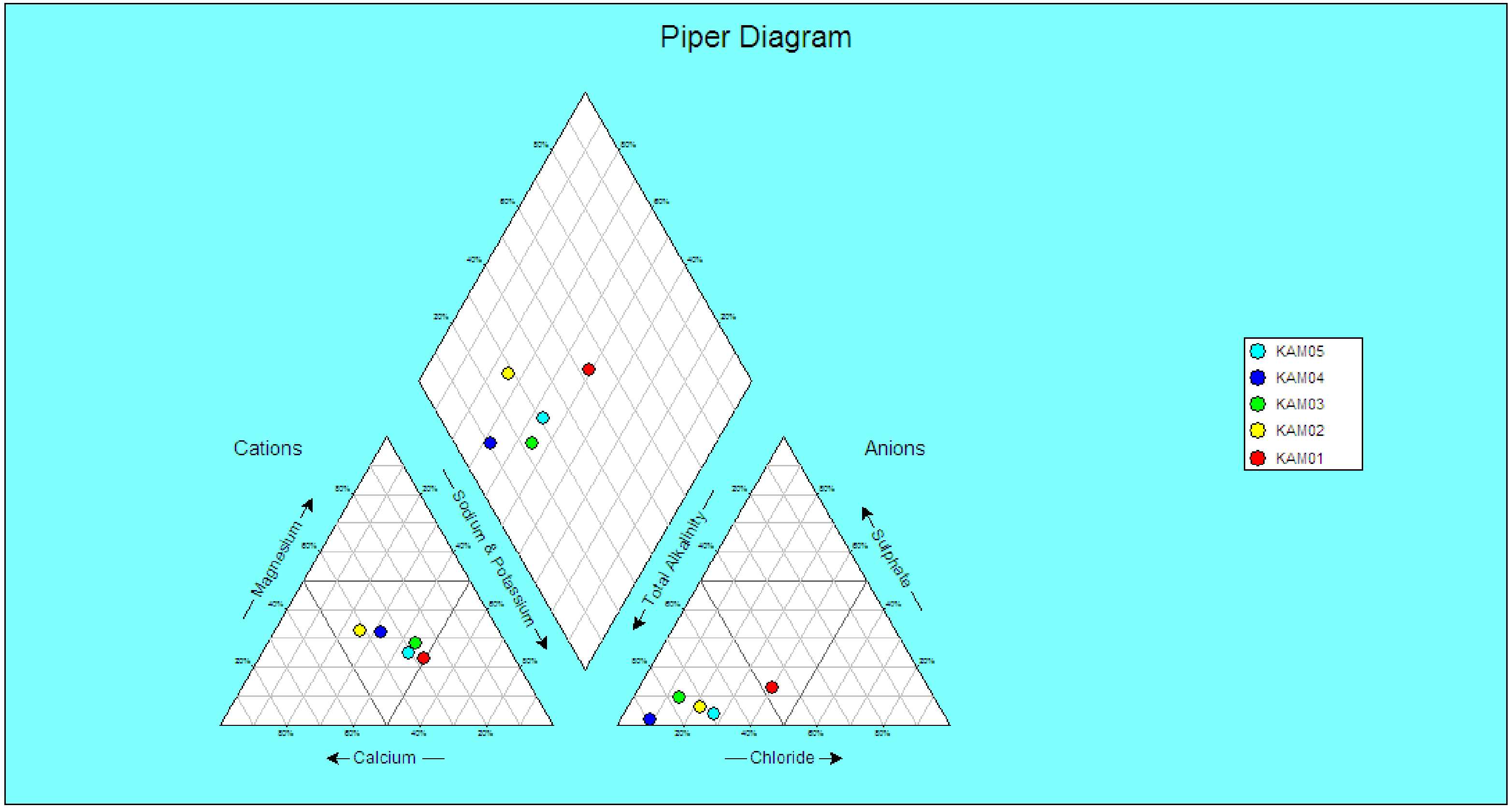

Figure 1-8: Piper diagram from the groundwater samples collected during the drilling programme

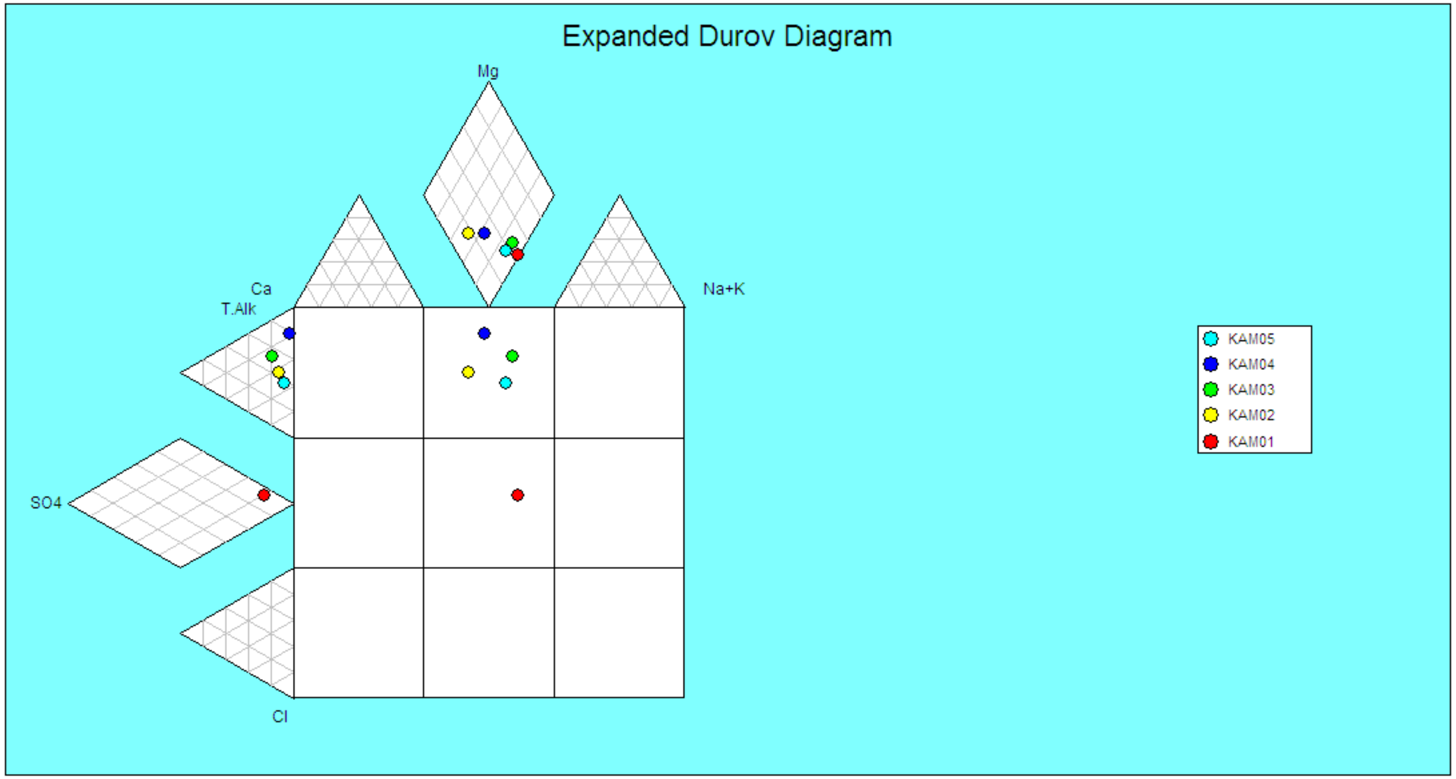

Figure 1-9: Expanded Durov diagram from the groundwater samples collected during the drilling programme

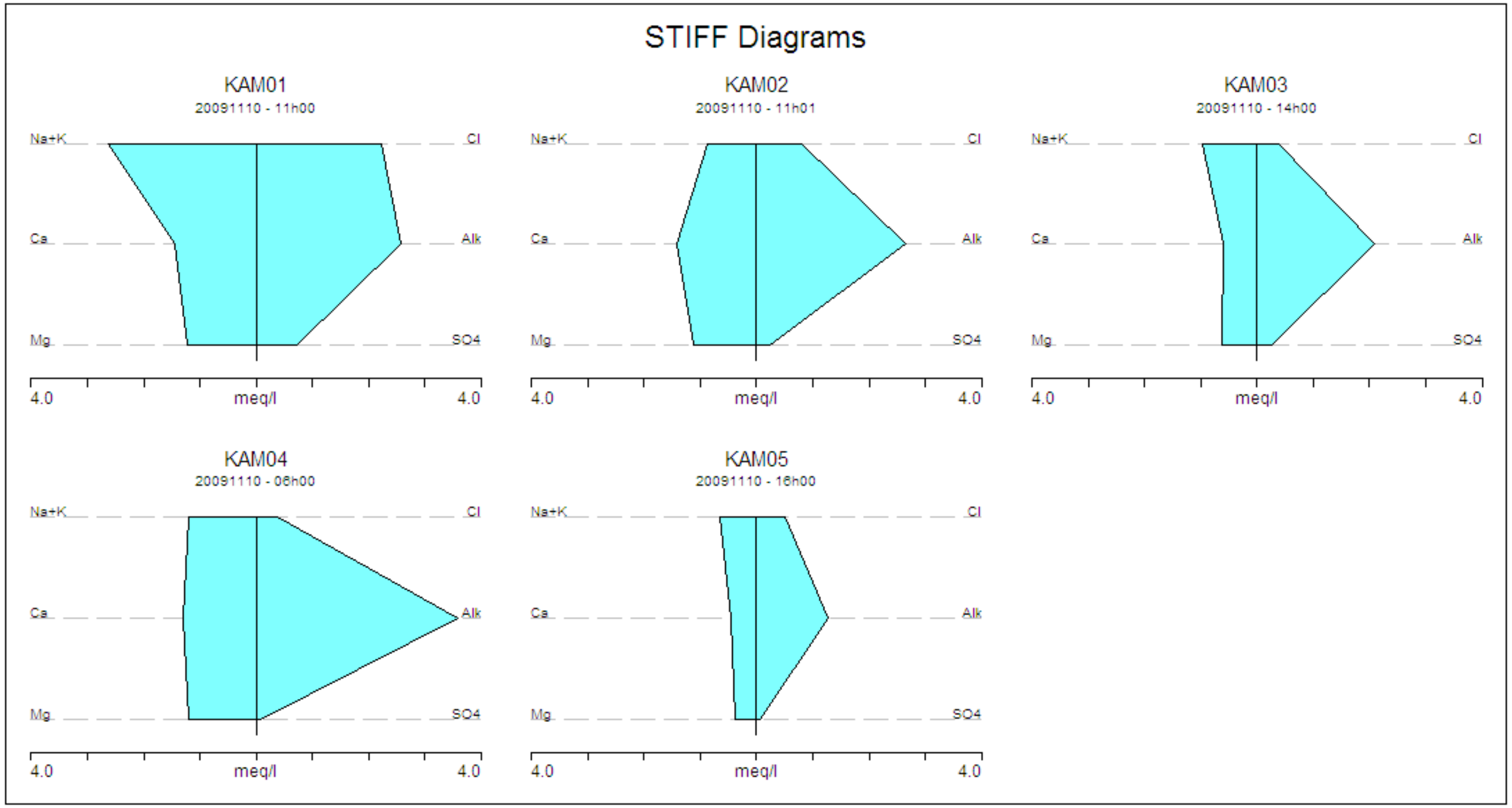

Figure 1-10: Stiff diagrams from the groundwater samples collected during the drilling programme

Table 1-8: Quality analysis of borehole samples taken during the drilling programme (values in mg/L unless otherwise noted)

Sample ID		Total Dissolved Solids	Nitrate NO3 as N	Chlorides as Cl	Total Alkalinity as CaCO3	Sulphate as SO4	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	Fluoride as F
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	<0.5
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	0.5-1
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	1-1.5
Class III	(Exceeding)	>2400	>20	>600	N/S	>600	>300	>100	>400	>100	>2	>1	>370	<4 or >10	>0.58	N/S	>1.5

Sample ID	Total Dissolved Solids	Nitrate NO3 as N	Chlorides as Cl	Total Alkalinity as CaCO3	Sulphate as SO4	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	Fluoride as F
KAM01	334.00	0.10	79.00	129.00	34.80	28.80	14.90	59.00	2.23	0.01	0.08	54.30	7.21	0.01	0.33	0.66
KAM02	200.00	8.20	8.00	133.00	11.50	28.50	13.60	17.80	3.99	0.36	0.10	33.60	7.75	0.01	0.20	0.20
KAM03	148.00	3.70	4.00	104.00	12.40	11.80	7.52	20.70	2.99	0.18	0.19	22.70	7.24	0.01	1.00	0.25
KAM04	220.00	0.77	11.00	179.00	3.70	26.00	14.50	23.30	6.95	0.09	0.19	33.60	7.63	0.04	0.20	0.38
KAM05	88.00	5.40	4.00	63.00	3.40	9.20	4.52	11.50	6.06	0.45	0.04	15.20	6.89	0.04	0.20	0.20

1.1.6.5 Acid base accounting

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

- $2FeS_2 + 2H_2O+7O_2 \rightarrow 2FeSO_4 + 2H_2SO_4$ (A)

(pH >4.5)

- $4FeSO_4 + O_2 + 2H_2SO_4 \rightarrow 2Fe(SO_4)3 + 2H_2O$ (B)

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

- $Fe_2(SO_4)_3 + 6H_2O \rightarrow 2Fe(OH)_3 + 3H_2SO_4$ (C)

(pH > 2.5)0

- $FeS + 14\ Fe^{3+} + 8H_2O \rightarrow 15Fe^{2+} + 2SO_4^{2-} + 16H^+$ (D)

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

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

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

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

1.1.6.5.1 Acid base accounting results for Kangala

Geological core sample were collected during the drilling programme at Kangala for ABA testing. The samples from various lithologies were submitted to SGS Lakefield Laboratories in Johannesburg, Gauteng Province for static testing.

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

Samples from three representative boreholes were analysed to determine possible geochemical alterations during mining and post closure phases at Kangala. The borehole numbers and additional information can be seen in Table 1-9 below.

Table 1-9: Geological information from the different boreholes sampled for ABA testing

Sample number	Depth (± mbgl)	Lithology
UNI 13a	24	Shale. Dark grey. Very fined grained. Slightly weathered.
UNI 13b	29.24	Sandstone. Light grey to grey. Fine grained. Slightly fractured to fresh.
UNI 13c	34.24	Siltstone. Grey. Fine grained. Slightly fractured to fresh. Micaceous.
UNI 13d	36.26	Sandstone. Brownish grey. Medium grained. Slightly fractured to fresh.
UNI 13e	37.01	Shale. Grey to dark grey. Very fine grained. Highly fractured and broken.
UNI 13f	67	Dwyka Tillites. Brownish grey. Fine to coarse grained. Highly fractured and broken. Dropstones and inclusions of various shape, size and colours visible.
UNI20a	24	Shale. Dark grey. Very fined grained. Slightly weathered.
UNI20b	27	Sandstone. Light grey to grey. Fine grained. Slightly fractured to fresh
UNI20c	40	Siltstone. Grey. Fine grained. Slightly fractured to fresh. Micaceous.
UNI20d	43	Shale. Grey to dark grey. Very fine grained. Highly fractured and broken.
UNI20e	45	Dwyka Tillites. Brownish grey. Fine to coarse grained. Highly fractured and broken. Dropstones and inclusions of various shape, size and colours visible.

Sample number	Depth (± mbgl)	Lithology
UNI23a	27.5	Shale. Dark grey. Very fine grained.
UNI23b	34.5	Siltstone. Light grey. Fine grained. Slightly fractured to fresh.
UNI23c	51.1	Dwyka. Brownish grey. Fine to coarse grained. Slightly fractured to fresh.

*meters below ground level (mbgl)

In addition to pH measurements, the actual acid and base potential of the overburden and interburden have been determined. These results are presented in the following tables.

Table 1-10: Modified Acid Base Accounting test results for Kangala

Acid Generation Potential (AGP)	Sample Identification	General reason for classification (with some exceptions)
Strong NP	None	None falling within this class
Medium AGP	UNI13a; UNI13f	Sulphide > 0.3% Negative net NP(<-20) NP/AP ratio <1
Low AGP	UNI20b	Sulphide < 0.3% Low NP Negative net NP NP/AP ration <1
Uncertain possible AGP or NP	UNI13d; UNI20d	Low AP Low NP NP/AP ratio between 1 and 3
Low NP	UNI13e; UNI20c; UNI20e; UNI23e; UNI23c	Sulphide < 0.1% Low NP
Medium NP	UNI13c ; UNI20a ; UNI23b	Sulphide < 0.5% Positive net NP)>10) NP/AP ratio > 3%
Strong NP	UNI13b	Strongly positive net NP (>20) NP/AP ratio > 4 High carbonate

The geological core collected for ABA testing did not include any of the two coal seams present at Kangala. The coal have been removed from four boreholes and analysis by Kangala and the test results from the raw coal analysis from the No. 2 and No. 4 coal seam can be seen in Table 1-11.

Table 1-11: Summary of the total coal seams characteristics

No. 4 coal seam raw coal quantities within the initial mining area						
	Moisture %	Ash %	Volatiles %	Fixed Carbon %	Sulphur %	CV (MJ/kg)
Average	4.29	28.17	26.55	40.99	2.30	21.11
Maximum	4.65	30.31	29.50	43.70	2.63	22.66
Minimum	3.61	23.93	22.42	39.40	1.39	19.89
No. 2 coal seam raw coal quantities within the initial mining area						
Average	4.88	31.70	19.82	43.60	1.15	19.09
Maximum	6.39	33.88	22.73	47.43	1.36	20.50
Minimum	3.76	28.89	15.03	39.62	0.74	17.86

Several factors calculated in ABA by Soregaroli and Lawrence (1998) indicated that for sustainable long-term acid generation, at least 0.3% sulphide-S is needed. Values lower then 0.3% can yield acidy but it is only of short-term significance. From the results shown in the table above it can be seen that both coal seams have a high tendency to produce acid formation when exposed during excavation. It should be noted that only small quantity of coal will remain after mining have ceased minimising the potential for AMD formation.

1.1.6.6 Concluding statement

The following conclusion can be reached from the above test results:

- High variability can be found in the geochemical characteristics in the overburden and interburden at Kangala. Sandstone layers fluctuate from strong neutralisation potential to low acid generation potential indicating a change in the chemical composition over the planned mining area;
- With the above taken into consideration Sandstone was the dominant lithology present (excluding the coal seams) in the overburden and contributed about 42 % of

the total samples taken. The majority of the Sandstone indicated a strong NP and should be backfilled into the opencast pit to reduce the impact of AMD formation;

- The second largest percentage of lithological strata from the samples acquired from the overburden were shales and indicated a medium AGP and should consequently not be backfilled into the opencast pit but discarded to the discard dump;
- The majority of the static test results indicated low to medium acid neutralisation potential. This will decrease the risk of acid formation and possible acid neutralisation in the presence of acid mine drainage. Sample UNI13a, UNI13f and UNI20b show possible acid generating potential;
- The analysis from the No. 2 and No. 4 coal seam showed high risk for acid generation. The majority of the coal will however be removed, but Kangala need to ensure that the Dwyka formation stay intact to prevent possible pollution to the underlying dolomites; and
- Acid mine drainage cannot be prevented and will remain a problem at all the collieries in the Mpumalanga Coal Field. The effect and long term impacts can however be reduced by sound management strategies.

It is recommended that Kangala continue to sample and analyse geological rock samples during the operational phase as required by the Best Practice Guidelines for Impact Prediction, BPG G4. This will indicate the variability of the material, the identification of any material with a high risk not currently identified and the management, or separate handling thereof if required. This information is invaluable for the closure planning and mine water closure plan. The life of mine is estimated to be 10 years so very little acidification is expected during life of mine. Long term chemical prediction will have to be undertaken to accurately assess the quality of water expected post closure.

1.1.7 Air quality

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

1.1.7.1 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. 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 1-11: Highveld priority area

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

1.1.7.2 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 1-12 below accounting for each of the individual mining operations.

Table 1-12: 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**

1.1.7.3 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 PM_{10} monitoring data was available at the time of this assessment. The Air Quality standards for PM_{10} used in the assessment were therefore applied solely to the modelled process contribution from the proposed Kangala Coal Mine.

Table 1-13: 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 PM_{10} 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 15). No baseline data exists for ambient PM_{10} conditions.

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

- Slight : less than 250 mg/m^2/day;
- Moderate : 250 to 500 mg/m^2/day;
- Heavy : 500 to 1200 mg/m^2/day; and
- Very heavy: more than 1200 mg/m^2/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.

1.1.8 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.

1.1.8.1 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 1-14. The location of the identified receptors in which noise measurement were taken can be seen on Plan 16.

Table 1-14: 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

Code	Farm	Portion	Receptor type	Owner
UN8	Strydpan 243 IR	31	Homestead	Eloff Mining Co pty ltd
UN9	Wolwenfontein 244 IR	1	Homestead	Kallie Madel Trust

1.1.8.2 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 below. Additionally this table also presents the recorded date, time and meteorological conditions.

1.1.8.2.1 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.

1.1.8.2.2 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.

1.1.8.2.3 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.

1.1.8.2.4 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.

1.1.8.2.5 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.

1.1.8.2.6 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.

1.1.8.2.7 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.

1.1.8.2.8 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.

1.1.8.2.9 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.

1.1.8.3 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.

Universal Coal are currently procuring the services of an independent noise specialist to undertake noise measurements.

Table 1-15: 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 :	Temp: 25.2°C-Wind: West @ 1.3 m/s-Humidity:

Sample ID	SANS rating limit			Measurement details			
	Type of district	Period	Acceptable rating level dBA	LAreq,T	Maximum/ Minimum dBA	Date/Time	Meteorological conditions
						13:15	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						

1.1.9 Air blasting and ground vibration

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

1.1.9.1 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.

1.1.9.2 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 1-12: 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 1-16 shows summary table with start and end dates and times, maximums recorded, date and time of maximums and notes.

Table 1-16: 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.

See Plan 20.

1.1.9.3 Concluding statement

The expected ground vibration and air blast levels from blasting operations required at the Kangala Coal, Wolvenfontein 244 IR, Portion 1 and 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.

1.1.10 Biodiversity

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

1.1.10.1 Vegetation

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

1.1.10.1.1 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).

1.1.10.1.2 Red Data plant species

Three species listed as officially protected were recorded, namely Gladiolus crassifolius, Kniphofia brachystachya and Gladiolus dalenii (Table 1-17). According to Mpumalanga Nature Conservation Act, Act No. 10 (1998) Section (69) 1 (a) and (b), the species in Table 1-17 are protected from destruction or removal, without proper consent in the form of permits from the department.

Table 1-17: 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

1.1.10.1.3 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 1-18). 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 1-18: 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

Scientific Name	Common Name	Ecological Status	Form
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

1.1.10.1.4 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 1-19) 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 1-19: 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

1.1.10.1.5 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 1-13 below.

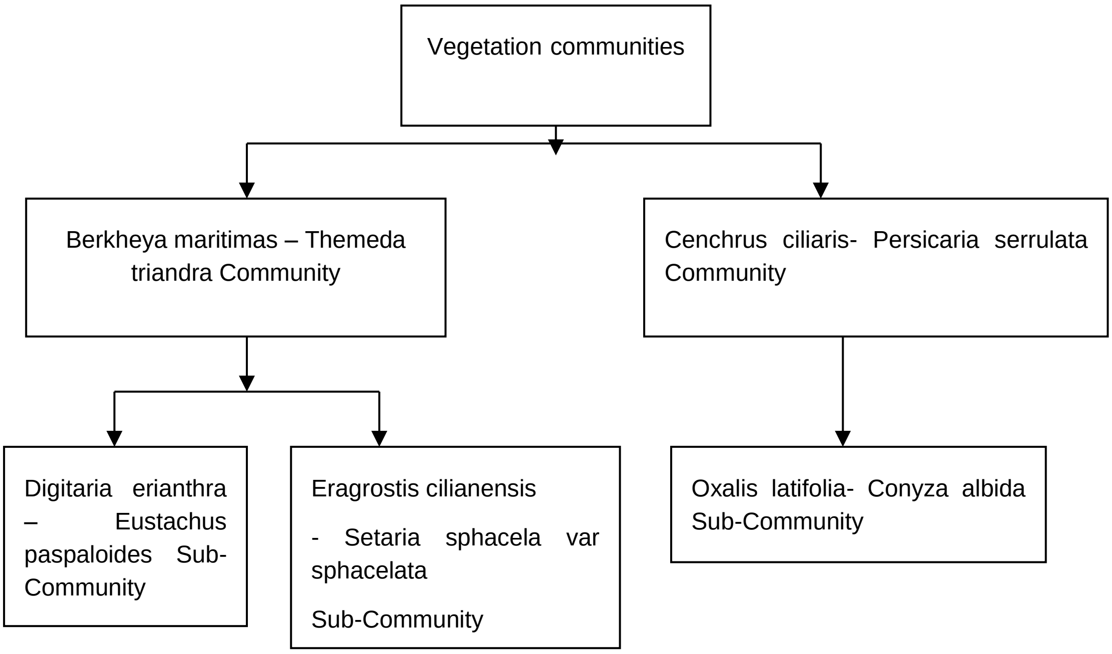

Figure 1-13: Dendrogram of plant communities

1.1.10.2 Animal life

1.1.10.2.1 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 1-20 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 1-20: Mammals known to occur on the Kangala Mine

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

1.1.10.2.2 Birds observed and recorded in the area

A total of 30 bird species were identified during the wet season survey (Table 1-21). 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 1-21: 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
Scientific	**English Name**	**Residency**	**Rareness**	**SA Red Data Status**	**IUCN Status**
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

1.1.10.2.3 Reptiles

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

1.1.10.2.4 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 1-22).

Table 1-22: 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-	Permanent water

					desert Desert	

1.1.10.2.5 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 1-23 the insects collected from grasslands and their abundances is shown.

Table 1-23: 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

	Families	Total Abundance
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

1.1.10.3 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.

1.1.11 Aquatic ecosystems

Digby Wells was appointed to undertake a biomonitoring programme at the Kangala Coal Mine. This study entails an assessment of the aquatic ecology within water courses associated with the Kangala Colliery project area. This includes the Wolvenfontein and Stompiesfontein farms watercourses which are tributaries of the larger Bronkhorstspruit River system located within the B20A quaternary catchment. An initial low flow survey was undertaken in August 2014. Eight sampling sites were identified, however only six were sampled, as two of the sites were dry.

1.1.11.1 Water quality

The water quality results obtained during the low flow survey indicated low dissolved oxygen levels at all six sites considered for the study. These low dissolved oxygen concentrations have a potentially negative impact on local fish and invertebrate community structures. The invertebrate assessment indicates modified water quality at two sites (KAN2 and KAN8), with site KAN3 having largely natural invertebrate community structure, based on the Average Score Per Taxon (ASPT). The low water levels should be taken into consideration when interpreting these results.

The results of the *in situ* water quality analysis indicate that pH values of the monitoring points remain within the recommended guidelines (DWAF, 1996). However dissolved oxygen levels are lower than guideline levels at all six sites, indicating high biological oxygen demand (BOD) or chemical oxygen demand (COD) within the various systems. This has a negative impact on the aquatic systems as adequate oxygen levels are critical for the survival and functioning of the aquatic biota, as it is required for respiration of all aerobic organisms. According to DWAF, 1996 values lower than 60% (sub-lethal) and 40% (lethal) are likely to cause acute toxic effects on aquatic biota. Low levels of dissolved oxygen saturation is often related to increased nutrient input (eutrophication) resulting in increased oxygen consumption and subsequent oxygen depletion. It should be noted that the increased nutrient input cannot be attributed to the Kangala mining operation.

The levels of conductivity at KAN4 exceeded recommended guideline levels. Many of the sites had low water levels and were reduced to standing pools which may have increased the concentration of dissolved salts (evaporation) within the systems.

1.1.11.2 Macro-invertebrate

The macro-invertebrate assessment index SASS5 was undertaken during the survey. A number of taxa were recorded. The tolerances of sampled taxa varied from tolerant species to moderately tolerant. This is an indication that water quality may be negatively influencing aquatic biota at some sites. The SASS5 results indicated that the sites range from large modified to seriously modified.

The ASPT values for the current sites ranged from 3.9 to 4.7. The low ASPT values may be related to sewage effluent present at the site, as conditions at the site can be considered eutrophic.

1.1.11.3 Fish

Two fish species were sampled during the low flow survey,this included *Barbus anoplus* and *Barbus paludinosus*. *Barbus anoplus* shows a high preference for slow-flowing water bodies and overhanging vegetation, and a high preference for aquatic macrophytes (Kleynhans, 2003). Additionally, *Barbus anoplus* shows moderate trophic and habitat specialisation, with a moderate preference for flowing, unmodified water quality. *Barbus paludinosus* is considered a hardy species, preferring habitats and conditions similar to that of *Barbus anoplus* (Skelton, 2011). The relative tolerance of the sampled species to the surrounding environment may be an indication of impacted aquatic systems.

1.1.12 Wetland delineation

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

1.1.12.1 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 1-14. 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 Appendix J.

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 1-24: The definition of the different HGM wetland types occurring in the study area

<table>
<tr><td rowspan="6">Pans</td><td>TOPOGRAPHIC SETTING</td><td colspan="2">DESCRIPTION</td></tr>
<tr><td>In depressions and basins, often at drainage divides on top of the hills</td><td colspan="2">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.</td></tr>
<tr><td colspan="3">HYDROLOGIC COMPONENTS</td></tr>
<tr><td>Inputs</td><td>Throughputs</td><td>Outputs</td></tr>
<tr><td>Runoff from the surrounding catchment area and lateral seepage from adjacent hillslope seepage wetlands.</td><td>None.</td><td>Evapo-transpiration and groundwater discharge from leakage.</td></tr>
<tr><td rowspan="5">Hillslope seepage wetlands connected to pans</td><td>TOPOGRAPHIC SETTING</td><td colspan="2">DESCRIPTION</td></tr>
<tr><td>Along the slopes of pan basins</td><td colspan="2">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.</td></tr>
<tr><td colspan="3">HYDROLOGIC COMPONENTS</td></tr>
<tr><td>Inputs</td><td>Throughputs</td><td>Outputs</td></tr>
<tr><td>Predominantly groundwater from perched aquifers and interflow.</td><td>Interflow and diffuse surface flow.</td><td>Variable but predominantly restricted to interflow and diffuse surface flow</td></tr>
<tr><td rowspan="5">Valley bottom wetlands without channels</td><td>TOPOGRAPHIC SETTING</td><td colspan="2">DESCRIPTION</td></tr>
<tr><td>Occur in the shallow valleys that drain the slopes.</td><td colspan="2">Valley bottom areas without a stream channel. Are gently or steep sloped and characterized by the alluvial transport and deposition of material by water.</td></tr>
<tr><td colspan="3">HYDROLOGIC COMPONENTS</td></tr>
<tr><td>Inputs</td><td>Throughputs</td><td>Outputs</td></tr>
<tr><td>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.</td><td>Surface flow and interflow.</td><td>Variable but predominantly stream flow.</td></tr>
<tr><td rowspan="5">Hillslope seepage wetlands connected to watercourses</td><td>TOPOGRAPHIC SETTING</td><td colspan="2">DESCRIPTION</td></tr>
<tr><td>Hillslopes</td><td colspan="2">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.</td></tr>
<tr><td colspan="3">HYDROLOGIC COMPONENTS</td></tr>
<tr><td>Inputs</td><td>Throughputs</td><td>Outputs</td></tr>
<tr><td>Predominantly groundwater from perched aquifers and interflow.</td><td>Interflow and diffuse surface flow.</td><td>Variable including interflow, diffuse surface flow and stream flow.</td></tr>
</table>

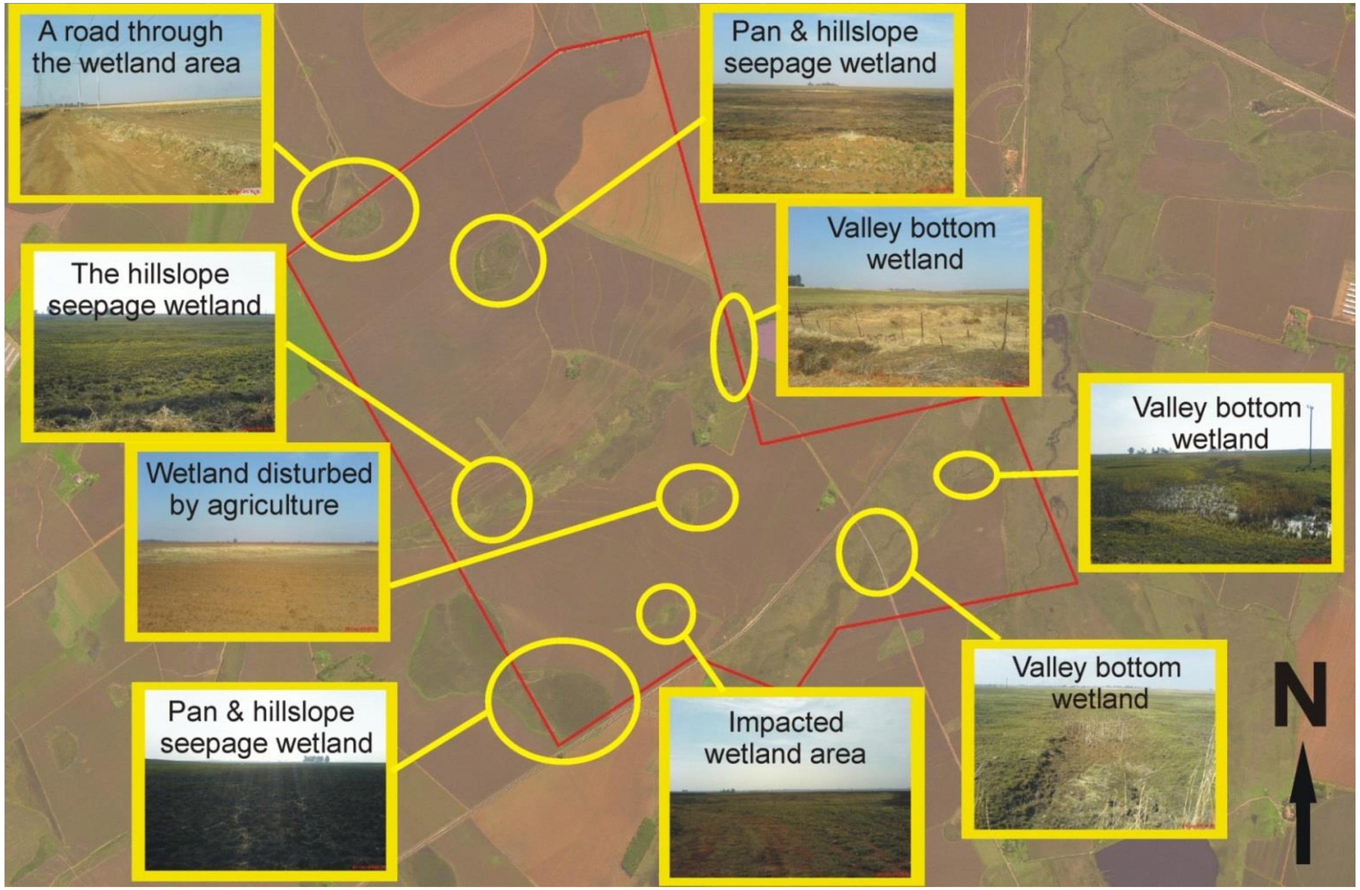

Figure 1-14: Photographs of the identified and delineated wetland units within the study area

1.1.12.2 Ecological functioning of the wetlands

1.1.12.2.1 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.

1.1.12.2.2 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.

1.1.12.2.3 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).

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 100 m 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.

1.1.13 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 18) 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 1-15

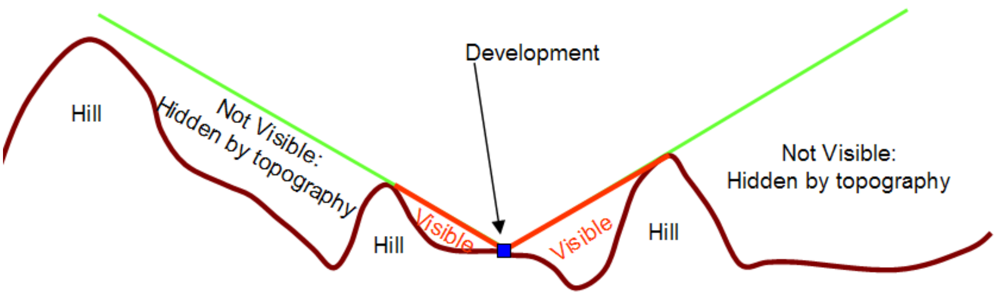

Figure 1-15: Theoretical background to viewshed modelling

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 is 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 295km^2, 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 are persons located on the farms mentioned in the above findings.

The viewshed model predicted that the mines visual disturbance extends 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.

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 is 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 is greatly reduced as the maize provides a visual screen, however once the crops in the area have been harvested so the visual impact once again becomes significant.

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

1.1.14 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 is transported from Kangala Coal Mine to the Leeuwpan railway siding which is approximately 10 km from the site. The transportation of coal will have an impact on the R555 and the R50 by substantially increasing traffic on the roads as a 70 haul trucks are leaving the site daily to deliver coal to the Leeuwpan siding (Plan 9). Universal Coal is committed to ensuring the safety of road users and therefore have undertaken the required traffic investigations into required road intersections. The Mpumalanga Department of Public Works, Roads and Transport – Roads Planning Division have granted an in principle approval to Universal Coal, dated 26 October 2012 (Refer to Appendix P).

The maintenance and management of the roads used for the transport of the coal has been negotiated with the local municipality in order to form collaboration between Universal Coal and the local municipality.

1.2 Description of environmental aspects that may require protection or remediation

1.2.1 Soils

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.

1.2.2 Surface water

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. Proper management measures will ensure that the downstream water users continue to receive the same quality of water during and post mining. The 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 m^3/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 12).

1.2.3 Groundwater

The analysis from the No. 2 and No. 4 coal seam showed high risk for acid generation. The majority of the coal will however be removed, but Universal Coal needs to ensure that the Dwyka formation stays intact to prevent possible pollution to the underlying dolomites. It is recommended that Kangala continue to sample and analyse geological rock samples during the operational phase as required by the Best Practice Guidelines for Impact Prediction, BPG G4. This will indicate the variability of the material, the identification of any material with a high risk not currently identified and the management, or separate handling thereof if required. This information is invaluable for the closure planning and mine water closure plan.

1.2.4 Wetlands

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 has been established 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.

1.3 Description of the specific land uses, cultural and heritage aspects and infrastructure on the site and neighbouring properties/farms

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.

1.3.1 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).

1.3.2 Population

The population within the Delmas LM is estimated at 56 207 people (Figure 1-16).

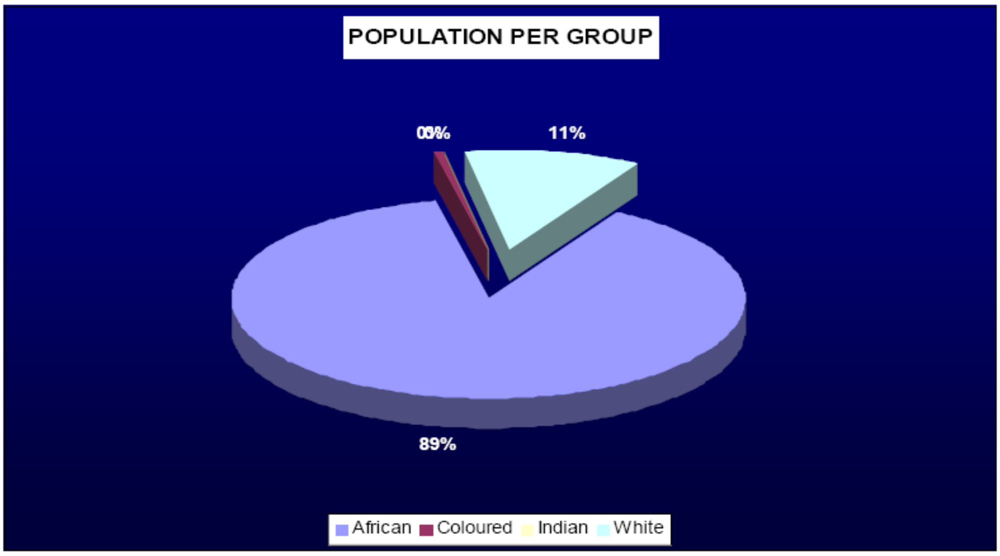

Figure 1-16: Population per group

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 1-17 illustrates what the employment figures are per each industry.

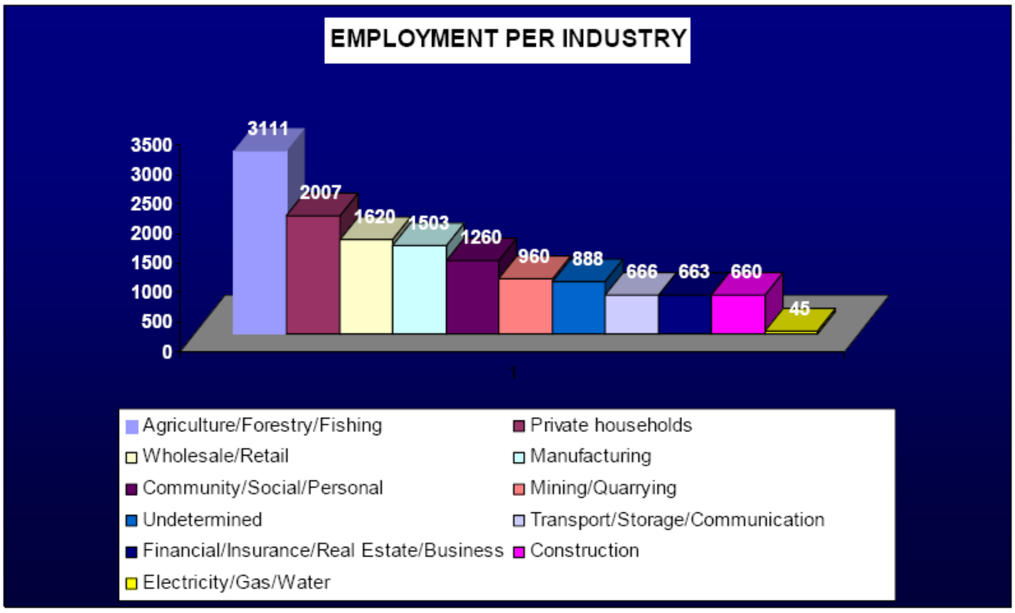

Figure 1-17: Employment figures per industry

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).

1.3.3 Housing

The present status of housing types in the Delmas Municipality area is reflected in Table 1-25.

Table 1-25: 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).

1.3.4 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).

1.3.5 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 1-18 reflects the relative individual monthly income (www.delmasmunic.co.za).

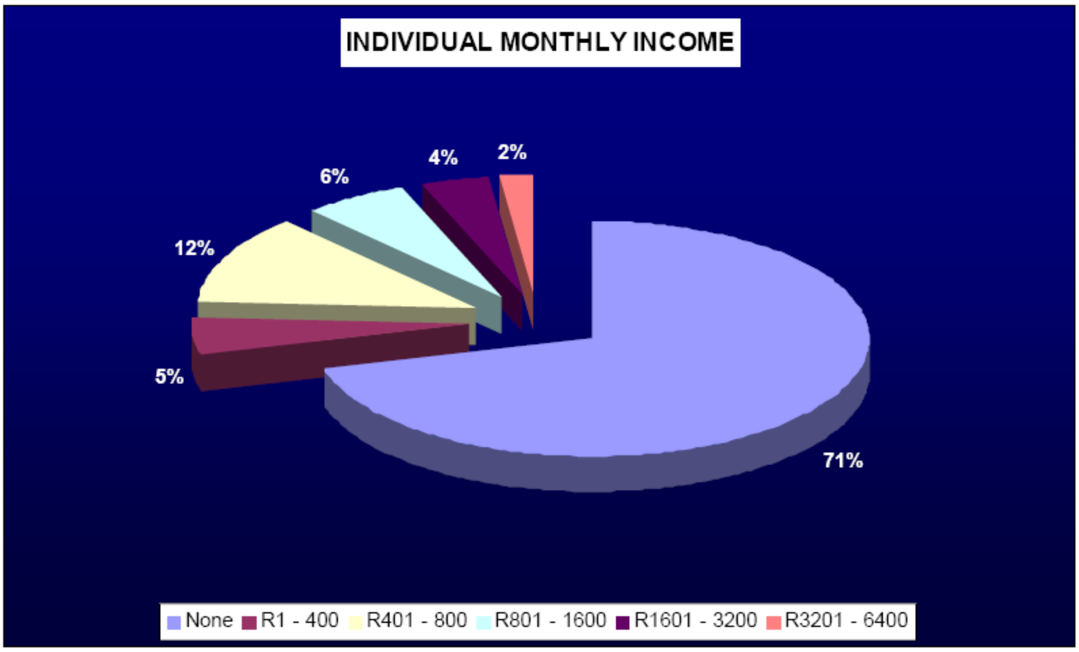

Figure 1-18: Relative Individual Monthly Income

1.3.6 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.

1.3.7 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.

1.3.8 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).

1.3.9 Sites of archaeological and cultural interest

The Archaeology Impact Assessment Report is attached in Appendix I.

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 19.

Table 1-26: 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.

1.4 Annotated map

Please refer to Plans 1 to 20 in Appendix O.

2 Mining operation

2.1 The mineral to be mined

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 2-1 summarises the estimated coal resources of the propose Kangala Coal Mine project.

Table 2-1: Kangala Coal Mine 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 2-2 summarises the raw and washed qualities of the mineable coal at Kangala Coal Mine.

Table 2-2: Raw and washed coal qualities

	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.

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 2-3: Typical quality specifications for Kangala coal

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

2.2 The mining method

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 2-1). An estimated 295ha will be disturbed which equates to approximately 31% of the total project area. Plan 3 provides a mine infrastructure plan which indicates the location of the opencast pit and the direction of the 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 2-2 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.

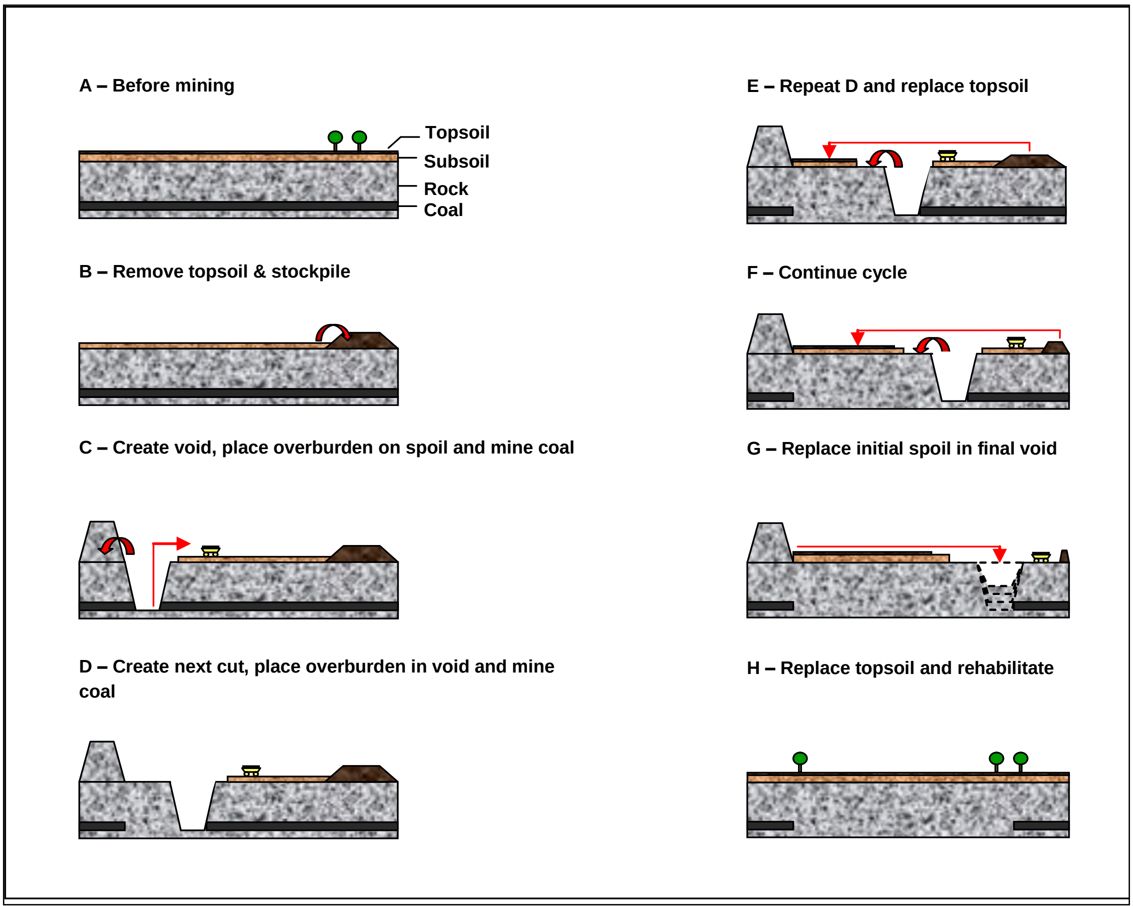

Figure 2-1: Illustration of strip mining

2.3 The main mining actions, activities, or processes

2.3.1 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.

2.3.2 Supporting infrastructure

The following infrastructure has been built on the project site and the location of these project components are illustrated on Plan 3. Plan 3A illustrates the old infrastructure map compared with the new infrastructure, as listed below:

- Two contractors camps that include contractor offices and workshop area and chemical storage areas and a wash bay:
- Universal Coal office;
- A diesel bay;
- Change houses and ablution facilities;
- A pollution control dam (PCD);
- A discard dump;
- A sewage purification plant;
- Overburden and topsoil stockpiles;
- Water diversion berms;
- Clean water storage dam;

- ROM stockpiles;
- Product stockpiles;
- Electrical substation (5MVA 22/11kV);
- Weighbridge
- Water Reservoir
- Temporary storage of hazardous waste;
- Security guard house; and ;
- Access and haul roads.

As part of this EMP report update new infrastructure is included, the following infrastructure has been established or is planned:

- Re-positioning of overburden and topsoil stockpiles to the south western boundary of the project site;
- Additional ROM stockpiles adjacent to the plant area;
- A new product stockpile area within the plant area;
- A new conveyor belt (309 m) from the plant to the two product stockpiles;
- A new contractor workshop located adjacent to Universal Coal's site office;
- Expansion of the discard dump by 4.14 ha (proposed);
- New clean water storage dam (1000m^3);
- New laundry to be located adjacent to Universal Coal's site office (proposed); and
- New weighbridge at the mine entrance.

2.3.3 Project activities and phase description

This section provides a preliminary description of activities that apart of 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 2-4, 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 2-4: Project activities for Kangala Mine

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:	Workshop activity and 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 and stockpiling
Activity 13:	Vehicular activity on haul roads and conveying of coal
Activity 14:	Water use around site
Activity 15:	Screening and washing
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

2.3.3.1 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. These materials and substances will be stored in containers within the contractor workshop areas as well as in the plant area.

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, pollution control dams, new laundry, weighbridge, overland conveyor belt, and clean water storage dam.

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.

2.3.3.2 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: Workshop activity and 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. These materials and substances will be stored in containers within the contractor workshop camps as well as in the plant area. The workshop areas also include a wash bay and oil separators.

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. Universal Coal has subsequently amended the location of the overburden and topsoil stockpiles to the south-western boundary of the project site.

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 and stockpiling

Once the coal seam is exposed by opencast strip mining, the coal is removed with shovels and transported with trucks to the plant area. The coal is stockpiled in three separate ROM stockpiles, two of these ROM stockpiles are for the planned Kusile Power Plant (which is not yet operational). Universal Coal have stopped producing coal for Kusile. Once the coal is washed and screened, it is transported via an overland conveyor belt to two separate product stockpile areas located within the plant footprint.

Activity 13: Vehicular activity on haul roads and conveying of coal

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. At the plant area, an overland conveyor belt, 309 m in length conveys coal product from the wash plant to the product stockpiles. This conveyor system is entirely within the footprint of the plant area. Smaller passenger vehicles also utilise haul roads to transport staff around the mining site.

Activity 14: Water use around site

During operations 35m^3/hr volume of water will be required in order to run the mine and process the coal, as well as for domestic use. Water is currently being sourced from boreholes on the site which is being stored in a clean water storage dam with a capacity of 1000m^3.

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. Universal Coal wish to extend the footprint of the discard dump. This proposed activity however will only be undertaken within the next two years. The current approved footprint of the discard dump is 16.5 ha. The proposed extension will be 4.14 ha with a final discard footprint of 20.6 ha.

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.

2.3.3.3 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 such as the workshops, offices, weighbridge, overland conveyor belt and water storage dam.

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.

2.3.3.4 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.

2.3.4 Waste management

2.3.4.1 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,

e) And includes waste generated by the mining, medical or other sector, but—

    a. A by-product is not considered waste; and

    b. 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.

2.3.4.2 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.

2.3.4.3 Mine waste

Beneficiation 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 compacted surface layer.

2.3.4.4 Discard dump

Please refer to Appendix N for the as-built design drawings. The waste disposal area has been designed to hold the slurry pool within an outer wall of coarse discard. The various components and layout are shown on the drawings and comprise the following:

- Clean water diversion trench/bund wall;
- Dirty water/leachate interception drains and filters; and
- Return water dam.

The co-disposal facility has been sized to contain 10 million tons of coarse and fine discard. The quantities of deposition and properties are given below based on 10% slurry.

Based on a 1,5 million tpa ROM, with a 57% yield the discard quantity is 495 000 tpa, with slurry at 15 000 tpa. Thus the life of the dump is 15 years compared with the mines planned 10 year life of mine, allowing for processing of coal brought into the site or extension of life of mine if additional resources are mined.

The current “footprint” of the discard area is approximately 16.5 ha in extent, and the outer coarse wall is to be constructed in phases so as to maintain stability and freeboard at all times. The discard dump facility will be constructed through the following phases:

- Phase I– Construct a compacted earth wall to act as a starter wall on the north-eastern perimeter of the slurry pool;
- Phase II– Raise the main body of the coarse discard by making use of a lower “bench” to maintain stability; and
- Phase III– Place the final “outer” zone of the coarse discard, to the “footprint” shown on the drawings.

The maximum height of the dump is in the order of 30m which may be placed in two platforms within 1:2,8 side slopes . The factors of safety will remain in line with accepted practice. Piezometers will be used during construction to monitor pore water pressure levels, for stability evaluation.

The following elements will be taken into consideration during development of the discard dump:

- Water Balance and Decant System: A water balance will be carried out to assess the water utilisation at the site, and how the co-disposal area will interact with this resource, as part of the preliminary design phase. A penstock outlet will be constructed within the slurry pond and the “free” water decanted into the Pollution Control Dam through a 400mm steel pipe laid to a fall of at least 1:200.
- Seepage Control: Due to some seepage that is likely to occur through the base of the discard area, a composite liner and drainage will be provided for the leachate which will then be led into the PCD, from where it will be pumped back to the plant for reuse. (See Appendix N for the as built drawings for the PCD for details).
- Stormwater Control: as shown on the drawing the open drains and berms separate the 1:100 “clean” water runoff, from the 1:50 “dirty” water, to divert clean run-off around the PCD’s and discard dumps. The PCD’s will be sized to collect the average dirty run-off from the dump and expected ingress into the open cast areas, plus the 1:100 24 hour storm. It will also act as a reservoir for the plant water requirements.
- Capping: in order to assist in the dump rehabilitation, and prevention of spontaneous combustion, the discard will be covered with top soil, as the dump is constructed, as shown on the drawings.

The proposed extension will be 4.14 ha. The final discard dump will be 20.6 hectares.

2.3.4.5 Sewage effluent

A sufficient number of chemical toilets have been provided on site. The change house facilities have been completed and sewage treatment plant installed for the management of sewage effluent.

2.3.5 Water use and resources

Universal coal is currently sourcing water from a borehole on site, this water is pumped to the reservoir for domestic use and also stored in a lined clean water storage dam with a capacity of 1000m^3. 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. Current predicted water volumes required for the mine are 19litres/s for the entire operation. This equates to 1641m^3/day and 49 248m^3 per month.

2.3.6 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 has been sized to contain the run-off from a 1:50 year storm event. The DWEA Best Practice Guidelines (BPG) for storm water management will in addition be implemented on site.

2.3.7 Transport

Kangala Coal Mine currently provides a bus service which transports the mine workers from the surrounding areas to the mine. No accommodation will be provided for the mine workers on the site.

Currently, at Kangala, the opencast truck and shovel roll over mining method is used on the No. 2 and No. 4 Coal seam of the Witbank Coal field. The extracted Run of Mine coal is crushed, screened and washed on site yielding an export coal product and a secondary product suitable for the inland power generation market.

Kangala has an agreement with Eskom to supply the Kusile Power Station, but due to the delays in the completion of the Kusile Power Station, 100 000 t/m is currently supplied to Kriel Power Station, 40 000 t/m to Kendal Power Station and 6 000 t/m to Leewpan siding for export. 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.

2.4 Plan showing the location and aerial extent of the main mining actions, activities, or processes

The mine infrastructure plan is included in Appendix O as Plan 3. The total property size is 951 ha, only 295 ha of this will be disturbed for the opencast workings and other infrastructure.

Please refer to Plan 3.

2.5 Listed activities in terms of NEMA EIA regulations

The Environmental Impact Assessment (EIA) regulations GN R543 (“NEMA EIA Regulations”), promulgated in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended (NEMA), were published on the 18 June 2010 and came into effect on 2 August 2010. Together with the NEMA EIA Regulations, the Minister also published the following Regulations in terms of sections 24 and 24D of the NEMA:

- Regulation GN R544 - Listing Notice 1: This listing notice provides a list of various activities which require environmental authorisation and which must follow the basic assessment process as described in section 21 to 25 of the NEMA Regulations.
- Regulation GN R545 – Listing Notice 2: This listing notice provides a list of various activities which require environmental authorisation and which must follow an environmental impact assessment process as describer in section 26 to 35 of the NEMA Regulations.
- Regulation GN R546 – Listing Notice 3: This notice provides a list of various environmental activities which have been identified by provincial governmental bodies which if undertaken within the stipulated provincial boundaries will require environmental authorisation. The basic assessment process as described in section 21 to 25 of the NEMA Regulations will need to be followed.

In accordance to the above listing notices the following table lists the activities which are applicable to the Kangala Colliery for which Universal Coal has applied and have been granted Environmental Authorisation from the Mpumalanga Department of Economic Development, Environment and Tourism (MDEDET). The Environmental Authorisation, dated 31 January 2012 with reference number MPP/EIA/0000063/2011 is attached as Appendix P.

Table 2-5: NEMA listed activities

GN R544 - Listing Notice 1	
Activity No	**Activity Description**
Activity 11	Construction of a bridge where construction occurs within a water course or within 32 meters of a water course, measured from the edge of a water course – (**construction of a bridge across a stream**)
Activity 12	The off stream storage of water including reservoirs and dams with a capacity of 50 000 cubic meters or more – (**pollution control dam**)
Activity 13	The above ground storage of dangerous goods with a combined capacity of more than 80 cubic meters but not exceeding 500 cubic meters at any one location or site. – (**above ground storage of diesel and oil**)
Activity 22	Construction of roads outside an urban area where no reserve exists where the road will be wider than 8 meters - (**construction of access roads on site**)
Activity 23	The transformation of underdeveloped (**farming**) land to industrial use outside an urban area where the total area will be less than 20ha (**supporting infrastructure**)
GN R 545 – Listing Notice 2	
Activity 5	Any activity that requires authorization under another regulatory body – (**Water Use License Application**)

In addition to the Environmental Authorisation, the Kangala Coal Mine also has a Waste Management Licence (WML), dated 09 July 2012 with reference number 12/9/11/L445/6 (Appendix P). The following table provides an indication of the waste activities which have been authorised in terms of the National Environmental Management Waste Act, 2002 (Act No. 59 of 2002), as amended (NEM:WA)

Table 2-6: NEM: WA listed activities

Category and Activity Number	Activity Description
Category A	
A(11)	"The treatment of effluent, wastewater or sewage with an annual throughput capacity of more than 2 000 cubic metres but less than 15 000 cubic metres."
A(18)	The construction of facilities for activities listed in Category A

Also worth mentioning is that Kangala Coal Mine have a Water Use Licence, dated 25 May 2012 with Licence Number 04/B20A/ABCGIJ/1506 (Appendix P) for the following water 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 c – Impeding or diverting the flow of water in a watercourse;
- 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; and
- Section 21 (i) – Altering the bed, banks, course of characteristics of a watercourse;
- 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.

All other approvals, including the Land Use Zoning Certificate, SAHRA Permit and access permit have been attached in Appendix P.

2.6 Indication of phases and estimated timeframes

The Kangala Coal Mine project developed in the following phases and timeframes:

- Exploration: Q2-Q4 2009
- Feasibility: Q2 2009 – Q2 2010

- Development: Q3 2012
- Construction & commission: Q1 2013 –Q4 2013
- Production: Q1 2014

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.

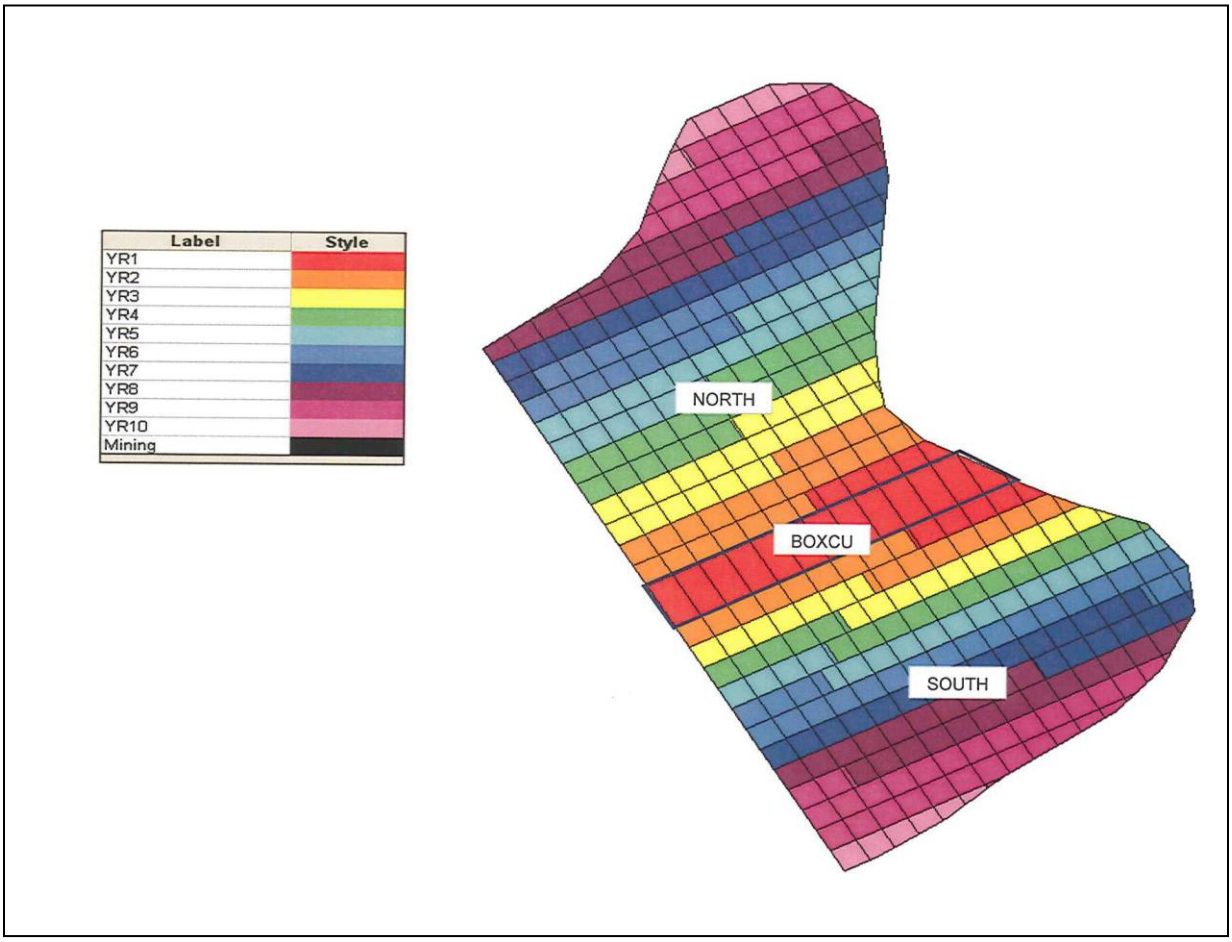

Figure 2-2: Kangala Coal Mine mining sequence.

3 Potential impacts

3.1 List of the potential impacts

This section describes the potential impacts that may emanate from the project activities on the receiving environment due to the activities from the development during the LoM. These potential impacts were then assessed and quantified and are described in greater detail in the Impact Assessment Section, Section 7.

The potential impacts have been assessed according to the current location of the surface infrastructure for each of the 3 phases of the project (construction, operational and decommissioning phases) and are detailed in the table below.

Table 3-1: Potential Impacts onto the biophysical environment during the construction phase

Impacted Environment	Activity	Summary of Impact
Geology	Establishment of initial boxcut and access ramps	Rock and overburden will be removed, permanantly altering the geology.
Topography	Site clearing and topsoil removal and establishment of initial boxcut and access ramps	The natural lie of the land will be altered. This alteration of the land will have further impacts on surface water flow dynamics as the natural drainage pattern is disrupted.
Soil	Transport of construction material	Compaction of soil.
	Site clearing and topsoil removal and construction of infrastructure	Compaction of soil, erosion of exposed areas and decrease in available land for agricultural practices.
	Establishment of initial boxcut and access ramps	Compaction of areas surrounding box cut. Loss of arable soil.
Surface water	Construction of surface infrastructure and establishment of initial box cut and access ramps	Reduction in base flow and in catchment area size and a change in flow dynamics.
Air Quality	Site clearing and topsoil removal ,construction of infrastructure, establishment of box cut	Increased vehicle movement on site and the clearing of topsoil to expose subsoil's will increase the dust fallout on site and the PM_{10} levels.
Wetlands	Site clearing and topsoil removal and establishment of initial boxcut and access ramps	Increase the potential load of sedimentation of the water resources. Erosion of exposed surfaces. The removal of the topsoil and vegetation reduces the potential for recharge of shallow aquifers that feed hillslope wetlands, which in turn reduces the flow in water resources. Possible dewatering of aquifers and loss of perched aquifer and interflow between certain wetland areas.

Table 3-2: Potential Impacts onto the biophysical environment during the operational phase

Impacted Environment	Activity	Summary of Impact
Geology	Coal removal and stockpiling	The coal will be removed, permanently altering the geology
Topography	Topsoil and overburden removal and stockpiling	The natural lie of the land will be altered. This alteration of the land will have further impacts on surface water flow dynamics as the natural drainage pattern is disrupted. Alteration of slope direction and slope percentages, thus creating the potential for erosion.
	Discard dump	Altering slope direction and percentages, thus creating the potential for erosion. Possibility of the siltation of drainage networks.
Soil	Topsoil and overburden removal and stockpiling	Compaction of soil, erosion of exposed areas and decrease in available land for agricultural practices. Natural soil horizons are destroyed.
	Vehicular activity on haul roads and conveying of coal	Compaction of soil, erosion of exposed areas and soil contamination.
Surface Water	Topsoil and overburden removal and stockpiling	Long term stockpiling of overburden resulting in prolonged exposure may result in the potential of Acid Mine Drainage concurring. As rehabilitation is undertaken it will alter the flow dynamics of the area and exposed soil will become susceptible to soil erosion which could result in siltation of surface water bodies.
	Discard dump	Potential contamination of surface water from seepage and runoff from the discard dump.
	Pollution control dams	Possible contamination of surface water due to leakages or spillages from pollution control dams.
Groundwater	Workshop activity and storage of fuel, lubricant and explosives	Possible contamination of groundwater through incorrect storage of, fuel and lubricants as well as through potential spillages at the workshop and dirty water run-off from the wash bay.
	Coal removal and stockpiling	Impact on groundwater quality.
	Discard dumps	Contaminated water from infiltrating to aquifers.
	Waste and sewage generation and disposal	Groundwater contamination through spillages and inadequate waste handling.

Impacted Environment	Activity	Summary of Impact
Air Quality	Topsoil and overburden removal and stockpiling, drilling and blasting and discard dump	The movement and placing of soil will contribute to dust levels. Exposed soil will also contribute to dust levels. Blasting activities will contribute to dust levels. The coal discard dump will result in windblown coal dust.
	Drilling and blasting of hard overburden	The blasting activities are expected to impact on the ambient noise levels of the area. The blasting and drilling activities will be the highest noise producing source during the operational phase.
Air blasting and ground vibration	Drilling and blasting of hard overburden	Air blasting could result in fly rock. Blasting activities could become problematic to nearby chicken farms. Ground vibration can result in damage to infrastructure. Blasting activities also contribute to both noise and dust fallout levels.
Wetlands	Topsoil and overburden removal and stockpiling	Increase the potential load of sedimentation of the water resources. Erosion of exposed surfaces. The removal of the topsoil and vegetation reduces the potential for recharge of shallow aquifers that feed hillslope wetlands, which in turn reduces the flow in water resources.
	Coal removal and stockpiling	Both soil and coal dust being created will increase the potential of excessive siltation. This will impact on the quality of water available in the wetland units as well as inhibit the ability of the wetland units to provide key ecological services. There will be a reduction on surface water quantity due to reduction in catchments size.
	Discard dump	Seepage from the discard dump into the underground aquifers may impact on the quality of water of these aquifers which in turn provide seepage to wetland areas. In spite of this seepage process providing some water quality enhancement ability, the seepage of impacted water quality from the discard dump may impact on wetland functioning as the quality of the impacted water may not be completely restored by the seepage process.

Table 3-3: Potential Impacts onto the biophysical environment during the decommissioning phase

Impacted Environment	Activity	Summary of Impact
Wetlands	Final replacement of overburden, topsoil and revegetation	May result in the restoration of the catchment size prior to being impacted on. This will restore the lost seepage areas and maintain sub-surface flow dynamics and restore ecological functioning.

3.2 Potential impacts on cultural and/or heritage resources

The potential impacts of the Kangala Coal Mine on the cultural and/ or heritage resources are described in Table 3-4.

Table 3-4: Potential Impacts on cultural/heritage resources

Impacted Environment	Activity	Summary of Impact
Archaeology and cultural heritage sites	The total destruction of the land surfaces in these footprint areas	*Site one: Cemetery* If at any stage the mining application area is extended and the cemetery is included in the application area, the cemetery needs to be fenced and a buffer zone of 20 m must be left around the site and adequate access must be provided for the family to visit the graves . *Site two: Historical Structures* The ages of these structures have not been confirmed; if it is older than 60 years a permit would be required from SAHRA. It is recommended that the site be evaluated by a conservation architect before construction commence to provide further recommendations on the mitigation necessary on the site. *Site three: Cemetery* If at any stage the mining application area is extended and the cemetery is included in the application area, the cemetery needs to be fenced and a buffer zone of 20 m be left around the site and adequate access must be provided for the family to visit the graves. In the event that the mining will impact directly on the graves and the need arise for the relocation of the cemetery a full grave relocation process must be followed.

Impacted Environment	Activity	Summary of Impact
		Site four: Cemetery Due to its geographical proximity to the project, the cemetery needs to be fenced and a buffer zone of 20 m be left around the site and adequate access must be provided for the family to visit the graves. In the event that the mining will impact directly on the graves and the need arise for the relocation of the cemetery a full grave relocation process must be followed.

3.3 List of all impacts that may potentially emanate from each activity (NEMA)

The potential impacts in this section have been discussed according to the activities that may trigger NEMA listed activities. These activities excluded mining.

The impacts that could potentially emanate from each activity, present on site, which is listed in terms of Listing Notice 1 and Listing Notice 2 of the NEMA EIA regulations is listed and described below (refer to Section 2.5 for the complete list of activities that could trigger NEMA activities).

3.3.1 Topography

Construction of surface infrastructure adds features to the surface thereby changing the current landscape character. The utilisation of earthmoving equipment could damage the surface of roads and impact on the topography.

3.3.2 Visual

The construction of mine infrastructure has a negative visual impact on the receiving environment. The development of haul roads has a negative visual impact on the receiving environment and the impact will occur for the life of the project. The project area will become noticeable to the nearby receptors as it will contrast the surrounding areas. Infrastructure construction will need noisy and abrasive activities that will affect the sense of place and the visual resource of the Kangala Coal Mine.

Plan 18 depicts the viewshed model.

3.3.3 Land Use and soil

Construction activities may result in soil contamination and compaction and loss of topsoil leading to reduced agricultural potential. Soil erosion (sediment release to land and surface water) may also occur.

The Project Activities during construction will result in the change of land use from natural vegetation and agriculture (primarily mixed arable and grazing) to industrial. Land capability and productivity will therefore be lost

3.3.4 Flora

The removal of vegetation for the mining activity and associated infrastructure will result in the definite loss of vegetation. The destruction of the vegetation will result in the permanent reduction of natural habitat of reptiles, birds, frogs and mammals present within the project area.

Loss of biodiversity will occur in the construction phase of the development as a result of clearing of the vegetation, and, to a lesser extent in the operational phase as a result of trampling and increased access to the wetland areas. This will result in the loss of plant species of special concern and an influx of alien invasive species.

The general functioning and provision of ecosystem services in the greater area ecosystem will be reduced and impaired. Fragmentation occurs with the breaking-up of continuous tracts of vegetation and plant dispersal.

3.3.5 Fauna

The birds, reptiles, frogs and mammals that currently inhabit this area will be directly affected.

Loss of biodiversity will occur in the construction phase of the development as a result of clearing of the vegetation, and, to a lesser extent in the operational phase as a result of trampling and increased access to the wetland areas. This will result in the loss of animal species of special concern.

The general functioning and provision of ecosystem services in the greater area ecosystem will be reduced and impaired. Fragmentation occurs with the breaking-up of continuous tracts of vegetation providing corridors for faunal movement and habitat.

3.3.6 Aquatic ecology

The removal or introduction (treated effluent) of water into an aquatic ecosystem has effects on the flow/depth scenarios and therefore on available habitat potentially negatively effecting aquatic biota.

Due to the increase in activities and the use of machinery within the catchment area the potential for harmful/modifying substances to enter into the aquatic ecosystems and the modification of water quality exists.

The following impacts on water quality have been listed below:

- Impact 1: Introduction of hydrocarbons and nutrients;
- Impact 2: Introduction of dissolved salts; and
- Impact 3: Alteration of pH.

3.3.7 Wetlands

The loss of wetlands as a result of surface infrastructure will result in the direct loss of wetland functionality such as biodiversity maintenance, water quality enhancement, stream flow augmentation which is services that wetlands provide to society at no cost.

3.3.8 Surface water

The water quantity effects include altered surface water drainage/ hydraulic response due to over compaction of some areas due to earth moving vehicles which could increase runoff which is still stored with dirty water.

Surface water quality deterioration could result from accidental spillages of construction material and silted runoff could result in increased turbidity.

3.3.9 Groundwater

Organic solvents, diesel or other organic fluids and inorganic solvents might be spilled on the ground surface, or leak from surface storage tanks.

The discard dump can release contaminants as rainfall infiltrating through them can reach the groundwater with unacceptable quality.

3.3.10 Heritage resources

Potential impacts and sources of threats and risk are limited to the project footprint. These threats and risks will be greatest during the construction phase, where the potential to damage or destroy unidentified heritage resources is high.

3.4 List of all potential cumulative environmental impacts

The combined, incremental effects of human activity, referred to as cumulative impacts, pose a serious threat to the environment. While they may be insignificant by themselves, cumulative impacts accumulate over time, from one or more sources, and can result in the degradation of important resources. Cumulative impacts result when the effects of an action are added to or interact with other effects in a particular place and within a particular time. It is the combination of these effects, and any resulting environmental degradation, that should be the focus of cumulative impact analysis. While impacts can be differentiated by direct, indirect, and cumulative, the concept of cumulative impacts takes into account all disturbances since cumulative impacts result in the compounding of the effects of all actions over time. Thus the cumulative impacts of an action can be viewed as the total effects on a resource, ecosystem, or human community of that action and all other activities affecting that resource no matter what entity is taking the actions.

3.4.1 Land aspects

The cumulative impact on soils, land capability, and land use by opencast mining in South Africa increases as the demand for energy constantly increases. This impact can only be mitigated by proper rehabilitation which should restore pre-mining soil and land capabilities.

The impact on soils, land capability and land use by opencast mining is not only severe but also costly to mitigate and requires continuous management and rehabilitation procedures within and integrated rehabilitation plan. Soil characteristics and climate are primary factors determining pre-mining land capability and possible land uses. Negative impacts on soil during the mining process will therefore adversely affect post mining land capability and land uses directly.

The cumulative impact on soils in the study area can increase even more should new industrial, commercial and mining operations commence in the area. The impacts will be far reaching, resulting in soil erosion, siltation of local streams, loss of arable areas and the loss of sufficient topsoil for rehabilitation. The cumulative impact on soils is of high severity and will occur on a regional scale. Impacts will last beyond closure of the mine and are almost certain to occur. The severity is therefore of high significance.

3.4.2 Surface water

Two existing collieries operate within the Bronkhorstspruit catchment, they are Leeuwpan Colliery and Stuart Coal Colliery.

Monitoring conducted by DWAF at the Bronkhorstspruit dam indicates that TDS and sulphate levels have remained consistent since 2000 when regular sampling commenced with the 90th percentile over the total data set being 259 mg/l and 21.94 mg/l respectively. This does not appear to indicate an adverse effect of mining currently at this monitoring point. No upstream monitoring points closer to the mines are regularly sampled.

Mining, as well as agriculture and urban areas, has the potential to impact on surface water through acid mine drainage, pesticides and fertilizers and sewage. Monitoring is therefore vital in determining changes in water quality and problem areas. Cumulatively these activities could have significant impacts on rivers and streams which then flow into neighbouring regions, affecting a wide area. Impacts are also very difficult to mitigate. The most significant impacts that were identified were for the post closure phase. The closure of all three these collieries therefore need to be properly managed to prevent adverse effects post closure.

3.4.3 Groundwater

The cumulative impacts due to the mining could be of a quantitative and qualitative nature. The aquifers within the region are classified as major aquifer systems. Recovery of the water level will result in a positive impact locally and could see the importance of groundwater increasing once again within the catchment. However, the water quality within the workings could be good or deteriorate depending on the geochemical characteristics of the material which could have disastrous impacts on the regional aquifer. The cumulative impact on the catchment will have to be taken into account for mining, agriculture and the remainder of the current surface and groundwater uses in the this catchment. High potential over a long period of time and will have a high potential overall significance, this will have to be closely monitored.

3.4.4 Air quality

All the activities in the mining project area (process contribution (PC)) together with activities occurring in the surrounding area will contribute to the possible cumulative impact on air quality in the area.

Table 3-5: Estimated cumulative dust deposition

Cumulative Dust Deposition mg/m²/day							
Mitigation at receptor level		0% Mitigation		50% Mitigation		90% Mitigation	
Receptor	Avg	PC	Cumulative	PC	Cumulative	PC	Cumulative
UN1	287	40	327	30	317	23	310
UN2	596	356	952	300	896	256	852
UN3	697	223	920	168	865	125	822
UN4	622	110	732	89	711	72	694
UN5	765	61	826	46	811	33	798
UN6	404	174	578	145	549	122	526
UN7	503	75	578	60	563	49	552
UN8	628	190	818	195	823	84	712
UN9	470	1892	2362	1397	1867	1001	1472

From the above table it can be concluded that only five out of the nine receptors will not be excessively impacted on by the predicted cumulative dust dispersion. Current dust fall out at UN3, UN4, UN5 and UN8 are already above residential limits of 600mg/m^2/day (*highlighted* *in orange*). The predicted cumulative dust deposition for UN2, UN3, UN4, UN5 and UN8 are above the residential limits but are within the industrial limits of 1200 mg/m^2/day. Only UN9 dust deposition is predicted to exceed the industrial limits. Overall the cumulative dust deposition is significant and will extend outside of the project boundary and the current agricultural activities will also contribute to the cumulative effect.

3.4.5 Noise

Cumulative impacts should be considered for the overall improvement of ambient noise levels. The Kangala Coal Mine project is considered a causative source of noise pollution that will contribute to the increase of the ambient noise levels in the area, especially during the night time as indicated by the impact assessment section.

The existing noise sources in the area are: The vehicular activity on the R555 and R42, the agricultural activities on the farms as well as the Leeufontein Colliery. The significance of the impacts of the existing noise sources on the relevant receptors is of a low significance. The low significance is due to the intermittent nature of the main existing noise sources, especially the seasonal noise e.g. during ploughing season general noise is expected to increase. If the mining activities on Wolwenfontein go ahead the cumulative impact will be more severe on the existing ambient noise levels. The significance will increase to a Medium - high significance. Potential future mines starting up in the area will also contribute to increased noise levels

Noise levels from the Kangala Coal Mine project must therefore be monitored on a monthly basis to determine potential sources of noise, increases and decreases in noise levels, and determine level of mitigation required. Once it is assessed that the mitigation measures have successfully decreased the specific noise from the project the monitoring should then be carried out on a quarterly basis. A grievance mechanism should be introduced whereby receptors and people in the area can make a complaint regarding noise levels. In this event each complaint is to be investigated to determine the source and possible noise reduction measures.

When the coal from the Kangala Coal Mine project area has been mined, processed and decommissioned, overall ambient levels will decrease and the cumulative impacts in the area could improve.

3.4.6 Biodiversity

According to the Mpumalanga Biodiversity conservation plan handbook the Mpumalanga province is categorised in six biodiversity conservation categories for terrestrial ecosystems using systematic biodiversity planning methods. In Table 3-6 one can see the six categories and the relevant percentages of each one in the province.

Plan 22 is a visual representation of the six categories show that the study area consists of two terrestrial categories, these are Least concern and No habitat remaining, these categories make up the majority of the province. Furthermore, three tributaries consisting of wetland vegetation (Ferrar and Lotter 2007), also exist on the area of interest.

The main threat to natural areas/biodiversity is the reduction of viable habitat, which can be contributed to the following, human settlement and urban development, mining, industry and manufacturing, energy, transport, agricultural activities and tourism and recreation (Ekurhuleni SoER 2003). All of the above with the possible exception of tourism and recreation are currently exerting pressure on the study area in general, by reducing the viable natural land. If the cumulative impacts of all the above mentioned seven threats are taken into account, the outcome is the percentages displayed in The No natural habitat remaining is the category in which most threats can be categorised, and the transformation of the natural habitat from Protected areas to No Natural Habitat remaining is driven by the seven threats.

Table 3-6: Terrestrial biodiversity conservation categories (Ferrar and Lotter 2007)

Category	Percentage
Protected areas	14.8% (10.4% KNP)
Irreplaceable	2.4%
Highly Significant	12.3%
Important and necessary	9.5%
Least concern	25.5%
No natural habitat remaining	35.8%

The reduction in natural habitat has taken place because of the current and continuing land use within the study area, which is agricultural, the change in land use from agricultural to mining will not have such a negative effect as changing land use from pastures to mining, for example. The main reason for this is the presence of natural habitat in pastures that could support fauna species.

Therefore the immediate and direct negative effect of this project on the natural environment is not seen as significant. However as illustrated previously the cumulative effects of threats in the general area and province is of serious concern and needs urgent attention. As this document only discusses the current project, mitigation measures suggested in this document is only relevant for this project.

It is imperative that the mitigation measures set forth in this document is strictly adhered to as to reduce the contribution this project could have to the Least Concern and No Natural Habitat remaining categories

3.4.7 Archaeology and sites of cultural heritage

Archaeological and heritage sites may be affected by the combined impacts of the industrial, agricultural and mining developments in the area, such as pollution (acid mine drainage), vandalism or property damage (influx of workers) and structural damage (blasting or vibrations). It is important to preserve and raise awareness of the importance of archaeological and heritage conservation. Cumulative impacts of industrial developments may also be positive, and capable of adding value through contributions towards archaeological and heritage research and effective documentation and mitigation of relevant heritage sites in the area. Ultimately, the developer should minimise or avoid all anticipated negative impacts and optimise and promote positive impacts

3.4.8 Wetlands

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

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

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

The dominant land use in the immediate and surrounding area is agricultural activity. The surrounding cultivated lands as well as livestock farming have impacted considerably on the associated wetlands. The significance of this impact was determined to be 48/100 (moderately low). The current land use does not impact on the underlying hydrology of the wetland areas and as a result of this, the cumulative loss of wetlands resulting from the future mining activities would be considerably higher. The significance of this cumulative impact was determined to be 67/100 (moderately high).

3.4.9 Traffic and safety

Currently the agricultural activities are the dominant activity affecting traffic and safety. With the addition of mining in the region, there will be a need for transportation of coal to various markets, which mean additional coal trucks on the local roads. In areas where coal mining is dominant, this has resulted in poor road conditions, decreased visibility to drivers and a safety threat from speeding trucks and pedestrians. Travelling at night is particularly dangerous and in winter there is fog which also impacts on road safety. If mining increases in the area, there will be a negative cumulative impact on the local roads and measures will need to be taken for maintenance and dust suppression. Mining houses need to engage with municipalities and provincial authorities to come up with regional plans for road improvements.

3.4.10 Socio-economic

Potential impacts on the agricultural-economic environment primarily result from the secondary effects of negative changes in the environment that causes land degradation such as pollution. The most important generic land degradation issues include soil erosion, contamination (pollution) of soil, poor rehabilitation practices, over-utilisation of resources, surface/groundwater pollution, a loss of production and bio-diversity value when land is transformed and negative impacts of land degradation on people. Negative impacts on the environment from the mining activities affect the natural resources that agriculture depends on and in turn, this may lead to direct or indirect effects on agricultural production or output.

According the Beeld Newspaper (17/04/2009, Elise Tempelhoff), farmers in Mpumalanga have joined forces to prevent authorities from approving new applications for coal and other mines in the area. It is reported that farming organisations were established in five areas including Delmas, Ermelo, Belfast, Carolina and Standerton in order to prevent agriculture from disappearing in these areas. Based on the average provincial yield of between four and five tonnes per hectare, it was assumed the average yield of the Delmas area is 5.5 t/ha, but this figure could be significantly higher in areas with such a high agricultural potential as in the project area. Due to the high agricultural potential of this region, the overall impact of mining is considered of high significance.

In terms of employment, skills development and local economic development, one coal mine is unlikely to provide a significant cumulative impact to this effect, however, when considering surrounding activities such as farming, industry and mining, the impacts can be significant if there is collaboration with government and these industries

3.5 Risk of acid mine drainage

Geological core sample were collected during the drilling programme at Kangala for Acid Base Accounting (ABA) testing. The samples from various lithologies were submitted to SGS Lakefield Laboratories in Johannesburg, Gauteng Province for static testing.

High variability can be found in the geochemical characteristics in the overburden and interburden at Kangala. Sandstone layers fluctuate from strong neutralisation potential to low acid generation potential indicating a change in the chemical composition over the planned mining area.

With the above taken into consideration Sandstone was the dominant lithology present (excluding the coal seams) in the overburden and contributed about 42 % of the total samples taken. The majority of the Sandstone indicated a strong Neutralising Potential (NP) and should be backfilled into the opencast pit to reduce the impact of AMD formation.

The second largest percentage of lithological strata from the samples acquired from the overburden were shales and indicated a medium Acid Generating Potential (AGP) and should consequently not be backfilled into the opencast pit but discarded to the discard dump.

The majority of the static test results indicated low to medium acid neutralisation potential. This will decrease the risk of acid formation and possible acid neutralisation in the presence of acid mine drainage.

The analysis from the No. 2 and No. 4 coal seam showed high risk for acid generation. The majority of the coal will however be removed, but Kangala need to ensure that the Dwyka formation stay intact to prevent possible pollution to the underlying dolomites.

Acid mine drainage cannot be prevented and will remain a problem at all the collieries in the Mpumalanga Coal Field. The effect and long term impacts can however be reduced by sound management strategies.

It is recommended that Kangala continue to sample and analyse geological rock samples during the operational phase as required by the Best Practice Guidelines for Impact Prediction, BPG G4. This will indicate the variability of the material, the identification of any material with a high risk not currently identified and the management, or separate handling thereof if required. This information is invaluable for the closure planning and mine water closure plan. The life of mine is estimated to be 10 years so very little acidification is expected during life of mine. Long term chemical prediction will have to be undertaken to accurately assess the quality of water expected post closure.

4 The alternative land use or developments that may be affected

The identification of alternative land uses and developments looks at what activities could be undertaken on the project site in the event that mining activities do not occur. When identifying alternative land use one needs to take into consideration current land use in the surrounding area as well as development plans for the regional area.

4.1 A concise description of the alternative land use of the area in which the mine is proposed to operate

4.1.1 Commercial agriculture

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

4.1.2 Community agricultural practices

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

4.1.3 Tourism

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

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

There are various constraints to the development of a tourism industry in the greater area which include the following: The environmental effects of coal mining such as land surface degradation; ground water and air pollution; the municipality lacks land for low income residential development. There is also little attraction to this area for tourism which will hinder the success of such tourism businesses.

4.1.4 Summary of alternative land uses

From the above mentioned possible land use alternatives, tourism will likely have the least impact on the receiving environment, however this may not be a favourable option due to the close proximity of existing mining activities and the current land use which is agriculture. When compared to mining, agriculture will be a preferred land use as it will have a less of a significant impact on the receiving environment in comparison to that of mining.

4.2 A list and description of all the main features and infrastructure related to the alternative land uses or developments

The main features and infrastructure related to the alternative land uses or developments that exist in local vicinity of the project area include:

- Tertiary roads used for access by farmers;
- Farm dams and boreholes;
- Fencing;
- Powerlines; and
- Residence/accommodation for tourists.

4.3 Map/plan

Please refer to Plan 8 for the current land use activities. It is anticipated that the proposed commercial and/or community agricultural developments as well as the proposed eco-tourism activities would occur within the same footprint and aerial extent as indicated in the map.

5 The potential impacts of the alternative land use or development (REGULATION 50 (B))

5.1 A list of the potential impacts of each of the aforesaid main features and infrastructure related to the alternative land use or development and related listed activities

5.1.1 Commercial agriculture

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

- Loss and degradation of habitat from clearing of grasslands and draining of wetlands;
- Reduction of fish stock in rivers as a result of pesticide runoff;
- Killing of wild predators in order to protect livestock;
- Loss of genetic diversity with replacing wild strains with monoculture strains;
- Erosion;
- Loss of fertility;
- Salinization and Water logging;
- Dust generation during harvesting and ploughing of lands;
- Air pollution in the event of slash and burn;
- Air pollutants from the use of fossil fuels during use of machinery
- Aquifer depletion;
- Increase runoff as a result of cleared vegetation;
- Sedimentation;
- Surface water pollution from pesticides and fertilizers; and
- Over fertilization of slow moving streams as a result of runoff of nitrates and phosphates from fertilisers and livestock waste.

5.1.2 Community agriculture

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

5.1.3 Tourism

Negative impacts that could result from tourism include the introduction of alien fauna and flora to make it aesthetically pleasing to visitors as well as the over utilisation of natural resources such as water. It is important to properly plan activities that could result in a nuisance factor like quad biking.

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

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

Table 5-1: Comparative assessment of alternative land uses

Aspect	Land use impact on the environment			
	Agriculture	**Community agriculture**	**Tourism**	**Mining**
Topography	Negligible or no impact. **Low significance**	Negligible or no impact. **Low significance**	Negligible or no impact **Low significance**	Temporary impact during mining. Potential for bulking effect at closure. **Medium-high significance**
Geology	No impact. **Low significance**	No impact. **Low significance**	No impact. **Low significance**	Geology will be removed in order to mine the coal deposit. **High significance**
Soils	Grazing and crop farming practices could result in	Community based agriculture can have significant impact on	Tourism facilities may cause soil compaction and soil	Negative impact on soil fertility from storage and

Aspect	Land use impact on the environment			
	Agriculture	**Community agriculture**	**Tourism**	**Mining**
	compaction of soil, reduction in soil fertility through poor crop management as well as loss of soil through erosion. Alteration of soil properties through fertilisation **Medium-high significance**	soil structure and fertility as a result of poor land management such as crop rotation and over grazing. Poor agricultural practices can also result in loss of soil through erosion. **Medium-high significance**	erosion (e.g. from activities such as quad biking) **Medium-low significance**	erosion. Impact on soil quality from hydrocarbons storage and AMD. **High significance**
Surface water	Water quality could be affected through fertilisers, soil and animal waste that wash into local streams. Stock watering and irrigation will also impact on water resources. **Medium-low significant**	Water quality could be affected through fertilisers, soil and animal waste that wash into local streams. Stock watering and irrigation will also impact on water resources. **Medium-low significant**	Limited impacts. If dams are constructed or additional lodges built it would impact on water courses. **Low significance**	Local resources could be contaminated from oxidation of coal. Water required for operations will also impact on resources. **High significance**
Groundwater	Fertilisers and animal waste entering groundwater resources. Abstraction for stock watering and irrigation will also impact resources.	Limited impacts as irrigation and fertiliser use will be minimal. **Low significance**	Limited impacts. Domestic waste/effluent and chemical compounds could enter groundwater. Abstraction for use to run tourism facilities. **Low significance**	Oxidation of coal will lead to contamination of groundwater resources. Abstraction of water will impact on local aquifers and surrounding water users.

Aspect	**Land use impact on the environment**			
	Agriculture	**Community agriculture**	**Tourism**	**Mining**
	Medium-low significance			**Medium-high significance**
Land capability	Poor grazing and farming practices may decrease land capability through erosion and nutrient reduction. **Medium-low significance**	Poor grazing and farming practices may decrease land capability through erosion and nutrient reduction. **Medium-low significance**	Preferred land capability for tourism is wilderness, thus loss of potential agricultural land or mineral reserves. **Low significance**	Reduction in land capability. **Medium-high significance**
Land use	Land use will not change since it is currently agricultural. **Low significance**	The current land use is agriculture; however community agriculture is undertaken on a smaller less intensive scale then commercial agriculture. **Low significance**	Tourism will result in a change of land use. It would be positive in terms of sustainability but negative in terms of loss of agricultural and mining potential. **Low significance**	Land use will change during opencast mining operations. **Medium-low significance**
Air quality	Ploughing/harvesting and movement of livestock will increase dust levels. **Medium-low significance**	Impact on air quality will depend on available equipment to the community. It is not likely that automotive equipment will be available for ploughing/harvesting. **Low significance**	Negligible impact **Low significance**	Increase in dust levels from mining activities and transportation of coal. **Medium-low significance**
Noise	Localised noise generation from farming equipment.	Minimal noise will be generated. **Low significance**	Potential for noise generated from quad bikes, hunting and clay pidgin shooting.	Sporadic increase in noise from blasting activities.

Aspect	Land use impact on the environment			
	Agriculture	**Community agriculture**	**Tourism**	**Mining**
	Low significance		The impact will be localised. **Medium-low significance**	Machinery and trucks will also contribute to a localised increase in noise levels. **Medium-low significance**
Fauna	Expansion of farming activities will result in further reduction of habitat which will cause a decrease in the local fauna. **Medium-low significance**	The area is already used for commercial agriculture. A reduction in scale may encourage natural vegetation growth and therefore increasing favourable habitats. **Low significance**	Generally increased preservation of habitat and thus fauna e.g. game farms. Negative impact if invasive species are introduced e.g. trout. **Low significance**	Animals living on site will move away due to the increase in movement and noise on the site as well as the loss of habitat. **Medium-low significance**
Flora	Expansion of farming activities will reduce the indigenous plant species due to grazing/lands. **Medium-low significance**	The area is already used for commercial agriculture. A reduction in scale may encourage natural vegetation growth. **Low significance**	Generally preservation of flora occurs with tourism e.g. game farm. **Low significance** Negative if the local flora is removed e.g. golf courses. **Medium-low significance**	While mining is taking place there will be a reduction in flora on site. This should go back to pre-mining status once rehabilitation is completed. **Medium-low significance**
Sites of archaeological and cultural interest	Impact will be negative if no archaeological assessment was done pre-agriculture. Sites are often	Impact will be negative if no archaeological assessment was done pre-agriculture. Sites are often destroyed from	Positive impacts since tourism activities usually preserve archaeological and cultural sites.	Archaeological sites can be preserved if an Archaeological impact assessment was conducted prior

Aspect	Land use impact on the environment			
	Agriculture	**Community agriculture**	**Tourism**	**Mining**
	destroyed from ploughing fields and overgrazing. **Low significance**	ploughing fields and overgrazing. **Low significance**	**Low significance**	to mining. Opencast mining will remove all potential sites below the soil. **Low significance**
Visual aspects	Large buildings associated with agriculture e.g. grain silos will have a localised visual impact. **Low significance**	Negligible impact. **Low significance**	Negligible impact. Any structures constructed usually conform to the surrounding landscape **Low significance**	Opencast mining will have a negative visual impact on the area. The dust created during mining as well as the machinery will also contribute to the impact. **Medium-high significance**
Traffic and safety	Negligible impact. **Low significance**	Negligible impact **Low significance**	Increase in traffic and possible increase in accidents. **Low significance**	Increase in vehicles and heavy machinery could lead to an increase in road and pedestrian accidents. **Medium-high significance**
Regional socio-economic structure	The land is currently used for commercial farming so no change is expected.	Community agricultural is undertaken on a subsistence level that will only benefit the family or	Positive impact through creation of employment opportunities with tourism facilities and training/education.	Increase in employment opportunities and skills development. Social upliftment

Aspect	Land use impact on the environment			
	Agriculture	**Community agriculture**	**Tourism**	**Mining**
	Limited employment and skills development. **Positive impact** **Medium-low significance**	community **Positive impact** **Low significance**	**Positive impact** **Medium-low significance**	of the area will also occur. **Positive impact** **Medium-high significance**

5.2 Description of potential cumulative impacts of the main features and infrastructure related to the alternative land use or development

5.2.1 Commercial agriculture

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

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

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

5.2.2 Community agriculture

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

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

5.2.3 Tourism

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

6 Identification of potential social and cultural impacts

6.1 List of potential impacts of the proposed mining operation on the socioeconomic conditions of other parties' land use activities both on the site and on adjacent and non- adjacent properties and farms to the extent that their socioeconomic conditions may be directly affected

The development of Kangala Coal Mine will provide employment opportunities to the local area. It will also provide contract opportunities for required services, such as the transport of coal. The development of mine will contribute to further skills development of the local workers, the opportunity for small business opportunities. As employment in the area increases so will regional spending. Kangala Coal mine will also contribute toward the national treasury.

Other impacts include those relating to visual and traffic impacts from the construction of surface infrastructure and use of roads.

Retrenchment will occur during the decommissioning phase. Employees will have obtained new skills during the operation of the mine which will be of benefit for seeking further development. There will, however, be a loss of employment which will require management.

6.2 List of potential impacts of the mining operation on any cultural and/ or heritage resources which may be applicable

The construction phase consists of activities performed in preparation of mining such as site clearing, top soil removal, construction of infrastructure, and transportation of construction material and the establishment of an initial boxcut and access ramps. Construction activities will therefore include the total destruction of the land surfaces in these footprint areas. Archaeological and heritage sites located in the directly affected areas will subsequently be impacted.

6.3 In cases where cultural impacts have been identified, describe the cultural aspect that will potentially be affected, and describe the potential impact on such cultural aspect.

According to the archaeological field survey, the following cultural sites will be directly affected by the construction phase. The location of significant archaeological and heritage sites is illustrated on Plan 19.

6.3.1 Site one: Cemetery

The cemetery is situated to the southeast of the mining application area and is not expected to be impacted on by the mining activities. If at any stage the mining application area is extended and the cemetery is included in the application area, the cemetery needs to be fenced and a buffer zone of 20 m must be left around the site and adequate access must be provided for the family to visit the graves .

6.3.2 Site three: cemetery

This cemetery is not expected to be impacted by mining activities, as this site is located outside the boundary of the project area. If at any stage the mining application area is extended and the cemetery is included in the application area, the cemetery needs to be fenced and a buffer zone of 20 m be left around the site and adequate access must be provided for the family to visit the graves. In the event that the mining will impact directly on the graves and the need arise for the relocation of the cemetery a full grave relocation process must be followed.

6.3.3 Site four: cemetery

This cemetery is not expected to be impacted by mining activities, as this site is located outside the boundary of the project area. Due to its geographical proximity to the project; however, the cemetery needs to be fenced and a buffer zone of 20 m be left around the site and adequate access must be provided for the family to visit the graves. In the event that the mining will impact directly on the graves and the need arise for the relocation of the cemetery a full grave relocation process must be followed.

The operational phase implies the commencement of mining activities. All related project operations, including coal beneficiation, waste generation and disposal, as well as concurrent rehabilitation forms part of this phase. Once the mining project is up and running, the urgency to identify, document and assess archaeological and heritage resources in the opencast area declines, conditional to the effective identification and documentation of significant sites during the previous phase. No additional impacts on sites of archaeological and heritage significance are expected during the operational phase if the mitigation and management measures outlined in the AIA report have been effective implemented in the pre-development and construction phases.

During the decommissioning and closure phase of the project, no new surface areas are expected to be disturbed and/or impacted. No additional sites of archaeological and heritage significance are therefore expected to be impacted during decommissioning. The majority of sites of archaeological and heritage significance (cultural and natural) will have been recorded, assessed and mitigated or conserved in preceding phases and should subsequently be protected from any additional impacts from decommissioning and closure activities.

6.4 In Cases where heritage features have been identified, describe such heritage feature and describe the potential impact on such heritage feature

According to the archaeological field survey, the following heritage site will be directly affected by the construction phase. The location of significant archaeological and heritage sites is illustrated on Plan 19.

6.4.1 Site two: historical structures

According to the current mine plan, these structures will be impacted by mining activities. The ages of these structures have not been confirmed; if it is older than 60 years a permit would be required from SAHRA. It is recommended that the site be evaluated by a conservation architect before construction commence to provide further recommendations on the mitigation necessary on the site.

Universal Coal has been granted a demolition permit for these historical buildings by SAHRA (Please refer to Appendix P)

6.5 Quantification of the impact on the socio-economic conditions of directly affected persons, as determined by the findings and recommendations of a specialist report in that regard

The current land use is one of agriculture, where land is planted with crops. The project will therefore result in a temporary loss of agricultural land and reduction in land capability as after mine closure and rehabilitation of mined areas, the land capability may be return to a lower state of land capability than pre-mining.

Prior to mining, no major infrastructure was required to be re-located such as powerlines, pipelines, buildings or roads. The potential impacts that can occur to surrounding land-uses from the mine are those relating to nuisance impacts such as air, noise, blasting and vibration impacts as well as traffic and visual disturbances. These are irregular impacts.

7 Impact assessment and evaluation

7.1 Impact assessment methodology

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 the 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&AP's 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 on the perceptions and values of all involved.

It is for this reason that it is crucial that all EIA's make reference to the environmental and socio-economic context of the 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 on 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 methodology employed for environmental impact assessment is divided into two distinct phases, namely, impact identification and impact assessment.

Impact identification is performed by use of an Input-Output model which serves to guide the assessor in assessing all the potential instances of ecological and socio-economic change, pollution and resource consumption that may be associated with the activities required during the construction, operational, closure and post-closure phases of the project. These activities were listed in Table 2-4.

Outputs may generally be described as any changes to the biophysical and socio-economic environments, both positive and negative in nature, and also include the product and waste produced by the activity. Negative impacts could include gases, effluents, dust, noise, vibration, other pollution and changes to the bio-physical environment such as damage to habitats or reduction in surface water quantity. Positive impacts may include the removal of invasive vegetation, construction of infrastructure, skills transfer or benefits to the socio-economic environment. During the determination of outputs, the effect of outputs on the various components of the environment (e.g. topography, water quality, etc.) is considered.

During consultation with I&APs perceived impacts were identified. These perceived impacts will become part of the impact assessment and significance rating in order to differentiate between probable impacts and perceived impacts.

7.2 Impact rating

The impact rating process is designed to provide a numerical rating of the various environmental impacts identified by use of the Input-Output model. As discussed above, 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. This gives the project proponent a greater understanding of the impacts of his project and the issues which need to be addressed by mitigation and also give the regulators information on which to base their decisions.

The significance rating process follows the established impact/risk assessment formula:

Significance = Consequence x Probability

Where Consequence = Severity + Spatial Scale + Duration

And Probability = Likelihood of an impact occurring

The matrix calculates the rating out of 75. The percentage is the figure quoted in the matrix. The weight assigned to the various parameters for positive and negative impacts in the formula.

Impacts are rated prior to mitigation and again after consideration of the mitigation measure proposed in the EMP. The significance of an impact is then determined and categorised into one of four categories, as indicated in Table 7-1. In accordance with Regulation 51 of the MPRDA, management actions will be assigned for all impacts, irrespective of significance.

Table 7-1: Significance threshold limits

Significance		
High	**57 - 75**	
Medium-High	**38 - 56**	
Medium-Low	**19 - 37**	
Low	**0 - 18**	

Table 7-2: Impact assessment parameter ratings

Rating	Severity		Spatial scale	Duration	Probability
	Environmental	**Social, cultural and heritage**			
5	Very significant impact/total destruction of a highly valued species, habitat or ecosystem or extremely positive impact over baseline environmental condition.	Irreparable damage to/destruction of highly valued items of great cultural significance or complete breakdown of social order or Extremely positive impact on social, economic and cultural environment.	National/ International	Permanent/ Irreversible	Certain/ Normally happens in cases of this nature (80-100% chance of happening)
4	Serious impairment of ecosystem function, or very positive impact over baseline environmental condition.	Serious social issues/Permanent damage to items of cultural significance or very positive impact on social, economic and cultural environment.	Provincial/ Regional	Long Term (10 to 25 years or beyond closure)	Will more than likely happen (60-79% chance)
3	Moderate negative alteration of ecosystem functioning or Moderately positive impact over baseline environmental condition.	Moderately important social issues and/or moderately significant damage to items of cultural significance or Moderately positive impact on social, economic and cultural environment.	Regional (substantially beyond site boundary)	Medium Term (5-10 years)	Could happen and has happened here or elsewhere (40-59% chance)

Rating	Severity		Spatial scale	Duration	Probability
	Environmental	Social, cultural and heritage			
2	Minor effects not affecting ecosystem functioning or Slightly positive impact over baseline environmental condition.	Minor Impacts on the local population, repairable over time. Temporary impairment of the availability of items of cultural significance or Minor positive impact on social, economic and cultural environment	Local (beyond site boundary and affects neighbours)	Medium-Short Term (1-4 years)	Has not happened yet, but could (20-39% chance)
1	Insignificant effects on the biophysical environment or Insignificantly positive impact over baseline environmental condition.	Insignificant social issues / low-level repairable damage to commonplace structures. positive impact on social, economic and cultural environment or Insignificant positive impact on social, economic and cultural environment	Site (does not extend beyond site boundary)	Short term (Less than a year)	Conceivable, but only in a set of very specific and extreme circumstances (0-19% chance)

7.3 List of all potential environmental impacts

The following chapter gives a description viewpoint of the potential impacts that the Kangala Coal Mine is currently having on the environment. The quantitative impact assessment has been undertaken according to a matrix, which is included in Appendix M. Each impact has been described according to the various activities. It is the activities which trigger the impact thus it is important to determine those activities which gives rise to the most significant impacts. In this way the activities can be managed effectively.

It should be noted that all activities and impacts associated with construction have already occurred since the Kangala Coal Mine is currently operational. All those activities and impacts associated with the operation of the mine are therefore currently occurring.

7.3.1 Topography

7.3.1.1 Construction phase:

Activity 4 and 6: Site clearing and topsoil removal and Establishment of initial boxcut and access ramps

As the site is cleared of vegetation and topsoil the topography will be impacted as the natural lie of the land will be altered. This alteration of the land will have further impacts on surface water flow dynamics as the natural drainage pattern is disrupted. The significance of these impacts will be severe during the construction phase and will continue to have an impact for the life of the mine.

7.3.1.2 Operational phase:

Activity 10: Topsoil and overburden removal and stockpiling

As the site is cleared of topsoil and overburden the topography will be impacted as the natural lie of the land will be altered. This alteration of the land will have further impacts on surface water flow dynamics as the natural drainage pattern is disrupted. Stockpiling further impacts the natural topography by altering slope direction and slope percentages thus creates the potential for erosion. The significance of these impacts can be severe if not mitigated and will exist through the life of the mine.

The re-positioning of the overburden and stockpiling areas are not likely to have an additional impact compared to the impact above.

Activity 16: Discard dumps

Discard dumps impact the natural topography by altering slope direction and percentages, thus creating the potential for erosion and therefore the possibility of the siltation of drainage networks. On site the discard dump and topsoil stockpile are located in close proximity to a non-perennial pan, so erosion prevention measures will need to be implemented, to reduce the risk of the pan being impacted by siltation.

It is proposed to extend the discard dump from the current approved footprint of 16.5 ha to a final discard footprint of 20.6 ha. The proposed extension will be to the south of the existing discard dump and located away from the non-perennial pan. However, the impact of the extension will result in a greater impact to the topography of the project site.

Activity 19: Concurrent replacement of overburden and topsoil and revegetation

If the replacement of overburden and top soil is performed in a manner which follows the original contouring of the land prior to mining, it is possible to restore surface flow dynamics.

7.3.1.3 Decommissioning phase

Activity 22: Final replacement of overburden and topsoil and revegetation

If the replacement of overburden and topsoil is performed in a manner which follows the original contouring of the land prior to mining, it is possible to restore surface flow dynamics. Care must be taken to avoid surface subsidence and slumping. The discard dump will, however, remain a permanent feature and form part of the future topography.

7.3.2 Land aspects

Soil cover thickness, texture and sequence of soil horizons status vary across and down the slope in response to bedrock type, slope gradient, climate and organic inputs. The topsoil is regarded as the upper 0.3 m – 0.35 m of the soil profile. The topsoil, subsoil and weathered rock that constitute the overburden must be removed and stockpiled during mining operations in most opencast mining situations.

The natural sequence of soil horizons are destroyed during opencast mining operations. It is normally intended that topsoil and subsoil materials are stored separately on stockpiles and that the rehabilitation process should occur in the reverse order of stripping. Some soils cannot be used as topsoil and should be kept separately for site specific applications. Topsoil stockpiles tend to degrade during long-term stockpiling and lose their organic content and fertility status. In the case of Wolvenfontein this is important to remember because the soil is used for arable agriculture. The pH and fertility status are therefore optimal for commercial crop production. Commercially viable soil fertility status, under arable farming conditions is expensive to reach and maintain and does not occur naturally. Rehabilitation should therefore take advantage of this by carefully separating top- and subsoil stockpiles. Rehabilitation should commence as soon as is practically possible.

Changing soil properties also changes land capability which is a function of the soil thickness and fertility status, slope, drainage, climatic regime and vegetation types. Wolvenfontein is classified as Class two arable land with very few limitations regarding arable use. Soil rehabilitation should aim to at least rehabilitate back to land capability emulating pre-mining land capability proportionally. The mined land and the end use options should strive to keep post mining land use as arable agriculture because the surrounding land use in Delmas is arable agriculture

7.3.3 Surface water

7.3.3.1 Construction phase

Risks identified for the construction phase with respect to surface water are the increase of the siltation due to earth moving activities and the risk of surface water contamination due to a major hydrocarbon spill.

The impact due to siltation is judged to be negative, to be of medium severity, local extent (as the dam immediately adjacent to the pit will accumulate the silt; this will however result in a loss of storage capacity) and medium term duration (the life of the project). The impacts will definitely occur if mitigation is not taken, mitigation is recommended.

The impact due to a major hydrocarbon spill on site is judged to be negative and of high significance. The impact will be regional (in the high flow season) and the impacts of medium term consequence (reputational damage may be permanent). The probability of occurrence is however very low.

7.3.3.2 Operational phase

The operational phase will see a continuance of the impacts identified in the construction phase.

The National water act requires mines to operate in accordance with Regulation 704 in terms of water management; it is assumed that the provisions of regulation 704 will be fully implemented.

The proponent considers applying for exemption of Regulation704 in terms of disposal of discard and slurry back into the mining pit. The replacement of discard into the void and the disposal of slurry will not have any direct impact on surface water resources during the operational phase, but post closure there could be impacts that will be discussed under this particular section.

Should permission not be granted a discard dump will be constructed on the property. The discard dump will allow for the formal management of the discard and slurry and should the provisions of regulation 704 be complied with no impacts on the surface water is expected.

The removal of the mining dirty water from the catchment area of the downstream dam will reduce the runoff into the dam. The current water use from the dam is probably irrigation. This impact is judged to be negative, site specific and of moderate significance and medium term duration. Stormwater planning must take into account the loss of yield and the current utilisation from the dam.

7.3.3.3 Decommissioning phase

The impacts from the construction phase will continue during the decommissioning phase.

Additional impacts are not expected during this phase, however the failure during this phase to adequately undertake closure of the discard dump will have impacts post closure. This impact is therefore identified here and discussed to ensure that it is not overlooked. Failure to allow for sustainable management of seepage from the discard dump will lead to long term contamination of the downstream surface water as management measures utilised during the operational phase will not be adequate for the closure requirements in terms of capacity and durability under low maintenance. The impact is judged to be negative and of regional extent as the pollution will migrate downstream. The significance is moderately high and the duration permanent. The impact could probably occur.

7.3.3.4 Post closure impacts

Post closure impacts on surface water is associated with the decant of groundwater to surface and seepage from the discard dump. The severity of the impact will be dependent on the post closure water quality. The DWAF Best Practice Guidelines require substantial geochemical characterisation during the life of the mine. The results thereof will allow for a more accurate assessment of the impacts.

The impacts on surface water are expected to be negative and very significant as the current water quality has a very low TDS. The impact will be of regional extent as the contamination migrates downstream. The impact will be of permanent duration and the overall significance will be very high.

7.3.4 Groundwater

7.3.4.1 Groundwater monitoring results (2014)

Digby Wells was contracted as an independent environmental consultant to assist Universal Coal with their quarterly groundwater reporting in November 2014. The groundwater monitoring was undertaken to comply with those requirements specified in the Department of Water and Sanitation's Water Use Licence (WUL) requirements (Licence No 04/B20A/ABCGIJ/1506). This section provides a summary of the results. The impact of the mining activities on the groundwater environment shall not exceed the water quality objectives for the area as indicated on the table below.

Table 7-3: Water variables

Variable	Limits
pH	5 – 9
Conductivity (EC) in mS/m	150.0
Sulphate (SO4) in mg/L	400.0
Chloride (Cl) in mg/L	200.0
Sodium (Na) in mg/L	200.0
Magnesium (Mg) in mg/L	70.0
Calcium (Ca) in mg/L	150.0
Iron (Fe) in mg/L	0.2
Manganese (Mn) in mg/L	0.1
Fluoride (F) in mg/L	1.0
Nitrate (NO_3) in mg/L	10.0

Kangala Coal Mine increased their groundwater monitoring network from eight (5) to a total of eleven (11) monitoring sites in September 2014. Only seven boreholes where sampled and sent to the laboratory for chemical analysis. The following sites were not sampled during Quarter 3 (2014):

- Borehole KAM01 was closed or locked and therefor it was not possible to sample and to measure the water level;
- Boreholes KAM06 and KAM07 were found to be dry during the September 2014 sampling run. Water level measurements or sampling have not been possible from either borehole during 2014 as they have been dry; and
- Boreholes KAM03 was destroyed and replaced by a new borehole (KAM03A). It was not possible to sample or measure the water level due to an installed pump, with no opening or a tap.

The results indicate that groundwater at Kangala Coal Mine can be classified as Magnesium-Bicarbonate type water, which is an indication of recent recharged water. All seven sampled groundwater points (KAM02, 04, 05, 08 and KGA12, 18 and 21) indicate a calcium-magnesium bicarbonate water type, typical of freshly recharged groundwater. The chemical results for the third quarter (2014) can be summarised as follows:

- The overall groundwater quality of the mining area falls within the recommended water quality concentration limits (Class I – SANS 241-1:2011), with the exception of the Nitrate concentration (11.70 mg/L) measured from borehole KGA21. Elevated Nitrate concentrations are associated with the agricultural fertilizers in the area;
- KAM02 and KGA18 exceed the WQG in terms of calcium concentrations. This potentially relates to natural processes and precipitation of calcium from solution;
- The groundwater in the area has a typical magnesium-bicarbonate signature indicating recent recharge, with no dominant cation; and
- None of the boreholes being monitored showed any significant fluctuation in element concentrations during 2014.

During the sampling run it was possible to measure groundwater levels from 5 of the 11 groundwater monitoring sites. Measured groundwater levels varied between 5.26 mbgl and 20.89 mbgl (meters below ground level). It was not possible to measure a water level form boreholes KAM01, KAM3A, KGA18, KAM06, KAM07 and KGA39 as they were not accessible due to installed equipment or found dry during the monitoring period.

7.3.4.2 Construction phase

Groundwater quality

The potential spillage of hydrocarbons from construction machines during the construction of infrastructure, topsoil and overburden stripping, opencast areas construction and haul road construction has the potential to cause the pollution of groundwater resources. The risk is low and localised and of short term. However if one large spill from a hydrocarbon tanker occur this will have a severe negative impact over a longer time.

The operation of the fuel and lubricants storage facility has the potential for causing contamination of surface water due to infrastructure failure (emergency), leakage or spillages during normal operation. Included in normal operation is the potential for the incorrect disposal of spill absorbing material. This is usually of medium risk over a short duration and can be mitigated, impacts are potentially low.

The operation of offices, ablutions and maintenance workshops has the potential for the contamination of groundwater due to incorrect disposal of domestic and hazardous wastes, incorrect handling of workshop effluent spills and leaks. This is usually of medium risk over a short duration and can be mitigated, impacts are potentially low.

The use of nitrate-based explosives during blasting for the establishment of the opencast areas has the potential to cause surface water pollution due to the addition of nitrates to water. This is usually of medium risk over a short duration and can be mitigated, impacts are potentially low.

Groundwater quantity

The establishment of hard paved areas during infrastructure construction and haul road construction reduces the recharge of aquifers due to increased runoff. This is normally a low impact, localised and short duration, however if not mitigated and carefully managed large scale erosion could be the end product, which potentially could have a negative long term impact.

The establishment of the opencast areas is expected to have a negative effect on the surrounding aquifers within the immediate area which can cause lowering of water levels in boreholes below actual total depth, causing adjacent boreholes to be out of commission. The boreholes that could see possible influence from this could be, KGA 1, 2, 11, 14, 15, 16, 21, 28, 29, 39, 40 and 41. This is usually a medium negative impact, with medium duration, but returns to within approximately 90 % of the original level after mining ceases and can be mitigated by close monitoring..

7.3.4.3 Operational phase

The local aquifer systems are classified as sensitive and major aquifer systems and the regional utilisation thereof coincides with town water supply and the principle land uses of major irrigation, to a lesser extent grazing and to provide domestic water supply. The changes induced by mining may lead to a dewatering cone in the immediate vicinity of the mine, an increase in recharge, storage capacity (opencast workings) and deterioration in water quality.

Groundwater quality

During the performance of all opencast mining activities the potential exists for the contamination of groundwater due to the spillage of hydrocarbons by mining machines and the use of rock drill lubricant. Low impact over medium term but can be managed closely.

The spillage of ammonium nitrate based explosives during charging of holes, misfires and incomplete combustion of explosives may lead to an increase in nitrate levels in groundwater. Medium impact over medium term but can be managed closely through monitoring.

The operation of the fuel and lubricants storage facility has the potential for causing contamination of groundwater due to either an infrastructure failure (emergency) or spillages during normal operation. Included in normal operation is the potential for the incorrect disposal of spill absorbing material. High impact over short duration and must be managed very closely, potential for spillages to cause long term impact on groundwater is there for the duration of operations.

The potential incorrect disposal of domestic waste at the offices and ablutions may have an impact on groundwater quality. This is a medium impact over short duration with potential high impact over short term.

The potential incorrect handling of sewerage at the offices and ablutions may have an impact on groundwater quality. This is a medium impact, medium term with overall medium significance.

The potential incorrect disposal of hazardous wastes, workshop effluent as well as spills and leaks at the maintenance workshops may have an impact on groundwater. This can be a short term very high potential impact to groundwater in the form of non-aqueous phase liquids with a long term impact.

AMD formation from spoil piles, exposed shale and backfilled spoils and discard in rehabilitated areas will affect groundwater quality through the acidification of groundwater and the leaching of salts and mobilization of heavy metals from rock. Depending on the buffering capacity of the host rock, AMD will either result in the formation of low pH, high dissolved salt and heavy metal content water (insufficient buffering capacity) or the formation of neutral pH, high saline (including sodium and sulphates) water, if high buffering capacity exists. This is potentially of high risk and long term duration and must be monitored carefully throughout and post mining, overall high significance if not mitigated.

Groundwater quantity

The establishment of hard paved areas during infrastructure construction and haul road construction reduces the recharge of aquifers due to increased runoff. Low potential and very localised with short duration.

The removal of vegetation during topsoil and overburden pre-stripping for haul road construction reduces the recharge of rain water to aquifers due to increased run-off. Low potential and very localised with short duration.

Mining of the opencast areas has the effect of dewatering adjacent aquifers or lowering the water table. This is a medium risk over medium term with medium overall significance.

Utilising groundwater as a resource could lower the water table within the dolomites, which could have subsidence and geotechnical associated issues. This is a short term high risk with a high overall significance.

7.3.4.4 Decommissioning phase

The quality of groundwater will be impacted upon by mining. Although not much can be done about the actual groundwater quality, mitigation is required against its surface water quality impacts. The mining area might produce a seepage zone or decant as the recharge to opencast workings have increased by the disturbance of the strata. Currently groundwater is the only source utilised in the area and poor quality groundwater emerging as seeps into the surface water environment can be seen as a negative, long term impact. Mitigation is usually not economically possible and the only reasonable control measures are to contain the polluted water and to minimise recharge (closed circuit). This will have a high risk over a long term with high overall significance if not monitored closely and contained.

The management of cumulative impacts and even the closure planning of existing operations need to be performed on a regional level. The mining companies, DWAF and water users associations need to be approached to establish a working relationship to allow the cumulative impacts to be determined and regional management measures from being implemented. High potential over a long period of time and will have a high potential overall significance.

Groundwater quality

The long term water quality impact for coal mining is the generation of AMD water. Opencast pits must be rehabilitated in such a way that recharge to the area is limited or does not occur at all. This is a high potential impact and overall significance over a long term.

The potential spillage of hydrocarbons by construction machines may contaminate groundwater. This is a medium potential, short term risk, low overall significance.

Incorrect disposal of hazardous, industrial and domestic waste may affect groundwater quality. This is a high potential impact and overall significance over a long term.

Potential exists for the contamination of groundwater due to incorrect sewerage handling. This is a medium potential, short term risk, low overall significance.

Groundwater quantity

In the opencast areas water levels will rise until the decant level is reached. Water quality in the opencast pits is not expected to be suitable for use and these areas will be sterilised in terms of available groundwater quantity. Groundwater use will also terminate during this phase and post mining and will recover to an extent depending on recharge. This is a medium impact over the medium term, medium overall significance.

7.3.5 Air quality

Figure 7-1 – Figure 7-7 illustrate the predicted dispersion of PM_{10} 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.

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 PM_{10} reference standard concentrations, as predicted by the atmospheric dispersion model. The illustrated values are 30 µg/m^3, 40 µg/m^3 and 60 µg/m^3 – i.e. the SANS 1929:2005 Target, SANS 1929:2005 Limit and NEMAQA reference standards for long term, Annual (yearly average exposure) for PM_{10} respectively

Depicted isopleths illustrate the relevant fallout dust reference standard concentrations, as predicted by the atmospheric dispersion model. The illustrated values are 100 µg/m^3, 300 µg/m^3 600 µg/m^3, 1200 µg/m^3 and 2400 mg/m^2/day – i.e. the SANS 1929:2005 Target, Action and Alert thresholds for dust deposition respectively.

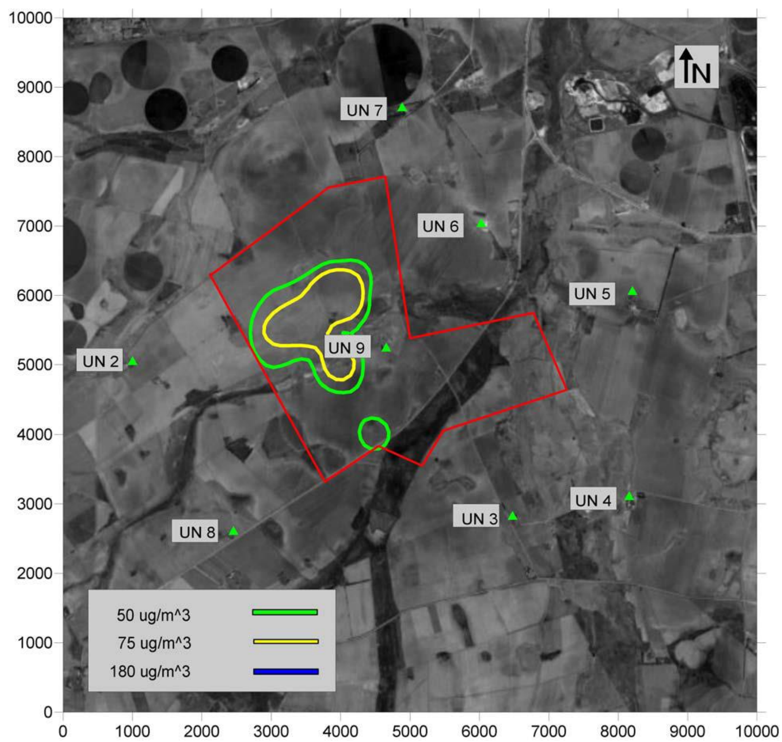

Figure 7-1: Predicted process contribution PM_{10} 24 hour exposure (0% mitigation)

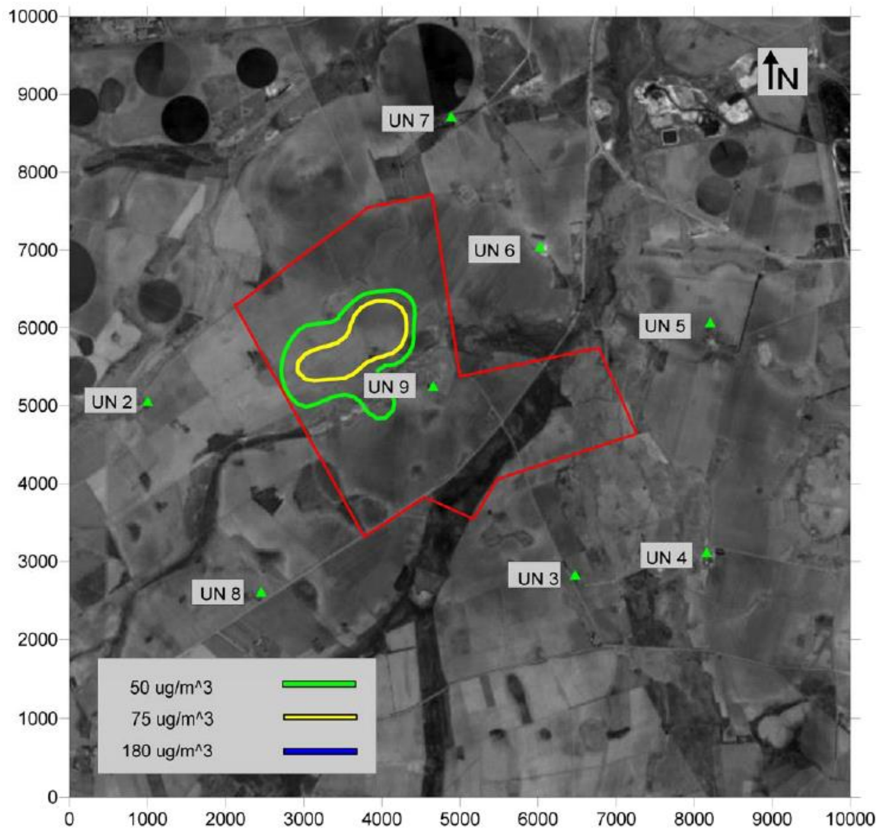

Figure 7-2: Predicted process contribution PM_{10} 24 hour exposure (50% mitigation)

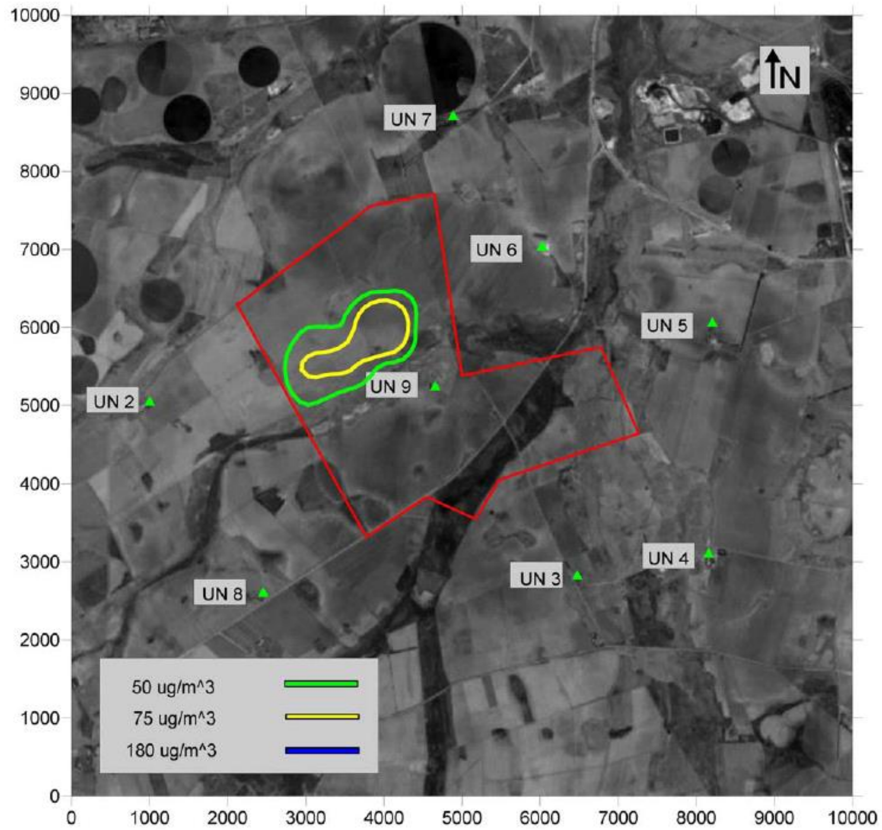

Figure 7-3: Predicted process contribution PM_{10} 24 hour exposure (90% mitigation)

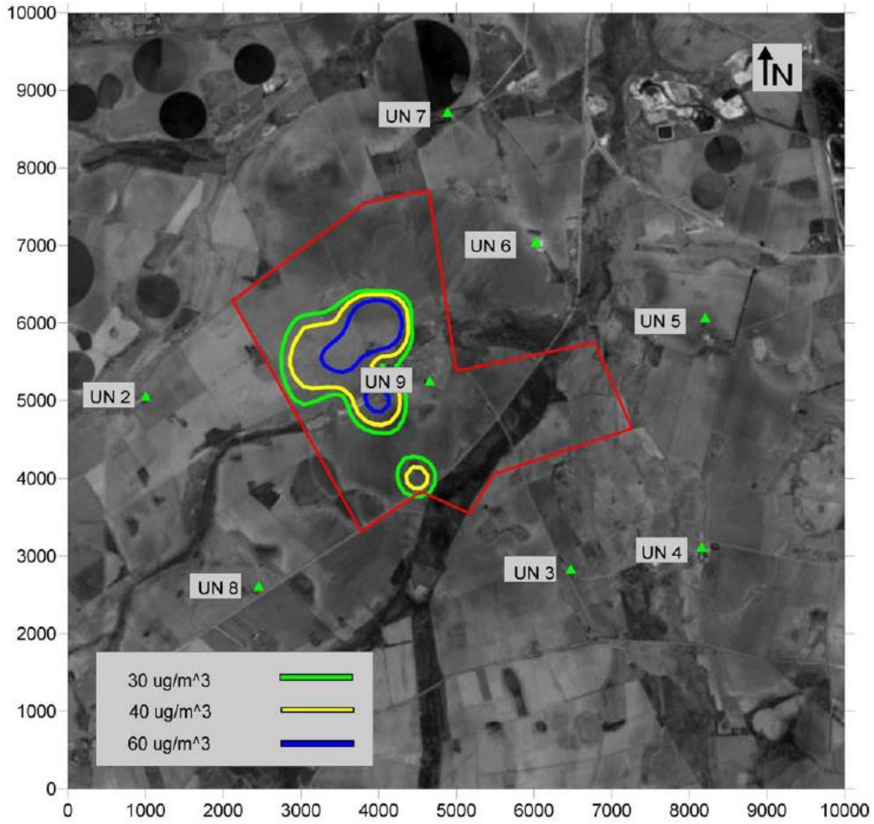

Figure 7-4: Predicted process contribution PM_{10} annual exposure (0% mitigation)

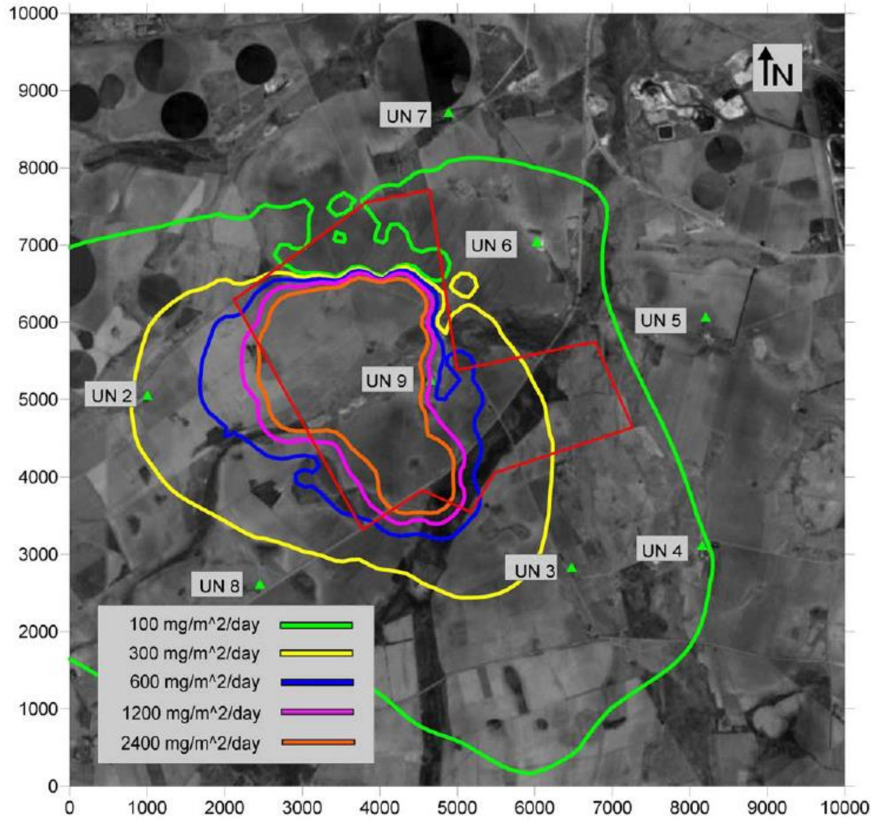

Figure 7-5: Predicted process contribution fallout dust annual exposure (0% mitigation)

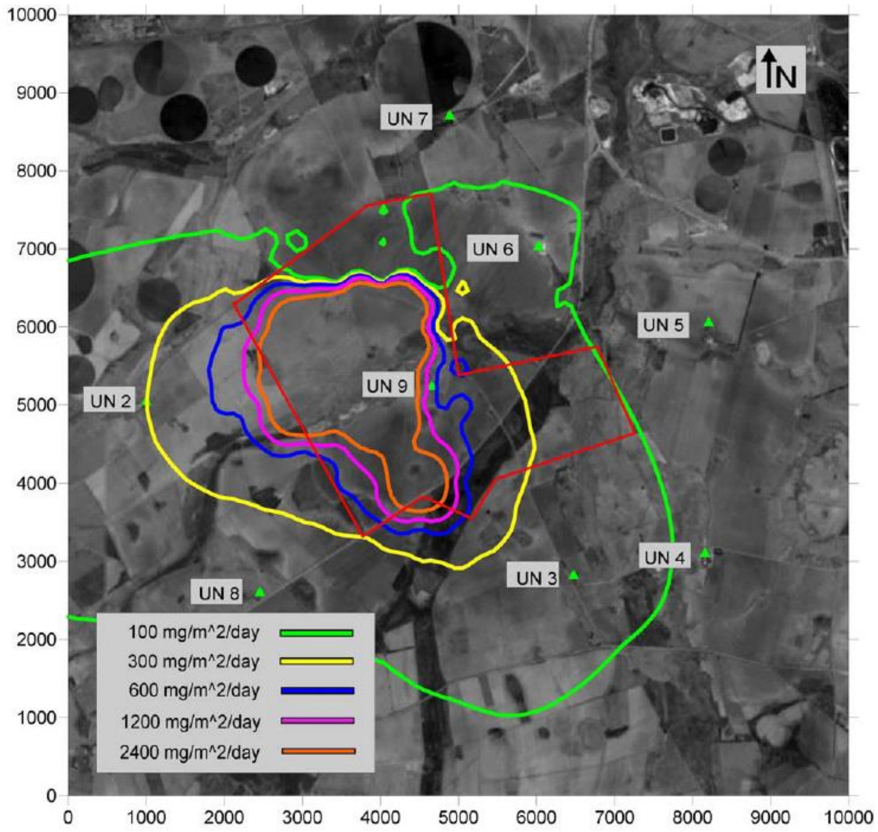

Figure 7-6: Predicted process contribution fallout dust annual exposure (50% mitigation)

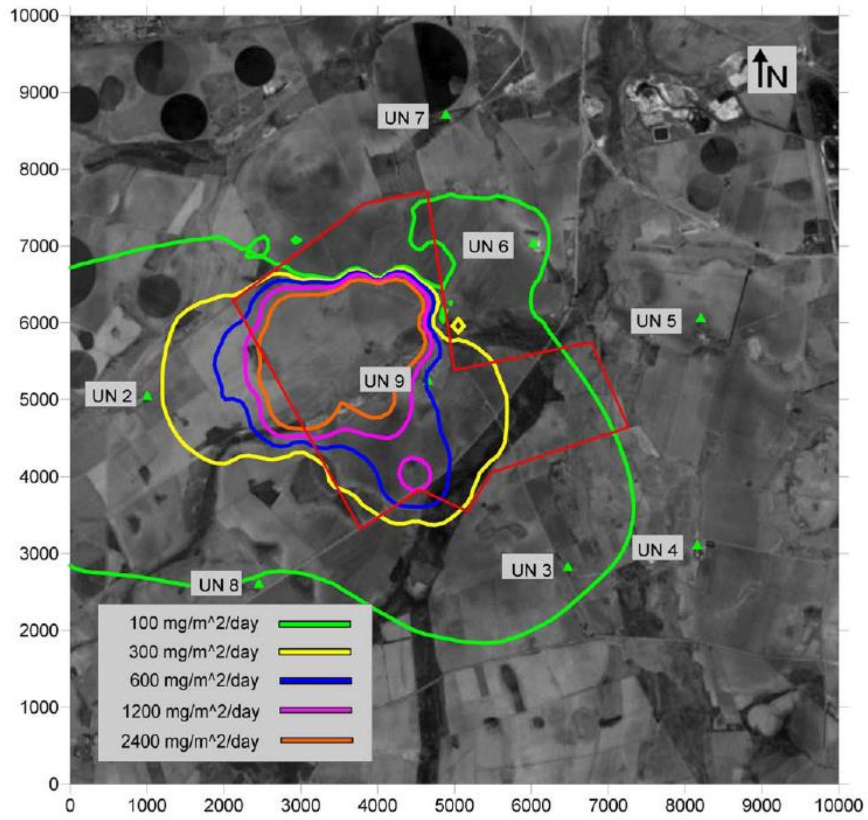

Figure 7-7: Predicted process contribution fallout dust annual exposure (90% mitigation)

7.3.5.1 Air quality monitoring results (2014)

Rayten Engineering Solutions was appointed by Universal Coal to undertake dust fallout monitoring for a period of one year at Kangala. This section summarises the results.

The location of Kangala Colliery is classified as a non-residential area. Thus the dust fallout concentrations that are permitted are within the range of 600 – 1200 mg/m^2/day. Kangala Colliery would be non-compliant with South African National Dust Fallout Regulations 2013 should the dust fallout concentrations exceed 1200 mg/m^2/day over two sequential months at a single monitoring site. The frequency of exceedence of dust fallout concentrations that are permitted per site (per dust bucket) is two within a single year (no two sequential months).

A total of nine dust fallout monitoring stations (UD-001 to UD-009) have already been installed at Kangala Colliery by an independent contractor.

The results indicated that dust fallout concentrations in October 2014 at four of the six sites (UD-001, UD-004 to UD-006) were below the residential area standard (600 mg/m^2/day). Dust fallout concentrations of 702.04 and 1069.02 mg/m^2/day were recorded at site UD-002 and UD-003 respectively which exceeds the maximum concentration of 600 mg/m^2/day permissible for residential areas but falls within the permissible range of 600 - 1200 mg/m^2/day for non-residential areas. This may be attributed to dust emissions associated with a high level of vehicle entrainment on the dirt road which is located in front of farm storage buildings near site UD-003. It should be noted that dust fallout concentrations exceeded the maximum permissible standard for non-residential areas in June 2014 and August 2014 at site UD-003. It was recommended that dust suppression measures be investigated around site UD-003 in order to prevent non-compliance.

7.3.5.2 Construction phase

Activity 4: Site clearing and topsoil removal, Activity 5: Construction of surface infrastructure and Activity 6: Establishment of initial boxcut.

During initial construction areas will need to be cleared for development and establishment of the initial boxcut. During site clearing soils become exposed to the element and therefore dust levels are likely to increase as dust is windblown off exposed areas. The increase vehicle movement on site and that will be disturbing exposed soils will also contribute to increased dust fallout and PM10 levels. The impact of the initial construction phase on air quality is seen to be of a medium low significance.

7.3.5.3 Operational phase

Activity 10: Topsoil and overburden removal and stockpiling, Activity 11: Drilling and blasting of hard overburden, and Activity 19: Concurrent replacement of overburden and topsoil and revegetation

The handling and movement of soil will result in the increase of dust fall out and PM_{10} levels. Once stockpiled until such time that vegetation has been established the soil will be exposed and will result in windblown dust. During the operational phase exposed soil will increase until such time as revegetation occurs, the significance of the impact of increase dust fallout and PM_{10} levels is seen as medium-high, as indicated in the sections above.

Activity 13: Vehicle activity on haul roads and conveying of coal

The movement of machinery on site and the haul trucks transporting coal from site to the siding will increase dust levels as the roads on site will be dirt roads. Furthermore, the transport of coal product from the wash plant to the product stockpiles may result in the generation of coal dust. This significance of the contribution of vehicle movement on the haul roads will have a medium-low impact.

Activity 16: Discard dump

During the development of a discard dump on site the coal discard will be exposed. Once dried this may result in windblown coal dust.

It is proposed to extend the discard dump from the current approved footprint of 16.5 ha to a final discard footprint of 20.6 ha. The proposed extension will be to the south of the existing discard dump and located away from the non-perennial pan. However, the impact of the extension will result in a higher impact to the air quality due to the extended footprint of the dump.

This impact will have a medium high significance.

7.3.5.4 Decommissioning phase

Activity 21: Demolition of infrastructure and Activity 22: Final replacement of overburden and topsoil and revegetation.

During the decommissioning phase there will be demolition activities which will increase dust levels, however they will be short lived. The movement of soil for final rehabilitation will contribute to dust fall out levels as soil will become exposed until such time of revegetation. This impact will be of medium low significance.

7.3.6 Noise

Mining activities generate noise from various sources. The predicted noise levels of the primary noise sources are presented in Table 7-4.

Table 7-4: Noise levels at source

Activity	Noise level at source measured in dBA
Blasting	± 127
Dozer	± 95
Excavator	± 98
Front end Loader	± 95
Haul trucks	± 90
Light delivery vehicles	± 80

The earth moving equipment and haul trucks on site are the primary source for continuous noise generated by the mining activities. Blasting activities cause the highest noise levels but are of an impulsive nature.

7.3.6.1 Noise Monitoring Results (2014)

Universal Coal appointed Rayten Engineering Solutions in September 2014 to undertake noise measurements at the Kangala Coal Mine. The monitoring survey was conducted according to SANS 1013:2008, the Code of Practice for the Measurement and Rating of Environmental Noise with Respect to Land Use, Health, Annoyance and Speech Communication.

The Kangala Coal Mine may be classed as a rural district in accordance with SANS 10103:2008 . As a result, a 45dBA limit and 35dBA limit apply for the control of noise during the day and night-time respectively, in this region. The main sources of noise may be attributed to the local fauna (birds and insects) and minor mining activities in the region.

Table 7-5 and Table 7-6 provides the results that show that all day time levels conformed to the standard limit of 45dBA and may be regarded as a satisfactory noise climate. However, the noise climate at night did not conform to the 35dBA standard at 8 of the 9 positions. The source of noise was mainly due to local fauna (insects & birds) residing close to those points. Correction for tonal character was applied due to these occurrences as per standard requirements.

From the results and evaluation it may be concluded that the noise climate in the communities surrounding the Kangala Mine area were below the standard guideline and therefore in conformance during the day time. However, local fauna (mainly birds) was responsible for the night time levels to exceed the 35dBA limit for night time noise climate in rural districts.

Table 7-5: Day time environmental noise results (2014)

Sampling Point	GPS coordinates	Sample A(LAleq) DAY	Sample D(LAleq) MORNING	Point Average (dBA)
Receptor 1 (UN1)	S 26° 10'2.28" E 28° 39'33.18"	42.3	41.7	42.0
Receptor 2 (UN2)	S 26 °12'18.0" E 28° 38'19.0"	40.7	35.4	38.1
Receptor 3 (UN3)	S 26° 13'26.58" E 28°41'41.49"	42.7	41.2	42.0
Receptor 4 (UN4)	S 26°13'18.78" E 28°42'42.06	38.7	39.8	39.3
Receptor 5 (UN5)	S 26°11'40.97" E 28°42'44.54"	37.8	36.8	37.3
Receptor 6 (UN6)	S 26°11'10.89" E 28°41'32.0"	42.8	40.7	41.8
Receptor 7 (UN7)	S 26°13'38.26" E 28°39'16.67"	42.8	45.6	44.2
Receptor 8 (UN8)	S 26°13'38.26" E 28°39'16.67"	48.4	41.6	45.0
Receptor 9 (UN9)	S 26°12'4.49" E 28°40'39.28"	42.4	40.6	41.5

Table 7-6: Night time environmental noise results (2014)

Sampling Point	GPS coordinates	Sample B (LAleq) EVENING	Sample C (LAleq) NIGHT	Point Average (dBA)
Receptor 1 (UN1)	S 26° 10'2.28" E 28° 39'33.18"	38.7	33.3	36.0
Receptor 2 (UN2)	S 26 °12'18.0" E 28° 38'19.0"	31.2	33.7	32.5
Receptor 3 (UN3)	S 26° 13'26.58" E 28°41'41.49"	38.0	32.2	35.1
Receptor 4 (UN4)	S 26°13'18.78" E 28°42'42.06	39.7	35.3	37.5
Receptor 5 (UN5)	S 26°11'40.97" E 28°42'44.54"	37.8	36.6	37.2
Receptor 6 (UN6)	S 26°11'10.89" E 28°41'32.0"	38.0	38.7	38.4
Receptor 7 (UN7)	S 26°13'38.26" E 28°39'16.67"	34.8	36.8	35.8
Receptor 8 (UN8)	S 26°13'38.26" E 28°39'16.67"	36.1	35.5	35.8
Receptor 9 (UN9)	S 26°12'4.49" E 28°40'39.28"	40.6	39.9	40.3

7.3.6.2 Construction phase

The construction machinery responsible for the following activities during the construction phase is expected to impact on the ambient noise level of the area:

- Activity 2: Transport of construction materials;
- Activity 4: Site clearing and topsoil removal;
- Activity 5: Construction of surface infrastructure; and
- Activity 6: The establishment of the initial box cut and access ramp.

The construction machinery will be a source of continuous noise throughout the construction phase.

To assess whether the noise from the mining activities will impact on the relevant receptors the calculated noise levels and the baseline noise levels are compared. An increase of about 8−10 dBA is required before the sound subjectively appears to be significantly louder (Brüel & Kjær, 2001). The difference between the predicted noise levels during the wet season and dry windy season is very little and therefore will have the same level of impact. The construction machinery will significantly impact on receptors UN7 and UN9 during the night time. The activity is considered to extend beyond the site boundary and the severity will be significant. The overall significance of the impact of the construction machinery on receptors UN7 and UN9 during the night time will be medium-high for a short duration and mitigation is required.

The blasting activities (related to Activity 6) during the construction phase is also expected to impact on the ambient noise levels of the area. The key noise producing operations during this phase will be the blasting operations required to allow for the establishment of the initial pit. The noise from the blasting activities will impact significantly on receptors UN1, UN2, UN6, UN7 and UN9 during the night time, but is intermittent of nature. The activity is considered to extend beyond the site boundary and the severity will be significant. The overall significance of the impact of the blasting on the above mentioned receptors during the night time will be medium-high for a short duration and mitigation is required.

7.3.6.3 Operational phase

Excavators and haul trucks will be in operation during the following activities:

- Activity 10: Topsoil and overburden removal and stockpiling;
- Activity 12: Coal removal and stockpiling;
- Activity 13: Vehicular activity on haul roads and conveying of coal; and
- Activity 19: Concurrent replacement of overburden and topsoil and re-vegetation.

The excavators and haul trucks and other construction machinery which will be responsible for the above mentioned activities will be a source of continuous noise throughout the operational phase.

The machinery will significantly impact on receptors UN1, UN2, UN6, UN7 and UN9 during the night time. The activity is considered to extend beyond the site boundary and the severity will be significant. The overall significance of the impact will be medium-high for a medium duration and mitigation is required.

Activity 11: Drilling and blasting of hard overburden

The blasting activities (Activity 11) during the operational phase are also expected to impact on the ambient noise levels of the area. The blasting and drilling activities will be the highest noise producing source during the operational phase.

During the operational phase the noise from the blasting activities is expected to impact significantly on receptors UN1, UN2, UN6, UN7 and UN9 during the night time, but the blasting activities will be intermittent of nature. The activity is considered to extend beyond the site boundary and the severity will be serious. The overall significance of the impact will be medium-high for a medium duration and mitigation is required.

Activity 15: Screening and Washing

The washing plant which will be responsible for the screening and washing of the ROM coal will be a noise source during the operational phase. The activity is considered to be localized and is expected not to extend beyond the site boundary and the severity is expected to be moderate. The overall significance of the impact will be low for a medium duration and mitigation is required.

7.3.6.4 Decommissioning phase

The machinery responsible for the following activities during the decommissioning phase is expected to impact on the ambient noise level of the area:

- Activity 21: Demolition of infrastructure
- Activity 22: Final replacement of overburden and topsoil and revegetation

The activities of the decommissioning phase involve the demolition of infrastructure. Construction machinery which will be responsible for demolition activities will be a source of noise during the decommissioning phase.

The decommissioning activities will not impact on the relevant receptors. The activity is not considered to extend beyond the site boundary and the severity will be minor. The overall significance of the impact will be low for a short duration. To prevent the noise levels form the decommissioning activities do not impact on the relevant receptors mitigation measures are still recommended. It is assumed that the decommissioning activities will take place during the daytime only.

7.3.7 Air blasting and ground 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.

7.3.7.1 Ground vibration

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 7-7 shows the ground vibration predictions for minimum charge and the possible concern for human tolerances and structure response. Table 7-8 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 7-7: Expected ground vibration levels for minimum charge at the various private structures

No.	Structure	Direction from Mine Position	Specific Vibration Limit (mm/s)	Distance (m)	Predicted PPV (mm/s)	Human Tolerance @ 30Hz	Structure Response @ 10Hz	Structure Response @ 30Hz
29	OHPowerline	N	75	233	14.2	No Human Interface	Acceptable	Acceptable
13	Road	N	150	240	13.5	No Human Interface	Acceptable	Acceptable
16	DamWall2	E	50	385	6.2	No Human Interface	Acceptable	Acceptable
30	Prop.Chicken Broiler	N	USBM	539	3.5	Perceptible	Acceptable	Acceptable
12	DamWall1	W	50	643	2.7	No Human Interface	Acceptable	Acceptable
5	Struct-4	E	USBM	824	1.8	Perceptible	Acceptable	Acceptable
1	Struct-1	W	USBM	1498	0.7	Low	Acceptable	Acceptable
17	DamWall3	E	50	1613	0.6	No Human Interface	Acceptable	Acceptable
27	Struct-8	NE	USBM	1632	0.6	Low	Acceptable	Acceptable
15	R42Road	SE	150	1658	0.6	Low	Acceptable	Acceptable
3	Chicken1	W	USBM	1769	0.5	Low	Acceptable	Acceptable
2	Struct-2	W	USBM	1803	0.5	Low	Acceptable	Acceptable
18	DamWall4	E	50	1900	0.4	No Human Interface	Acceptable	Acceptable
11	Struct-5	E	USBM	2204	0.3	Low	Acceptable	Acceptable
23	DamWall5	E	50	2294	0.3	No Human Interface	Acceptable	Acceptable
19	Informal	E	USBM	2632	0.3	Low	Acceptable	Acceptable
21	Struct-7	N	USBM	2634	0.3	Low	Acceptable	Acceptable
20	Struct-6	NW	USBM	2757	0.2	Low	Acceptable	Acceptable
4	Struct-3	S	USBM	2880	0.2	Low	Acceptable	Acceptable
22	Chicken2	W	USBM	3166	0.2	Low	Acceptable	Acceptable

Table 7-8: Expected ground vibration levels for maximum charge at the various private structures

No.	Structure	Direction from Mine Position	Specific Vibration Limit (mm/s)	Distance (m)	Predicted PPV (mm/s)	Human Tolerance @ 30Hz	Structure Response @ 10Hz	Structure Response @ 30Hz
29	OHPowerline	N	75	233	72.7	No Human Interface	Acceptable	Acceptable
13	Road	N	150	240	69.2	No Human Interface	Acceptable	Acceptable
16	DamWall2	E	50	385	31.7	No Human Interface	Acceptable	Acceptable
30	Prop.Chicken Broiler	N	USBM	539	18.2	Unpleasant	Acceptable	Acceptable
12	DamWall1	W	50	643	13.6	No Human	Acceptable	Acceptable

						Interface		
5	Struct-4	E	USBM	824	9.0	Unpleasant	Acceptable	Acceptable
1	Struct-1	W	USBM	1498	3.4	Perceptible	Acceptable	Acceptable
17	DamWall3	E	50	1613	3.0	No Human Interface	Acceptable	Acceptable
27	Struct-8	NE	USBM	1632	2.9	Perceptible	Acceptable	Acceptable
15	R42Road	SE	150	1658	2.9	Perceptible	Acceptable	Acceptable
3	Chicken1	W	USBM	1769	2.6	Perceptible	Acceptable	Acceptable
2	Struct-2	W	USBM	1803	2.5	Perceptible	Acceptable	Acceptable
18	DamWall4	E	50	1900	2.3	No Human Interface	Acceptable	Acceptable
11	Struct-5	E	USBM	2204	1.8	Perceptible	Acceptable	Acceptable
23	DamWall5	E	50	2294	1.7	No Human Interface	Acceptable	Acceptable
19	Informal	E	USBM	2632	1.3	Perceptible	Acceptable	Acceptable
21	Struct-7	N	USBM	2634	1.3	Perceptible	Acceptable	Acceptable
20	Struct-6	NW	USBM	2757	1.2	Perceptible	Acceptable	Acceptable
4	Struct-3	S	USBM	2880	1.1	Perceptible	Acceptable	Acceptable
22	Chicken2	W	USBM	3166	1.0	Perceptible	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.

7.3.7.2 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 7-9 shows the air blast predictions for minimum charge and the possible concern for human tolerances and structure response. Table 7-10 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 7-9: Expected air blast levels for minimum charge at the various private structures

No.	Structure	Direction from Mine Position	Distance (m)	Air blast (dB)	Possible Concern?
29	OHPowerline	N	233	127.6	N/A
13	Road	N	240	127.3	N/A
16	DamWall2	E	385	122.3	N/A
30	Prop.Chicken Broiler	N	539	118.8	Acceptable
12	DamWall1	W	643	117.0	N/A
5	Struct-4	E	824	114.4	Acceptable
1	Struct-1	W	1498	108.2	Acceptable
17	DamWall3	E	1613	107.4	N/A
27	Struct-8	NE	1632	107.3	Acceptable
15	R42Road	SE	1658	107.1	Acceptable
3	Chicken1	W	1769	106.4	Acceptable
2	Struct-2	W	1803	106.2	Acceptable
18	DamWall4	E	1900	105.7	N/A
11	Struct-5	E	2204	104.1	Acceptable
23	DamWall5	E	2294	103.7	N/A
19	Informal	E	2632	102.3	Acceptable
21	Struct-7	N	2634	102.3	Acceptable
20	Struct-6	NW	2757	101.8	Acceptable
4	Struct-3	S	2880	101.4	Acceptable
22	Chicken2	W	3166	100.4	Acceptable

Table 7-10: Expected air blast levels for maximum charge at the various private structures

No.	Structure	Direction from Mine Position	Distance (m)	Air blast (dB)	Possible Concern?
29	OHPowerline	N	233	134.5	N/A
13	Road	N	240	134.2	N/A
16	DamWall2	E	385	129.2	N/A
30	Prop.Chicken Broiler	N	539	125.7	Complaint / problematic
12	DamWall1	W	643	123.9	N/A
5	Struct-4	E	824	121.3	Complaint
1	Struct-1	W	1498	115.1	Acceptable
17	DamWall3	E	1613	114.3	N/A
27	Struct-8	NE	1632	114.2	Acceptable
15	R42Road	SE	1658	114.0	Acceptable
3	Chicken1	W	1769	113.3	Acceptable
2	Struct-2	W	1803	113.1	Acceptable
18	DamWall4	E	1900	112.6	N/A
11	Struct-5	E	2204	111.0	Acceptable
23	DamWall5	E	2294	110.6	N/A
19	Informal	E	2632	109.2	Acceptable
21	Struct-7	N	2634	109.2	Acceptable
20	Struct-6	NW	2757	108.7	Acceptable
4	Struct-3	S	2880	108.3	Acceptable
22	Chicken2	W	3166	107.3	Acceptable

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.

7.3.7.3 Air Blast and Ground Vibration Monitoring Results (2014)

Universal Coal appointed Blast Analysis Africa to undertaken vibration monitoring at the Kangala Coal Mine in November 2014. Three monitoring stations were set up on 02 October 2013 to monitor blast induced ground vibrations and air blast at certain buildings near the mine. The seismographs were placed at the following positions.

Table 7-11: Location of monitoring points

Station	Position	GPS Position	
1	Chicken Farm	S 26° 11’ 51.0’	E 28° 38’ 09.3”
2	Kangala Farmhouse	S 26° 12’ 07.9’	E 28° 40’ 35.9”
3	Residence of JF du Plessis	S 26° 10’ 02.0’	E 28° 39’ 31.0”

There are no standards for maximum acceptable levels for ground vibration or air-blast. The DMR however has accepted and applies the maximum recommended levels established by the United States Bureau of Mines (USBM).

Empirical work by the USBM has shown that the ability of ground vibrations to cause damage to buildings is proportional to the Peak Particle Velocity (PPV) of that shock wave and inversely proportional to the frequency. Thus, a ground vibration with a high PPV and a low frequency is most likely to create damage. The maximum allowable ground vibration amplitudes are frequency-dependent with higher frequencies allowing higher peak amplitudes. In general, at lower frequencies, the ground vibration should not exceed 12.7 mm/s, but at higher frequencies, the limit can increase to 50 mm/s. Generally, the ground vibration should not be allowed to exceed 12.7 mm/s at any building to limit the risk of cosmetic or any more serious damage.

Based on work carried out by Siskind (1980), monitored air blast amplitudes up to 135 dB are safe, provided the monitoring instrument is sensitive to low frequencies (down to 1 Hz). Persson (1994) has published the following estimates of damage thresholds based on empirical data.

- 120 dB - Threshold of pain for continuous sound;
- >130 dB - Resonant response of large surfaces (roofs, ceilings). Complaints start;
- 134 db - USBM recommended limit for human irritation;
- 150 dB - Some windows break;
- 170 dB - Most windows break; and
- 180 dB - Structural Damage.

Table 7-12 provides the monitoring results. NT indicates that the seismograph was not triggered by this blast. As can be seen from the results, no blasting events exceeded the USBM maximum recommended levels for ground vibrations or air blast on these seismographs for this monitoring period.

Table 7-12: Monitoring results (2014)

Date	Time	Station 1 Chicken Farm			Station 2 Kangala Farm			Station 3 Du Plessis			Station 4 Roos		
		Event No	mm/s	dB	Event No	mm/s	dB	Event No	mm/s	dB	Event No	mm/s	dB
03/11/14	14:53	N/T			424	1.20	128	N/T			N/T		
04/11/14	12:10	N/T			425	1.33	123	N/T			N/T		
07/11/14	16:36	N/T			427	0.90	130	N/T			N/T		
13/11/14	13:47	N/T			454	1.16	127	N/T			N/T		
18/11/14	16:58	N/T			457	0.65	131	N/T			N/T		
19/11/14	15:32	N/T			458	0.68	127	N/T			N/T		
20/11/14	15:33	N/T			497	1.37	129	N/T			N/T		
25/11/14	18:45	N/T			505	1.02	132	N/T			136	0.31	126
28/11/14	17:23	N/T			524	0.55	128	N/T			138	0.31	125

7.3.7.4 Construction and operational phase

Activity 11: Drilling and blasting of hard overburden

Blasting will contribute to the dust fall out and noise on site. In the event of worst case scenario air blasting and ground vibration could have a potential impact on surrounding structures. Due to human perception it may result in complaints. It has the potential to become problematic and therefore seen to be of high significance, as indicated in the section above.

7.3.8 Biodiversity

7.3.8.1 Construction phase

Activity 2: Transport of construction material

This activity will be associated with all heavy duty transport of materials and general operating of vehicles. It is likely that the increase in vehicle use will cause further damage (deterioration) to the informal roads which will result in further exposure of non-vegetated areas increasing the potential for erosion and sedimentation during rainfall periods. The increase in vehicle numbers will also increase the potential of spillages and leaks from operating vehicles which will have a negative impact on vegetation growth and even rehabilitation. Dust created during activity could have a detrimental effect on plant evapotranspiration. This activity is considered to be ongoing through the life of mine and long term in duration and also site specific with regards to extent of impacts. The severity of the impact was determined to be minor.

Activity 3: Storage of fuel, lubricant and explosives

The storage of fuel, lubricant and explosives will be required for the life of mine. Incorrect, inadequate or negligent storage and handling of these materials may result in the potential pollution of surface water and top soil resources due to pollutant and toxicant spillages and leaks which may impact negatively on the water (drinking) and soil quality (plant growth) availability to plants and subsequently animals. Such spills will also negatively affect the ecological functioning of the systems. This activity is considered to be medium in duration as it will be required for the life of mine. The impact will be local in extent. The severity of the impact was determined to have moderate effects.

Activity 4: Site clearing and topsoil removal

The existing vegetation within the area of development will be impacted on as the existing vegetation will be removed to facilitate the construction of mining related infrastructure. This will include the continuous and complete removal of vegetation and soil as the opencast pit is excavated. This activity is considered to be medium term during life of mine as it will be required for the construction and operating phases of the mine. The impact will be site specific in extent with impacts likely to occur on site. The severity of the impact was determined to be medium.

The partial degradation of natural vegetation and habitat for animal life has already taken place within the surrounding environment due to current land use practices. The destruction of the areas with undisturbed natural grassland will result in the permanent reduction of natural habitat of reptiles, birds, frogs, insects and mammals present within the areas. The grassland and surrounding vegetation offers habitat to certain birds, reptiles, frogs, insects and mammals that could be present. The impact will be site specific in extent with impacts likely to occur on site. The severity of the impact was determined to be moderate.

Activity 5: Construction of surface infrastructure

The construction of the discard dump, pollution control dam, workshops/offices, sewage treatment facility and other infrastructure will increase the favourable habitat for alien invasive plant species to establish themselves, primarily due to open/cleared ground being available to the very efficient establishment strategies of alien invasive plant species. The new workshop and proposed laundry is located adjacent to the existing workshop and offices to reduce the footprint impacted on by surface infrastructure. The new conveyor and weighbridge are also located within the disturbed footprint of the plant area and access road respectively. The area designated for surface infrastructure will no longer allow for seepage of surface water into underground aquifers due to the hardening of surfaces. The infiltration will increase the surface water runoff, which in turn will increase erosion that will lead to loss of topsoil, which is detrimental to plant species. This activity is considered to be short term in duration as well as local in extent. The severity of the impact was determined to be minor.

Activity 6: Establishment of initial boxcut and access ramps

The establishment of the mining area by means of an initial boxcut will remove soil and vegetation. There will be a reduction in availability of soil for plant establishment, which will bring about a net loss of vegetation. This activity is considered to be long term in duration as it will be required for the life of mine. The impact will be site specific in extent with impacts likely to occur on site. The severity of the impact was determined to be medium.

7.3.8.2 Operational phase

Activity 10: Topsoil and overburden removal and stockpiling

The removal of topsoil and overburden will result in stockpiling of the material which will increase the potential of the stockpiles becoming eroded as a result of winds and rain moving across the areas. As the only vegetation present on the actual footprint is maize fields, the removal of these plants will negatively affect soil binding, and surface runoff. This activity is considered to be medium in duration as it will be required for the construction and operational phases. The impact will be site specific in extent with impacts likely to on site. The severity of the impact was determined to be low.

The re-positioning of the overburden and topsoil stockpiles is not likely to have an additional impact to that described above.

Activity 13: Vehicular activity on haul roads and conveying of coal

The vehicular activity and use of conveyor will result in the creation of soil based and coal dust which will increase the deposits these materials on plant leaves, blocking stomata and inhibiting evapotranspiration. Natural dust will be created from use of the haul road and coal dust will be created during transport by haul trucks. This will impact on the vegetation health and availability as food items as well as inhibit the ability of the plants units to provide ecological services. This activity is considered to be medium in duration as it will be required for the operational phase. The impact will be site specific in extent with impacts likely to occur on site. The severity of the impact was determined to be minor.

Activity 19: Concurrent replacement of overburden and topsoil and re-vegetation

This may be considered to be a positive impact if implemented properly. The replacement of overburden and topsoil throughout the operational phase may result in the reduction of available space for alien invasive species, soil erosion and soil compaction, associated with top soil storage areas. This activity will create favourable habitat for indigenous plant species, and promote rehabilitation efforts. This activity is considered to be medium in duration as it will be required for the operational phase as well as the decommissioning phase. The extent will be site specific with effects being on site. The severity of the impact was determined to be moderate.

7.3.8.3 Decommissioning phase

Activity 21: Demolition of infrastructure

The demolition and removal of infrastructure may result in impacts to vegetation, as large machinery is needed for removal of infrastructure. Of concern here is the destruction of vegetation, creation of favourable habitat for fast growing invasives and ground compaction. Also of concern are the possible spillages from infrastructure holding hazardous material. These spillages and leaks may be considered for infrastructure such as sewerage and waste facilities, toxicant, pollutant and fuel storage infrastructure and general vehicle use. In the event that this infrastructure is not demolished properly and with caution, resulting spillages and leaks would impact on vegetation and soil quality. The demolition of infrastructure may require vehicles making use of non-designated areas, special care must be taken not to destroy rehabilitated areas. This activity is considered to be short in duration as well as site specific in extent with impacts being on site. The severity of the impact was determined to be minor.

Activity 22: Final replacement of overburden and topsoil and revegetation

This may be considered to be a positive impact if implemented properly. The replacement of overburden and topsoil throughout the life of mine as well as the final replacement during the decommissioning phase may result in the restoration of the natural vegetation. This activity is considered to be medium in duration as it will be required for the decommissioning phase. The extent will be site specific with effects being on site. The severity of the impact was determined to be moderate

7.3.9 Archaeology and cultural heritage sites

7.3.9.1 Construction phase

The construction phase consists of activities performed in preparation of mining such as site clearing, top soil removal, construction of infrastructure, and transportation of construction material and the establishment of an initial boxcut and access ramps. Construction activities will therefore include the total destruction of the land surfaces in these footprint areas. Archaeological and heritage sites located in the directly affected areas will subsequently be impacted. The location of significant archaeological and heritage sites is illustrated on Plan 19. According to the archaeological field survey, the following sites will be directly affected by the construction phase:

1. Site one: Cemetery

The cemetery is situated to the southeast of the mining application area and is not expected to be impacted on by the mining activities. If at any stage the mining application area is extended and the cemetery is included in the application area, the cemetery needs to be fenced and a buffer zone of 20 m must be left around the site and adequate access must be provided for the family to visit the graves .

2. Site two: Historical Structures

According to the current mine plan, these structures will be impacted by mining activities. The ages of these structures have not been confirmed; if it is older than 60 years a permit would be required from SAHRA. It is recommended that the site be evaluated by a conservation architect before construction commence to provide further recommendations on the mitigation necessary on the site.

3. Site three: Cemetery

This cemetery is not expected to be impacted by mining activities, as this site is located outside the boundary of the project area. If at any stage the mining application area is extended and the cemetery is included in the application area, the cemetery needs to be fenced and a buffer zone of 20 m be left around the site and adequate access must be provided for the family to visit the graves. In the event that the mining will impact directly on the graves and the need arise for the relocation of the cemetery a full grave relocation process must be followed.

4. Site four: Cemetery

This cemetery is not expected to be impacted by mining activities, as this site is located outside the boundary of the project area. Due to its geographical proximity to the project; however, the cemetery needs to be fenced and a buffer zone of 20 m be left around the site and adequate access must be provided for the family to visit the graves. In the event that the mining will impact directly on the graves and the need arise for the relocation of the cemetery a full grave relocation process must be followed.

7.3.9.2 Operational phase

The operational phase implies the commencement of mining activities. All related project operations, including coal beneficiation, waste generation and disposal, as well as concurrent rehabilitation forms part of this phase. Once the mining project is up and running, the urgency to identify, document and assess archaeological and heritage resources in the opencast area declines, conditional to the effective identification and documentation of significant sites during the previous phase. No additional impacts on sites of archaeological and heritage significance are expected during the operational phase if the mitigation and management measures outlined in the AIA report have been effective implemented in the pre-development and construction phases.

7.3.9.3 Decommissioning phase

During the decommissioning and closure phase of the project, no new surface areas are expected to be disturbed and/or impacted. No additional sites of archaeological and heritage significance are therefore expected to be impacted during decommissioning. The majority of sites of archaeological and heritage significance (cultural and natural) will have been recorded, assessed and mitigated or conserved in preceding phases and should subsequently be protected from any additional impacts from decommissioning and closure activities.

7.3.10 Wetland areas

7.3.10.1 Construction phase

Activity 2: Transport of construction material

This activity will be associated with increased traffic of heavy duty transport and operating vehicles. It is likely that the increase in vehicle use will cause further damage (deterioration) to the informal roads which will result in further exposure of non-vegetated areas increasing the potential for erosion and sedimentation during rainfall periods. The increase in vehicle numbers will also increase the potential of spillages and leaks from operating vehicles into the wetland systems which would impact on water quality. This activity is considered to be short in duration as well as local in extent with impacts being transported downstream away from the site by the wetlands. The severity of the impact was determined to be minor.

Activity 3: Storage of fuel, lubricant and explosives

The storage of fuel, lubricant and explosives will be required for the life of mine. Incorrect, inadequate or negligent storage of these materials may result in the potential pollution of surface water resources due to pollutant and toxicant spillages and leaks which may impact negatively the water quality and ecological functioning of the systems. This activity is considered to be medium in duration as it will be required for the life of mine. The impact will be local in extent with impacts being transported downstream away from the site by the wetlands. The severity of the impact was determined to have moderate effects.

Activity 4: Site clearing and topsoil removal

The clearing and removal of topsoil will result in the removal of vegetated areas causing open areas to become exposed. This will increase the potential load of sedimentation of the water resources due to erosion of the exposed areas and topsoil stockpiles during periods of high rainfall. These exposed areas will also become eroded as a result of high winds moving across the areas. The removal of the topsoil and vegetation reduces the potential for recharge of shallow aquifers that feed hillslope wetlands, which in turn reduces the flow in water resources. This activity is considered to be medium in duration as it will be required for the construction and operating phases of the mine. The impact will be local in extent with impacts likely to occur further downstream away from the site. The severity of the impact was determined to be severe.

Activity 5: Construction of surface infrastructure

The area designated for surface infrastructure will no longer allow for seepage of surface water into underground aquifers due to the hardening of surfaces. The reduction in the seepage potential of the catchment will result in a decrease in surface water quantity reporting to the downstream system. The reduction in water quantity will in turn result in a loss of wetland areas due to these areas being “starved” of water, as well as wetland areas being reduced and ecological functioning inhibited. Hardening of surfaces will increase the velocity of runoff which will increase the potential for erosion of exposed open areas. This activity is considered to be short in duration as well as local in extent with impacts being transported downstream away from the site by the wetlands. The severity of the impact was determined to be minor.

Activity 6: Establishment of initial boxcut and access ramps

The establishment of the mining area by means of an initial boxcut will dewater surrounding aquifers. There will be a reduction on surface water quantity due to reduction in catchments size. Some wetlands within the study area are linked to perched aquifers which provide a water source through lateral seepage and interflow. The potential loss of these aquifers will in turn result in a loss of certain wetland areas. This activity is considered to be medium in duration as it will be required for the life of mine. The impact will be local in extent with impacts likely to occur further downstream away from the site. The severity of the impact was determined to be very severe.

Activity 7: Temporary waste and sewerage handling and treatment

The temporary storage of waste and sewerage as well as the handling and treatment may potentially impact on the quality of water through spillages and leaks in the event of this activity not being conducted correctly or with negligence. This activity will be ongoing throughout the life of mine and spillages and leaks of waste and sewerage will also impact on ecological functioning of wetland units affecting not only water quality enhancement services but also biodiversity maintenance of the systems. This activity is considered to be medium in duration as it will be required for the life of mine. The extent will be local with impacts being transported downstream away from the site by the wetlands. The severity of the impact was determined to have moderate effects.

7.3.10.2 *Operational phase*

Activity 9: Workshop activity and storage of fuel, lubricant and explosives

Similarly to what was described for Activity 3, the storage of fuel, lubricant and explosives will be required for the life of mine. Incorrect, inadequate or negligent storage and handling of these materials may result in the potential pollution of surface water resources due to pollutant and toxicant spillages and leaks which may impact negatively the water quality and ecological functioning of the systems. This activity is considered to be medium in duration as it will be required for the life of mine. The impact will be local in extent with impacts being transported downstream away from the site by the wetlands. The severity of the impact was determined to have moderate effects.

The new contractor workshop and storage area is not likely to have an additional impact on the wetland feature from that described above.

Activity 10: Topsoil and overburden removal and stockpiling

Similarly to Activity 4, the removal of topsoil and overburden as well as stockpiling will increase the potential load of sedimentation of the water resources due to erosion of the stockpiles during periods of high rainfall. These stockpiles will also become eroded as a result of rain and high winds moving across the areas. The increased sediment load of wetland areas inhibits these systems to provide ecological services such as water quality enhancement. The removal of the topsoil and vegetation reduces the potential for recharge of shallow aquifers that feed hillslope wetlands, which in turn reduces the flow in water resources. This activity is considered to be medium in duration as it will be required for the construction and operational phases. The impact will be local in extent with impacts likely to occur further downstream away from the site. The severity of the impact was determined to be severe.

The re-positioning of the overburden and topsoil stockpiles is not likely to have an additional impact to that described above as the 100 m buffer at the pan has been maintained on site.

Activity 12: Coal removal and stockpiling

The removal and stockpiling of coal (ROM and product stockpiles) will result in the generation of coal dust which will increase the potential for siltation of the wetland areas. This will impact on the quality of water available in the wetland units as well as inhibit the ability of the wetland units to provide key ecological services. There will be a reduction on surface water quantity due to reduction in catchments size. This activity is considered to be medium in duration as it will be required for the operational phase. The impact will be local in extent with impacts likely to occur further downstream away from the site. The severity of the impact was determined to be very severe.

Activity 13: Vehicular activity on haul roads and conveying of coal

The vehicular activity and conveying of coal will result in the creation of soil as well as coal dust which will increase the potential of excessive siltation of the wetland areas. Natural dust will be created from use of the haul road and coal dust will be created during transport by haul trucks. This will impact on the quality of water available in the wetland units as well as inhibit the ability of the wetland units to provide key ecological services. This activity is considered to be medium in duration as it will be required for the operational phase. The impact will be local in extent with impacts likely to occur further downstream away from the site. The severity of the impact was determined to be minor.

Activity 14: Water use around site

The use of water to mitigate mining related impacts as well as for mine operation may result in underground aquifers and/or opencast areas being pumped to make water available for use. In the event of an aquifer being pumped, this may decrease the lateral seepage potential of the area resulting in a reduction of wetland size and potentially wetland loss. Additionally, the use of dirty water from opencast areas may impact on the quality of water within the wetland systems if the dirty water is exposed to these systems. This in turn will inhibit the ability of these wetland units to provide beneficial ecological services. A clean water storage dam has been established to store clean water for use on and around the mine site.

This activity is considered to be medium in duration as it will be required for the operational and decommissioning phases. The impact will be local in extent with impacts likely to occur further downstream away from the site. The severity of the impact was determined to have moderate effects.

Activity 15: Screening and washing

Ineffective management and poor maintenance of the screening and washing plant and process may result in leaks as well as spillages from this infrastructure. The dirty water from the screening and washing process which makes its way to the wetland areas will impact on the quality of water of the systems which will have a greater impact on downstream water users. This activity is considered to be medium in duration as it will be required for the operational phase. The impact will be local in extent with impacts likely to occur further downstream away from the site. The severity of the impact was determined to have moderate effects.

Activity 16: Discard dump

Seepage from the discard dump into the underground aquifers may impact on the quality of water of these aquifers which in turn provide seepage to wetland areas. In spite of this seepage process providing some water quality enhancement ability, the seepage of impacted water quality from the discard dump may impact on wetland functioning as the quality of the impacted water may not be completely restored by the seepage process.

It is proposed to extend the discard dump from the current approved footprint of 16.5 ha to a final discard footprint of 20.6 ha. The proposed extension will be to the south of the existing discard dump and located away from the non-perennial pan.

This activity is considered to be medium in duration as it will be required for the operational phase. The impact will be local in extent with impacts likely to occur further downstream away from the site. The severity of the impact was determined to have moderate effects.

Activity 17: Pollution control dams

Ineffective management and poor maintenance of the pollution control dams may result in leaks as well as spillages from this infrastructure. The dirty water which makes its way to the wetland areas will impact on the quality of water of the systems which will have a greater impact on downstream water users. This activity is considered to be medium in duration as it will be required for the operational phase. The impact will be local in extent with impacts likely to occur further downstream away from the site. The severity of the impact was determined to have moderate effects.

Activity 18: Waste and sewerage generation and disposal

Similarly to Activity 7, generation of waste and sewerage as well as the disposal may potentially impact on the quality of water through spillages and leaks in the event of this activity not being conducted correctly or with negligence. This activity will be ongoing throughout the life of mine and spillages and leaks of waste and sewerage will also impact on ecological functioning of wetland units affecting not only water quality enhancement services but also biodiversity maintenance of the systems. This activity is considered to be medium in duration as it will be required for the life of mine. The extent will be local with impacts being transported downstream away from the site by the wetlands. The severity of the impact was determined to have moderate effects.

Activity 19: Concurrent replacement of overburden and topsoil and revegetation

This may be considered to be a positive impact if implemented properly. The replacement of overburden and topsoil throughout the construction phase may result in the reduction of the catchment size being limited so that the footprint of the disturbed area is kept to a minimum. This will also allow for the seepage areas to be restored to maintain sub-surface flow dynamics and restore ecological functioning. Sedimentation of the water resources due to erosion of the rehabilitated areas will be limited through the revegetation of the area. This activity will assist by limiting the reduction in recharge of shallow aquifers that feed hillslope wetlands. This activity is considered to be medium in duration as it will be required for the operational phase as well as the decommissioning phase. The extent will be local with effects being noted further downstream away from the site. The severity of the impact was determined to be positive and severe.

7.3.10.3 Decommissioning phase

Activity 21: Demolition of infrastructure

The demolition and removal of infrastructure may result in impacts to water quality through spillages and leaks, this may occur particularly through the decommissioning and removal of the workshop and storage areas as well as components of the overland conveyor belt. These spillages and leaks may be considered for infrastructure such as sewerage and waste facilities, toxicant, pollutant and fuel storage infrastructure and general vehicle use. In the event that this infrastructure is not demolished properly and with caution, resulting spillages and leaks would impact on water quality and functioning of wetland units. The demolition of infrastructure may require vehicles making use of non-designated areas such as wetlands which will modify the health and functioning of these impacted systems. This activity is considered to be short in duration as well as local in extent with impacts being transported downstream away from the site by the wetlands. The severity of the impact was determined to be minor.

Activity 22: Final replacement of overburden and topsoil and revegetation

Similarly to Activity 19, this may be considered to be a positive impact if implemented properly. The replacement of overburden and topsoil throughout the life of mine as well as the final replacement during the decommissioning phase may result in the restoration of the catchment size prior to being impacted on. This will restore the lost seepage areas and maintain sub-surface flow dynamics and restore ecological functioning. Sedimentation of the water resources due to erosion of the rehabilitated areas will be limited through the revegetation of the area. This activity is considered to be medium in duration as it will be required for the decommissioning phase. The extent will be local with effects being noted further downstream away from the site. The severity of the impact was determined to be positive and severe.

7.3.11 Visual aspects

7.3.11.1 Construction phase

Activity 2: Transport of construction material

The transport of the material to the site for construction will require the use of trucks. These trucks will be utilising public transport routes and smaller farm roads. The result of this increased transportation will directly affect the visual impact caused by the mine. This impact is envisaged to be moderate as the trucks will travel close to the town of Delmas as well as pass homesteads on their way to the mine site. The visual disturbance cause by the trucks will exist for the life of the mine.

Activity 4: Site clearing and topsoil removal

This activity will cause a visual impact to surrounding receptors as the project site is cleared of vegetation and top soil. The project site will become noticeable as it will be in stark contrast to surrounding areas. This will be a severe visual impact to receptors located in close proximity to the mine site.

Activity 5: Construction of surface infrastructure

Visual impacts are envisaged to surrounding receptors as the agricultural land-use is transformed to that of mining. Once the infrastructure is established and lighting installed there will be light pollution in the evenings. The visual impact caused by the infrastructure is envisaged to be moderate and will occur for the life of mine. The new infrastructure such as the contractor workshop, proposed laundry, weighbridge and overland conveyor belt will not have a significant visual impact as the mine is currently operational.

Activity 6: Establishment of initial boxcut and access ramps

The boxcut is in stark contrast to the surrounding agricultural landscape and as a result will cause a visual impact. The visual impact caused by the boxcut and opencast mining is envisaged to be severe and will occur until the opencast has been filled and rehabilitated.

7.3.11.2 Operational phase

Activity 10: Topsoil and overburden removal and stockpiling & Activity 16: Discard dumps

Overburden stockpiles and discard dumps are expected to be approximately 30m in height, and will contribute the most severe visual disturbance to surrounding receptors. This visual disturbance will exist for the life of the mine. The re-positioning of the overburden and topsoil stockpiles along the south-western boundary of the project site will have a higher visual impact.

7.3.11.3 *Decommissioning phase*

Activity 21: Demolition of infrastructure

Initially the visual impact will be severe as there is increased transportation of removed infrastructure and machinery. The act of demolition will cause dust clouds which will further the visual impact to surrounding receptors. Once the demolition ceases the visual disturbance created by the mine will decrease as the removed infrastructure will no longer cause an impact and so to the light pollution in the evening will be removed.

Activity 22: Final replacement of overburden and topsoil and revegetation

This activity will decrease the amount of visual disturbance created by the mine. The visual disturbance will be lessened further once the vegetation on the site has been rehabilitated.

7.3.12 Traffic

7.3.12.1 Construction phase

Activity 2: Transport of construction material.

During the construction phase construction material and equipment will be transported to site. This will not increase traffic significantly, however there will be the transport of large equipment which may create a burden to other road users. There will be increase vehicle movement on site during the construction phase which will increase both noise and dust levels.

7.3.12.2 Operational phase

Activity 13: Vehicular activity on haul roads

During the operational phase it is estimated that 70 trucks will be leaving the mine per day. This will significantly increase the traffic on the roads and add stress to an already deteriorating road network. This significant increase in traffic will pose further risk to other road users. Increased vehicular movement on site will further increase both noise and dust.

7.3.12.3 Decommissioning phase

Activity 21: Demolition of infrastructure

During the demolition of infrastructure, materials and equipment will either be transported off site for disposal or will be sold and transported to its new destination. Traffic on the surrounding roads will decrease from the operational phase, however large loads will still be leaving the site. The vehicular movement occurring on site will also have reduced from the operational phase but it will still be mildly contributing to noise and dusts levels.

7.3.13 Socio-economic

7.3.13.1 Construction and operational phase

Activity 1 & 8: Recruitment, procurement and employment

The development of Kangala Coal Mine will provide employment opportunities to the local area. It will also provide contract opportunities for required services, such as the transport of coal. The development of mine will contribute to further skills development of the local workers, the opportunity for small business opportunities. As employment in the area increases so will regional spending. Kangala Coal mine will also contribute toward the national treasury.

7.3.13.2 *Decommissioning phase*

Activity 20: Retrenchment

Retrenchment will occur during the decommissioning phase. Employees will have obtained new skills during the operation of the mine which will be of benefit for seeking further development. There will, however, be a loss of employment which will require management.

8 Alternative land uses which will be impacted upon (REGULATION 50 (D))

8.1.1 Impacts on current 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. 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 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.

The project will result in a temporary loss of agricultural land and reduction in land capability as after mine closure and rehabilitation of mined areas, the land capability may be return to a lower state of land capability than pre-mining.

Prior to mining, no major infrastructure was required to be re-located such as powerlines, pipelines, buildings or roads thus no major services have been impacted. The potential impacts that can occur to surrounding land-uses (i.e. farms) from the mine are those relating to nuisance impacts such as air, noise, blasting and vibration impacts as well as traffic and visual disturbances. These are irregular impacts.

8.1.2 Assessment of duration of impacts

The mining activities will occur over a 10 year period. The post mining activities include rehabilitation of the affected area.

8.1.3 Assessment of severity

Various specialist investigations have assessed and quantified the potential impacts of the mining activities. The severity during the construction, operational and decommissioning phases on the current land use is discussed in Section 7.

9 Sustainable Development

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

9.1 Sustainability overview

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.

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. As integrated part of the environmental and social studies completed for the project, the sustainability chapter was compiled to evaluate the three key aspects of sustainable development, which include environmental integrity, social justice and economic efficiency. The ultimate aim of sustainable development for the Kangala Coal Mine is to promote the sustainable use of resources in the area

9.2 Discussion

General land use surrounding the Kangala Coal Mine project area includes a variety of agricultural activities. The project area (Portions 1 and 2 of Wolvenfontein) are currently used for maize and dry bean farming. Maize, beans and soya are common crops farmed in the surrounding area. Additional agricultural activities in the region include chickens, cattle, citrus, instant lawns and table grapes. In addition to the existing land uses and agricultural activities described in the Sustainability Chapter for the Kangala Mine, the assessment of potential impacts on social, economic and environmental resources are considered. Resources such as soil, water and air are the bare essential resources on which the agricultural industry dependents. Increased impacts on these elements may therefore have a secondary negative impact on the aforementioned agricultural industry. 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.

Sustainable agriculture refers to the ability to produce fertile soil for crops and livestock without causing severe or irreversible damage to ecosystem health. The agricultural industry in the Delmas area is considered to be sustainable due to its high agricultural potential and its ability to reap and sow on a continuous and long term basis. The confirmation of a regional 'sustainable' agricultural industry is confirmed by local farming initiatives such as Middelbult, Wolvenfontein and regional production by the Rossouw Group. The sustainability of the agricultural industry in the Delmas area is; however, 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.

A sustainable balance between social justice, environmental integrity and economic efficiency can only be attained if the recommendations outlined in the EIA/EMP are effectively implemented and monitored through the integration of agricultural concerns and needs, and responsible management 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.

9.3 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.

9.4 Recommendations

Through an integrated high-cost/low-impact approach, the mining industry may be able to provide support to the existing agricultural industry. Support from the mining industry may be provided through 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 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

10 Mitigation measures (REGULATION 50 (e))

10.1 List of all significant impacts as identified in the EIA

The following are the most significant impacts that have been determined by the above methodology for each phase. The complete impact matrix is attached in Appendix M.

Significance = Consequence x Probability

Where **Consequence** = Severity + Spatial Scale + Duration

And **Probability** = Likelihood of an impact occurring

Table 10-1: Construction phase

Activity, Phase and Impact					Impact Rating (before mitigation)								Impact Rating (after mitigation)						
Impacted Environment	Phase impact occurs (C, O, D, PC)	Activity No.	Activity	Summary of Impact	Reference in EIA	Nature of Impact (positive / Negative	Extent (5)	Duration (5)	Severity (5)	Probability (5)	Consequence (15)	Significance (75)	Nature of Impact (positive / Negative	Extent	Duration	Severity	Probability	Consequence	Significance (75)
Biophysical Impacts																			
Geology	C,O	6	Establishment of initial boxcut and access ramps	Rock and overburden will be removed, permanantly altering the geology	7.3	N	1	5	3	5	9	45	N	1	5	3	5	9	45
Topography	C,O,D, PC	4 & 6	Site clearing and topsoil removal and establishment of initial boxcut and access ramps	The natural lie of the land will be altered. This alteration of the land will have further impacts on surface water flow dynamics as the natural drainage pattern is disrupted.	7.2/ 11.3.1	N	1	3	4	5	8	40	N	1	3	3	5	7	35
Soil	C	2	Transport of construction material	Compaction of soil	7.4/ 11.3.2	N	3	1	4	5	8	40	N	3	1	3	5	7	35
	C,O	4&5	Site clearing and topsoil removal and construction of infrastructure.	Compaction of soil, erosion of exposed areas and decrease in available land for agricultural practices.		N	2	4	5	5	11	55	N	1	4	4	5	9	45
	C	6	Establishment of initial boxcut and access ramps	Compaction of areas surrounding box cut. Loss of arable soil.		N	1	4	4	5	9	45	N	1	4	4	5	9	45
Surface water	C	5 & 6	Construction of surface infrastructure and establishment of initial box cut and access ramps	Reduction in base flow and in catchment area size and a change in flow dynamics		N	3	4	4	4	11	44	N	3	4	3	4	10	40

Activity, Phase and Impact					Impact Rating (before mitigation)								Impact Rating (after mitigation)						
Impacted Environment	Phase impact occurs (C, O, D, PC)	Activity No.	Activity	Summary of Impact	Reference in EIA	Nature of Impact (positive / Negative	Extent (5)	Duration (5)	Severity (5)	Probability (5)	Consequence (15)	Significance (75)	Nature of Impact (positive / Negative	Extent	Duration	Severity	Probability	Consequence	Significance (75)
Air Quality	C,O	4,5 & 6	Site clearing and topsoil removal ,construction of infrastructure, establishment of box cut	Increased vehicle movement on site and the clearing of topsoil to expose subsoil's will increase the dust fallout on site and the PM10 levels	7.7/ 11.3.5	N	2	3	3	5	8	40	N	1	3	2	4	6	24
Wetlands	C,O	4 & 6	Site clearing and topsoil removal and establishment of initial boxcut and access ramps	Increase the potential load of sedimentation of the water resources. Erosion of exposed surfaces. The removal of the topsoil and vegetation reduces the potential for recharge of shallow aquifers that feed hillslope wetlands, which in turn reduces the flow in water resources. Possible dewatering of aquifers and loss of perched aquifer and interflow between certain wetland areas.	7.12/ 11.3.10	N	2	4	5	5	11	55	N	2	4	5	4	11	44
Social Impacts																			
Visual	C,O,D	4 & 6	Site clearing and topsoil removal and establishment of initial boxcut and access ramps	The project site will become noticeable as it will be in stark contrast to surrounding areas	7.13/ 11.3.11	N	2	3	3	5	8	40	N	2	3	2	5	7	35
	C,O,D	5	Construction of surface infrastructure	Agricultural land-use is transformed to that of mining. Once the infrastructure is established and lighting installed there will be light pollution in the evenings		N	3	3	3	5	9	45	N	2	3	2	5	7	35
Traffic	C,O	2	Transport of construction material	Increase of vehicular activity on site and the traffic to the site	7.13/ 11.3.11	N	3	2	3	5	8	40	N	3	2	2	4	7	28

DIGBY WELLS ENVIRONMENTAL

Table 10-2: Operational phase

Activity, Phase and Impact					Impact Rating (before mitigation)								Impact Rating (after mitigation)						
Impacted Environment	Phase impact occurs (C, O, D, PC)	Activity No.	Activity	Summary of Impact	Reference in EIA	(positive / Negative	Extent (5)	Duration (5)	Severity (5)	Probability (5)	Consequence (15)	Significance (75)	(positive / Negative	Extent	Duration	Severity	Probability	Consequence	Significance (75)
Biophysical Impacts																			
Geology	O	12	Coal removal and stockpiling	The coal will be removed, permanently altering the geology	7.3	N	1	5	3	5	9	45	N	1	5	3	5	9	45
Topography	O,D	10	Topsoil and overburden removal and stockpiling	The natural lie of the land will be altered. This alteration of the land will have further impacts on surface water flow dynamics as the natural drainage pattern is disrupted. Alteration of slope direction and slope percentages, thus creating the potential for erosion.	7.2/ 11.3.1	N	2	3	4	5	9	45	N	2	3	4	5	9	45
	O,D	16	Discard dump	Altering slope direction and percentages, thus creating the potential for erosion. Possibility of the siltation of drainage networks.		N	1	3	4	5	8	40	N	1	3	3	5	7	35
Soil	O	10	Topsoil and overburden removal and stockpiling	Compaction of soil, erosion of exposed areas and decrease in available land for agricultural practices. Natural soil horizons are destroyed.	7.4/ 11.3.2	N	1	3	5	5	9	45	P	1	3	4	5	8	40
	O,D	13	Vehicular activity on haul roads and conveying of coal	Compaction of soil, erosion of exposed areas and soil contamination.		N	1	3	4	5	8	40	P	1	3	3	5	7	35

Activity, Phase and Impact					Impact Rating (before mitigation)								Impact Rating (after mitigation)						
Impacted Environment	Phase impact occurs (C, O, D, PC)	Activity No.	Activity	Summary of Impact	Reference in EIA	(positive / Negative	Extent (5)	Duration (5)	Severity (5)	Probability (5)	Consequence (15)	Significance (75)	(positive / Negative	Extent	Duration	Severity	Probability	Consequence	Significance (75)
Surface Water	O	10	Topsoil and overburden removal and stockpiling	Long term stockpiling of overburden resulting in prolonged exposure may result in the potential of Acid Mine Drainage concurring. As rehabilitation is undertaken it will alter the flow dynamics of the area and exposed soil will become susceptible to soil erosion which could result in siltation of surface water bodies		N	3	4	5	4	12	48	P	2	3	4	3	9	27
	O,D,PC	16	Discard dump	Potential contamination of surface water from seepage and runoff from the discard dump		N	3	5	5	4	13	52	P	2	3	4	4	9	36
	O, D, PC	17	Pollution control dams	Possible contamination of surface water due to leakages or spillages from pollution control dams		N	3	4	4	4	11	44	P	2	4	3	3	9	27
Groundwater	C,O& D	9	Workshop activity and storage of fuel, lubricant and explosives	Possible contamination of groundwater through incorrect storage of, fuel and lubricants as well as through potential spillages	7.6/11.3.4	N	2	3	3	5	8	40	N	1	3	2	4	6	24
	O	12	Coal removal and stockpiling	Impact on groundwater quality		N	2	5	5	5	12	60	N	2	5	5	5	12	60

Activity, Phase and Impact					Impact Rating (before mitigation)								Impact Rating (after mitigation)						
Impacted Environment	**Phase impact occurs (C, O, D, PC)**	**Activity No.**	**Activity**	**Summary of Impact**	**Reference in EIA**	**(positive / Negative**	**Extent (5)**	**Duration (5)**	**Severity (5)**	**Probability (5)**	**Consequence (15)**	**Significance (75)**	**(positive / Negative**	**Extent**	**Duration**	**Severity**	**Probability**	**Consequence**	**Significance (75)**
	O &D	16	Discard dumps	Contaminated water from infiltrating to aquifers		N	2	4	5	5	11	55	N	1	5	3	4	9	36
	C, O & D	18	Waste and sewage generation and disposal	Groundwater contamination through spillages and inadequate waste handling		N	2	3	3	5	8	40	N	1	3	2	4	6	24
Air Quality	O,D,PC	10, 11 & 19	Topsoil and overburden removal and stockpiling, drilling and blasting and discard dump	The movement and placing of soil will contribute to dust levels. Exposed soil will also contribute to dust levels. Blasting activities will contribute to dust levels. The coal discard dump will result in windblown coal dust	7.7/ 11.3.5	N	2	4	3	5	9	45	N	2	4	2	3	8	24
	O	11	Drilling and blasting of hard overburden	The blasting activities are expected to impact on the ambient noise levels of the area. The blasting and drilling activities will be the highest noise producing source during the operational phase.		N	3	3	4	5	10	50	P	3	3	2	5	8	40

Activity, Phase and Impact					Impact Rating (before mitigation)								Impact Rating (after mitigation)						
Impacted Environment	Phase impact occurs (C, O, D, PC)	Activity No.	Activity	Summary of Impact	Reference in EIA	(positive / Negative	Extent (5)	Duration (5)	Severity (5)	Probability (5)	Consequence (15)	Significance (75)	(positive / Negative	Extent	Duration	Severity	Probability	Consequence	Significance (75)
Air blasting and ground vibration	O	11	Drilling and blasting of hard overburden	Air blasting could result in fly rock. Blasting activities could become problematic to nearby chicken farms. Ground vibration can result in damage to infrastructure. Blasting activities also contribute to both noise and dust fallout levels.	7.9/ 11.3.7	N	3	3	5	4	11	44	N	3	3	4	4	10	40
Wetlands	O	10	Topsoil and overburden removal and stockpiling	Increase the potential load of sedimentation of the water resources. Erosion of exposed surfaces. The removal of the topsoil and vegetation reduces the potential for recharge of shallow aquifers that feed hillslope wetlands, which in turn reduces the flow in water resources.	7.12/ 11.3.10	N	2	3	5	5	10	50	N	2	3	4	4	9	36
	O	12	Coal removal and stockpiling	Both soil and coal dust being created will increase the potential of excessive siltation. This will impact on the quality of water available in the wetland units as well as inhibit the ability of the wetland units to provide key ecological services. There will be a reduction on surface water quantity due to reduction in catchments size.		N	2	3	5	5	10	50	N	2	2	3	3	10	30

Activity, Phase and Impact					Impact Rating (before mitigation)								Impact Rating (after mitigation)						
Impacted Environment	Phase impact occurs (C, O, D, PC)	Activity No.	Activity	Summary of Impact	Reference in EIA	(positive / Negative	Extent (5)	Duration (5)	Severity (5)	Probability (5)	Consequence (15)	Significance (75)	(positive / Negative	Extent	Duration	Severity	Probability	Consequence	Significance (75)
	O,D,PC	16	Discard dump	Seepage from the discard dump into the underground aquifers may impact on the quality of water of these aquifers which in turn provide seepage to wetland areas. In spite of this seepage process providing some water quality enhancement ability, the seepage of impacted water quality from the discard dump may impact on wetland functioning as the quality of the impacted water may not be completely restored by the seepage process.		N	2	4	4	4	10	40	P	2	4	3	4	9	36
Social Impacts																			
Visual	O, D, PC	10	Topsoil and overburden removal and stockpiling	Overburden stockpiles and discard dumps are expected to be approximately 30m in height, and will contribute the most severe visual disturbance to surrounding receptors	7.13/ 11.3.11	N	3	3	3	5	9	45	N	2	3	3	5	8	40
Traffic	O,D	13	Vehicular activity on haul roads	Increase of vehicular activity on site and the traffic to the site	7.13/ 11.3.11	N	2	3	4	5	9	45	N	2	3	4	3	9	27
Socio-economic	O	7	Employment	Mine continues to support the local economic sector through direct and indirect employment	7.15/ 11.3.13	P	2	3	3	4	12	48	P	2	3	4	4	13	52

Table 10-3: Decommissioning phase

Activity, Phase and Impact					Impact Rating (before mitigation)								Impact Rating (after mitigation)						
Impacted Environment	Phase impact occurs (C, O, D, PC)	Activity No.	Activity	Summary of Impact	Reference in EIA	(positive / Negative	Extent (5)	Duration (5)	Severity (5)	Probability (5)	Consequence (15)	Significance (75)	(positive / Negative	Extent	Duration	Severity	Probability	Consequence	Significance (75)
Biophysical Impacts																			
Wetlands	D,PC	22	Final replacement of overburden, topsoil and revegetation	May result in the restoration of the catchment size prior to being impacted on. This will restore the lost seepage areas and maintain sub-surface flow dynamics and restore ecological functioning.	7.12/ 11.3.10	**P**	2	3	5	4	10	40	**P**	2	3	5	5	10	50
Social Impacts																			
Socio-economic	D,PC	20	Retrenchment	Loss of employment and required services	7.15/ 11.3.13	N	2	5	4	5	11	55	**P**	2	5	3	3	10	30

Potential impact zones

A GIS density technique was used to model the results from the specialist investigations to give a graphical representation of the areas of potential impact and the associated significance. Refer to Plan 21. The opencast area is the main area of significance and the associated impacts such as noise, air quality, visual, traffic, surface water and air blasting and ground vibration are overlaid to depict areas of potential impact zones.

11 Public consultation (REGULATION 50 (f))

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. There was no public consultation undertaken as part of this EMP report update.

Public participation is a key component of any EIA. It involves those interested in or affected by the 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.

In approaching the development of a PPP strategy for this project the consultant team aimed for a rigorous and methodical process that will stand up to scrutiny, thereby limiting project risks based on procedural grounds. The process also encouraged 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.

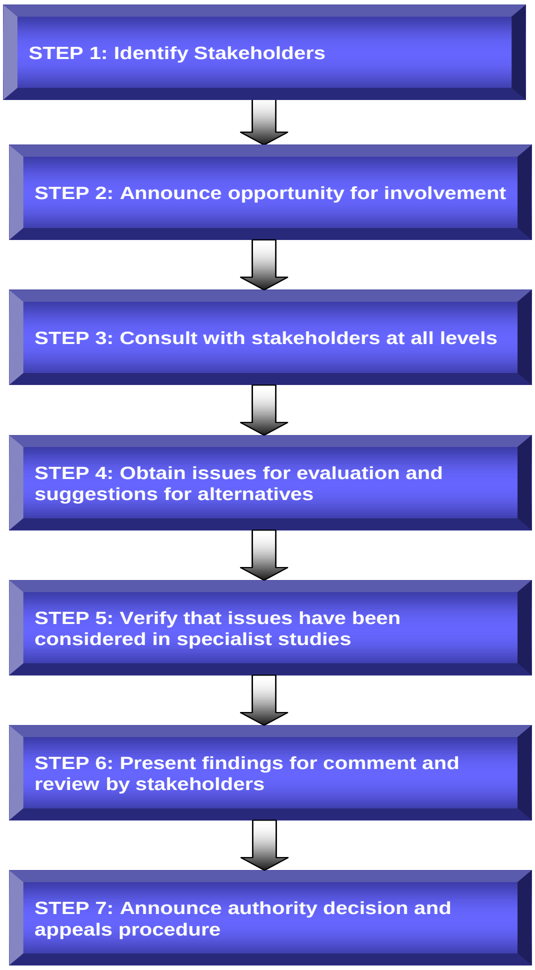

Figure 11-1: Public participation process

11.1 The details of the engagement process

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

Table 11-1: Summary of consultation

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	Hand	Farmers

Date	Type of Consultation/ Documentation	By Means Of	Stakeholder Group
	and registration form		
13 July 2009	Public meeting	Delmas Country Lodge	Authorities, general public and farmers
16 July 2009	Minutes from Information Sharing Meetings and notification of Scoping Report	Email, fax, post and SMS	Authorities, general 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

Date	Type of Consultation/ Documentation	By Means Of	Stakeholder Group
Once ROD is received from Regulatory authority	ROD	Email, fax, post	General public, farmers, landowners and land users

11.2 Details regarding the manner in which the issues were addressed

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 11-2: 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?	Topsoil and overburden stockpiles will be kept separately.

Issue Raised	Response
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?	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 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?	Coal is often situated in areas where the land is of high agricultural potential. It all depends on the exploration drilling results. The 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

Issue Raised	Response
	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 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 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

Issue Raised	Response
	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 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

Issue Raised	Response
	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 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 dependent 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

Issue Raised	Response
	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 monitored 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.
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

Issue Raised	Response
	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.

12 Knowledge gaps and limitations (REGULATION 50 (g))

The following chapter lists the knowledge gaps that currently exist for the EIA.

It should be noted that all the Plans contained in this EIA/EMP report update have been based on the assessments undertaken between 2009 and 2010.

12.1 Flora and fauna assessment

The biggest limitation during the dry season was that a large portion of the natural habitat was destroyed by uncontrolled burning and this not only hindered the current sampling run, but also raised the question of the effect of frequency and timing of these fires on species composition and diversity

12.2 Wetland delineation

Due to the wetland assessment being conducted during the autumn months, a comprehensive ecological assessment could not be effectively conducted. This should be taken into consideration when interpreting the results. Findings from other specialist studies conducted during the summer season have been used to supplement this report which may contribute to an increase in the confidence of the findings.

12.3 Visual assessment

Disseminating the visual disturbance of a development is very subjective; as many factors can enhance and decrease the amount of visual disturbance a mine develops. Factors such as vegetation in and around ones viewpoint of the mine can greatly reduce that individual's visual of the development. It is near impossible to determine the impact of each and every individual's view of the mine. As a result of this only the size of the Viewshed and main areas and receptors affected by the Viewshed has been discussed.

13 Monitoring and management of environmental impacts (REGULATION 50 (h))

Several monitoring programmes have been implemented in order to fully assess the potential impacts of the historical, current and future mining activities, on the environment.

Monitoring is required in order to check compliance with agreed upon standards or objectives and targets. Monitoring helps to establish trends and patterns, assist in predicting non-compliance and describe remedial measures to address non-compliance. Full detailed monitoring programmes and protocols should be drawn up once more detail on the mine is in hand. These should be drawn up with the input of the mine management and relevant Governmental departments and a copy should be given to the Environmental Manager on site.

There are a number of social and environmental aspects which require monitoring during the phases of the project. Those social and environmental aspects that act as environmental indicators and are most common have been detailed here, however a number of additional monitoring plans, such as toxicological elements, climate change, community health and cultural integration are also possible.

13.1Soil monitoring

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.

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

Progressive monitoring of the stripping, stockpiling, shaping of spoil surfaces and replacing of topsoil will ensure successful post-mining land and soil reclamation. Assessing post-mining soil characteristics and associated land capability and land uses is necessary but lack the opportunity to correct failures during the rehabilitation process.

The mine rehabilitation plan should contain the following important soil information:

Location of soil types than can be stripped and stockpiled together.

- Stripping depths of different soil types;
- The location, dimensions and volume of planned stockpiles for different soil types;
- Progressive monitoring should take place on at least a quarterly basis and should involve the following;
- Inspection of stripping depths;
- Inspection of stockpiles to check degradation and or pollution;
- Inspection of spoil surfaces before replacing soil to ensure that pre mined topography is emulated;

- Random inspection of soil thickness on rehabilitated sections;
- Fertility analysis and amelioration procedures prior to re-vegetation; and
- Evaluating and readjusting the rehabilitation plan.

A final post-mining rehabilitation performance assessment should be done and information should be adequate for closure applications which involve:

- Assessment of rehabilitated soil thickness and soil characteristics by means of auger observations on a 100 x 100 m grid;
- A post-mining land capability map based on soil thickness and characteristics
- A proposed post-mining land use map;
- Erosion occurrences;
- Soil acidity and salt pollution analyses (ph, electrical conductivity and sulphate) at 0-250 mm soil depth every 4 ha (200x200m);
- Fertility analysis (exchangeable cations K, Ca, Mg and Na and phosphorus) every 16 ha (400x400m); and
- Bulk density analysis every 4 ha.

13.2Noise monitoring

It is recommended that the monitoring plan be implemented to determine potential sources of noise, increases and decreases in noise levels, and determine level of mitigation required. Components to be included in the proposed monitoring plan are discussed below.

Baseline noise monitoring is to be conducted on a monthly basis for the first 3 months to determine the impact of the noise levels on the relevant receptors as well as determine the level of mitigation. Once it is established that the mitigation measures have decreased the specific noise levels from the mining activities, the noise monitoring should be carried out on a quarterly basis thereafter. The noise measurements should be taken at the locations where the baseline monitoring was undertaken (Plan). A report must be compiled monthly/quarterly, depending on the intervals of the monitoring programme then submitted to management to ascertain compliance with the required standards. Mine management should be advised of any significant increase in the ambient sound level as operations continue. The measurement points must take into account noise sensitive receptors, such as farmsteads, schools, hospitals, churches etc. and only sensitive areas within a radius of two kilometres from the mining activities will be taken into account. The reason for the two kilometre buffer zone is in accordance to the Concawe method (SANS 10357) of calculating noise propagation. At each measurement point the ambient noise level will be sampled in terms of the following parameters:

- The A-weighted equivalent sound pressure level (LAeq) for duration not less than 30 minutes per monitoring point.
- Measurements to be taken during both daytime (06:00 to 22:00) and the night time (22:00 to 06:00).

13.3 Surface water monitoring

An environmental monitoring programme has to be put in place for the assessment and management of impacts on the environment that could result from the mining activities.

13.3.1 Objectives

To monitor any possible pollution from the mine operations through continuous measurement of water quality

13.3.2 Monitoring locations

Surface water monitoring will be done at strategic locations as follows:-

- Downstream of possible sources of pollution e.g. downstream of the decant points of both the North and South pits;
- Downstream of a stockpile area;
- Downstream of the pits to establish a possibility of any pollution to the streams;
- Downstream of infrastructure that could be possible sources of surface water pollution such as the hydrocarbons storage facilities; and
- The surface water points sampled during the hydrocensus (Plan 11).

13.3.3 Frequency

- Sampling will be conducted on a monthly basis during the first year to establish seasonal trends; and
- After the first year of mining, sampling will be conducted quarterly.

13.3.4 Monitoring data handling

Water quality will be the main item that will be monitored by the surface water monitoring programme. Fluctuations in water quality will assist in identifying and informing reviews of management plans and mitigation measures. Samples will be submitted to a reputable laboratory for water quality analysis. A full analysis report on the quality of the water will be submitted to the mine management on an annual basis.

13.4Groundwater monitoring

The main objective of any water monitoring program is to understand the short-, medium- and long-term impacts that mining may have on the integrated surface and groundwater regime of the immediate and receiving environment. Groundwater Monitoring forms an integral part in the management thereof. It serves ultimately as a pre-warning system for mitigative actions when anomalous concentrations or water level problems occur.

Monitoring at Kangala must be quantitative and qualitative due to the sensitive nature of the dolomitic aquifer. It is a very important management tool to ensure that groundwater resources are conserved effectively.

It is recommended that a baseline sampling run be conducted, analysing as broad a spectrum of determinants as possible to ensure that the correct determinants are targeted during the long term monitoring programme. This will be achieved by analysis with Induced Coupled Plasma (ICP) and Mass Spectrometer (MS) methodology, which is a quick scan of the major cations, anions and full spectrum trace elements (within 5 % accuracy of normal laboratory analysis techniques). The results from this sampling programme will dictate the frequency and details of the surface and groundwater long term monitoring at the site.

A database using Windows Information System for Hydrogeologist (WISH) software or similar should be used to establish temporal data for the project area. The following reporting should also be conducted according to DWS:

Quarterly monitoring reports with the combined results of the surface and groundwater monitoring will be compiled. The monthly results are combined cumulatively in the quarterly reports. A quarter is typically three months. This will include all findings and results and typically includes the following information:

- Project description and objectives;
- Water use license detail and directives;
- Methodology and protocols;
- Comparison with legislative framework, i.e. quality standards and guidelines;
- Analysis results in the form of diagrams and graphs (Piper, Durov etc.);
- Recommendations and conclusions;
- Mitigative measures (if required); and
- Maps depicting project area and positions of monitoring.

The five newly drilled boreholes will be used initially along with three strategically placed boreholes from the hydrocensus. The detail of the three boreholes is listed in Table 13-1.

Table 13-1: Details of the hydrocensus boreholes and newly drilled boreholes currently used for monitoring

Site ID	Coordinates		Type	Farm
	Latitude	Longitude		
KGA12	26.18134	28.66826	DWAF Directorate of hydrogeology borehole	Witklip 232 IR
KGA21	26.18569	28.69183	Borehole	Wolvefontein 244 IR
KGA39	26.20445	28.64004	Borehole	Strydpan 243 IR
KAM01	26.21273	28.67163	Borehole	Wolvenfontein
KAM02	26.19756	28.67773	Borehole	Wolvenfontein
KAM03	26.18977	28.67634	Borehole	Wolvenfontein
KAM04	26.19260	28.66187	Borehole	Wolvenfontein
KAM05	26.20103	28.66602	Borehole	Wolvenfontein
KAM06	26.1945	28.6776	Borehole	Wolvenfontein
KAM07	26.1926	28.6522	Borehole	Wolvenfontein
KAM08	26.1828	28.66830	Borehole	Wolvenfontein

The suggested frequency for groundwater monitoring is as follows:

- Monthly for the first six months; and
- Bi monthly for the next six months.

If results are stable (except for seasonal changes) and a trend is established, quarterly monitoring will be sufficient but will have to be revisited after the first year and adjusted according to results. The minimum constituents to be analysed for during the groundwater monitoring are summarised in Table 13-2.

Table 13-2: Summary of minimum required constituents to be analysed for monitoring

Major Inorganic Constituents *(in mg/L unless stated otherwise)*	
Major Ions	
Cations	***Anions***
Sodium	Bicarbonate
Calcium	Chloride

Magnesium	Nitrate as N
Potassium	Sulphate
Minor Ions	
Fluoride	
Iron	
Nitrate as N	
Trace Elements	
Aluminium	
Manganese	
Physico-Chemical Parameters	
Electrical Conductivity (EC) - *L + F	
pH - *L + F	
Total Alkalinity - *L	
Total Dissolved solids - *L + F	
Optional Trace Elements	
Arsenic	
Chromium (Hexavalent)	
Lead	
Ortho-Phosphate	
Uranium	
Zinc	
Bacteriological	
General hygienic quality indicators	
Standard plate count	
Faecal Coliforms	
Total Coliforms	
***Laboratory measured and Field measured**	

13.5Air quality monitoring plan

13.5.1 Aims and objectives

The air quality monitoring programme allows for the monitoring of dust fallout of which the dust fallout is analysed for its weight characteristics. The monitoring programme allows for the monitoring of particulate matter smaller than 10 micrometers (PM_{10}). A permanent PM_{10} sampler will be used to take real-time continuous readings (at a relevant receptor) which can then be compared with the 24hr limit standards for PM_{10} according to the National Environmental Management Air Quality Act no 39 of 2004 (NEMAQA). After a period of 12 months the annual average can then be compared with the annual average limit according to NEMAQA. DWA recommend a TEOM sampler for the sampling of particulate matter (PM_{10} particles).

The primary aim of the dust monitoring programme is to measure the impact of the proposed mining operation on the dust levels especially PM_{10} levels which pose a health risk. The objective is to ensure that no receptors are significantly impacted, and if impacts do occur to alert management to this fact in order for them to action additional mitigation measures.

13.5.2 Positioning of samplers

The positions of the samplers (dust fallout as well as PM_{10}) are essential to the interpretation of the results, and needs to take into account the surrounding sensitive receptors, historical directional wind data for the area, and topographical features that may affect the wind direction.

Before the samplers are erected on site the area is surveyed using topographical maps and historical climate data to determine the various wind flow patterns and topographical features that may influence the migratory patterns of fallout dust on site. Once these factors have been determined the location of the dust buckets as well as the PM_{10} sampler is pinpointed taking into consideration the position of various sensitive receptors. For the single dust fallout samplers, the buckets are filled with distilled water and left out on site for a period of 30 days (+/- 3 days); according to SANS:1929; from there the buckets will be transported to a reputable Laboratory for analysis.

The sample locations for dust fallout have been identified and are indicated in Appendix E, Plan 15. Table 13-3 represents the relevant receptors where dust fallout monitoring is to take place. With regards to PM_{10} monitoring it is recommended that a permanent PM_{10} sampler be setup at receptor UN9, which is the closest receptor.

Table 13-3: Receptor points where dust fallout monitoring is to take place

Code	Farm	Portion	Receptor type	Owner	Figure
UN1	Middelbult 235 IR	39	Homestead	Josua Boerdery	1
UN2	Strydpan 243 IR	15	Homestead	Eloff Mining Co pty ltd	2
UN3	Weilaagte 271 IR	9	Homestead	Adriaan Bruwer	3
UN4	Weilaagte 271 IR	4	Homestead	Koos Uys	4
UN5	Wolwenfontein 244 IR	5	Homestead	Willem Ooterhuis	5

UN6	Wolwenfontein 244 IR	R	Stores	Kallie Madel Trust	6
UN7	Witklip 232 IR	28	Homestead	Hendrik Schoeman en Seuns	7
UN8	Strydpan 243 IR	31	Homestead	Eloff Mining Co pty ltd	8
UN9	Wolwenfontein 244 IR	1	Homestead	Kallie Madel Trust	9

13.5.3 Frequency

The air quality monitoring programme has been initiated. The buckets are changed on a monthly basis for dust fall out monitoring. The mine is in the process of procuring a particulate monitoring station to measure the PM_{10}. The permanent PM_{10} sampler will sample the ambient PM_{10} levels on a continuous basis throughout life of mine. Incident reports are submitted to the mine as well as to the relevant competent authority upon receipt of results exceedances. In case of no exceedance this will be confirmed.

13.5.4 Methodology

All dust fall out samples will be taken in accordance to the SANS 1929:2005 guidelines until the air quality regulations for South Africa have been finalised, after which all sampling will be done according to these guidelines. The PM10 samples will be taken in accordance with the SANS 1929:2005 guidelines, but will be assessed according to the air quality standards of the NEMAQA (Act 39 of 2004).

13.5.4.1 Sampling methodology

Installation of buckets

Step 1

- Fill up buckets with distilled water (distilled water should be available at any battery center);
- Place 1 teaspoon of bleach into each bucket;
- Make sure all padlock keys are present;
- Travel to chosen receptor points;
- Confirm that sample bucket positions are correct according to GPS data;
- Dig +-30cm deep hole and place pole with platform attached into hole and secure; and
- Otherwise pole and platform may be secured to a fence pole etc.

Step 2

- Place a small section of masking tape on each of the sample buckets;

- Write a sample bucket identification label on the tape for each of the sample buckets (e.g. Kangala Colliery, sampler 1 = KC01);
- Place bucket on platform; and
- Remove bucket lids.

Retrieving buckets (on monthly basis)

Step 1

- Remove the sample buckets from the sampler cradle and place in a box ready to be sent to a reputable SANAS accredited laboratory for analysis; and
- Include the sample custody form inside the box to allow the reputable SANAS accredited laboratory to identify each sample when they are analysing.

Step 2

- Place new buckets in the sample cradle and remove bucket lids.

Sample Submission

All the samples must be submitted to a reputable SANAS accredited laboratory with a quality management plan.

13.5.4.2 Analysis

For dust fallout analysis, the analysis of samples should take place within one week of collection to ensure the accuracy of the results. The sample bucket lids should not be removed at any stage after the lid has been placed on the bucket at the site until the samples have reached the laboratory. The PM_{10} measurements will be read off the data logger as soon as the PM_{10} meter measured for a 24hr period. The constituents to be analysed for are displayed in Table 13-4.

Table 13-4: Constituents to be analysed for

Relevant Fall-out Per Bucket	Total Fall-out Per Bucket	PM_{10} (24hr analysis)
mg/m²/day	mg	µg/m^3

13.5.4.3 Data interpretation

In order to assess the results, the collected dust is filtered through a sub-micronic pre-weighed filter using a vacuum filter bench. Once the wet filtrate has been desiccated by evaporation of any retained moisture, the filter is reweighed to ascertain the collected mass (Insoluble particulate). The soluble particulate is assessed by evaporating the catch media and weighing the resulting solids. The filter is then sent through a 30 element ICP scan. As for the PM10 levels, they are assessed according to the ambient air quality standards of the NEMAQA (Act. 39 of 2004)

South African Fallout Dust Classification

Table 13-5: Fallout dust classification as per the standards set by the Department of Environmental Affairs and Tourism (DEAT)

S.A. Classification (DEAT)	mg/m²/day
Slight	<250
Moderate	251 – 500
Heavy	501 – 1200
Very heavy	>1200

Table 13-6: PM_{10} levels according to the ambient air quality standards (NEMAQA)

24hr Average (µg/m3) The 24hr limit may not be exceeded by more than 3 times in a year	Annual Average (µg/m3)
180	60

Table 13-7: Four-band scale evaluation criteria for dust deposition (After SANS 1929: 2004)

Band Number	Band Description Level	Dust fall rate (D) (mg.m^2.day, 30 day average)	Comment
1	Residential	D < 600	Permissible for residential and light commercial.
2	Industrial	600 < D <1,200	Permissible for heavy commercial and industrial.
3	Action	1,200 < D <2,400	Requires investigation and remediation if two sequential months lie in this band, or more than three occur in a year.
4	Alert	2,440 < D	Immediate action and remediation required following the first incidence of dust fall rate being exceeded. Incident report to be submitted to the relevant authority.

Table 13-8: Target, action and alert thresholds for dust deposition (After SANS 1929: 2004)

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

These dust fall-out guidelines are descriptive without giving any guidance for action or remediation. On the basis of the cumulative South African experience of dust fall-out measurements, Standards South Africa have published two important new standards in terms of air quality underlying limits for dust fall-out rates. In terms of dust deposition standards, a four-band scale evaluation is used as well as target, action and alert thresholds.

Units are monitored monthly, the results are then analysed and placed into various graphs and tables that best indicate the dust fallout situation on site.

13.5.5 Reporting

A report is then compiled every three months detailing all findings and includes a full assessment of the results along with conclusions and recommendations for future monitoring on site. These reports should highlight any negative impacts on the air quality due to the mining operations as well as determine the sources of the impacts. The reports will discuss possible actions which can be used to mitigate any negative impacts. Relevant results will be graphed so that trends may be visually observed.

13.5.6 Duration

The programme will be implemented on a monthly basis for the life of the mine. This will only be altered if the sampling data indicates that either more or less sampling is to take place. The programme will be reviewed on an annual basis

13.6Air blasting and ground vibration monitoring

It is recommended that a process of monitoring the blasting operations must be applied for all blasting to be done in the mine operation. This process should be to ensure that levels are within limits at all times. Early monitoring will also give indications of what ground vibrations levels are recorded at what distances and help with being proactive on the levels observed. It is proposed that at least four seismographs be placed at the positions as indicated on Plan 23. One at the Dam Wall, one at the Chicken Pen West of the mine, one at the new Chicken Pen North of the mine and one at Structure 4, east of the mine.

13.7 Post closure monitoring

Monitoring of possible decant from the pits will be required post closure as this may have a significant impact on surface water. For a detailed monitoring plan, refer to Section 15.

13.7.1 Air quality

The dust fallout stations should be maintained for a period of 5 years after closure or until a long term trend is established. If it is known that dust in excess of the baseline levels is occurring then the source of this dust will be established and suitable mitigation measures should be instituted.

13.7.2 Water monitoring

Surface and groundwater monitoring should continue for a period of at least 5 years after the cessation of production activities or until the pre mining models are verified and the impacts from the various facilities are understood. Monitoring will continue further if results indicate a lack of compliance with water quality objectives. These water monitoring points should be left open for future monitoring by authorities if required, with suitable access control.

13.7.3 Social aspect

The social impact of the mine closure should be managed for a period of 3 years after final closure to ensure that any plans and closure activities related to training of staff and resettling of staff have proved successful. Also the surface owners should be consulted with for a period of 3 years to ensure that they know how to maintain the various facilities which are remaining. The community development impact should be monitored for a period of 3 years after closure.

SECTION B
ENVIRONMENTAL MANAGEMENT PROGRAMME

14 Environmental management programme

14.1 Environmental objectives (Regulation 51 (a))

14.1.1 Specific goals for mine closure

The overall closure objectives for the Kangala Coal Mine project are as follows:

- Return land, mined by opencast methods, as far as possible to a land capability to that which existed prior to mining and that the management level required to utilise the rehabilitated land is within the means of the farmer who uses it;
- Ensure that as little water as possible seeps out of the various sections of the mine and where this is unavoidable, to ensure that the water is contained or treated if the volume is significant and if it does not meet statutory water quality requirements;
- Remove all mine infrastructure that cannot be used by a subsequent land owner or a third party. Where buildings can be used by a third party, arrangements will be made to ensure their long term sustainable use;
- Clean up all coal stockpiles and loading areas and rehabilitate these as far as possible to a land capability to that which existed prior to mining.
- Follow a process of closure that is progressive and integrated into the short and long term mine plans and that will assess the closure impacts proactively at regular intervals throughout project life;
- Implement progressive rehabilitation measures, beginning during the construction phase wherever possible;
- Leave a safe and stable environment for both humans and animals and make their condition sustainable;
- To prevent any soil and surface/groundwater contamination by managing all water on site;
- Comply with local and national regulatory requirements;
- Form active partnerships with local communities to take of management of the land after mining, where possible; and
- To maintain and monitor all rehabilitated areas following re-vegetation or capping and, if monitoring shows that the objectives have been met, making an application for closure.

14.1.2 Specific goals for the management of identified environmental, socio-economic and cultural impacts

Refer to Table 14-1.

14.2 Management programme (Regulation 51 (b))

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

The action plans listed in the EMP refer to detailed plans which will be required prior to mining taking place. These plans are drawn up with input from mine management, environmental officers and HR personnel and are used to guide audits that will regularly take

DIGBY WELLS ENVIRONMENTAL

Table 14-1: EMP table

No	Activity	Affected Environment	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after mitigation
1	Recruitment, procurement and employment	Socio-economic	Ensure that recruitment strategies for the mine prioritises the sourcing of local labour, and share in gender equality. Empower the workforce to develop skills that will equip them to obtain employment in other sectors of the economy. Contribute to the sustainable development of a community (not dependent on the mine) surrounding the area of operation	Positive impact will be implemented through LED initiative as part of Social and Labour Plan and local development and need to be managed. Ad-hoc, informal recruitment at the gate or through other unapproved channels by setting up recruitment stands in built up areas should be prohibited. Relationships with local government through LED programmes should be developed. Stakeholder database should be established to identify partners and develop collaborative networks	Ongoing	As per Social and Labour Plan	The social plans to involve action plans aimed at providing development opportunities and benefits to the affected local communities.	Construction phase	HR manager	Major (Positive)
2	Transport of construction material	Soil	Minimization of disturbed area and prevention of compaction of soil	All heavy machinery operators and truck drivers should stay in designated areas	Ongoing		Rehabilitation and closure plan	LoM	Mining engineer and environmental coordinator	Medium-Low
		Noise	To prevent the noise emanating from the Transport vehicles from impacting on the sensitive receptors	Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust mufflers. Noisy machinery to be used during daylight hours preferably. Grievance mechanism to record complaints should be kept on site and investigated. Noise monitoring to take place.	Ongoing. Monitoring to be weekly.	NEMAQA , ECA	Noise monitoring programme to be followed. Vehicle maintenance plan. Contractors operating EMP	LoM	Environmental officer, contractor manager	Medium-Low
		Biodiversity & Aquatic environment	Restrict removal and disturbance of vegetation to those areas absolutely essential for the development	Make use of existing roads and/or areas and roads designated for the mining operation	Ongoing	NEMA & NWA	Rehabilitation and closure plan	LoM	Mining Engineer	Medium-Low
			Avoid impacts to vegetation and soil through spillages and leaks	Proper maintenance of operating vehicles and regular vehicle inspections. Parking of trucks in designated, concrete areas.			Vehicle maintenance and Monitoring programme	LoM	Environmental /safety officer	
			Limit the negative effects of excessive dust and	Remove lose earth from the road sides. Periodic spraying of roads with water.	On going		Air quality monitoring plan	LoM	Environmental officer	

No	Activity	Affected Environment	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after mitigation
			erosion							
		Visual	Limit the extent of the visual intrusion as far as possible	Dirt roads need to be wet by a water browser so as to reduce dust plumes.	On going		Ambient air quality standard operating procedure including monitoring plan	LoM	Environmental officer	Medium-Low
		Traffic and safety	Create safe environment for pedestrians, animals and motorists	Speed limits must be implemented on site as well as safety controls. Investigations into the requirement of safety intersections must be undertaken	Continuous		Grievance Mechanism	LoM	Safety officer	Medium-Low
3&9	Workshop activity and storage of fuel, lubricant and explosives	Surface Water	Prevention of contaminate surface runoff	All hazardous chemical must be stored in a bunded facility. Handling of such chemicals must be undertaken on a non-permeable surface. All water that may collect in an area used for the storage of hydrocarbons must pass through an oil water separator before been discharged as dirty water. Spillages on the open soil must be contained and removed and treated as hazardous waste. Inspections should be conducted of storage facilities.	Monthly	NWA, SANS	Hydrocarbon management plan/operation procedure	LoM	Environmental officer	Medium-Low (Positive)
		Biodiversity and Aquatic Environment	Avoid impacts to vegetation and soil by means of leaks and spillages.	The storage of materials and substances will be housed in suitable facilities. Management of these facilities will be ongoing and this will include regular inspections to detect faults/issues. Emergency response plan to be put in place if spillages occur.	Monthly	NEMA	Hydrocarbon management plan/operation procedure	LoM	Environmental officer	Minor
		Groundwater	Prevent contamination of aquifers	All hydrocarbons, lubricants and explosives should be adequately stored and bunded off to prevent any contamination to the groundwater during an accidental spill.	Monthly inspections	NWA	Spill Prevention, Emergency response plan	Construction phase	Environmental Officer	Medium-Low

No	Activity	Affected Environment	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after mitigation
4	Site clearing and topsoil removal	Soil	Prevent soil loss through erosion. Preserve topsoil for future rehabilitation.	Ensure all vehicles stay within the designated areas. Ensure storm water control measures are put in place to control surface run off over exposed areas. Remove and stockpile topsoil from roads, building platforms, stockpile and dam areas prior to construction	Ongoing		Storm water management plan/ water management procedure	LoM	Environmental officer	Medium-High
		Surface Water	Prevention of siltation of surface water bodies	The areas excavated should have berms that are vegetated in order to separate dirty and clean water systems, and as an erosion control measure. The stockpiles must be vegetated to prevent erosion and subsequent siltation of clean and dirty water streams as well as surface water resources. Upslope diversion and down slope silt containment structures will be constructed. Monitoring of surface water resource pre-mining and during construction must be implemented as per the monitoring programme. Construction of infrastructure located close to local streams should take place in the dry season, when possible.	Ongoing	NWA,DWAF BPG	Storm water management plan/ water management procedure	LoM	Environmental officer	Medium-Low
		Air Quality	Reduction of dust fallout levels and particulate matter	The removal of vegetation will be minimised during stripping to reduce the effects of dust pollution as a result of exposed soil. Dust suppression must take place. Dust monitoring must be undertaken in accordance to the monitoring programme. Topsoil stockpiles for more than two days should be kept moist and topsoil stock piles for more than a year should be planted and water to sustain biological components as well as prevent dust emissions. Cover all trucks hauling soil.	Ongoing/ Quarterly monitoring	NEMAQA	Ambient air standard operation procedure including monitoring programme. Contractors operational EMP	LoM	Environmental officer	Medium-Low

No	Activity	Affected Environment	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after mitigation
		Noise	To prevent the noise emanating from the construction machinery from impacting on the sensitive receptors	A noise barrier in the form of a berm should be constructed on the western as well as south eastern side of the proposed area of disturbance (as per current mine plan) so that it is situated between the main noise source and sensitive noise receptor UN9, as close to the noise sources as possible. The berm will help with the attenuation of noise produced by the mining activities. The barrier should be at least 13m tall for best performance (Sound Fighter Systems, 2007). Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust mufflers. Switching off equipment when not in use.	Ongoing	NEMAQA , ECA	Noise monitoring plan	LoM	Environmental officer	Medium-Low
		Biodiversity & aquatic environment	Limit degradation and destruction of natural environment to designated project areas	Keep the footprint of the disturbed area to the minimum and designated areas only. Vegetate and wet stockpiles to limit erosion. Berms created below the piles to trap particles and runoff from the stockpile. Community awareness should be implemented as part of the stakeholder engagement procedure to create awareness of biodiversity and preservation of natural habitats	Daily	NEMA	Rehabilitation plan	LoM	Mining engineer	Medium-Low
			Restrict alien invasive plant recruitment	Removal of vegetation during stripping and dump operation will be minimised to reduce the risk of open areas occurring.		CARA	Alien invasive monitoring and control programme		Environmental officer	
			Limit erosion of exposed areas and stockpiles as well as sediment load reporting to wetlands	Keep the footprint of the disturbed area to the minimum and designated areas only. Vegetate and wet stockpiles to limit erosion. Berms created below the piles to trap particles and runoff from the stockpile		NWA	Rehabilitation plan	Construction, operational phases	Environmental officer	Medium-High
			Limit reduction in the re-charge of aquifers	Removal of vegetation during stripping and dump operation will be minimised to reduce the risk of the aquifers being drained and not properly recharged.						

No	Activity	Affected Environment	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after mitigation
		Visual	Reduce the visual impact caused by site clearing and topsoil removal.	Ensure site to be cleared is restricted to the mine plan. Topsoil stockpiles will need to be vegetated as soon as possible, to reduce the risk of erosion and decrease there visual disturbance.	Ongoing		Contractors operational EMP including mine plan	Construction, operational phases	Mining engineer, Environmental officer	Medium-Low
5	Construction of infrastructure	Soil	Prevent loss of soil structure from compacting of soil. Preserve soil fertility for later use.	Remove and stockpile topsoil from roads, building platforms and infrastructure areas prior to construction and stockpile as per the rehabilitation guidelines.	Once-off		Rehabilitation plan	Construction phase	Environmental officer	Medium-High
		Surface Water	To protect existing users of surface water from impacts on water quality. To maximise the clean surface water run-off.	Areas of disturbance must be in line with the mine plan provided to minimise the loss of catchment area. Clean and dirty water separation must be undertaken and clean water areas must be maximised. Reuse of inpit/dirty water needs to be maximised.	Ongoing	NWA	Contractors EMP & Water monitoring plan/ procedure	Construction phase	Mining engineer and Environmental officer.	Medium-High
		Noise	To prevent the noise emanating from the construction machinery from impacting on the sensitive receptors	As per mitigation for activity 4.	Ongoing	NEMAQA , ECA	Noise monitoring plan	Construction phase	Environmental officer	Medium-Low
		Biodiversity & Aquatic environment	Limit areas suitable for alien invasive recruitment	Removal of vegetation during construction of infrastructure will be minimised to reduce the risk of open areas occurring.	Weekly	CARA	Rehabilitation plan	LoM	Mining engineer	Medium-Low
			Limit the erosion potential of the site. Preserve the flora, including areas not directly affected by project activities. Ensure rehabilitation plans are initiated during construction	Make use of permeable materials for pavements and walk-ways. Introduce a storm water management programme. Restrict removal and disturbance of vegetation to those areas absolutely essential for the development. Community awareness should be implemented as part of the stakeholder engagement procedure to create awareness of biodiversity and preservation of natural habitats	Monthly	NEMA	Storm water management plan/procedure Community Forums once or twice in a year		Environmental officer	

No	Activity	Affected Environment	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after mitigation
			Limit the reduction in catchment size	The planned reduction in catchment size will be managed to ensure that there will not be a dramatic reduction in catchment size.	Monthly	NWA	Rehabilitation plan	Construction and operational phase	Environmental officer	Minor
		Visual	Reduce the visual impact of permanent infrastructure	To reduce the visual impact of permanent structures, colours for roofing, walls etc. should be of a matt finish to reduce reflection. The colour chosen should be one that softens the visual impact, colours that are suited to the natural tones in the area, such as pastel browns and greens. Avoid up lighting of structures but rather direct the light downwards and focused on the object to be illuminated.	Once off			Construction phase	Environmental officer	Medium-Low
6	Establishment of initial boxcut and access ramps	Soil	Limit soil disturbance outside of the mining plan	Use truck and shovel to minimize compaction of non-mined soil	Continuous		Mine plan and contractors EMP	LoM	Mining engineer and environmental officer	Medium-High
		Surface Water	Maximisation of clean water areas	Separation of clean and dirty water must be undertaken. Clean water areas must be maximised. Reuse of inpit/dirty water needs to be maximised.	Continuous		Waste water management plan / procedure & monitoring plan	LoM	Mining engineer	Medium-High
		Air Quality	Reduction of dust fallout levels and particulate matter	Pre-wet areas to be excavated to minimize dust. The limit value for the 24 hour average for PM10 is 75 ug/m3 and this may not be exceeded 4 times within a year. The limit value for the yearly average for PM10 is 40ug/m3	Monthly	NEMAQA	Ambient air quality standard operating procedure including monitoring plan	LoM	Environmental officer	Medium-Low
		Noise	To prevent the noise emanating from the construction machinery from impacting on the sensitive receptors	As per mitigation for activity 4.	Ongoing	NEMAQA , ECA	Noise monitoring programme	Construction phase	Environmental coordinator	Medium-Low

No	Activity	Affected Environment	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after mitigation
		Air Blasting and Ground Vibration	Reduction of disturbance to neighbouring activities	Pre blast survey of all structures identified surrounding the mining area. Ground vibration survey in the form of signature trace study to be done for determination of ground vibration constants that can be used for accurate prediction of ground vibration. Redesign with alternative diameter blast holes and charge masses to accomplish safe blasting. Investigate the possibility of electronic initiation. Monitoring of blasting operations.	Monthly or per every blast		Blast monitoring programme and structural survey pre-mining	Construction phase	Environmental officer	Medium-Low
		Biodiversity & Aquatic Environment	Removal of vegetation during boxcut construction will reduce available areas for plant recruitment.	Removal of vegetation during stripping and construction will be minimised to reduce the erosion potential. Topsoil will only be removed off areas proposed for immediate mining or construction as in accordance to the conceptual mine plan	Ongoing	NEMA	Rehabilitation plan	Construction phase	Mining engineer	Medium-Low
			All construction activities will be planned and managed to ensure that there will be a minimal reduction in catchment size and water reporting to the wetland.	Keep footprint area as minimal as possible. Vegetate all stockpiles . Minimise vegetation removal.	On going	NWA	Rehabilitation plan	Construction phase	Mining engineer	Medium-High
		Visual	Reduce the visual impact caused by transportation.	Dirt roads need to be wet by a water browser so as to reduce dust plumes.	As and when required		Ambient air quality standard operating procedure including monitoring plan	LoM	Environmental officer	
7	Temporary waste and sewage handling treatment	Surface Water	Prevention of contamination of surface water	Storage facilities with bunding must be constructed. An emergency spillage protocol must be developed and accessible. It will be ensure proper servicing and maintenance of the potable ablution facilities is undertaken	Continuous		Waste water management plan/procedure	Construction phase	Environmental coordinator	Minor
		Biodiversity & Aquatic Environment	Avoid impacts to water quality and wetland functioning through spillages and leakages.	A waste water management system will be introduced on site to ensure that potential pollution of the water resource will be minimised. The storage of materials and	Weekly	NEMA	Waste water management plan	LoM	Environmental officer	Minor

No	Activity	Affected Environment	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after mitigation
				substances will be housed in suitable facilities.						
8	Employment	Socio-economic	Empower the workforce to develop skills that will equip them to obtain employment in other sectors of the economy. Contribute to the sustainable development of a community (not dependent on the mine) surrounding the area of operation	Ensure skills training continues, increase employment where possible, employ local companies and contractors, and liaise with the local community development officers.	Ongoing	SLP	The social plans to involve action plans aimed at providing development opportunities and benefits to the affected local communities.	LoM	HR manager	Major
10	Topsoil and overburden removal and stockpiling	Soil	To preserve integrity of soil	Ensure all activities occur within designated areas. Compile accurate soil map showing classification, thickness, fertility status. Remove and stockpile topsoil in berms or heaps less than 2 – 3 m high. Do not use as storm water control feature. Vegetate with diverse grass mix to control erosion. Wetland soils should only be stockpiled at heights of 1 – 2 m. Subsoil stockpiles can be bigger but must be protected against erosion similar to topsoil stockpiles	Ongoing		Rehabilitation plan including soil management component. Contractors operating EMP	LoM	Mining engineer, Environmental officer	Medium-High (Positive)

No	Activity	Affected Environment	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after mitigation
		Surface Water	Prevention of contamination of surface water bodies	Siltation of surface water resources will be minimized by road wetting. The areas excavated should be have berms that are vegetated in order to separate dirty and clean water systems while enhancing the maximization of clean and minimization of dirty areas and water systems respectively, and as an erosion control measure. The stockpiles must be vegetated to prevent erosion and subsequent siltation of clean and dirty water streams as well as surface water resources. Upslope diversion and down slope silt containment structures will be constructed. Monitoring of surface water resource pre-mining and during construction must be implemented in order to be used during operation, decommissioning and post-closure as per the monitoring programme.	Continuous	NWA, DWAF BPG	Surface water monitoring programme	LoM	Environmental officer	Medium-Low (Positive)
		Air Quality	Reduction of dust fallout levels and particulate matter	Vegetation needs to be encouraged on all soil stockpiles to reduce dust levels.	Continuous	NEMAQA	Ambient air quality standard operating procedure including monitoring programme	LoM	Environmental officer	Medium-Low
		Noise	To prevent the noise emanating from the construction machinery from impacting on the sensitive receptors	As per mitigation for activity 4	Ongoing	NEMAQA , ECA	Noise monitoring programme	LoM	Environmental officer	Medium-Low (Positive)
		Biodiversity & Aquatic Environment	Limit erosion of exposed areas and stockpiles.	Keep the footprint of the disturbed area to the minimum and designated areas only. Vegetate and wet stockpiles to limit erosion. Berms created below the piles to trap particles and runoff from the stockpile	As and when required	NEMA	Storm water management plan	Construction and operation	Environmental officer	Minor
			Limit erosion of exposed areas and stockpiles as well as sediment load reporting to wetlands	Keep the footprint of the disturbed area to the minimum and designated areas only. Vegetate and wet stockpiles to limit erosion. Berms created below the piles to trap particles and runoff from the stockpile	As and when required	NWA	Rehabilitation plan	Construction, operational phases	Environmental as and when required	
			Limit reduction in the re-charge of aquifers	Removal of vegetation during stripping and dump operation will be minimised to reduce the risk of the aquifers being drained and not properly						

No	Activity	Affected Environment	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after mitigation
				recharged.						
		Visual	Reduce the visual impact of topsoil, overburden and discard dumps	Where possible stockpiles and overburden dumps should be kept as low as possible, rather make the dumps longer than higher. Establish vegetation where possible	On going		Rehabilitation plan	Operational and decommissioning phase	Environmental officer	Medium-High
11	Drilling and blasting of hard overburden	Air Quality	Reduction of dust fallout levels and particulate matter	Dust fall out during blasting will need to be monitored. Monitoring weather conditions when blasting especially during the dry season will minimize the impact of the dust cloud formed from an air blast, by allowing the contractor to know whether the conditions are favorable to perform a blast. The limit value for the 24 hour average for PM10 is 75 ug/m3 and this may not be exceeded 4 times within a year. The limit value for the yearly average for PM10 is 40ug/m3	During blasting		Ambient air quality standard operating procedure including monitoring plan	Operational phase	Environmental officer	Medium-Low
		Noise	To prevent the noise emanating from the blasting from impacting on the sensitive receptors	As for the blasting operations it is generally intermittent and should be limited to daylight hours when ambient noise levels are highest. The following with regards to blasting operations is recommended: The use of millisecond delays between rows of blast holes in a given blasting pattern in order to reduce the amount of explosive charge detonated at any given instant is recommended (Sengupta, M.1993); Reduction of the powder factor, that is, use of less explosive per cubic yard of overburden; Restriction of blasting to daylight hours are mitigation measures that should be followed (Sengupta, M.1993); and Areas to be clearly demarcated and signs to be erected indicating blasting zones	Before blasting	NEMAQA , ECA	Noise monitoring programme, contractors operational EMP	Operational phase	Environmental officer	Medium-High

No	Activity	Affected Environment	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after mitigation
		Air Blasting and Ground Vibration	Reduction of disturbance to neighbouring activities	Pre blast survey of all structures identified surrounding the mining area. Ground vibration survey in the form of signature trace study to be done for determination of ground vibration constants that can be used for accurate prediction of ground vibration. Redesign with alternative diameter blast holes and charge masses to accomplish safe blasting. Investigate the possibility of electronic initiation. Monitoring of blasting operations.	Pre blast survey – once off Monthly		Blast monitoring programme and structural survey pre-mining	Construction phase	Environmental officer	Medium-High
12	Coal removal and stockpiling	Geology	To minimise impacts on geology	Limited mitigation is available - comply to the mine plan	Ongoing		N/A	LoM	Mining engineer and Environmental officer	Medium-High
		Wetlands	All removal activities will be planned and managed to ensure that there will not be a significant reduction in catchment size and water reporting to the wetland.	The continuous removal of coal will dewater the surrounding aquifers and the impacts will be unavoidable, because of this mitigation will not be possible.	On going	NWA	Rehabilitation plan	Operational phase	Mining engineer and Environmental officer	Medium-Low
			Prevent siltation of the wetland units from coal and natural dust	Wetting of exposed and operating areas to suppress dust creation.	As and when required					
		Groundwater	-	No mitigation possible	-	-	-	-	-	Major
13	Vehicular activity on haul roads	Soil	Reduction of areas of soil compaction	All vehicles must remain on haul roads and within in demarcated areas	Ongoing		Contractors operating EMP	LoM	Environmental officer	Medium-Low (Positive)

No	Activity	Affected Environment	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after mitigation
	and conveying of coal	Air Quality	Reduction of dust fallout levels and particulate matter	Road surfaces, for example the access road, will be sprayed and treated with water and a dust binding agent. Water will be applied to haul roads three times daily, except during periods of rainfall. All coal haul trucks must be covered. The overland conveyor belt will also be covered and where coal on the conveyor will be sprayed to reduce emissions. The limit value for the 24 hour average for PM10 is 75 ug/m3 and this may not be exceeded 4 times within a year. The limit value for the yearly average for PM10 is 40ug/m3.	As and when required	NEMAQA	Ambient air quality standard operating procedure, contractors operating EMP	LoM	Environmental officer	Medium-Low (Positive)
		Biodiversity & Aquatic Environment	Prevent excess dust creation, that could inhibit plant growth	Wetting of the haul road to suppress dust creation as well as cover haul trucks to prevent dust emissions during transport. The overland conveyor belt will also be covered and where coal on the conveyor will be sprayed to reduce emissions.	As and when required	NEMA	Ambient air quality standard operating procedure	Operational phase	Environmental officer	Minor
			Prevent siltation of the wetland units from coal and natural dust from the haul road and from the use of trucks	Wetting of the haul road to suppress dust creation as well as cover haul trucks to prevent dust emissions during transport. The overland conveyor belt will also be covered and where coal on the conveyor will be sprayed to reduce emissions. Implement the necessary emergency response systems such as a pull wire or roll back prevention mechanism to avoid spillages from the conveyor system.	As and when required	NWA	Rehabilitation plan, Ambient air quality standard operating procedure, Contractors operational EMP	Operational phase	Environmental officer	
		Noise	Minimise noise as far as possible along the roads	Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust mufflers. Noisy machinery to be used during daylight hours preferably. Grievance mechanism to record complaints should be kept on site and investigated. Noise monitoring to take place.	Ongoing. Monitoring to be weekly.	NEMAQA , ECA	Noise monitoring programme to be followed. Vehicle maintenance plan. Contractors operating EMP	LoM	Environmental As and when required, contractor manager	Medium-Low
		Traffic & safety	Ensure safety on road network	Speed limits must be implemented on site as well as safety controls. Investigations into the requirement of safety intersections must be undertaken	Continuous			LoM	Safety officer	Medium-Low

No	Activity	Affected Environment	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after mitigation
14	Water use around site	Surface Water	Maximise reuse of water	All dirty water must be captured and recycling of water must be emphasized and implemented throughout the mine	Continues	NWA	Waste water management plan/procedure	LoM	Environmental As and when required	Medium-Low (Positive)
		Aquatic Environment	Limit the use of water from aquifers	A water management plan will be implemented to prioritise the recycling of water and use of rain (storage) water. Maintain the clean water storage dam to ensure there are no losses.	On going	NWA	Water monitoring programme	Operational phase	Environmental officer	Medium-Low
			Avoid impacts to water quality from dirty water	A dirty water management system will be introduced on site to ensure that potential pollution of the water resource will be minimised						Medium-Low
15	Screening and washing	Surface Water	Prevention of contamination of surface water	The plant must be constructed on an impermeable compacted surface and all waste water resulting from the process must be collected and reused. All runoff from the plant area must be collected and treated as dirty water.	Continuous	NWA	Waste water management plan	Operational phase	Environmental officer	Medium-Low (Positive)
		Noise	To prevent the noise emanating from washing plant from impacting on the sensitive receptors	Optimum location of plant, away from nearest sensitive receptors. Noise barriers in the form of screens (trees, etc) to be installed at various positions around the wash plant.	Ongoing through operational phase	NEMAQA , ECA	Noise monitoring programme	Operational phase	Environmental officer	Minor
		Wetlands	Avoid impacts to water quality from spillages and leakages.	Continuous maintenance and inspection of the infrastructure as part of the water management programme.	on going	NWA	Water monitoring programme	Operational phase	Environmental officer	Medium-Low
16	Discard dump	Surface Water	Prevention of contamination of surface water	The discard dump must be designed correctly in order to prevent seepage and contaminated runoff entering the surrounding environment. The area of the discard dump should be lined with compacted impermeable material as proposed in the Discard designs (Appendix N) and cut off trenches built around the dump. All water coming off the discard dump must be treated as dirty water.	Continuous	NWA, DWAF BPG	Waste water management plan	Operational and decommissioning phase	Mining engineer and Environmental officer	Medium-Low

No	Activity	Affected Environment	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after mitigation
		Groundwater	Prevent contaminated water from infiltrating to aquifers	The discard dump footprint should be compacted and lined as proposed in the Discard designs to prevent infiltration of contaminated water into the sub-surface. Water collected from penstock should be pumped back to the pollution control dams. Runoff from discard dump must be contained and managed. Monitoring boreholes must be drilled and sampled to detect any contamination from dump.	During construction phase and ROM	NWA	Water Monitoring Programme/procedure	Construction phase	Environmental Officer&Civil Engineer	Medium-Low
		Air Quality	Reduction of dust fallout levels and particulate matter	Areas of the dump that become available must be covered in topsoil and vegetated as soon as possible to reduce exposed surfaces; this should be done progressively due to the proposed extension of the discard dump.	Continuous		Rehabilitation plan	Operational and decommissioning phase	Environmental officer	Medium-Low
		Wetlands	Avoid impacts to water quality of aquifers	Placement of perforated pipes and cut-off trenches to capture and drain dirty water.	As and when required	NWA	Water monitoring programme	Operational phase	Environmental officer	Medium-Low (Positive)
		Visual	Reduce the visual impact of topsoil, overburden and discard dumps	Where possible stockpiles and overburden dumps should be kept as low as possible, Establish vegetation where possible	as and when required		Rehabilitation plan	Operational and decommissioning phase	Environmental officer	Medium-High
17	Pollution control dams	Surface Water	Prevention of contamination of surface water	Water pollution control dams needs to be well designed and properly maintained to prevent any leakages or spillages into dirty water into clean water systems. The operation of the PCDs on site will be undertaken in accordance with the requirements of the DWAF: Best Practice Guideline A4: Pollution Control Dams (August 2007). Recycled water will be diluted if required to meet the quality and quantity demands. All applicable DWAF Best Practice Guidelines for water management must be complied with and in particular, the DWAF: Best Practice Guideline H3: Water Reuse and Reclamation (June 2006).	Monthly	NWA, DWAF BPG	Waste water management plan	Operational phase and decommissioning phase	Environmental officer	Medium-Low (Positive)
		Wetlands	Avoid impacts to water quality from spillages and leakages.	Continuous maintenance and inspection of the infrastructure as part of the water management programme.	On going	NWA	Water monitoring programme	Operational phase	Environmental officer	Medium-Low

No	Activity	Affected Environment	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after mitigation
18 & 23	Waste and sewage generation and disposal	Surface Water	Prevention of contamination of surface water	Waste facilities must be inspected. Skips for waste collection should be covered. Sewage disposal facilities must be maintained to ensure there are no leakages and that the facilities are operating correctly.	Monthly	NWA	Waste water management plan	Operational and decommissioning phase	Environmental officer	Medium-Low (Positive)
		Groundwater	Prevent contaminated water from infiltrating to aquifers	All waste storage areas should be adequately stored and bunded off to prevent any contamination to the groundwater during an accidental spill or leaks. Sewage should be collected by an authorized contractor and disposed of at a licensed waste disposal site	Monthly inspections	NWA	Spill Prevention, Emergency response plan	Construction and operational phase	Environmental officer	Medium-Low
		Wetlands	Avoid impacts to water quality and wetland functioning through spillages and leakages.	A waste water management system will be introduced on site to ensure that potential pollution of the water resource will be minimised. Waste disposal facilities must be correctly managed and maintained. Sewage disposal facilities must be monitored to ensure correct operation	Weekly	NWA	Water monitoring programme	LoM	Environmental officer	Minor
19	Concurrent replacement of overburden and topsoil and revegetation	Topography	Ensure overburden is placed in a manner to restore a functioning topography	The replacement of overburden and top soil should be replaced so it follows the original contouring of the land prior to mining. The area would need to be revegetated to decrease the risk of erosion.	Monthly		Rehabilitation plan	Operation and decommissioning phase	Mining engineer	Medium-Low (Positive)
		Soil	To ensure soil profile can sustain vegetation	Restore overburden to recreate slope form and topsoil with optimal fertilisation based on soil analysis. Ensure monitoring and remediate if necessary soil fertility, soil acidity and depths	Ongoing		Rehabilitation plan	Operation and decommissioning phase	Environmental officer	Medium-High (Positive)

No	Activity	Affected Environment	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after mitigation
		Surface Water	Prevention of contamination of surface water	When designing and mining opencast areas, the final decant point will, as far as possible, be kept above the level of spoil replacement. This is done in an effort to ensure that replaced spoils are completely flooded when groundwater levels recover to reduce the contact of spoils with air in an effort to reduce oxidation. During rehabilitation, the contouring of the surface will be such as to avoid ponding of water on rehabilitated surface to reduce the infiltration of water into areas where spoils have been replaced and which are prone to AMD. Water entering the pit during the operational phase should be pumped out as rapidly as possible to minimize its contact with AMD generating material. This water should be re used on site, or discharged if quality is such that it meets discharge permit conditions. All applicable DWAF Best Practice Guidelines for surface water management must be complied with and in particular Water management measures should be undertaken in accordance with the requirements of the DWAF: Best Practice Guideline A5: Water Management for Surface Mines (July 2008).	Ongoing		Rehabilitation plan	Operational and decommissioning phase	Environmental officer	Medium-Low
		Air Quality	Reduction of dust fallout levels and particulate matter	When backfilling during earthmoving operations, dedicate a water truck or large hose to backfilling equipment and operations and apply water as needed; or, cover or enclose stationary backfill material; if needed, mix backfill soil with water prior to moving. Empty loaders buckets slowly and minimize their drop heights. Immediately after backfilling, apply soil stabilization compounds to form a crust. The limit value for the 24 hour average for PM10 is 75 ug/m3 and this may not be exceeded 4 times within a year. The limit value for the yearly average for PM10 is 40ug/m3	On going	NEMAQA	Ambient air quality operating procedure and contractors EMP	Operational phase	Environmental officer	Medium-Low

No	Activity	Affected Environment	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after mitigation
		Noise	To prevent the noise emanating from the construction machinery from impacting on the sensitive receptors	As per mitigation for activity 4	Ongoing	NEMAQA , ECA	Noise monitoring plan, Contractors EMP	Operational phase	Environmental coordinator	Medium-Low
		Biodiversity & Aquatic Environment	Reduce areas available for alien infestation	The footprint of the area disturbed by the mining operation will have natural vegetation restored.	On going	CARA	Alien invasive monitoring and control programme	Operation and decommissioning phase	Environmental officer	Medium-Low (Positive)
			Limit the erosion potential of exposed areas	Once overburden and topsoil has been placed on the area seeding must be undertaken as soon as possible where required, with grasses such as a standard seed-mix . Any alien invasive species that establish themselves in rehabilitated areas must be removed. If compaction of the areas occurs they must be ripped to encourage plant growth. Rehabilitated areas must be monitored and maintaining to prevent soil erosion as stipulated in the rehabilitation plan that is compiled as part of the closure plan for the mine.	On going	NEMA	Alien vegetation Monitoring plans			
			Restore water infiltration, and reduce surface water runoff	Re-vegetated areas will form seepage areas which will help aid infiltration. Restore of wetland areas and low gradient rehabilitation to create seepage units.						
			Restore the size of the impacted/disturbed catchment area	The footprint of the area disturbed by the mining operation will have topsoil and overburden replaced to restore the total catchment area.	On going	NWA	Rehabilitation to represent original contours and topography as per the Rehabilitation and Closure Plan	Operational phase	Environmental officer	Medium-High (Positive)
			Restoration of sub-surface flow dynamics	The soil profile will be replaced to represent the original make-up and structure.			Rehabilitation plan			

No	Activity	Affected Environment	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after mitigation
			Restore the re-charge potential of aquifers	Re-vegetated areas will form seepage areas which will help to re-charge aquifers. The soil profile will be replaced to represent the original make-up and structure. Exposed areas will be revegetated which will help with the recharge of the aquifer.			Restore of wetland areas and low gradient rehabilitation to create seepage units			
20	Retrenchment	Socio-Economic	Ensure that decommissioning and retrenchments take place in a legally compliant and human manner	The LED plan should be implemented to assist local business development. The workforce should be empowered to develop skills that will equip them to obtain employment in other sectors of the economy	Ongoing		The social plans to involve action plans aimed at providing development opportunities and benefits to the affected local communities.	Operation and decommissioning phase	HR Manager	Medium-Low (Positive)
21	Demolition of infrastructure	Noise	To prevent the noise emanating from the demolition activities from impacting on the sensitive receptors	Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust mufflers. Limiting demolition activities to daylight hours. Switching off equipment when not in use	On going	NEMAQA , ECA	Noise monitoring programme	Decommissioning phase	Environmental officer	Minor
		Biodiversity & Aquatic Environment	Avoid spillage of hazardous materials, thereby protecting vegetation and soil.	The correct and careful handling of the infrastructure housing pollutants and toxicants to prevent spillages and leaks such as workshop areas and the overland conveyor and plant area.	On going	NEMA	Rehabilitation plan	Decommissioning phase	Mining engineer	Minor
			Avoid destruction of vegetation, the creation of favorable habitat for fast growing invasive plants and ground compaction.	Vehicles to make use of existing roads and designated areas. Avoid rehabilitated and natural habitat areas as far as possible.						
			Impacts to wetlands from vehicle use.	Vehicles to make use of existing roads and designated areas. Avoid wetland and natural habitat areas.	On going	NWA		Decommissioning phase	Environmental officer	
		Visual	Reduce the visual impact during demolition	Dirt roads need to be wet by a water browser so as to reduce dust plumes by vehicles carrying infrastructure.	As and when required			Decommissioning phase	Environmental officer	Minor

No	Activity	Affected Environment	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after mitigation
		Traffic & safety	Create safe environment for pedestrians, animals and motorists	Vehicle movement on site must be restricted to daylight hours. All speed and safety controls must be adhered to. Vehicles must be maintained.	On going		Grievance Mechanism	LoM	Safety officer	Minor (Positve)
22	Final replacement of overburden and topsoil revegetation	Topography	Ensure overburden is placed in a manner to restore a functioning topography.	The replacement of overburden and top soil should be replaced so it follows the original contouring of the land prior to mining. The area would need to be revegetated to decrease the risk of erosion.	Monthly		Rehabilitation plan	Operation and decommissioning phase	Mining engineer	Medium-Low (Positive)
		Soil	To achieve determined post mining land capability	Scarify roads and stockpile areas to a depth of 500mm and infrastructure areas and restore topsoil cover. Implement soil conservation measures. Integrate disturbed area to most appropriate land use to ensure long-term stability of restored topsoil. Rehabilitation must ensure long-term stability and not compromise post-mining land use objectives.	Ongoing		Rehabilitation plan	Decommissioning and post closure phase	Mining engineer, environmental officer	Medium-High (Positive)
		Surface Water	Prevention of contamination of surface water	The filling of the void must be controlled to maintain the correct slopes so as to prevent the alteration of a free drainage system, where there was initially a natural drainage line. The water from the PCD should be either re-cycled for stored for evaporation, or treated to levels that can be discharged to a municipal system or nearby rivers (this must be a registered water activity). Decommissioning activities must be conducted in accordance with DWAF best Practice Guidelines: A5 Water Management Aspects for Mine Closure (December 2008). The final decant point must be at level higher than the level of spoil replacement. Decant water to be contained.	Ongoing	NWA, DWAF BPG	Rehabilitation plan	Decommissioning and post closure phase	Mining engineer and Environmental officer	Medium-Low

No	Activity	Affected Environment	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after mitigation
		Air Quality	Reduction of dust fallout levels and particulate matter	When filling of final void , dedicate a water truck or large hose the filling equipment and operations and apply water as needed; or, cover or enclose stationary backfill material; if needed, mix backfill soil with water prior to moving. Empty loader buckets slowly and minimize their drop heights. Immediately after backfilling, apply soil stabilization compounds to form a crust. The limit value for the 24 hour average for PM10 is 75 ug/m3 and this may not be exceeded 4 times within a year. The limit value for the yearly average for PM10 is 40ug/m	On going	NEMAQA	Ambient air standard operating procedure, Contractors Operational EMP	Decommissioning phase	Environmental officer	Minor
		Noise	To prevent the noise emanating from the machinery from impacting on the sensitive receptors	Limiting activities to daylight hours. Mining-related machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installing exhaust mufflers. Switching off equipment when not in use.	Ongoing through decommissioning phase	NEMAQA , ECA	Noise monitoring programme	Decommissioning and post closure phase	Environmental officer	Minor
		Biodiversity & Aquatic environment	Restore natural vegetation	The footprint of the area disturbed by the mining operation will have topsoil and overburden replaced to restore the vegetation cover. The areas that have been rehabilitated should be protected from further disturbances. Fences should be erected around certain areas that need extra protection	On going	NEMA	Rehabilitation plan	Decommissioning phase	Mining engineer	Medium-High (Positive)
			Limit the erosion potential of exposed areas.	Once overburden and topsoil has been place on the area seeding must be undertaken as soon as possible, where required with grasses such as A standard seed-mix is 5 kg/ha of Smuts finger grass (Digitaria eriantha), 5 kg/ha of Rhodes grass (Chloris gayana) and 5 kg/ha of teff (Eragrostis tef). A second option is 10 kg/ha of love grass (Eragrostis curvula) and 5 kg/ha of teff. Any alien invasive species that establish themselves in rehabilitated areas must be removed. If compaction of the areas occur they must be ripped to encourage plant growth. Rehabilitated areas must be monitored and maintaining to prevent soil erosion as stipulated in the rehabilitation plan that is compiled as part of the closure plan for the mine.	Weekly		Storm water management plan & monitoring plans		Environmental officer	

No	Activity	Affected Environment	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after mitigation
			Restore the size of the impacted/disturbed catchment area	The footprint of the area disturbed by the mining operation will have topsoil and overburden replaced to restore the total catchment area.	On going	NWA	Rehabilitation plan	Decommissioning phase	Environmental officer	
			Restoration of sub-surface flow dynamics	The footprint of the area disturbed by the mining operation will have topsoil and overburden replaced to restore the total catchment area. The soil profile will be replaced to represent the original make-up and structure. Exposed areas will be vegetated. Monitoring to take place to determine level of rehabilitation.						
		Visual	Reduce the visual impact	Overburden and topsoil should be replaced following the original topography of the site prior to mining. Re-establish vegetation where possible.	On going		Post closure rehabilitation plan	Decommissioning Phase	Environmental officer	Medium-Low (Positive)
24	Post closure monitoring and rehabilitation	Soil, Surface Water, Biodiversity and Wetlands	Ensure that the area is not a source of pollution after closure of the mine.	Woody vegetation should be establishment to minimize water ingress into the discard will be applied. It is essential that the coal discard dump be placed, shaped and compacted as part of concurrent operations. Soil will be required to cover the discard dump. The quantities of soil required as well as the timing of the operation will depend on the design and operation of these facilities. Surface water runoff controls will be engineered to prevent future soil erosion of the rehabilitated discard dump. Re-vegetation will assist in controlling erosion by wind and water. Monitoring will be ongoing for 3years to determine potential water contamination. For the first year monitoring should be undertaken quarterly and from the results it can be determined if quarterly monitoring is required or bi-annual monitoring will be sufficient. After three years it will be assessed if further monitoring is required.	Ongoing for 5 years post mining or longer if required	NWA	Rehabilitation and Closure Plan	Decommissioning and post closure phase	Mining engineer, environmental officer	Medium-Low

No	Activity	Affected Environment	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after mitigation
24	Post closure monitoring and rehabilitation	Soil, Surface Water, Biodiversity and Wetlands	Establishment of post mining land capability and ensure post mining land use fits the capability	Analyse soils, treat to ameliorate salinity or contamination and dispose of untreatable soil at an approved disposal site. Restore overburden to recreate slope form and topsoil with optimal fertilisation based on soil analysis. Implement soil conservation measures. Integrate available land with activities in adjacent areas. Rehabilitation must ensure long-term stability and not compromise post-mining land use objectives. Take into account developments in surrounding areas and design post-mining land use options to support and enhance long-term development options. Ongoing monitoring to establish status of environment post closure	Ongoing for 5 years post mining or longer if required	NWA	Rehabilitation and closure plan	Decommissioning and post closure phase	Mining engineer, environmental officer	Medium-Low

14.3 Environmental action plan

As contemplated in Regulation 50 (a), specific action plans need to be implemented to achieve the objectives and specific goals of each specialist study.

14.3.1 Time schedules

As contemplated in Regulation 50 (a) and Regulation 51 (b), specific timeframes for the mitigation and management of environmental impacts need to be provided. The EMP (Table 14-1) provides the schedules of the frequency of the mitigation and management measures.

15 Environmental emergency plan

The environmental management programme and associated management options are intended to minimise environmental risk as far as possible. Should, however, circumstances lead to unacceptable risks, emergency systems and procedures have been designed and will be implemented in the case of an emergency to prevent or minimise the consequential environmental damage. The environmental emergency contingency plan addresses any reasonably anticipated failure (most probable risk) for the entire mining area and focuses on incidents that could cause environmental emergencies.

15.1 Description of the on-going monitoring and management measures to be implemented, to provide the early warning systems necessary to avoid environmental emergencies

If the emergency has potential to affect surrounding communities, they will be alerted via alarm signals or contacted in person. The surrounding community will be informed prior to mining taking place, of the potential dangers and emergencies that exist, and the actions to be taken in such emergencies.

Communication is vital in an emergency and thus communication devices, such as mobile phones, radios, pagers or telephones, must be available around the mine. A checklist of emergency response participants must be consulted and the relevant units notified. In this case, many of the emergency services will be sourced from Belfast, Carolina and Middelburg, the nearest towns.

The checklist includes:

- Fire department;
- Police;
- Emergency health services such as ambulances, paramedic teams, poisons centres;
- Hospitals, both local and for evacuation for specialist care;
- Public health authorities;

- Environmental agencies, especially those responsible for air, water and waste issues;
- Other industrial facilities in the locality with emergency response facilities;
- Public works and highway departments, port and airport authorities; and
- Public information authorities and media organisations.

The conceptual emergency response plan will be only implemented once the mine becomes operational. Therefore, it will be of paramount importance that the plan be reviewed after an incident or accident to ensure that the necessary measures are in place to protect the environment and protect the mine against liability claims that could result. In addition, a yearly review of the emergency response plan will be carried out, irrespective of whether an incident occurred during that year.

15.2 Description of procedures that will be in place in cases of environmental related emergencies

The following is a list of potential emergencies that could occur:

15.2.1 Accidents

In the case of a medical accident or problem, a first aid kit will be available on the mine.

A checklist of emergency response participants must be consulted and the relevant units notified. In this case, many of the emergency services will be sourced from the nearest main town, Witbank.

15.2.2 Fire

Veld fires and fires resulting from other sources must be handled with extreme caution. Fire extinguishers will be placed around the mine.

Procedure:

- The alarm will be activated to alert occupants of the mine in the event of a fire;
- In the event of a small fire the fire extinguishers placed around the mine should be used to contain and extinguish the fire;
- In the event of a large fire, the local area council's fire department will be consulted; and
- All staff will receive training in response to a fire emergency on site.

15.2.3 Hydrocarbon spillage

Hydrocarbons such as diesel, petrol, and oil will be kept on site as fuel for the mine machinery. In the event of a spillage, procedures must be put into place to ensure that there are minimal impacts to the surrounding environment.

Procedure:

- In the event of a small spillage, the soil will be excavated and treated;
- In the event of a large spillage, adequate emergency equipment for spill containment or collection such as additional supplies of booms and absorbent materials will be available and if required, a specialised clean-up crew will be called in to decontaminate the area; and
- After a major spill water quality samples of any water sources utilised within 500m from the spill will be monitored for hydrocarbons for the next three months on a monthly basis and further remediation recommended based on the results thereof.

15.2.4 Flooding

There is potential for flooding during the rainy season, but particularly November to January when severe thunderstorms can occur. This could result in a large volume of water flowing downstream and could cause major damage to equipment and endanger the lives of employees on site. Heavy rainfall could also cause the pollution control dam to overflow and could flood mine workings. If this water leaves the sites is will enter water resources on site and cause contamination. Procedures must be put in place to ensure that there is a quick response to these events and damage is kept to a minimum.

Procedure:

- DWAF's flood warning system should be reviewed annually;
- The use of emergency pumps will occur if the water floods the pits, where it may be exposed to contamination; and
- Mine management should be made aware of any such event so they can take appropriate action to ensure production losses are kept to a minimum.

15.3 Technical, management and financial options that will be in place to deal with the remediation of impacts in cases of environmental emergencies

The most crucial aspect of the emergency system is the identification and communication of the emergency to the appropriate persons. Consequently, the names of the appropriate contact person together with their contact numbers would be prominently displayed around the facility. The contact details will be updated on a regular basis. First-party employees (such as security, safety superintendents, mine overseers, environmental officers) will be trained to respond to the responsible personnel in the event of an emergency.

Each person's responsibility would be cleared with him/her beforehand and a copy of the emergency contingency plan would be distributed to each person, including the responsible and/or affected persons not associated with the mine:

- Disaster management and firefighting agencies,
- Downstream water supply authorities,
- Downstream users that could be affected in the case of an emergency such as neighbouring mines, farmers and local communities;
- Relevant government authorities such as DWAF and DME; and
- Approved professional person (engineer).

It must be ensured that operating and supervisory staff is familiar with the emergency plan, and that the content thereof is understood and familiar to them. The emergency procedures will therefore be included in the induction programme of the mine. Regular training sessions in this regard on a more business-specific basis will be performed.

The emergency response plan will be updated as circumstances change or operating procedures are amended, and as a minimum in the event of:

- Any additional recommendations made by a professional engineer (annual safety inspections) or environmental auditors;
- Any change in operational procedures and/or management of the mining activity;
- The identification of any issues of concern or additional risks as a result of regular inspections and/or monitoring results; and
- Any unplanned or unforeseen emergency situation.

All emergency response procedures will be implemented on the initiation of the construction stage. All employees of the Kangala Coal Mine mining operation will be trained in these procedures as part of the mine induction process. Universal Coal will ensure that all emergency numbers are located in various locations around the site and these locations are known to all employees for easy accessibility in the event of an emergency.

16 EMP performance assessment

16.1 List of the environmental aspects that will be monitored

Details of the manner in which monitoring on the project will be conducted have been outlined in each specialist report. Below, provides a description of the monitoring to take place.

Table 16-1: Description of monitoring to take place

Monitoring	Locations	Standards and/or legislative requirements	Description of the analysis to be conducted and the records to be kept
Soil Monitoring	Progressive monitoring of the stripping, stockpiling, shaping of spoil surfaces and replacing of topsoil	Mine rehabilitation plan	Progressive monitoring should take place on at least a quarterly basis and should involve the following; ■ Inspection of stripping depths; ■ Inspection of stockpiles to check degradation and or pollution; ■ Inspection of spoil surfaces before replacing soil to ensure that pre mined topography is emulated; ■ Random inspection of soil thickness on rehabilitated sections; ■ Fertility analysis and amelioration procedures prior to re-vegetation; and ■ Evaluating and readjusting the rehabilitation plan.

Monitoring	Locations	Standards and/or legislative requirements	Description of the analysis to be conducted and the records to be kept
Air Quality - Dust monitoring (dust buckets)	Refer to Plan 15.	National Environment Management: Air Quality Act (Act No. 39 of 2004) (NEM: AQA).	For the single dust fallout samplers, the buckets are filled with distilled water and left out on site for a period of 30 days (+/- 3 days); according to SANS:1929; from there the buckets will be transported to a reputable Laboratory for analysis. The air quality monitoring programme should initiate as soon as construction commences. The buckets should be changed on a monthly basis and the filters of the permanent PM10 sampler should be changed daily. The permanent PM10 sampler will need to be near a power source. The permanent PM10 sampler will sample the ambient PM10 levels on a continuous basis throughout life of mine. Incident reports will be submitted to the mine as well as to the relevant competent authority upon receipt of results exceedances. In case of no exceedance this will be confirmed.

Monitoring	Locations	Standards and/or legislative requirements	Description of the analysis to be conducted and the records to be kept
Baseline noise monitoring is to be conducted on a monthly basis for the first 3 months to determine the impact of the noise levels on the relevant receptors as well as determine the level of mitigation. Once it is established that the mitigation measures have decreased the specific noise levels from the mining activities, the noise monitoring should be carried out on a quarterly basis thereafter.	Locations as per Plan 16	The approach used in investigating noise impacts is based on guidelines provided by the South African National Standards (SANS). The following legislation was considered for this survey: ▪ The National Environmental Management Act (Act 107 of 1998), NEMA; ▪ The National Environmental Management Air Quality Act (Act 39 of 2004), NEMAQA; and ▪ The Environment Conservation Act, 1989 (Act 73 of 1989).	At each measurement point the ambient noise level will be sampled in terms of the following parameters: ▪ The A-weighted equivalent sound pressure level (LAeq) for duration not less than 30 minutes per monitoring point. ▪ Measurements to be taken during both daytime (06:00 to 22:00) and the night time (22:00 to 06:00). A report must be compiled monthly/quarterly, depending on the intervals of the monitoring programme then submitted to management to ascertain compliance with the required standards.

Monitoring	Locations	Standards and/or legislative requirements	Description of the analysis to be conducted and the records to be kept
Surface Water - Surface water monitoring (samples from monitoring points) Sampling will be conducted on a monthly basis during the first year to establish seasonal trends; and After the first year of mining, sampling will be conducted quarterly.	Surface water monitoring will be done at strategic locations as follows:- ▪ Downstream of possible sources of pollution e.g. downstream of the decant points of both the North and South pits; ▪ Downstream of a stockpile area; ▪ Downstream of the pits to establish a possibility of any pollution to the streams; ▪ Downstream of infrastructure that could be possible sources of surface water pollution such as the hydrocarbons storage facilities; and ▪ The surface water points sampled during the hydrocensus (Plan 11).	▪ Republic of South Africa. (1998). Regulation GN 704 published in terms of the National Water Act of 1998. (Act no 36 of 1998), Pretoria; ▪ Department of Water Affairs South African Water Quality Guidelines for Domestic Use Target Values (DWA SAWQTV); and ▪ South Africa National Standard (SANS 241-1:2011) drinking water standard in order to evaluate the groundwater quality.	Water quality will be the main item that will be monitored by the surface water monitoring programme. Fluctuations in water quality will assist in identifying and informing reviews of management plans and mitigation measures. Samples will be submitted to a reputable laboratory for water quality analysis. A full analysis report on the quality of the water will be submitted to the mine management on an annual basis.

Monitoring	Locations	Standards and/or legislative requirements	Description of the analysis to be conducted and the records to be kept
Groundwater - Groundwater monitoring (samples from monitoring points) The suggested frequency for groundwater monitoring is as follows: ▪ Monthly for the first six months; and ▪ Bi monthly for the next six months. If results are stable (except for seasonal changes) and a trend is established, quarterly monitoring will be sufficient but will have to be revisited after the first year and adjusted	Refer to Plan 11	▪ The Environmental Regulatory Framework in South Africa (Sections 7, 8 and 24 of the Bill of Rights); ▪ Major Hazard Installation (MHI) Regulations (GNR 692 of 2001); ▪ National Environmental Management Act (Act 107 of 1998), as amended (NEMA), GNR 544 and GNR 545 (Section 24 (1)); ▪ National Water Act 36 of 1998 (Sections 19-22) and GN 704; ▪ Water Services Act 108 of 1997; ▪ National Environmental Management: Waste Act (Act 59 of 2008) (NEMWA) and List of Waste Management Activities requiring a Waste Management Licence	The following parameters will be monitored: major ions, minor ions, physicochemical parameters and trace elements. See Table 13-2. Quarterly monitoring reports with the combined results of the surface and groundwater monitoring. The monthly results are combined cumulatively in the quarterly reports.

Monitoring	Locations	Standards and/or legislative requirements	Description of the analysis to be conducted and the records to be kept
according to results.		(WML) GN 718 of 2008; ▪ Hazardous Substances Act (Act 15 of 1973); ▪ Facilities Regulations (GNR 924 of 2004); and ▪ Hazardous Chemical Substances Regulations (GN 1179 of 1995).	
Air Blasting and Ground Vibration Monitoring	It is proposed that at least four seismographs be placed at the positions as indicated on Plan 23. One at the Dam Wall, one at the Chicken Pen West of the mine, one at the new Chicken Pen North of the mine and one at Structure 4, east of the mine.	USBM Guideline Limits	Incident report

16.2 Performance assessment process

Performance assessments will be conducted by professional consultants on an annual basis throughout the life of mine, to monitor the EIA and EMP process and the rehabilitation process and advice on any mitigation measures which need to be added to the existing programmes.

A report will be submitted to mine management annually covering all aspects investigated during the audit, and providing suggestions and recommendations as to how the rehabilitation programme is progressing, and any improvements which could be made.

An assessment of compliance to applicable legislation will be included in the assessment and will take into consideration the management principals and strategies stated in the Environmental Management Programme, and assess whether this strategy is providing the required results. Any flaws found in the rehabilitation process will be included in the report along with the recommended mitigation measures.

A report will be compiled on an annual basis to mine management, who may then decide the appropriate actions to be taken, along with an updated financial provision

17 Financial provision

The closure cost assessment involves the quantification of mining and infrastructure components and applying rates to rehabilitate each component. The environmental liability is described in monetary terms in order for a financial provision to be set-aside in a dedicated fund for closure and rehabilitation purposes.

Regulation 53 lists the following methods available to mines to make financial provision available:

- A financial guarantee;
- A cash deposit;
- An approved contribution; and
- Any other method deemed satisfactory by the directorate.

Digby Wells updated the closure cost estimate for the Kangala Coal Mine to include the new infrastructure as provided by Universal Coal.

17.1 Decommissioning and closure map

Mine closure is an ongoing programme designed to restore the physical, chemical and biological quality or potential of air, land and water regimes disturbed by mining to a state acceptable to the regulators and to post mining land users. The activities associated with mine closure are designed to prevent or minimise adverse long term environmental impacts, and to create a self-sustaining natural ecosystem or alternate land use based on an agreed set of objectives. The objective of mine closure is to obtain legal (government) and community agreement that the condition of the closed operation meets the requirements of those entities, whereupon the companies' legal liability is terminated.

Closure will include some form of rehabilitation. Rehabilitation can be divided into two different streams, namely concurrent rehabilitation and final rehabilitation. Concurrent rehabilitation must be carried out along with the operations on the coal mine, and will decrease the final liability that the mine will carry at the time of closure. This concurrent rehabilitation will be carried out within the context of the EMP. Final rehabilitation will be carried out once the mine goes into its closure phase. This final rehabilitation will be carried out within the context of the closure plan (Bailie, 2006).

The closure plan should be modified and adapted as the mining project continues and more knowledge is generated about the mine environment and the impacts of the project. Consequently a more detailed closure plan will be developed as more information is available.

A coal mine will obtain a closure certificate only once it can prove that rehabilitation is satisfactory, and that if any residual pollution effects exist they can be adequately managed. It is recommended that, whatever form of rehabilitation is used, a post-closure monitoring programme is implemented before the mine applies for closure (this should be for a period of 5 years, or until the long term trends of the impacts are understood). The institution of this monitoring programme will enable the mine to identify and rectify any residual pollution impacts.

Plan 3 (included in Appendix O) depicts the infrastructure to be constructed and decommissioned during the decommissioning phase of the LoM activities.

The following activities will be undertaken at decommissioning and closure:

17.1.1 Stockpile areas

The objective is to ensure that the area is not a source of pollution after closure of the mine. This will be achieved by:

- Removal of all stockpiled coal from the site;
- The sacrificial coal layer will be removed and the area topsoiled and vegetated to ensure no erosion takes place; and
- The area must be monitored thereafter to ensure that vegetation is established.

17.1.2 Opencast pits/strips

The environmental objective of the pit is to make it as safe as possible for humans and animals at closure, to affect the required water control and to achieve the highest land capability possible.

- Infilling of the pit/strips will occur as mining progresses and subsequent spoils rehabilitation will also take place for the areas which can only be accessed at the end;
- Material will be replaced in the reverse order to which it has been removed;
- If a certain lithology could significantly affect water quality it should be buried below the final expected water table; and
- The areas that have been infilled will be shaped to reduce the likelihood of ponding occurring on surface and to blend in with the surrounding topography.

17.1.3 Infrastructure areas

- All portable infrastructure will be removed off the site;
- Structures that require demolishing such as the hard park area will be demolished to 1m below ground level for areas which cannot be used by a subsequent land user;
- The rubble will either be buried on site provided it will not have any detrimental impacts on water quality; and
- All areas will be shaped and topsoiled with 300mm of topsoil and vegetated.

17.1.4 Pollution control dams

- The pollution control dam will become evaporation dams (wilderness land) at and after closure. During decommissioning activities, dirty water will continue to be fed into it, but once the area has been fully rehabilitated and maintained for three years, run-off from these areas will be tested in terms of quality and when and the water is accepted to be clean and allowed to discharge.
- It will be covered by a layer of soil that will be able to support plant growth under a normal level of farm management; and
- All surface water, which will be considered to be clean water and meets the necessary catchment objectives after vegetation has established itself, will be diverted past the pollution control dam into the catchment until such time as that all water entering the pollution control dam is of an acceptable quality for discharge. Then it will be rehabilitated to maintain natural drainage lines.

17.1.5 Discard dump

- Woody vegetation should be establishment to minimize water ingress into the discard will be applied.

- It is essential that the coal discard dump be placed, shaped and compacted as part of concurrent operations.
- Soil will be required to cover the discard dump. The quantities of soil required as well as the timing of the operation will depend on the design and operation of these facilities.
- Surface water runoff controls will be engineered to prevent future soil erosion of the rehabilitated discard dump. Re-vegetation will assist in controlling erosion by wind and water.
- Monitoring will be ongoing for 3years to determine potential water contamination. For the first year monitoring should be undertaken quarterly and from the results it can be determined if quarterly monitoring is required or bi-annual monitoring will be sufficient. After three years it will be assessed if further monitoring is required.

17.1.6 Access roads

Access roads around the site should be ripped for all areas except those needed to access the facilities for inspection after closure. Wherever there are access roads that should be useable by the surface owner, these should be left.

17.1.7 Power line and electrical infrastructure

The environmental objective is to remove all infrastructure not required by future users of the property.

All onsite electrical reticulation infrastructure should be removed from site or, if the property of Northern Coal, should be sold and disposed of. The regional power line will be the property of Eskom and should remain on site for future use as it will serve the other customers around the area.

17.2 Standard guideline document (Regulation 54(1) 2)

For the purpose of this document the DMR's, "Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision provided by a Mine" is used as a basis for the calculation of the closure cost. The DMR guideline document divides the activities on a mine in components with a specific number and main description for each component.

Table 17-1 indicates the different components with a description of each component according to the DMRs guideline. The table furthermore indicates the activities associated with the Kangala Mine and whether they are applicable to the DMR guideline.

Table 17-1: Description of closure components (DMR guidelines) and the relevance to Kangala Mine

Component Number	Description	Applicable at Kangala Mine	Comment
1	Dismantling of processing plant & related structures (incl. overland conveyors & Power lines)	Yes	Washing Plant at Kangala Mine and new overland conveyor included
2 (A)	Demolition of steel buildings & Structures	Yes	Workshops and steel structures
2 (B)	Demolition of reinforced concrete buildings & structures	Yes	Concrete slabs for offices and diesel bund area, as the containers will be salvaged
3	Rehabilitation of access roads	Yes	Access, haul and other roads
4 (A)	Demolition & rehabilitation of electrified railway lines	No	Not present
4 (B)	Demolition & rehabilitation of non-electrified railway lines	No	Not present
5	Demolition of housing &/or administration facilities	Yes	Offices, change house, gate office etc.
6	Opencast rehabilitation including final voids & ramps	Yes	Size of current void
7	Sealing of shafts, adits & inclines	No	Not present
8 (A)	Rehabilitation of overburden & spoils	Yes	Hard wastes and stockpiles
8 (B)	Rehabilitation of processing waste	No	Not present

Component Number	Description	Applicable at Kangala Mine	Comment
	deposits & evaporation ponds (basic, salt producing waste)		
8 (C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	Yes	Discard facility and PCD
9	Rehabilitation of subsidised areas	No	Not present
10	General surface rehabilitation	Yes	Total area affected by mining
11	River diversions	No	Not present
12	Fencing	Yes	Fences to be removed
13	Water management	Yes	Void, ramps, open cast area
14	2 to 3 years of maintenance & aftercare	Yes	Maintenance and monitoring of all disturbed areas

The information included in the above table is based on available information provided by Kangala Mine.

17.2.1 Rates

The closure liability costs for the mine have been determined by using the DMR guidelines. The master rates stated in the guideline make certain assumptions on the level and quality of rehabilitation and closure activities to be undertaken. The master rates used in the calculation of the closure cost estimate was received from Kangala Mine. The master rates were updated by an average rate of inflation.

17.2.2 DMR classification

The DMR guideline classifies a mine according to a number of factors which allows one to determine the appropriate weighting factors to be used during the quantum calculation. The following factors are considered:

- The mineral mined;

- The risk class of the mine;
- Environmental sensitivity of the mining area;
- Type of mining operation; and
- Geographic location.

Once the risk class (Class A, B or C) and the sensitivity of the area where the mine is located (Low, Medium or High) had been determined using the appropriate tables (Table 17-2, Table 17-3, Table 17-4 and Table 17-5) the unit rates for the applicable closure components were identified.

Table 17-2: Primary risk class type of mineral mined (Kangala Mine's class highlighted in red)

Mineral	Ore	Size: large if > than (tpm)	Primary risk class			
			Large mine		Small mine	
			Mine and Mine waste	Mine, mine waste, plant and plant waste	Mine and Mine waste	Mine, mine waste, plant and plant waste
Antimony		1000	A	A	C	C
Asbestos		0	A	A	A	A
Base metals (Copper, Cadmium, Cobalt, Iron ore, Molybdenum, Nickel, Tin, Vanadium)	Sulphide	10 000	A	A	C	A
	Oxide	10 000	C	A	C	A
Coal		0	A	A	A	A
Chrome		10 000	C	A	C	C
Diamonds and precious stones		10 000	C	B	C	C
Gold, silver, uranium		10 000	B	A	B	A
Phosphate		10 000	C	B	C	C
Platinum		10 000	C	B	C	B
Mineral sands (Ilmenite, Titanium, Rutile, Zircon)		10 000	C	B	C	C
Zinc and Lead		10 000	C	A	C	A

Mineral	Ore	Size: large if > than (tpm)	Primary risk class			
			Large mine		Small mine	
			Mine and Mine waste	Mine, mine waste, plant and plant waste	Mine and Mine waste	Mine, mine waste, plant and plant waste
Industrial Minerals (Andalusite, Barite, Bauxite, Cryolite, Fluorspar)		10 000	C	C	C	C

Table 17-3: Criteria used to determine the area sensitivity

Sensitivity	Sensitivity criteria		
	Biophysical	Social	Economic
Low	• Largely disturbed from natural state, • Limited natural fauna and flora remains, • Exotic plant species evident, • Unplanned development, • Water resources disturbed and impaired.	• The local communities are not within sighting distance of the mining operation, • Lightly inhabited area (rural).	• The area is insensitive to development, • The area is not a major source of income to the local communities.
Medium	• Mix of natural and exotic fauna and flora, • Development is a mix of disturbed and undisturbed areas, within an overall planned framework, • Water resources are well controlled.	• The local communities are in the proximity of the mining operation (within sighting distance), • Peri-urban area with density aligned with a development framework, • Area developed with an established infrastructure.	• The area has a balanced economic development where a degree of income for the local communities is derived from the area, • The economic activity could be influenced by indiscriminate development.
High	• Largely in natural state, • Vibrant fauna and flora, with species diversity and abundance matching the nature of the area,	• The local communities are in close proximity of the mining operation (on the boundary of the mine), • Densely inhabited area (urban/dense settlements),	• The local communities derive the bulk of their income directly from the area, • The area is sensitive to development that could compromise the existing economic

Sensitivity	Sensitivity criteria		
	Biophysical	**Social**	**Economic**
	• Well planned development, • Area forms part of an overall ecological regime of conservation value, • Water resources emulate their original state.	• Developed and well-established communities.	activity

Table 17-4: Weighting factor 1 – nature of terrain

	Flat	Undulating	Rugged
Weighting factor 1: Nature of terrain	1.00	1.10	1.20

Note:

- Flat: Generally flat over the mine area;
- Undulating: A mix of sloped and undulating areas within the mine area; and
- Rugged: Steep natural ground slopes (greater than 1:6) over the majority of the mine area.

Table 17-5: Proximity to urban area

	Urban	Peri-urban	Remote
Weighting factor 2: Proximity to urban area	1.00	1.05	1.10

Note:

- Urban - Within a developed urban area;
- Peri-urban - Less than 150 km from a developed urban area; or
- Remote - Greater than 150 km from a developed urban area.

The classification of Kangala Mine has been summarised in Table 17-6. It must be noted, however, that of the 18 closure components that exist only 3 are influenced by the risk class and sensitivity, the remaining 15 have a standard multiplication factor, irrespective of the class or sensitivity.

Table 17-6: Kangala Mine Classification

Mine	Risk Class	Sensitivity	Terrain	Proximity to Urban Areas
Kangala	A	Medium	Flat (1.00)	Peri-urban (1.05)

17.2.3 Assumptions

The assumptions for the closure cost calculation are as follows:

- This study did not include a detailed assessment of issues concerning shallow or deep aquifer ground water pollution and long term decant from workings;
- Infrastructure measured by the Kangala Mine surveyors are assumed to be accurate and used as such in the calculation of the closure cost calculation;
- All roads within the mining area are the responsibility of Kangala Mine except where they are proclaimed national or provincial roads;
- The surface area of the access and haul roads were calculated by Digby Wells;
- The Master Rates used in the calculation of the closure costs were received from Kangala Mine;
- A 12% project management cost has been included as the Subtotal (Capital Expenditure) is less than R 100 000 000 as per the DMR guidelines;
- A contingency of 10% has been included to allow for areas which may have been undervalued or which have been overlooked as per the DMR guidelines;
- The calculation does take into account Value Added Tax (VAT) as per the DMR guidelines;
- Calculations don't account for any value recovered from the sale of plant or other material; and
- Three years of monitoring and maintenance of vegetation after rehabilitation have been included as per the DMR guidelines.

17.2.4 Post-Closure Management

Each mine requires management, maintenance and monitoring after the operation has ceased and its facilities have been demolished and rehabilitated. This will be undertaken according to the latest approved EMPR.

A contingency of 10% on all infrastructure costs has been allowed for. A 12% allowance has been made for project management fees as the costs (Capital Expenditure) are below R 100 000 000.

17.2.5 Summary of Liabilities

The closure liability costs as part of the Kangala Mine EMPR update were calculated by means of the DMR's standard method for assessment of mine closure. The total environmental liability of the Kangala Mine is **R 51 465 580**.

A summary of the calculated closure liability costs as part of the EMPR update for Kangala Mine is presented in Table 17-1.

It is recommended that the closure cost assessment be updated annually or in accordance with the requirements as stipulated by the DMR.

Table 17-7: Summary of liabilities for Kangala Mine (DMR guideline)

Mine:	Kangala Colliery	**Location:**	Delmas, Mpumalanga				
Evaluators:	Digby Wells Environmental	**Date:**	25-Nov-14				
No.:	**Description:** **Class C (Low Risk)**	**Unit:**	**A** **Quantity**	**B** **Master rate**	**C** **Multiplication factor**	**D** **Weighting factor 1**	**E=A*B*C*D** **Amount (Rands)**
			Step 4.5	**Step 4.3**	**Step 4.3**	**Step 4.4**	
1	Dismantling of processing plant & related structures (incl. overland conveyors & Power lines)	m^3	16 459.79	12.21	1.00	1.00	R 200 974
2 (A)	Demolition of steel buildings & Structures	m^2	730.60	170.13	1.00	1.00	R 124 297
2 (B)	Demolition of reinforced concrete buildings & structures	m^2	1 265.65	250.72	1.00	1.00	R 317 324
3	Rehabilitation of access roads	m^2	400 607.90	30.44	1.00	1.00	R 12 194 504
4 (A)	Demolition & rehabilitation of electrified railway lines	m		295.49	1.00	1.00	R 0
4 (B)	Demolition & rehabilitation of non-electrified railway lines	m		161.17	1.00	1.00	R 0

Mine:	Kangala Colliery	**Location:**	Delmas, Mpumalanga				
Evaluators:	Digby Wells Environmental	**Date:**	25-Nov-14				
No.:	**Description:** **Class C (Low Risk)**	**Unit:**	**A** **Quantity** **Step 4.5**	**B** **Master rate** **Step 4.3**	**C** **Multiplication factor** **Step 4.3**	**D** **Weighting factor 1** **Step 4.4**	**E=A*B*C*D** **Amount (Rands)**
5	Demolition of housing &/or administration facilities	m^2	1 668.74	340.26	1.00	1.00	R 567 806
6	Opencast rehabilitation including final voids & ramps	ha	10.40	178 368.43	**0.52**	1.00	R 964 338
7	Sealing of shafts, adits & inclines	m^3	0.00	91.33	1.00	1.00	R 0
8 (A)	Rehabilitation of overburden & spoils	ha	55.15	118 912.28	1.00	1.00	R 6 557 445
8 (B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	ha		148 103.10	1.00	1.00	R 0
8 (C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	ha	22.35	430 161.62	**0.80**	1.00	R 7 691 290
9	Rehabilitation of	ha		99 571.13	1.00	1.00	R 0

Mine:	Kangala Colliery	**Location:**	Delmas, Mpumalanga				
Evaluators:	Digby Wells Environmental	**Date:**	25-Nov-14				
No.:	**Description:** **Class C (Low Risk)**	**Unit:**	**A** **Quantity**	**B** **Master rate**	**C** **Multiplication factor**	**D** **Weighting factor 1**	**E=A*B*C*D** **Amount (Rands)**
			Step 4.5	**Step 4.3**	**Step 4.3**	**Step 4.4**	
	subsidised areas						
10	General surface rehabilitation	ha	50.00	94 198.59	1.00	1.00	R 4 709 930
11	River diversions	ha		94 198.59	1.00	1.00	R 0
12	Fencing	m	12 501.00	107.45	1.00	1.00	R 1 343 232
13	Water management	ha	10.40	35 816.95	**0.67**	1.00	R 249 501
14	2 to 3 years of maintenance & aftercare	ha	50.00	12 535.93	1.00	1.00	R 626 797
15 (A)		SUM			**1.00**	1.00	R 0
15 (B)		SUM			**1.00**	1.00	R 0
						Total (Sum of items 1 to 15 Above)	**R 35 547 438**
	Weighting Factor 2 (Step 4.4)				**1.05**	**Sub Total 1**	**R 37 324 809**
	Preliminary and General			12% of Sub Total 1			**R 4 265 693**
	Contingency			10% of Sub Total 1			**R 3 554 744**
						Sub Total 2	**R 45 145 246**
	VAT (14%)						**R 6 320 334**
						GRAND TOTAL	**R 51 465 580**

17.3 Capacity to manage and rehabilitate (Section 39 (4))

Section 39 (4) (a) (iii) of the Act, read together with section 37 (2) of the Act, requires that the applicant will have the capacity, or have provided for the capacity, to rehabilitate and manage negative impacts on the environment.

The following recommendations are applicable to the management and rehabilitation of the negative impacts on the environment:

- The liability figures need to be updated on an annual basis as a requirement by the MPRDA. This will ensure that all costs become more accurate over time and will reflect current market conditions.

18 Environmental awareness plan (Section 39 (3) (c))

18.1 Description of awareness plan

In Section 39(3)(c) of the MPRDA it is stated that…

"An applicant who prepares an environmental management programme or an environmental management plan must –

(c) develop an environmental awareness plan describing the manner in which the applicant intends to inform his or her employees of any environmental risks which may result from their work and the manner in which the risks must be dealt with in order to avoid pollution or the degradation of the environment…"

The purpose of an Environmental Awareness Plan (EAP) is to outline the methodology that will be used to inform the mine's employees of any environmental risks which may result from their work and the manner in which the risks must be dealt with in order to avoid pollution or the degradation of the environment. The awareness plan is primarily a tool to introduce and describe the requirements of the range of environmental and social plans to the construction and operational personnel.

On arrival on site, all site staff and their managers will undergo environmental awareness training. Refresher courses will be held at suitable intervals. New contract staff and new employees on site will be required to undergo the training.

The training will incorporate the following components:

- A description of the social and environmental context within which Kangala Mine will be implemented;
- An identification of the key issues and mitigation measures;
- A description of the relevant procedures and protocols to be followed; and
- A definition of roles and responsibilities;

Contractors will be responsible for training of, and skills transfer to local labour, and will be expected to present training plans to management, who will be responsible for ensuring that the plans are adequate, and who will monitor the effectiveness of the training.

Training will be site and job specific and based on legal requirements, required productivity outputs and safe working behaviour, all based on best practice and international standards.

18.2Communication strategy

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

There must be open communication with adjacent land owners at all times. Communication regarding environmental issues and blasting times must be undertaken at all times. A grievance log book should be established for any person who would like to place a grievance regarding the mines activities. These grievances must be responded to by the mine management.

Communication is a vital component of the EAP. The communication of the environmental risks for each phase of the project will take place at local training centres with personnel from both the administrative and professional worker sectors of the mine.

Methods of communication for training include:

1. One Day Workshops: Each environmental and social aspect and impact will be described as well as their significance. Risks associated with each aspect will be discussed to ensure that an understanding of how each action of the project may impact on the environment. The mitigation of the environmental risk will be elaborated on. It is important that each person understands these management strategies as it ensures that the impact on the environment is kept to a minimum. Data collection regarding each aspect will also be explained to ensure that each aspect is monitored according to those protocols specified by the EMP. Along with data collection the reporting of findings will be discussed.

2. Full Day (or few days if required) Induction Course: To ensure that each person is aware of the environmental risks associated with the project. This induction will form part of the health and safety induction. This induction course will explain and describe the relevant phases of the project as well as those environmental risks that may occur during these phases.

3. Theatrical Plays and Interactive Workshops: As a method of gaining an understanding of the relevant risks, a play or industrial theatre will be performed to explain lay issues and the employees will be encouraged to rehearse and act out a play of their own. These workshops will be conducted in English as well as the local language and translators will be provided where necessary. The course will take

place prior to construction, thus ensuring an understanding of the mines and power plant workings and risks.

18.3Evaluation of the environmental awareness plan

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

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

The table below provides an overview of the environmental awareness plan at the Kangala Coal Mine.

Phase	Aspect	Environmental Risk	Communication Strategy				Mitigation Activity
			Management	Administration	Mine workers	Contractors	
Construction Phase	Soil	Increase in soil erosion	Workshop	Course	Induction	Induction	Rehabilitate the area as soon as possible. Stockpile soil in the correct manner.
	Animals	Disturbance					Workers must be educated on animal species. Report any rare or endangered species, and animal fatalities.
	Vegetation	Damage					Limit the area of disturbance to local flora.
	Surface / Groundwater	Contamination & waste					Contain hydrocarbons, limit water use and recycle where possible.
Operational Phase	Soil	Loss of structure and fertility. Contamination of soils. Loss of soil through erosion.	Workshop	Course	Induction & Monthly Meetings	Induction & Monthly Meetings	Stockpiled to height of less than 3m and vegetated. Hydrocarbon spill kit kept on site and rehabilitation area designated. Areas of erosion reported on a monthly basis and rehabilitated.
	Animals	Habitat loss Fire Hazard					Remediation of the soil and re-vegetation will restore animal habitat. Hunting and trapping prohibited on the mine property. Open fires will be prohibited on the property.
	Vegetation	Removal of vegetation Invader species					Red Data species reported to Mpumalanga Parks Board. Invader species will be eradicated on site. Areas will be re-vegetated after the cut is rehabilitated.
	Surface water	Contaminated runoff from the mining property					All contaminated water to be stored and treated on site before being returned to the catchment.
	Groundwater	Acid mine drainage could cause contamination. Potential to de-water natural springs.	Workshop	Course	Induction & Monthly Meetings	Induction & Monthly Meetings	Precautions will be implemented to prevent acid-mine drainage. Water ingress into the pits will be prevented to limit AMD.
	Air quality	Dust generation by blasting and coal trucks					Dust will be suppressed by water cart on the haul roads and in the pit.
	Sensitive Landscapes	Pollution of watercourses Degradation of wetlands and pans					Pollution control measures are designed for a 1:50 year flood event. An event in excess of this will lead to a dilution of the potential contamination and overflow will be discharged along natural drainage paths. Any accidental spillages will be handled in accordance with the Emergency Action & Response Plan A buffer zone will be established around pans and wetlands.

Decommissioning Phase	Soil	Lack of soil fertility	Workshop	Course	Induction	Induction	Fertilisation programmes will be introduced.
	Vegetation	Alien Species					Remove alien species & plant only indigenous vegetation.
	Surface water	Acid mine drainage – Decrease quality of the water source/s	Workshop	Course	Induction	Induction	Monitoring of water sources
	Groundwater	Acid mine drainage – Contamination of aquifers					Monitoring of water sources

19 Undertaking

I,.., the undersigned and duly authorised thereto by .... have studied and understand the contents of this document in its entirety and hereby duly undertake to adhere to the conditions as set out therein.

Signed at ....on this.............day of..........................

Signature of applicant

Designation

20 Conclusion

This EIA and EMP report was compiled in support of a mining right application for the Universal Coal Kangala Coal Mine. The aim of the EIA process and the related studies was to provide adequate information to the decision makers in order to make an informed decision on the way forward.

The necessary social and environmental studies were conducted in order assess the impacts on the physical, biological and social environments within the mining area. The impacts that mining is expected to have on these different environments have been assessed using a detailed quantitative impact assessment methodology. Mitigation measures and monitoring programs were generated and are included to assist in minimising and avoiding the negative impacts and maximising the benefits of the mining operation.

The **average significance** of the impacts that were identified during the construction, operational and decommissioning phases will be **medium-low** before mitigation. These potential impacts should be mitigated and managed during the life of mine in order to reduce the significance of the impacts. Impacts such as AMD, removal of the coal seam, increase in traffic and impacts on I&APs will still remain significant, despite mitigation measures.

Some of the more significant positive and negative impacts that are expected to result from the Kangala Coal Mine include the following:

- Alteration to topography from opencast pits and rehabilitation will have a negative impact on the topography of the site;
- Disturbance to the geological sequence and removal of coal. This is a permanent impact and mitigation will not be possible;
- Increase in erosion potential to soils from surface disturbance and vegetation removal. This could result in the loss of topsoil;
- Loss of the natural soil structure and soil properties from handling and contamination;
- Loss of the current agricultural land use and loss of high agricultural potential land;
- AMD could result in deterioration of surface and groundwater resources after closure;
- The establishment of the opencast may dewater the surrounding aquifers;
- The opencast areas will result in the destruction of habitats. A buffer zone will be required around the wetland areas and aquatic ecosystems to minimise/prevent impacts on them;
- Modification of hydrological processes will occur in areas where dewatering will take place; and

- Positive impacts are expected in terms of employment (limited), skills development, regional spending, and contribution to taxes, implementation of the Social and Labour Plan and the continuous supply of coal to Eskom to ensure electricity generation.

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

In addition, the new activities that have been planned at the Kangala Coal Mine are not considered to have a significant impact on the bio-physical or socio-economic environments as the infrastructure has been or will be placed within the existing footprint of the mine area which has been developed with the necessary pollution control systems. Potential impacts that have been considered is the visual impact associated with the re-positioning of the overburden and topsoil dumps along the south-western boundary which cannot be mitigated. The potential impact on topography and air quality associated with the proposed extension of the discard dump was also considered. Mitigation for these impacts has been proposed.

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.

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