Real Mining, Real People, Real Difference

Bank Colliery

FINAL
Environmental Impact Assessment and Environmental Management Programme

Bank Colliery
Access Brown Shaft II

September 2013

Submitted as contemplated in Regulation 30, 31 and 32 of the Environmental Impact Assessment Regulations, 2010 (GNR 543 in Government Gazette 33306 of 18 June 2010)

For the application for Environmental Authorization in terms of the National Environmental Management Act, 1998 (Act No.107 of 1998)

DEDET Reference No.: 17/2/3 N - 206

Executive Summary

Bank Colliery, which is a Division of Anglo Operations Proprietary Limited, is an operational mine located 20 km south of Middleburg in the Nkangala District Municipal within the Mpumalanga Province (See Figure 1). Bank Colliery had two mining operations i.e. Bank 2 Seam and Bank 5 Seam mining operations. Bank 2 Seam operations were opened in 1966 to produce Steam Coal and expanded to produce Low Ash Coal in 1977. The No. 5 Seam operations originally opened as Blesbok Colliery in 1947 to produce Metallurgical coal. The two mining operations were merged in 1981 to form Bank Colliery. Currently, the No. 2 and 4 seam product is exported. Bank Colliery is operating under a converted old order mining right and an approved EMPR under the Mineral and Petroleum Resources Development Act of 2002.

Due to the depth of the coal seams Bank Colliery conducts its mining operations mainly by means of underground mining methods. Bank Colliery is currently mining the No. , 2 and 4 coal seams within their mining right area. The mine has one operational shaft (Main Shaft) and six decommissioned shafts, (South Shaft, Brown Shaft I, Five Shaft, East shaft and West shaft). R.O.M coal from the mining operations is processed at a washing plant (Bank 2 coal washing plant) and discard produced from the washing plant is disposed of at a co-disposal facility (Bank 2 co-disposal site).

This document concerns changes at Bank Colliery's mining area, i.e. Access Brown Shaft II, whereby a new shaft will be constructed for the exploitation of the No. 2 seam coal reserves. This project will be conducted on certain portions of the farm Wolvenfontein 471 JS, Blesbokvlakte 596 IS, Blesbokvlakte 24 IS, Bankfontein 340 JS and Bank Colliery 608 IS. The proposed Access Brown Shaft II Underground Mining Project entails the removal of the No. 2 coal seam by means of underground mining, using the Bord and Pillar mining methods. Access to the workings will require the construction of a new access shaft i.e. Access Brown Shaft II.

The National Environmental Management Act, 1998 (Act 107 of 1998) requires that any person or entity that intends to undertake activities listed in government notices 544, 545 and 546 must obtain an environmental authorisation in terms of section 24D of the National Environmental Management Act before undertaking such activities. On evaluation of the Access Brown Shaft II project, the following listed activities were identified i.e. GN 544: Activity 9: The construction of a dirty water and raw water pipeline exceeding 1000 metres in length for the bulk transportation of water, with a peak throughput of 120 litres per second. Activity 11: The construction of infrastructure (Ventilation Shaft, raw water pipeline and dirty water pipeline) covering more than 50 square metres where such construction occurs within 32 metres of a tributary of the Spookspruit, Spookspruit and Bankspruit, measured from the edge of a watercourse.

GN 545: Activity 5: The construction of a pollution control dam for the storage of effluent and the discharge of water into a water resource in terms of the National Water Act 36 of 1998. Activity 6: The transportation of coal, outside an industrial complex, using a conveyor with a throughput capacity of more than 50 tons per day. Activity 15: The physical alteration of undeveloped land to commercial (mining) and industrial (mining) use, where the total area to be transformed is more than 20 hectares.

GN 546: Activity 16: The construction of infrastructure (Ventilation Shaft, raw water pipeline and dirty water pipeline) covering more than 10 square metres such construction occurs within 32 metres of a tributary of the Spookspruit, Spookspruit and Bankspruit respectively.

Based on the above, an application for an environmental authorisation for the above listed activities was undertaken with the Department of Economic Development, Environment and Tourism (eMalahleni Regional Office). The final Scoping Report has been accepted and the Environmental Impact Assessment (EIA) and Environmental Management Programme (EMP) (this document) is thereby being submitted.

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SECTION ONE

Introduction

1. INTRODUCTION

1.1 WHO IS DEVELOPING THE EIA/EMP REPORT?

EIA/EMP Report Compilation :	Geovicon Environmental (Pty) Limited P.O. Box 4050 MIDDELBURG, 1050 Tel: (013) 243 0542 Fax: (086) 632 4936 Contact: Mr. O.T. Shakwane

Geovicon Environmental (Pty) Limited has been appointed by Anglo Operations (Pty) Ltd as the independent environmental consultant to compile this EIA/EMP Report and has no vested interest in the project.
Geovicon Environmental (Pty) Limited is a geological and environmental consulting company. The company was formed in 1996, and currently has seventeen years experience in the geological and environmental consulting field. During the past ten years, Geovicon Environmental (Pty) Limited has successfully completed consulting projects in the Mining sector (coal, gold, base metal and diamond), Quarrying sector (sand, aggregate and dimension stone), Industrial sector and housing sector. Geovicon Environmental (Pty) Limited has undertaken contracts within all the provinces of South Africa, Swaziland, Botswana and Zambia. During 2001 Geovicon Environmental (Pty) Limited entered the field of mine environmental management and water monitoring.

Geovicon Environmental (Pty) Limited is a Black Economically Empowered Company with the BEE component owning 60% of the company. Geovicon Environmental (Pty) Limited has three shareholders i.e. O.T. Shakwane, J.M Bate and T.G. Tefu.

Mr. O.T Shakwane obtained his BSc (Microbiology and Biochemistry) from the University of Durban Westville in 1994, and completed his honours degree in Microbiology in 1995.

Mr. T.G. Tefu is a geologist. He obtained his BSc. in geology at the University of Witwatersrand. He worked with several mining companies and was also employed by the Department of Mineral Resources' Environmental Management directorate.

Mr. Bate, founder of Geovicon Environmental (Pty) Limited, is used by the company on an ad hoc (consultancy) basis. He is also a qualified geologist. He obtained his BSc (geology) from the Potchefstroom University for CHE in 1993, and completed his honours degree (cum Laude) in geology in 1994. He obtained his MSc (cum Laude) in 1995.
Over the past years Geovicon Environmental (Pty) Limited has formalised working relationships with companies that offer expertise in the following fields i.e. Geohydrology, Civil and Geotechnical Engineering, Geotechnical Consultancy, Survey and Mine Planning and Soil & Land Use Consultancy.

1.2 WHO WILL EVALUATE THE EIA/EMP REPORT?

Before the proposed listed activities applied for can proceed, the environmental impacts that may result from the proposed project must be assessed. Based on the information provided in this EIA/EMP report, DEDET will decide whether or not to authorise the proposed listed activities.

In the spirit of co-operative governance, other commenting authorities will be consulted with. These include:

Department of Mineral Resources (DMR)

Mpumalanga Tourism and Parks Agency (MTPA)

Department of Water Affairs (DWA)

National Department of Agriculture, forestry and fisheries (NDA)

South African Heritage Resources Agency (SAHRA)

1.3 LEGAL REQUIREMENTS

The National Environmental Management Act, 107 of 1998 (NEMA) requires that a Scoping Report be conducted and that the Environmental Impact Assessment (EIA) be carried out for activities listed in GNR 545.

In addition to the NEMA, the following key legislation is also relevant to the EIA/EMP Report:

Minerals and Petroleum Resources Development Act (MPRDA), No 28 of 2002

Environment Conservation Act (ECA), No 73 of 1989

The National Environmental Management Act (NEMA), No 107 of 1998

The Mine Health and Safety Act (MHSA), No 29 of 1996, as amended

The National Water Act (NWA), No 36 of 1998, as amended

National Environmental Management Biodiversity Act (NEMBA), No 10 of 2004

Air Quality Act (AQA), No 39 of 2004.

1.4 PURPOSE OF THE EIA/EMP REPORT

The EIA/EMP report addresses the requirements as contemplated in the Environmental Impact Assessment Regulations, 2010. This report also documents the issues and concerns raised during the consultation phase (if any), and includes the findings of the specialist assessments for issues that have been raised.

The aim of this EIA/EMP Report is to:

Provide information on the proposed project and present the findings of the Studies to the authorities

Provide information regarding alternatives that have been considered

Show how authorities and interested and affected parties were afforded the opportunity to contribute to the project, and to indicate the issues raised and the responses to those issues

Describe the baseline receiving environment

Describe the extent of environmental consequences for the construction and operating phases of the proposed project

Propose mitigation measures for impacts that are considered significant

Describe the environmental feasibility of the proposed project

Present findings in a manner that facilitates decision-making by the relevant authorities

SECTION TWO

Project Background & Context

2. PROJECT BACKGROUND AND CONTEXT

2.1 OVERVIEW OF THE PROJECT

2.1.1 Name of the Applicant

Anglo Operations Proprietary Limited

2.1.2 Name of the Proposed Project

Bank Colliery's Access Brown Shaft II

2.1.3 Address of proposed Project

Bank Colliery's Access Brown Shaft II

Portion 7 of the farm Wolvenfontein 471 JS
MIDDELBURG

2.1.4 Project Manager

Ms. Kgaowelo Moshokwa

2.1.5 Contact Person

Ms. Kgaowelo Moshokwa
Anglo Operations (Pty) Ltd, Bank Colliery
Private Bag X410, Van Dyksdrift, 2245
Cell: 079 687 5458

2.2 LOCATION

Refer to Figure 1 for the regional setting of the proposed Access Brown Shaft II. The proposed Access Brown Shaft II is situated on the remaining extent of portion 7 of the farm Wolvenfontein 471 JS along the R545 road within a Bank Colliery's Brown Shaft II mining right area. Associated infrastructure such as the raw and dirty water pipeline fall on certain portions of the farms Wolvenfontein 471 JS, Blesbokvlakte 24 IS, Blesbokvlakte 596 IS, Bank Colliery 608 IS and Bankfontein 340 JS.

2.2.1 Magisterial District & Regional Services Council

Middelburg, Mpumalanga

District Municipality: Nkangala District Municipality

Local Municipality: Steve Tshwete Local Municipality

2.2.2 Direction and Distance to Nearest Towns

Table 1: Direction and Distance to Nearest Towns.

Town	Direction	Distance (km)
Middelburg	North	20 km
Witbank	Northwest	25 km
Bethal	South	50 km

2.2.3 Surface Infrastructure

The area on which Access Brown Shaft II will be constructed is currently an area used for the cultivation of hay grass. With the exception of the servitude described below, no surface infrastructure exists within the proposed mining project area.

2.2.4 Presence of Servitudes

A number of servitudes such as power lines, overland conveyor route, provincial road (R35), Duhva water pipeline, and a vent shaft occur in the vicinity of the proposed Access Brown Shaft II project area. See Appendix 12 for a plan indicating the servitudes in the vicinity of the proposed Access Brown Shaft II project area.

2.2.5 Name of River Catchments

Bank Colliery mining right area falls within the Upper Olifants River catchments. Bank Colliery mining right area falls within the B11 and B12 tertiary drainage regions of the Olifants River catchment. Within these tertiary regions the mine falls within the B11B, B11G, B11H, B12D and B12B quaternary drainage regions.

A number of streams have their headwaters within the Bank Colliery's mining right area or slightly upstream of the mining right area. These streams can be divided into two groups. Those that drain into the Olifants River upstream of the Witbank Dam and those that drains into the Olifants River downstream of the Witbank Dam into the Loskop Dam. The streams that drain into the Olifants River upstream of the Witbank Dam include the Koring Spruit and the Boschmanskranz Spruit. The Spook Spruit drains downstream of the Witbank Dam and hence drains into the Loskop Dam. The proposed Access Brown Shaft II Underground Mining area falls within the Spook Spruit catchment.

2.3 Name and Address of Land Owner & Farm Description

Table 2 indicate the surface owners on the proposed Access Brown Shaft II underground mining project water use areas.

Table 2: Description of immediate and adjacent landowners and their property

FARM	PORTION	SURFACE RIGHT OWNERS
Wolvenfontein 471 JS	Portion 7*	Mr. D.S. van Wyk
Wolvenfontein 471 JS	Portion 8*	Anglo Operations Limited
Wolvenfontein 471 JS	Portion 9*	Anglo Operations Limited
Wolvenfontein 471 JS	Portion 11*	Anglo Operations Limited
Blesbokvlakte 24 IS	Portion 9*	Bleswolf Boerdery (Pty) Limited
Blesbokvlakte 596 IS	Remaining extent*	SANCOR (Pty) Limited
Bank Colliery 608 IS	The farm*	Anglo Operations Limited
Bankfontein 340 JS	Portion 9*	Anglo Operations Limited
Bankfontein 340 JS	Portion 10*	Anglo Operations Limited

***** Indicate farm portions on which the proposed Access Brown Shaft II Underground Mining Project and associated infrastructure will be undertaken.

Table 3: Details of Immediate and Adjacent Landowners

Farm Name/Portions	Surface Owner	Contact Person	Telephone
Bankfontein 340 JS Portion 10 and portion 9 (portion of portion 6)	Anglo Operations Limited	Leased to Mr. D.S. van Wyk	Cell: 083 633 5773
Wolvenfontein 471 JS, Portion 5	BECSA Middelburg Mine	Div de Villiers	Tel: 013 689 4212
Wolvenfontein 471 JS, Portion 8 (portion of portion 3)	Anglo Operations Limited	Leased to S.I.S. Farming	Tel: 013 291 5600/082 388 3186
Wolvenfontein 471 JS, Portion 6 and portion 18	Bleswolf Boerdery	Jannie Schoeman	Cell: 082 388 3111
Wolvenfontein 471 JS, Portion 14	Komatie Ontwikkelings MPY (Pty) Ltd	Ebrahim Suliman	Cell: 082 551 7794
Wolvenfontein 471 JS, Portion 15	Republic of South Africa	Andre Hennop (land occupier)	Cell: 083 327 9830
Blesbokvlakte 24 IS	Bleswolf Boerdery (Pty) Ltd	Jannie Schoeman	Cell: 082 388 3111
Blesbokvlakte 596 IS	SANCOR (Pty) Ltd	Jannie Schoeman	Cell: 082 388 3111

2.4 BRIEF PROPOSED PROJECT OVERVIEW

Anglo Operations Proprietary Limited intends to undertake an underground coal mining operation called Access Brown Shaft II. The underground mining will utilise the bord and pillar mining technique. The mining operation will result in the construction of an incline shaft and associated overburden stockpiles. This will require construction of the associated infrastructure, which includes a pollution control dam, access roads, fuel bay, LV substation, ventilation shaft, conveyor belt, workshop, wash bay, dirty water pipeline to south shaft and a raw water pipeline from Bankfontein. In terms of sections 24 and 24D of the National Environmental Management Act (Act no. 107 of 1998) read together with Government Notice 544, 545 and 546, Anglo Operations Proprietary Limited will require an environmental authorisation before commencement of the above-mentioned activities. Hence the following listed activities will be applied for:

2.4.1 NEMA Listed Activities in terms of Government Notice R544 – Listing Notice 1 of 2010

Activity 9: *The construction of facilities or infrastructure exceeding 1000 metres in length for the bulk transportation of water, sewage or storm water -(i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more, excluding where: a. such facilities or infrastructure are for bulk transportation of water, sewage or storm water or storm water drainage inside a road reserve; or b. where such construction will occur within urban areas but further than 32 metres from a watercourse, measured from the edge of the watercourse.*

The construction of a raw water pipeline (2880m long, 160mm diameter HDPE PE100 PN 18, buried pipeline, as well as a 1000m long 150mm diameter GMS pipe constructed above surface alongside the conveyor) and dirty water pipeline (6800m long, 200mm diameter HDPE PE100 PN 16, buried pipeline). The raw water pipeline will transport raw water from the existing Bank Colliery to the proposed access Brown Shaft II area, to be used for the mine machinery such as the continuous miners. The dirty water from the proposed Access Brown Shaft II pollution control dam will be transported via pipeline to old underground workings in the existing South shaft area.

Activity 11: *The construction of: (i) canals; (ii) channels; (iii) bridges; (iv) dams; (v) weirs; (vi) bulk storm water outlet structures; (vii) marinas; (viii) jetties exceeding 50 square metres in size; (ix) slipways exceeding 50 square metres in size; (x) buildings exceeding 50 square metres in size; or (xi) infrastructure or structures covering 50 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.*

A ventilation shaft more than 50 square metres will be constructed for Access Brown shaft II within 32 metres of the wetland of the tributary of the Spookspruit .It should be noted that although the soils are indicative of a wetland area, the area has already been disturbed by agricultural activity (grazing land.). A raw water pipeline and dirty water pipeline will also be constructed within 32 metres from the Spookspruit and Bankspruit respectively.

2.4.2 NEMA Listed Activities in terms of Government Notice R545 – Listing Notice 2 of 2010

Activity 5: *The construction of facilities or infrastructure for any process or activity which requires a permit or license in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent and which is not identified in Notice No. 544 of 2010 or included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case that Act will apply. The construction of a pollution control dam for the storage of dirty water and the discharge of water into a water resource in terms of the National Water Act 36 of 1998*.

A pollution control dam will be constructed to store all dirty water and runoff from the Access Brown shaft II area and underground mine workings. This will trigger a water use in terms of the National Water Act 36 of 1998.

Activity 6: *The construction of facilities or infrastructure for the bulk transportation of dangerous goods* *(i) in gas form, outside an industrial complex, using pipelines, exceeding 1000 metres in length, with a throughput capacity of more than 700 tons per day; (ii) in liquid form, outside an industrial complex, using pipelines, exceeding 1000 metres in length, with a throughput capacity more than 50 cubic metres per day; or (iii) in solid form, outside an industrial complex, using funiculars or conveyors with a throughput capacity of more than 50 tons day.*

The coal that will be mined and will be transported from the Access Brown shaft II underground workings to the existing Bank colliery for further processing via conveyor belt, with a throughput capacity of more than 50 tons per day.

Activity 15: *Physical alteration of undeveloped vacant or derelict land for residential retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more; except where such physical alteration takes place for: (i) linear development activities; or (ii) agriculture or afforrestation where activity 16 in this Schedule will apply.*

The construction of the Access Brown shaft as well its associated infrastructure will result in the transformation of more than 20 hectares of grazing land to commercial (mining) and industrial (mining) use.

2.4.3 NEMA Listed Activities in terms of Government Notice R546 – Listing Notice 3 of 2010

Activity 16: The construction of: (i) jetties exceeding 10 square metres in size; (ii) slipways exceeding 10 square metres in size; (iii) buildings with a footprint exceeding 10 square metres in size; or (iv) infrastructure covering 10 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.

A ventilation shaft, raw water pipeline and dirty water pipeline, more than 50 square metres will be constructed for Access Brown shaft II within 32 metres of the wetland of the tributary of the Spookspruit, Spookspruit and Bankspruit respectively .It should be noted that although the soils are indicative of a wetland area, the area has already been disturbed by agricultural activity (grazing land.)

SECTION THREE

Baseline Information

3. BASELINE INFORMATION

3.1.1 Geology

3.1.1.1 Regional Geology

The Bank Colliery mining area is situated in the central block of the Witbank Coalfield. The stratigraphic sequence typically comprises sediments of the Dwyka Group and the Vryheid Formation of the Ecca Group, which rest unconformably on an uneven floor of basement rocks comprised of gabbro diabase and felsites of the Bushveld Igneous Complex. The Dwyka sediments are typically diamictite and grit, while the Vryheid Formation consists of sandstone, siltstone, interlaminated sand/siltstone, shale and coal seams. Up to seven coal seams exist with the Bank Colliery Mining Right area. However, only four of these, the No. 1, 2, 4, and 5 Seams are considered to be of economic importance.

The No 2 seam, which is the target seam for the proposed Access Brown Shaft II is developed over virtually the entire mining right area and lies at an average depth of 60m. The No. 2 coal seam has an average thickness of 6m.

Figure 2 indicates the typical stratigraphic column of boreholes drilled over the proposed Access Brown Shaft II. From the above mentioned figure it is evident that an alternating package of sandstone, mudstone and shale layers is situated above the No. 2 coal seam.

3.1.2 Climate

3.1.2.1 Regional Climate

Bank Colliery falls into the Eastern Plateau Highveld climate zone, characterised by relatively warm wet summers and cold dry winters.

3.1.2.2 Mean Monthly Rainfall

Average monthly rainfall and the number of days experiencing rainfall are presented in Table 4. The mean annual precipitation of the site is 687 mm. The mean annual evaporation of the site is 1522 mm (S-Pan). The Mpumalanga Highveld has distinct wet and dry seasons. 91% of the Colliery's mean annual rainfall falls between October and April inclusively. 68% of the area's mean annual evaporation occurs in this period (Midgley et al., 1990).

Table 4: Average Rainfall for the region (over 77 years from 1929 to 2006)

MONTH	MM	AVERAGE NO OF RAIN DAYS
January	116.5	10.4
February	96.3	7.8
March	74.8	7.1
April	42.8	4.5
May	16.3	2.1
June	7.6	1.2
July	6.6	0.9
August	6.9	1.0
September	24.2	2.8
October	67.8	7.0
November	112.6	10.4
December	110.6	10.3
Annual Average	**687**	

3.1.2.3 Mean Monthly Maximum and Minimum Temperatures

No weather stations are located in close proximity to the proposed colliery. The closest weather stations are located in Witbank and Springs. Temperature data from the Witbank weather station (Station number 0515320) was analysed and a summary of the data is presented in Table 5. The temperature data spanned 2001 to 2010

Table 5: Mean monthly temperature data for 0515320 (Witbank)

Month	Average daily minimum temperature (ºC)	Average daily maximum temperature(ºC)
January	15.3	26.1
February	14.9	26.3
March	13.3	25.0
April	10.7	23.2
May	7.1	20.8
June	4.8	18.3
July	4.1	18.5
August	6.6	21.3
September	9.3	24.9
October	12.3	26.0
November	13.5	25.2
December	14.7	26.1

3.1.2.4 Wind Direction and Speed at the Project area

In the study area, the mean daytime surface winds are predominantly north westerly as a result of the prevalent anticyclonic circulation, with easterly winds being the next most frequent. In the winter, the frequency of south westerly winds increases because of the passage of cyclonic westerly waves.

Light topographically induced winds from the eastern sector are common at night. The so-called Escarpment Breeze that develops at night under weak pressure gradients is up to 1 000m deep. Winds are mostly light except during thunderstorms. Very occasionally tornadoes do occur. Sunshine duration in summer is about 60% and in winter about 80% of the possible.

3.1.2.5 Mean Monthly Evaporation

The mean monthly evaporation (S-Pan) for the region obtained from Bethal Weather Station is presented in Table 6. The mean annual evaporation of the site is 1522 mm (S-Pan). The Mpumalanga Highveld has distinct wet and dry seasons. 91% of the Colliery's mean annual rainfall falls between October and April inclusively. 68% of the area's mean annual evaporation occurs in this period (Midgley et al., 1990).

Table 6: Mean monthly evaporation for the region.

MONTH	Evaporation (mm)
January	167.4
February	139.6
March	137.7
April	105.9
May	89.2
June	72.4
July	79.3
August	105.0
September	136.1
October	164.1
November	154.8
December	170.5
TOTAL	**1522**

3.1.2.6 Extreme weather conditions

Hail: Occurs 4 to 7 times per year

Drought: ± every 6 years

Frost: Can occur from end of April to September

3.1.3 Topography

3.1.3.1 Local topography

The mine is situated in the Eastern Highveld region of Mpumalanga, which is characterised by a gentle undulating plateau with fairly broad to narrowly incised valleys such as the Olifants River valley.

Bank Colliery's Access Brown Shaft II lies between 1 560 m and 1 600 mamsl, with gently undulating topography. The area slopes to the north towards the Vaalbankspruit and to the west towards the

Spookspruit.

3.1.4 Soils

Pedoplan International Consultants was appointed by Geovicon to conduct a detailed soil-landform assessment over the proposed Access Brown Shaft II, which occurs on the farm Wolvenfontein 471 JS, south of Middelburg, Mpumalanga. See Appendix 1 for the detailed report. The objectives of the study were as follows:

To conduct a detailed assessment of the soils-landform resources, comprising identification, description, classification and mapping of the soil-terrain types and assessing their attributes relating to agricultural potential, the potential for other land uses, susceptibility to erosion and topsoil quality.

To identify pre-mining land uses.

To assess the land capability of soil, terrain and climate combinations.

To identify and demarcate wetland zones from a soil-landform perspective.

To assess the impact of strip and subsurface coal mining on the soil-landform resources and propose mitigation measures.

3.1.4.1 Landform

The project area forms part of the Highveld Plateau. The latter constitutes a remnant of an old, high altitude (1600 m above sea level), gently undulating land surface, with pans in places. It is mainly underlain by coal bearing shale and sandstone of the Vryheid formation (Geological Survey, 1986).

On a meso scale, the land surface is predominantly composed of level to gently sloping (1-3% slope) crests (about 5% in extent), gently to moderately sloping (3-8% slope) midslopes (about 70%), gently to moderately sloping (2-8% slope) footslopes (about 20%), and a level (0-2%) bottomland (about 5%).

3.1.4.2 Soil Form Map

The distribution of the soil-landform resources is given on the detailed soil-landform map (Figure 3). The map legend, also contained in Figure 3, indicates the dominant soil components as well as the position (hillslope unit and slope class) they occupy in the landscape. The sizes of map units are also shown in Table 7.

Table 7: Soil-landform map units

MAP UNIT	LANDFORM COMPONENT	SOIL COMPONENT	AREA (ha)	AREA (%)
Hu	Gently to moderately sloping midslopes (3-6% slope)	Moderately deep to deep (80-120 cm), well-drained, dark red, apedal, sandy clay loam of the Hutton form, on weathered rock	5.99	1.40
Li1	Level to gently sloping crests or upper midslopes (1-2% slope)	Deep (100-140 cm), well-drained, red, apedal, sandy loam or sandy clay loam on hard plinthite of the Lichtenburg form	5.02	1.17

Li2	Level to gently sloping midslopes (2-5% slope)	Moderately deep (60-90 cm), well-drained, red, apedal, sandy loam or sandy clay loam on hard plinthite of the Lichtenburg form; many, hard Fe-Mn concretions in subsoil	26.04	6.09
Li3	Level to gently sloping crests or upper midslopes (1-2% slope)	Shallow (30-50cm), well-drained, dark red, apedal, sandy loam or sandy clay loam on hard plinthite of the Lichtenburg form; few to many, hard Fe-Mn concretions	14.86	3.47
Gc1	Level to gently sloping crests (1-3% slope)	Deep (100-120 cm), well-drained, yellow-brown, apedal, sandy loam or sandy clay loam on hard plinthite of the Glencoe form	2.11	0.49
Gc2	Gently to moderately sloping midslopes (2-8% slope)	Moderately deep (50-100 cm), well-drained, yellow-brown, apedal, sandy loam or sandy clay loam on hard plinthite of the Glencoe form	13.56	3.17
Gc3	Gently to moderately sloping midslopes (4-8% slope)	Shallow (30-50 cm), well-drained, yellow-brown, apedal, sandy loam on hard plinthite of the Glencoe form; few to many, hard Fe-Mn concretions	5.63	1.32
Li-Gc	Gently sloping midslopes (2-5% slope)	Association of shallow to moderately deep (40-60 cm), well-drained, red or yellow-brown sandy loam or sandy clay loam on hard plinthite; few to many, hard Fe-Mn concretions	31.47	7.36
Cv	Gently to moderately sloping midslopes (2-6% slope)	Deep to very deep (100->150 cm), well-drained, yellow-brown, apedal, sandy loam to sandy clay loam of the Clovelly form on weathered sandstone	17.11	4.00
Av1	Gently to moderately sloping crests or midslopes (1-6% slope)	Moderately deep to deep (effective depth 80-130 cm), moderately well-drained, yellow-brown, apedal, sandy loam or sandy clay loam on soft plinthite deep subsoil of the Avalon form	71.75	16.78
Av2	Gently sloping footslopes (2-4 % slope)	Moderately deep (effective depth 60-90 cm), moderately well- drained, yellow-brown, mottled, apedal, sandy loam or sandy clay loam on soft plinthic deep subsoil of the Avalon form	20.65	4.83
We	Gently to moderately sloping footslopes and valley bottom (1-8% slope)	Shallow (effective depth 30-40 cm), poorly drained, grey brown, sandy loam or sandy clay loam topsoil on plinthic, sandy clay loam subsoil of the Westleigh form	34.79	8.14
Lo	Gently to moderately sloping footslopes (4-8% slope); unevensurface roughness in places in the form of erosion channels	Shallow (effective depth 30-40 cm), somewhat poorly drained, grey-brown or grey, loamy sand or sandy loam topsoil and E horizon, on grey, plinthic, sandy clay loam deep subsoil of the Longlands form	109.77	25.66
Lo-We	Level valley bottom (0-1% slope); uneven surface roughness in places in the form of erosion channels and overburden deposits	Association of poorly drained soils with shallow effective depth (10-40 cm): (i) grey, loamy sand or sandy loam topsoil and E horizon, over grey, plinthic, sandy clay loam deep subsoil of the Longlands form, and (ii) grey, sandy loam or sandy clay loam topsoil, on plinthic, sandy clay loam subsoil of the Westleigh form; water tables commonly present; associated with Katspruit form in places; sandy or loamy overburden in places	22.67	5.30
Lo-We-Es	Level valley bottom (0-1% slope); uneven surface roughness in places in the form of erosion channels and overburden deposits	Association of somewhat poorly to poorly drained soils with shallow effective depth (10-40 cm): (i) grey, loamy sand or sandy loam topsoil and E horizon, over grey, plinthic, sandy clay loam deep subsoil of the Longlands form; (ii) grey, sandy loam or sandy clay loam topsoil on plinthic, sandy clay loam subsoil of the Westleigh form; and (iii) loamy sand topsoil and E horizon, over grey-brown, strong prismatic, sandy clay subsoil of the Estcourt form	10.88	2.54
Se	Gently sloping footslopes (2-4 % slope)	Shallow (effective depth 20-30 cm), greyish brown, finely mottled, weak to moderate blocky, sandy clay loam over, greyish brown, mottled, strong angular blocky, sandy clay loam or sandy clay subsoil of the Sepane form	14.03	3.28
Ka	Level valley bottom (0-1% slope)	Deep soil materials: very poorly drained, dark grey, sandy loam or sandy clay loam topsoil on grey, gleyed sandy clay of the Katspruit form	5.29	1.24
Dr	Gently to moderately sloping midslopes and footslopes (4-8% slope)	Shallow (30-40 cm) somewhat poorly drained, dark grey, mottled, sandy loam on hard plinthite of the Dresden form; associated with similar soil of the Wasbank form	8.50	1.99

GP	Miscellaneous land class: Gravel pit	2.16	0.50
E	Miscellaneous land class: Erosion	0.27	0.06
D	Dam	1.03	0.24
P	Pan	4.25	0.99
	TOTAL	**427.83**	**100.0**

3.1.5 Land Capability

3.1.5.1 Suitability for dryland agricultural use

In this study to assess suitability for agriculture, the rating process has been based on the land capability system and diagnostic criteria as described by Scotney*et al*., 1987 and Schoeman*et al*., 2002. Due to the nature of this study only the **physical suitability for agriculture** has been appraised (See Table 8). Climate with its C2 rating is regarded as uniform over the project area. (The map units can therefore not be ranked into capability classes higher than class II.)

Table 8: Land Capability Assessment

MAP UNIT	LAND CAPABILITY CLASS*	PHYSICAL AGRICULTURAL POTENTIAL	MAP UNIT	LAND CAPABILITY CLASS*	PHYSICAL AGRICULTURAL POTENTIAL
Hu	II	Moderately high	We	VI	Very low
Li1	II	Moderately high	Lo	VI	Very low
Li2	III	Moderate	Lo-We	V	Very low
Li3	IV	Low	Lo-We-Es	V	Very low
Gc1	II	Moderately high	Se	V	Very low
Gc2	II	Moderate	Ka	V	Very low
Gc3	IV	Low	Dr	VI	Very low
Li-Gc	III	Moderate	GP	VII	Very low-None
Cv	II	Moderately high	E	VII	Very low-None
Av1	II	Moderately high			
Av2	II	Moderately high			

3.1.5.2 Land capability according to the Chamber of Mines' guidelines

According to these guidelines for the classification of land (2007), the land capability subdivisions reflect four classes, viz. class I (wetland), class II (arable land) class III (grazing land), and class IV (wilderness land). For the project area, these classes are shown in Figure 4 and explained in Table 9 albeit with a difference: the arable class is complemented with its agricultural land capability rating (Table 8), and wetland identification by the different classes of wetlands.

Table 9: Land capability (Chamber of Mines' guidelines)

LAND	LAND CAPABILITY	SOIL-LANDFORM MAP	AREA	AREA

CAPABILITY MAP UNITS		UNIT	(ha)	(%)
I-p	Class I – Wetland: permanent	D, P	5.28	1.23
I-s	Class I – Wetland: seasonal	Ka, Lo-We, Lo-We-Es	38.84	9.08
I-t	Class I – Wetland: temporary	Lo, We, Se, Dr	167.09	39.07
II-mh	Class II – Arable land: moderately high potential	Hu, Li1, Gc1, Cv, Av1, Av2	122.63	28.67
II-m	Class II – Arable land: moderate potential	Li2, Gc2, Li-Gc	71.07	16.62
III	Class III – Grazing land	Li3, Gc3	20.49	4.79
IV	Class IV – Wilderness land	GP, E	2.43	0.56
		TOTAL	**427.83**	**100.0**

3.1.6 Land Use

The land use at the proposed mining area consists predominantly of cattle grazing and grass harvesting in places. The land use within the proposed mining area can be divided as follows i.e. approximately 85% is used for grazing with the remainder used for grass harvesting. No further infrastructure, apart from the fences, power lines and the existing servitudes is present at the Access Brown Shaft II.

3.1.7 Natural Vegetation / Plant Life

Geovicon Environmental (Pty) Limited undertook a vegetation survey over the Access Brown Shaft II mining area. A report from this survey is attached as Appendix 2 of this report .The proposed Bank Colliery, Access Brown Shaft II, proposed shaft and infrastructure area, raw water pipeline and used water pipeline are situated in the Grassland Biome of South Africa (Rutherford, 1988). Mucina and Rutherford (2006) classify these areas within the Eastern Highveld Grassland vegetation unit (Gm 12) of the Mesic Highveld Grassland Bioregion.

The 1:50 000 topocadastral maps, 2629AB, 2629BA, 2529CD and 2529DC indicate the proposed shaft and infrastructure area, the raw water pipeline area and the used water pipeline area as cultivated fields and grazing land. The proposed shaft and infrastructure area comprises mainly a cultivated weeping love grazing area. The proposed raw water pipeline comprises mainly grazing land on the western side of the R 35 and cultivated pasture on the eastern side of the R 35. The proposed used water pipeline comprises firstly a cultivated grazing area from the proposed shaft, then cultivated maize areas and grassland areas up to the defunct South Shaft from where it will follow the existing water pipeline servitude between existing maize fields.

Hundred and eighteen plant species were observed in total in the different areas of investigation. This is quite a large number for areas where intensive crop cultivation, livestock farming and mining activities are the main land uses. It thus seems that the vegetation biodiversity is high, but it must be taken into account that many of these species are exotic species due to the current land uses. Some declared weed and invader species were also observed. Of the 118 plant species, 31 are grass species and 5 are rush/sedge species while quite a number of forb species (not grass, tree, sedge or rush species) are established in the areas (82 in total).

According to the amended regulations in the Conservation of Agricultural Resources Act (no 43 of 1983), five declared weed and invader species were observed in the areas of investigation *viz.* Pampas grass (Cortaderia selloana), Scottish thistle (*Cirsium vulgare*), Large cocklebur (*Xanthium strumarium*), Thorn apple (*Datura stramonium*) and Mexican poppy (*Argemone ochroleuca*). These plants must be eradicated.

According to the National red list of South African Plants version 2012.1, one plant species encountered in the areas of investigation is listed as declining (*Hypoxis hemerocallidea* – African potato). This plant is still used by the local people. It occurs in large numbers in the area where the proposed raw water pipeline will be constructed.

Eleven medicinal plant species were observed in the areas of investigation *viz*. *Aster harveyanus* (Bloublommetjie), *Helichrysum nudifolium* (Everlastings), *Dicoma anomala* (Maagbitterwortel), *Vernonia oligocephala* (Bitterbossie), *Hypoxis hemerocallidea* (African potato), *Pelargonium luridum* (Wild malva), *Gomphocarpus fruticosus* (Milkweed), *Elephantorrhiza elephantine* (Elephant's root), *Centella asiatica* (Pennywort), *Typha capensis* (Bulrush) and *Physalis viscosa* (Sticky gooseberry). All these plant species are widespread.

The proposed raw water and used water pipelines will transect certain wetland areas associated with the Bankspruit and its tributaries. These wetland areas are in close proximity to existing agriculture (cultivation and grazing), pipeline servitude, road and mining activities.

3.1.8 Mammal List

Determination of mammals present over an area to be impacted on by mining activities is a prerequisite before commencement with any mining activities. The information regarding the mammals of the area must be part of the Environmental Impact Assessment and Environmental Management Programme Report. Big C Rock Engineering cc was appointed by Geovicon to compile a mammal list on a portion of the farm Wolvenfontein 471 JS over the proposed shaft area and a report was compiled based on the information gathered. A copy of the report is attached as Appendix 3.

3.1.8.1 Methodology

Prior to investigation of the area a study was conducted on historic occurrence of mammals which is attached in Appendix 3 as an addendum. Line transects per foot was conducted in the study area order to identify species through either behavioural (nesting, footprints, etc.) or actual sightings

3.1.8.2 Findings

Table 10: Mammals (or signs thereof) that were detected on the study area with their respective conservation status:

Species Name	Common Name	Conservation Status	
		IUCN	**NEMBA**
Canis mesomelas	Black backed Jackal	Least Concern	Not Listed
Civettictis civetta	African Civet	Least Concern	Not Listed
Cynictis penicillata	Yellow Mongoose	Least Concern	Not Listed

Felis lybica	African Wild Cat	Least Concern	Not Listed
Genetta genetta	Small Spotted Genet.	Least Concern	Not Listed
Lutra lutra (Picture 2)	Spotted Necked Otter	Near Threatened	Protected Species
Otomys irroratus	Vlei Rat	Least Concern	Not Listed
Tatera brantsii	Highveld Gerbil	Least Concern	Not Listed

Table 11: The bird species that were observed on the study area:

Species Name	Common Name
Anas sparsa	African Black Duck
Ardea melanocephala	Black Headed Heron
Boystrichia hagedash	Hadeda Ibis
Bubulcus ibis	Cattle Egret
Cisiticola fulvicapilla	Neddicky
Cisticola tinniens	Levaillant's Cisiticola
Euplectes orix	Red Bishop
Fulica cristata	Red – Knobbed Coot
Himantopus himantopus	Black – Winged Stilt
Platalea alba	African Spoonbill
Ploceus capensis	Cape Weaver
Streptopelia capicola	Cape Turtle Dove
Streptopelia senegalensis	Laughing Dove
Threskiornis aethiopicus	Sacred Ibis
Vanellus armatus	Blacksmith Lapwing
Vanellus coronatus	Crowned Lapwing

Table 12: Invertebrates that were observed on the study area:

Species Name	Common Name
Apis mellifera	Honey Bee
Olorunia ocellata	Common Grass Funnel Web Spider
Onitis alexis	Bronze Dung Beetle
Trinervitermes spp.	Snouted Harvester Termite

3.1.9 Surface Water

Ilanda Water Services was appointed by Geovicon to conduct a specialist Surface water study over the proposed Access Brown Shaft II. See Appendix 4 for the detailed report.

Bank Colliery's mining right area falls within the Olifants River and Klein Olifants catchments. The Access Brown Shaft II falls within Bank Colliery's mining right. Bank Colliery's mining right area falls in the B11 and B12 tertiary drainage regions of the Olifants River catchment. Within these tertiary regions the mine falls within the B11B, B11G, B11H, B12D and B12B quaternary drainage regions. The Access Brown Shaft II site is located in quaternary catchment B11H.

Figure 5 depicts the location of the Access Brown Shaft II area in relation to the tertiary and quaternary drainage regions within the Olifants River.

The proposed Access Brown Shaft II shaft, infrastructure area and raw water pipeline falls within the

Spookspruit catchment. The dirty water pipeline falls within the tributary of the Blesboklaagtespruit (Bankspruit) catchment. The Access Brown Shaft II area in relation to the major catchments and the natural surface streams are shown on Figure 6. A number of streams have their headwaters within the Bank Colliery's mining right area or slightly upstream of the mining right area. These streams can be divided into three groups. Those that drain into the Olifants River upstream of the Witbank Dam, those draining into the Olifants River just downstream of the Witbank Dam and those that drain into the Middelburg dam. The streams that drain into the Olifants River upstream of the Witbank Dam include the Koringspruit and the Boschmanskranzspruit. The Spookspruit and the Vaalbankspruit drain downstream of the Witbank Dam and upstream of the Middelburg dam catchments respectively.

3.1.9.1 Catchment Boundaries

3.1.9.1.1. Catchment Delineation

The subcatchments of all three streams that traverse the study area were delineated using the Surveyor General's 5m contour data. These catchment boundaries are shown in Figure 6.

The proposed Access Brown Shaft II area falls within the tributary of the Spookspruit catchment, which measures 20.1 km^2 where it exits the study area. The Blesboklaagtespruit catchment measures 7.3 km^2 where it passes under the proposed conveyor. The tributary of the Blesboklaagtespruit catchment measures 25.3 km^2 where it passes under the proposed conveyor.

3.1.9.1.2. Catchment Characterisation

The proposed mining activities are located in quaternary catchment B11H, in the Olifants Water Management Area. The catchments are typical Mpumalanga Highveld catchments. Vegetation is predominantly Highveld grasslands and dry land maize lands. Limited lands appear to be under irrigation. There are numerous small dams located on the rivers within the study areas. There is little development in Spookspruit tributary and Blesboklaagtespruit tributary catchments, with a few farmsteads scattered throughout the catchment. The villages of Bank and Schoongesicht are located in the Blesboklaagtespruit catchment. All catchments can be considered as rural.

3.1.9.1.3. Mean Annual Runoff

The mean annual runoff for the tributary of the Spookspruit is 0.56 Mm^3 where it exits the study area. The mean annual runoff for the tributary of the Blesboklaagtespruit is1.17 Mm^3 where it exits the study area. The mean annual runoff for the Blesboklaagtespruit is 0.34 Mm^3 at the point where it exits the study area.

The mean annual runoff for the quaternary catchment B11H is 11.38 Mm^3 (Middleton and Bailey, 2009). The catchment characteristics of the rivers and streams mentioned above are similar to those of the quaternary catchment so the mean annual runoff was scaled from the quaternary catchment runoff, based on relative catchment size.

3.1.9.2 River Diversions

No river diversions are planned for the activities covered by this Report**.**

3.1.9.3 Water Authority

The Olifants River basin upstream of the Witbank Dam is a government water controlled catchment. The authority in charge is the Department of Water Affairs (Mpumalanga Regional Office).

3.1.10 Sensitive Landscapes

Bank Colliery recognises that all streams and wetlands occurring in the mining right area should be treated as sensitive landscapes. To this extent, Digby Wells Environmental (Digby Wells) was commissioned by Anglo Operations Limited to conduct an integrated wetland assessment for the Bank Colliery. This specialist study consisted of the identification and delineation of wetland areas associated with the mining operation. In addition to this, the ecological functioning and integrity (health) of the delineated wetland systems was described. Findings from this specialist study are attached as Appendix 5.

The proposed Brown Shaft II and infrastructure area is situated on the western side of a wetland area associated with the tributary of the Spookspruit. The proposed Brown Shaft II will not be constructed within this wetland area although part of the Access Brown Shaft II infrastructure, namely the ventilation shaft, raw and dirty water pipeline will be constructed within 32 metres of the wetland. It should be noted that although the soil types indicate a wetland area, the vegetation has been disturbed by agricultural activity and is now transformed to grazing land and maize fields.

Several farm dams were constructed in this tributary resulting in the occurrence of standing water only during heavy rainfall events. Water is not flowing in this tributary. No definite channel was observed. Where ploughing can take place, cultivated maize areas occur in close proximity to this wetland area. An Eskom power line is also constructed through this wetland area in the vicinity of the proposed shaft and infrastructure area.

The proposed raw water pipeline will cross the Spookspruit immediately on the northern side of the dam wall of the Bankfontein dam. This area is in close proximity to the mining activities of Bank Colliery. The dam is utilised for recreational activities.

The proposed used- water pipeline (dirty water pipeline), where it will be constructed in the existing conveyor belt area of the defunct South Shaft, is in close proximity of the wetland area of the far eastern tributary of the Bankspruit. Since the pipeline will be constructed within the existing conveyor belt area, no additional wetland areas will be utilised. Soybean cultivation is also taking place in this area.

From the defunct South Shaft, the proposed used water pipeline will cross the eastern tributary of the Bankspruit and the Bankspruit itself. In this area the pipeline will be constructed within existing water pipeline servitude between maize fields.

3.1.10.1 Wetland Delineation

The wetland FEPAs were considered for a desktop delineation of the wetland areas within the study area. In order to ground truth these findings, the wetland areas were delineated in accordance with the DWAF (2005) guidelines, whereby features such as soil, vegetation and topography were considered. In addition to this, a soil investigation conducted by Digby Wells was jointly considered on a confirmatory basis for the delineation of wetland areas. The delineated wetland areas for Bank Colliery are presented in Figure 7.

3.1.10.2 Wetland Unit Identification

The wetland types associated with the study area were initially identified at desktop level and then ground truthing was conducted to confirm these findings. The wetland types were determined according to the classification system developed by Kotze et al. (2007). This system focuses on the HGM determinants of wetlands and incorporates geomorphology, water movement into, through and out of the wetland and landscape and topographic setting. The size and percentage of HGM units identified for the project area are presented in Appendix 5. The HGM units associated with Bank Colliery are presented in Figure 8.

3.1.10.3 General Functionality of the Wetlands

The identified wetland units were screened at a desktop level to establish whether these systems are likely to be providing any hydrological benefits. The hydrological benefits that are likely to be provided by the wetland system in the particular HGM types are summarised below:

3.1.10.3.1. Valley bottom wetlands with channels

•A key benefit is the enhancement to the quality of water.

•Contribute less towards flood attenuation and sediment trapping.

•Offer some nitrate and phosphate removal potential.

3.1.10.3.2. Valley bottom wetlands without channels

•Offer a service in the enhancement to the quality of water.

•Removes of toxicants and nitrates.

•Trapping and the retention of sediment carried by runoff waters.

•Provide flood attenuation.

•Provide valuable grazing ground during winter periods and early spring.

3.1.10.3.3. Hillslope seepage wetlands

•Contributes to the release of water to the stream system during low flow periods.

•Remove excess nutrients and inorganic pollutants.

•Relatively high removal potential for nitrogen in particular.

•Tend to be very important from an erosion control point of view.

3.1.10.3.4. Depressions (Pans)

•Limited ability to attenuate floods.

•Capture run-off during stormflow conditions.

•Unlikely to contribute to streamflow regulation.

•Temporary pans allow for the precipitation of minerals, including phosphorous.

3.1.10.4 Ecological integrity assessment

The health assessment of the identified wetland areas made use of the indicators hydrology, geomorphology and vegetation. The overall (combined) findings of the WET-Health assessment for the HGM types are presented in Appendix 5. The ecological integrity of the identified HGM units for Bank Colliery is presented in Figure 8.

3.1.11 Groundwater

Geo Pollution Technologies – Gauteng (Pty) Ltd was appointed by Geovicon to perform a Geohydrological Study in support of the proposed Access Brown Shaft II Project. The report, which details the prevailing ground water conditions, aquifer sensitivity, and groundwater impacts assessment for the study area is attached as Appendix 6.

3.1.11.1 Regional Hydrogeology

According to the 1:50 000 General hydrogeological Map (Johannesburg 2526) groundwater resources are widespread but limited with borehole yields generally between 0.1 and 0.5l/s. Groundwater occurrence is better developed along aquifers associated with the contact zones of the dolerite intrusions where yields of 0.5 – 2.0 l/s are likely to occur. The aquifer represents important source for base flow into the streams draining the area. The hydrogeology of the area can be described in terms of the saturated and unsaturated zones. From the previous studies, the summary below of the aquifer system is given.

The aquifer represents an important source for base flow into the streams draining the area. The hydrogeology of the area can be described in terms of the saturated and unsaturated zones:

3.1.11.1.1. Saturated Zone

In the saturated zone, at least four aquifer types may be inferred from knowledge of the geology of the area:

- A shallow aquifer formed in the weathered zone, perched on the fresh bedrock.
- An intermediate aquifer formed by fracturing of the Karoo sediments.
- Aquifers formed within the more permeable coal seams and sandstone layers.
- Aquifers associated with the contact zones of the dolerite intrusives.

Although these aquifers vary considerably regarding geohydrological characteristics, they are seldom observed as isolated units. Usually they would be highly interconnected by means of fractures and intrusions. Groundwater will thus flow through the system by means of the path of least resistance in a complicated manner that might include any of these components.

3.1.11.1.2. Shallow perched aquifer

A near surface weathered zone is comprised of transported colluvium and *in-situ* weathered sediments and is underlain by consolidated sedimentary rocks (sandstone, shale and coal). Groundwater flow patterns usually follow the topography, often coming very close to surface in topographic lows, sometimes even forming natural springs. Experience of Karoo geohydrology indicates that recharge to the perched groundwater aquifer is relatively high, up to 3% of the Mean Annual Precipitation (MAP).

3.1.11.1.3. Fractured Karoo rock aquifers

The host geology of the area consists of consolidated sediments of the Karoo Supergroup and consists mainly of sandstone, shale and coal beds of the Vryheid Formation of the Ecca Group. Most of the groundwater flow will be along the fracture zones that occur in the relatively competent host rock. The geology map does not indicate any major fractures zones in this area, but from experience it can be assumed that numerous major and minor fractures do exist in the host rock. These conductive zones effectively interconnect the strata of the Karoo sediments, both vertically and horizontally into a single, but highly heterogeneous and anisotropic unit

3.1.11.1.4. Aquifers associated with coal seams

The coal seam forms a layered sequence within the hard rock sedimentary units. The margins of coal seams or plastic partings within coal seams are often associated with groundwater. The coal itself tends to act as an aquitard allowing the flow of groundwater at the margins. Geohydrological Report for the Proposed Underground Mining at Access Brown Shaft 2 Bank Colliery, Mpumalanga Province

3.1.11.1.5. Aquifers associated with dolerite intrusives

Dolerite intrusions in the form of dykes and sills are common in the Karoo Supergroup, and are often encountered in this area. These intrusions can serve both as aquifers and aquifuges. Thick, unbroken dykes inhibit the flow of water, while the baked and cracked contact zones can be highly conductive. These conductive zones effectively interconnect the strata of the Ecca sediments both vertically and horizontally into a single, but highly heterogeneous and anisotropic unit on the scale of mining. These structures thus tend to dominate the flow of groundwater. Unfortunately, their location and properties are rather unpredictable. Their influence on the flow of groundwater is incorporated by using higher than usual flow parameters for the sedimentary rocks of the aquifer.

3.1.11.1.6. Unsaturated Zone

Although a detailed characterization of the unsaturated zone is beyond the scope of this study, a brief description thereof is supplied.

The unsaturated zone in the proposed mining area is in the order of between 1 and 10 metres thick (based on static groundwater levels measured in the existing boreholes) and consists of colluvial sediments at the top, underlain by residual sandstone/siltstone/mudstone of the Ecca Group that becomes less weathered with depth.

3.1.11.2 Local Hydrogeology

Groundwater resources are spatially widespread (17 boreholes points were found in the area, most of which were not in use).

3.1.11.2.1. Hydrosensus

A hydrocensus was conducted on and around the proposed mining site (to a distance of approximately two kilometres) during July 2012. The position of all the boreholes relative to the proposed mining area can be seen in Figure 9. A total of 14 boreholes and 3 surface water bodies and streams were identified during this hydrocensus study. Although there were no privately owned boreholes identified, the area is utilized for grazing of large livestock. All the boreholes are on the mine property.

Water Levels

Groundwater levels, varying between 4.31 and 88.36 mbgl, were measured in the surrounding area during the survey. The average static water level was measured to be 8.7 mbgl.

Usually a good relationship should hold between topography and static groundwater level. This relationship can be used to distinguish between boreholes with water levels at rest, and boreholes with anomalous groundwater levels due to disturbances such as pumping or local geohydrological heterogeneities. The relationship using the boreholes from the hydrocensus is shown in Figure 10. It is evident that an unrealistic low groundwater level has been measured in UG2, UG3, BH20 and BHX4. Due to the presence of extensive underground mining activities in the area, these boreholes have most probably been drilled into the underground mine and are thus not representative of the general groundwater level in the area. This will most definitely lead to unrealistic water levels, as the water level in the mine is measured in such a case and not the actual groundwater level. A good correlation (98.7%) was found between the static water levels and the topography. This general relationship is useful to make a quick calculation of expected groundwater levels at selected elevations, or to calculate the depth of to the groundwater level (unsaturated zone).

However, due to the heterogeneity of the subsurface, these relationships should not be expected to hold everywhere under all circumstances, and deviations could thus be expected. The calibrated static water levels as modelled have been contoured and are displayed in Figure 11. Groundwater flow direction should be perpendicular to these contours and inversely proportional to the distance between contours. Using this relationship, the inferred groundwater flow directions are depicted as Figure 12. As can be expected, the groundwater flow is mainly from topographical high to low areas, eventually draining to local streams.

These static water levels were also subtracted from the elevations to determine the unsaturated aquifer thicknesses of different points over the study area. These values are intrinsically the same as the depth to the natural groundwater level measured from the surface. The average depth to the groundwater levels in the fractured aquifer in the proposed mining area are 8 meters.

3.1.11.3 Groundwater Quality

Seventeen (17) water samples were collected from hydrocensus boreholes, streams and open pits around the site during the investigation. The samples were submitted for major cation and anion analyses to determine water quality in the area. The groundwater results are compared with the maximum recommended concentrations for domestic use, see Figure 13.

The results from these analyses were plotted as Pie diagrams (circular graphs as in Figure 14), Stiff diagrams (Figure 15) and a piper diagram (Figure 16).

The pie diagrams show both the individual ions present in a water sample and the total ion concentrations in meq/L or mg/L. The scale for the radius of the circle represents the total ion concentrations, while the subdivisions represent the individual ions. It is very useful in making quick comparisons between waters from different sources and presents the data in a convenient manner for visual inspection.

A Stiff pattern is basically a polygon created from four horizontal axes using the equivalent charge concentrations (meq/L) of cations and anions. The cations are plotted on the left of the vertical zero axis and the anions are plotted on the right. Stiff diagrams are very useful in making quick comparisons between waters from different sources.

On the piper diagram the cation and anion compositions of many samples can be represented on a single graph. Certain trends in the data can be discerned more visually, because the nature of a given sample is not only shown graphically, but also show the relationship to other samples. The relative concentrations of the major ions in mg/L are plotted on cation and anion triangles, and then the locations are projected to a point on a quadrilateral representing both cation and anions.

3.1.11.3.1. General Groundwater Description

In general the groundwater is of good quality for most parameters analysed with exceptions of Ca, Mn, Fe F SO_4 and TDS in some samples. Sulphates are within the target quality water range for the majority of the samples, although high sulphate values were observed in borehole UG3, where an elevated concentration was observed.

The major anion constituting the groundwater composition can be observed to be bicarbonate. It can also be seen from this figure that a general tendency of higher sulphates exists around the existing mine (Bank Colliery). Most boreholes located down-gradient and around the proposed shaft area show groundwater compositions that are of a good quality, with no signs of impact by ARD. However, the boreholes BH14, BH15, BH16, BH18 and KLIP5 located around the proposed underground mining area are likely to be impacted by ARD, given the neutral pH value of the groundwater and likely insufficient carbonate buffering capacity as illustrated in UG3 where bicarbonate has been depleted by sulphate.

Neutral to slightly acidic pH values can be seen in all boreholes. These pH levels may be attributed to the buffering of acid rock drainage (ARD) by the local carbonate rich geology.

The elevated metal concentrations (Fe and Mn) in numerous boreholes (BH15, BH16, BH18, BH20, KLIP5, UG3, X3 and X5) are at predominantly at Class II level according to the DWAF standards, with UG3 exceeding the maximum allowable limit for Mn. The cause of this exceedance in Mn concentration can be attributed to an initially lowered pH value. At low pH's certain metals become soluble in water and thus can be attributed to the formation of ARD in the vicinity.

From Figure 16 (piper diagram) it can be seen that water in the area has a very similar signature with sulphates causing a single anomaly in the stiff diagram of UG3. The boreholes BH16, BH18, BH20, X3 and X5 have a Ca-HC03 signature, while BH14, BH15 and KLIP5 display a mixed signature between Ca-HCO3 and Na-HCO3 indicating a mixing of younger, fresh groundwater and deep, The groundwater around the proposed mine generally has a low alkalinity and therefore a low buffer capacity.

Table 13: Average values and concentrations for groundwater at Bank Colliery

Sample NR	BH14	BH15	BH16	BH 18	BH20	UG3	KLIP 5	X3	X5
Ca (mg/l)	12.40	5.45	27.50	52.60	39.80	9.61	242.00	9.17	52.40
Mg (mg/l)	3.62	2.70	11.50	24.90	20.70	7.90	61.60	5.92	26.90
Na (mg/l)	21.20	8.67	12.10	38.40	60.60	17.20	41.10	11.10	14.00
K (mg/l)	3.11	2.97	3.79	11.10	5.98	4.44	7.49	2.74	7.79
Mn (mg/l)	0.00	0.00	0.00	0.86	0.38	0.13	3.36	0.22	1.25
Fe (mg/l)	0.00	0.52	0.02	0.90	0.05	0.00	0.12	0.00	0.07
F (mg/l)	0.00	0.00	0.00	0.46	23.60	0.00	1.13	0.00	0.00
NO_3 (mg/l)	14.87	0.00	1.24	0.00	0.49	27.80	0.49	0.00	0.00
Al (mg/l)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HCO_3 (mg/l)	36.59	30.48	141.00	411.66	330.02	40.24	222.78	76.50	360.61
Cl (mg/l)	34.00	6.50	8.60	18.00	11.00	30.00	28.00	7.40	6.50
So_4 (mg/l)	1.30	14.00	13.00	4.95	5.40	6.63	783.00	3.17	2.71
TDS by sum (mg/l)	122.00	60.00	158.00	406.00	348.00	136.0	1268.00	86.00	346.00
M-Alk($CaCO_3$)	30.00	25.00	116.00	338.00	272.00	33.00	183.00	63.00	297.00
pH	6.52	6.73	7.57	7.25	7.76	6.69	7.35	7.66	7.70
EC	16.60	8.61	25.30	64.60	53.40	20.60	150.00	13.80	52.90

3.1.11.3.2. Potential Groundwater pollutants

The potential contaminants associated with the mining activities may emanate from the underground mining area, product stockpile, and pollution control dam (PCD) and R.O.M. area.

Workshops and fuel and oil handling facilities are likely sources of hydrocarbon related contaminants. Oils, grease and other hydrocarbon products (such as petrol and diesel) handled in these areas may contaminate the environment by spillages and leakages. Oils and greases are removed and collected in oil traps. Run-off (contained with hydrocarbons) which is not collected may enter the storm water system from where it may contaminate surface water bodies and groundwater. Septic tanks and sewage treatment plants potentially contaminate groundwater. Contaminants associated with these plants include coliforms (e.g. E.coli), bacteria viruses, ammonia, phosphate, sulphate and nitrate. Effluent from these systems usually contains elevated concentrations of organic matter which may lead to elevated COD and BOD. Waste disposal areas may source a wide range of contaminants, ranging from metals, organic matter, hydrocarbons, phosphates, etc.

Sulphate is probably the most reliable indicator of pollution emanating from coal mining. Sulphate concentrations can however increase due to mobilisation during the mining process.

3.1.11.3.3. Aquifer Sensitivity

A Groundwater Quality Management Index of 4 was estimated for the study area from the ratings for the Aquifer System Management Classification. According to this estimate a **medium level groundwater protection** is required for the fractured aquifer. Reasonable and sound groundwater protection measures are recommended to ensure that no cumulative pollution affects the aquifer, even in the long term.

DWA's water quality management objectives are to protect human health and the environment. Therefore, the significance of this aquifer classification is that if any potential risk exists, measures must be taken to limit the risk to the environment, which in this case is:

- The protection of the underlying aquifer (weathered & fractured)
- The Spookspruit streams/wetlands to the northeast.

3.1.12 Air Quality

Mining and related activities have a potential to impact on the air quality of its surrounding area. Potentially air pollution may arise as a result of particulates entering the atmosphere. These particulates arise as dust from earth movement, material movement on haul roads and other gravel roads and product stockpiles.In view of this, it is crucial that the current status of the air quality is determined. Environmental and Health Risk Consulting was appointed by Geovicon to perform an ambient air quality impact assessment in support of the proposed Access Brown Shaft II Project. The report, which details the air quality assessment criteria, background information and air quality impacts assessment for the study area is attached as Appendix 7.

Briefly the following were the key findings from the above-mentioned study:

- Suspended particulates account for most emissions from the process with PM10 being the criteria pollutant of consequence.

- Dispersion of particulate emissions from the process was modelled using the ISC-AERMOD View model based on the standard Gaussian solution.

- The results present the spectrum from maximum ground level concentration to maximum impact area, and accounts for daily and annual reference periods.

- Ground level concentrations were predicted for atmospheric conditions based on local meteorological data for the period June 2007 to May 2012.

- Nuisance dust from construction operations will probably exceed the residential action level up to a distance of 400m downwind of operations. The receivers of concern are the commercial/residential dwellings at the R35/Bank Road intersection.

- During normal operations dust deposition rates as high as 1 100mg/m^2/day are predicted onsite, during extreme pollution episodes associated with dry and windy spells. Vehicles entering and leaving the mine will always be the most visible sources of pollution.

- It is unlikely that nuisance dust emanating from the project will have negative long term health impacts on people residing in the study area.

- PM10 concentrations are likely to remain below the 24-hour and annual AQA limits during the operational phase of the project.

- Maximum daily concentrations as high as 118µg/m^3 could occur within the shaft area boundary.

- Annual PM10 concentrations will remain below the current background levels at the nearest sensitive receivers.

- Air quality management during the operational phase of the mine should focus on all residences within a radius of 1 kilometre from the mining operation.

- The impact assessment considered the cumulative effects on air quality caused by the aggregate of past and present actions in the area.

- Modelling predictions are based on emission reduction factors ranging from 70% to 90% for selected activities. Implementation of a combination of control measures in a focused approach will see a further reduction in the predicted impact area.

- Source monitoring should be used in combination with modelling to assess the effectiveness of control measures at the receiving environment.

- Strict monitoring of ambient air quality will assist effective air quality management and open communication to all stakeholders.

3.1.13 Noise

M2 Environmental Connections was commissioned to undertake a specialist study to determine the potential noise impact on the surrounding sound environment due to the establishment of the Access Brown Shaft II mining project. A copy of the report is attached as Appendix 8 of this report. The report describes the potential noise impact that the mine and its associated infrastructure may have on the surrounding sound environment, highlighting the methods used, potential issues identified, findings and recommendations.

3.1.13.1 The Study area

The development is proposed in a relatively flat topography. There are man-made berms and structures that will serve as noise barriers.

Roads and rail roads

The R35 carries high traffic volumes (relative to sound emissions) and traverses the study site from north to south separating the proposed facility (including the start of the proposed conveyor belt) from the existing facility (end of the proposed conveyor belt). The locality of this road is also along the boundary of a few noise-sensitive developments (also known as NSD or receptor) in the study area.

An unnamed/unidentified paved road with less traffic volumes than the R35 road was viewed to traverse the area from east to west and is one of the main vehicle routes from the R35 road to the existing facility in the study area. Other smaller paved and un-paved roads traverse the area but it carries insignificant traffic. The locality of R35 road is illustrated in Figure 17.

Surrounding Land use

The surrounding land use is mainly mining considering the existing development in the study area. Areas further away from the existing development were seen to be rural in terms of acoustics..

Ground conditions and vegetation

The area is not well covered with vegetation with low growing grass defining the area along with a few scattered areas of trees. Ground conditions were seen to be of hard ground conditions, which would not be very acoustically absorbent in nature.

Existing Background Ambient Sound Levels

The study area has a rural character in terms of the background sound levels. Onsite measurements and the existing soundscape are discussed in more detail in the report attached in Appendix 8.

3.1.13.2 Potential Sensitive Receptors

Potentially sensitive receptors, also known as noise-sensitive developments (NSDs) were initially identified using Google Earth®, supported by a site visit to confirm the status of the identified dwellings.

The reason for the site visit, apart from sampling ambient sound levels, is that there could be a number of derelict or abandoned dwellings that could be seen as a sensitive receptor, or small dwellings that could not be identified on the aerial image, or those that were built after the date of the aerial photograph. The status of the building (commercial, industrial or residential) needs to be indentified as well.

Potential receptors in and around the proposed development were identified and are presented in Figure 18, with their localities defined in Table 14.

Table 14: Locations of the identified noise-sensitive developments (Datum type: WGS84 – Hartbeeshoek)

Noise-sensitive development	Status	Location (Latitude)	Location (Longitude)	Est. distance to development (m)
NSD01	Residential	-26.000516°	29.494486°	1,900
NSD02	Residential/business	-25.989823°	29.481740°	950
NSD03	Religious	-25.982195°	29.479753°	740
NSD04	Residential/commercial	-25.982257°	29.479035°	810
NSD05	Residential	-25.982034°	29.477758°	980
NSD06	Residential	-25.973490°	29.486566°	990

3.1.13.3 Current Environmental Sound character

Measurement Procedure

Ambient (background) noise levels were measured at appropriate times in accordance with the South African National Standard SANS 10103:2008. The equipment defined in Table 15 below was used for gathering data. It should be noted that the microphones used in conjunction with the various sound level meters are regularly laboratory checked between calibration intervals. These would include instances where the diaphragm of the microphone would be cleaned of any minor contaminates.

Table 15: Equipment used to gather data

Equipment	Model	Serial no	Calibration
SLM	Rion NL-32	01182945	23 January 2012
Microphone*	Rion UC-53A	315479	23 January 2012
Preamplifier	Rion NH-21	28879	23 January 2012
Calibrator	Rion NC-74	34494286	24 January 2012
Anemometer	Kestrel 4000	587391	Calibrated[1]
SLM	Svan 955	27324	31 January 2012
Microphone*	ACO 7052E	49596	31 January 2012
Preamplifier	Svantek SV12L	25685	31 January 2012

On Site Measurements

Measurements were taken during the day and night of the 12th and 13th of June 2012. The sound measuring equipment was calibrated directly before, and directly after the measurements was collected. In all cases drift was less than 0.2 dBA. These points are considered sufficient to determine the ambient (background) sound levels in the area. The results of the singular ten minute bin samples are presented in Table 16 with the average of numerous 10 minute bins taken over a 20 hour day/night-time period presented in

Table 17.

Table 16: Results of singular ten minute bin sound level samples (Datum type: WGS84, Decimal Degrees)

Point name	Latitude, Longitude	$L_{Aleq,T}$ (dBA)	L_{A90} (dBA)	$L_{A, max}$ (dBA)	$L_{A, min}$ (dBA)	Ave Wind Speed (m/s)	Comments and sounds during monitoring
GNBS02(R)	-25.979235° 29.480011°	73.0	35.0	89.0	30.3	1.7	Road traffic noise.
GNBS03(A)	-25.981520° 29.479083°	59.2	49.6	69.7	46.3	5	Wind friction, road traffic noise (R35 and access road to NSD03 – NSD05), compressor and light industrial activities at NSD03 – NSD05 and people talking.

Table 17: Results of 20 hour ten minute bin ambient sound level samples (Datum type: WGS84, Decimal Degrees)

Point name	Latitude, Longitude	Ave. $L_{Aleq,T}$ (dBA)	Ave L_{A90} (dBA)	Minimum L_{A90} (dBA)	Maximum L_{A90} (dBA)	Highest wind gust (m/s)	Comments and sounds during monitoring
GNBS01(A)	-25.975345° 29.482577°	53.81	36.54	25.8	54.8	3.1	Ambient day/night-time monitoring point.
GNBS05(Ref)	-25.973657° 29.452435°	58.87	52.28	40.50	59.2	8.2	Existing mine day/night-time monitoring point.

Estimated Minimum Ambient Soundscape

The main anthropogenic noises of significance in the vicinity of the proposed development during the day/night-time hours were the road traffic noise emanating from the R35 road and the existing facility (mining facility).

3.1.13.4 Potential Noise Sources

Potential Noise Sources: Construction Phase

Construction activities include:

- **Establish access roads** – It is expected that access to the proposed development will make use of the existing dirt road on the site (i.e. purple line in Figure 19);
- **Drilling** – It is highly likely that blasting by means of explosives would be used to excavate the mine shaft. As is the practice with blasting, core holes are drilled into rock, blasted, and aggregate removed by means of plant equipment;
- **Site preparation activities** - Includes clearance of vegetation at the footprint of all infrastructures. These activities will require the stripping of topsoil which will need to be

stockpiled, backfilled and/or spread on site. Site preparation for the mine shaft is expected to consist of rock rubble removal from blasted rock;

- **Construct foundations** – The volume of concrete for bases/foundations and strip footings is unknown for this report. Due to the small size of the project in terms of construction, it is unlikely that an on-site batching plant would be used to source concrete aggregate;

- **Transport of components & equipment to site** –All components will be brought to site by means of heavy or other vehicles. The typical civil engineering construction equipment will need to be brought to the site for the civil works (e.g. excavators, trucks, graders, compaction equipment, cement trucks, etc); and

- **Erect infrastructure** – Various mechanical, electrical and other non concrete related plant equipment would require installation. This would include the conveyor belt and its associated components (conveyor drive train, conveyor gearbox etc).

The equipment likely to be required to complete the above tasks will typically include: excavator/graders, bulldozer(s), dump trucks(s), vibratory roller, bucket loader, rock breaker(s), drill rig, pile drivers, concrete truck(s), , fork lift(s) and various 4WD and service vehicles.

Material Supply: Concrete Batching Plants and use of Borrow pits

There exist three options for the supply of the concrete to the development site. These options are:

1. The transport of "ready-mix" concrete from the closest centre to the development.

2. The transport of aggregate and cement from the closest centre to the development, with the establishment of a small concrete batching plant close to the activities. This would most likely be a movable plant.

3. The establishment of a small quarrying activity, where aggregate will be mined, crushed and screened and used onsite. Cement will still be transported to the site, where there will be a small movable concrete batching plant.

For the purpose of the EIA, Option 2 was assumed as being the preferred option. Aggregate will be sourced from existing commercial borrow pits in the area.

Blasting

Blasting may be required as part of the civil works to clear obstacles or to prepare foundations. However, blasting will not be considered during the EIA phase for the following reasons:

- Blasting is highly regulated, and control of blasting to protect human health, equipment and infrastructure will ensure that any blasts will use the minimum explosives and will occur in a controlled manner. The breaking of obstacles with explosives is also a specialized field and when correct techniques are used, causes significantly less noise than using a rock-breaker.

- People are generally more concerned over ground vibration and air blast levels that might cause building damage than the impact of the noise from the blast. However, these are normally associated with close proximity mining/quarrying.

- Blasts are an infrequent occurrence, with a loud but a relative instantaneous character. Potentially affected parties generally receive sufficient notice (siren) and the knowledge that the duration of the siren noise as well as the blast will be over relative fast results in a higher acceptance of the noise. Note that with the selection of explosives and blasting methods, noise levels from blasting is relatively easy to control.

Traffic

A significant source of noise during the construction phase is additional traffic to and from the site as well as traffic on the site. This will include trucks transporting equipment, aggregate and cement as well as various components used to construct the development.

Construction traffic is expected to be generated throughout the entire construction period, however, the volume and type of traffic generated will be dependent upon the construction activities being conducted, which will vary during the construction period. Noise levels due to additional traffic will be estimated using the methods stipulated in SANS 10210:2004 (Calculating and predicting road traffic noise).

It is expected that an existing dirt road on the site will be used by the construction crew.

Potential Noise Sources: Operational Phase

Noise emitted by proposed development can be associated with various types of noises and noise sources. These include mechanical sources due to operation of plant equipment, material impact noises (such as found at a feeder bin where material is dropped at a height to ground level) and electrical noise (reverse hooters from trucks). These sources generally have different characteristics and can be considered separately.

The following potential noisy infrastructure has been identified for the proposed development:

- **Feeder bin** - (impact, friction noise). At conveyor belt junctions (where conveyors change direction) on route to the existing facility, it is expected that feeder bins would be required to link the previous stretch of the conveyor belt to the following stretch;

- **General work at the workshop area** - (mechanical, impact and friction noises). This would be activities such as equipment maintenance, off-loading and material handling;

- **Front end loader (small – medium size)** - (Mechanical, friction noise). Any stockpiles (small or large) considered on the mine shaft will need to be managed by means of a front end loader (FEL); and

- **Grader** (**small – medium size)** - (mechanical, friction noise). Management of surface areas may make us of a grader

3.1.14 Sites of Archaeological and Cultural Interest

Archaetnos cc was appointed by Geovicon to conduct a heritage impact assessment for the proposed Access Brown Shaft II Project. A report compiled after the survey of the proposed mining area is attached as Appendix 9 of this report.

Based on the Report, no site of significant archaeological or cultural interest has been identified over the proposed Access Brown Shaft II area.

3.1.15 Areas of Palaeontological Interest

Professor Bruce Rubidge (PhD, FGSSA, FRSSA, Pr Sci Nat) from the University of the Witwatersrand was appointed by Geovicon to conduct a Desktop Palaeontological Impact Assessment for the proposed Access Brown Shaft II Project. The Palaeontological desktop report compiled of the proposed mining area is attached as Appendix 10 of this report.

A desktop Palaeontological Impact Assessment was undertaken on the proposed Access Brown Shaft II Coal Mine in the Steve Tshwete Local Municipality, Nkangala District Municipality Mpumalanga Province, situated south of Middelburg. The proposed development involves the development of a new underground coal mine with typical supporting infrastructure.

Following the geological map (2528 Pretoria and 2628 East Rand sheets 1:250 000 Geological Series, Geological Survey) the entire study area is underlain by sedimentary rocks of the Permian Vryheid Formation of the Ecca Group of the Karoo Supergroup.

The rocks of the Ecca Group are renowned for their wealth of plant fossils of the famous Gondwanan *Glossopterus* flora which has been described from Permian-aged rocks. This flora is the source of the coal which is mined from the Vryheid Formation in South Africa and is the reason for the coal mining operations. Within the Vryheid Formation there are occurrences of well-preserved elements *Glossopteris* flora comprising wood and/or leaves. Large collections of fossil flora from this Formation are present in the collections of the Council for Geoscience in Pretoria and the Evolutionary Studies Institute at the University of the Witwatersrand in Johannesburg.

The process of coal mining has the potential to destroy palaeontological heritage, and by its nature coal mining will destroy plant fossils. However, as these fossils are not currently exposed, the development of a coal mine will in fact enhance possibilities to discover plant and possibly other fossils. If fossils are exposed in the course expanding the mining development at Brown Shaft II Coal Mine a qualified palaeontologist must be contacted to assess the exposure for fossils so that the necessary rescue operations are implemented.

3.1.16 Visual Aspects

The proposed project area is situated within an approved mining right area, and there is the presence of mining activity within the surrounding areas. The current land use is on the project area is grazing and hence is already disturbed. The implication of this is that the "sense of place" of the study area has been impacted on by these activities. In terms of the proposed Access Brown Shaft II project, infrastructure such as the withdrawal conveyor belt and overland conveyor belt transfer point will be visible from the R35.

3.1.17 Regional Socio-Economic Structure

3.1.17.1 Population Growth and Location

Bank Colliery's Access Brown Shaft II is situated within Steve Tshwete Local Municipality which falls within the Nkangala District Municipality. The estimated population growth figures increased from the period between 1996 and 2001 and 2001 and 2011 from 1.1% to 2.5% growth rate. The population for the Steve Tshwete Local Municipality based on the 2011 Census is 229 831. The population density in the local area where Bank Colliery's Access Brown Shaft II area is located is limited to residents of the mine village, the residents of the informal settlements and the workers of the nearby supermarket. Access Brown Shaft II area is not an area that has been targeted for extensive development; therefore it is unlikely that the current population will expand significantly. It is therefore expected that population changes will only occur as a results of births and deaths in the area.

3.1.17.2 Major Economic Activities and Sources of Employment

The major economic activities in the Witbank/Middelburg area are those associated with coal mining, metallurgical industries, commerce and light engineering, power generation, agriculture and administration. 70% of the Witbank area's economic base is founded in minerals. The area's main export is coal (currently only 24% of the total mined), steel and steel products, thus, making the Witbank and Middelburg economy relatively sensitive to world economic cycles.

3.1.17.3 Unemployment Estimate for the Area

Mining methods are changing from the traditional labour intensive underground mining to capital intensive, low-labour opencast mining, which is leading to increased unemployment amongst the semi- and unskilled workers.

Based on the 2011 Census, the unemployment rate for the Steve Tshwete Local Municipality from year 1996 to 2001 almost doubled, from 11 311 in 1996 to 22 785 in 2001. From 2001 to 2011 there was a decrease in the unemployment rate from 22 785 in 2001 to 20 325 in 2011 which results in a 19.9 % unemployment rate in 2011. Bank Colliery will not employ new full time employees for this project. Current employees will be moved from areas to be decommissioned to the Access Brown Shaft II area. New employment opportunities will however be created only during the construction phase, where contractors will be used for the establishment of the access shaft are. This will not have an impact on the stats since the contractors will be using employees in the pay roll.

3.1.17.4 Water Supply

There are two abstraction points for raw water supply to Bank Colliery. All of these abstraction points originate from the Komati Water Scheme pipeline. This scheme was started as a result of an agreement between the existing collieries in the local region (including Bank Colliery, which is now a part of Bank Colliery, Springbok Colliery, Koornfontein mine, Eskom, etc.). The source of water for the Komati Water Scheme is the Nooitgedacht Dam. Permits for the limited abstraction of water from the scheme have been issued by DWAF.

Farm owners and nearby informal settlements obtain water from Bank Colliery.

3.1.17.5 Power Supply

Power supply will be obtained from Eskom.

SECTION FOUR

Details of Public Participation Process

4. DETAILS OF THE PUBLIC PARTICIPATION PROCESS

In terms of Chapter 6 of the NEMA regulations (GN543), all potential interested and affected parties should be informed of the project and be given a chance to register as an interested and affected party in order to raise any comments and concerns with related to the proposed project.

4.1 THE CONSULTATION PROCESS

4.1.1 Registration phase

Immediate and adjacent landowners, relevant ward councillor, municipality in whose jurisdiction the proposed project falls, State departments and the greater public have been notified either via email, site notice and local newspaper advertisement (English and Afrikaans) of the intention to undertake the proposed activities at the Access Brown Shaft II area. See Appendix 11 for the proof of consultation during the registration phase.

4.1.1.1 Registered Interested and Affected Parties (I&AP's)

The registered I&AP's identified are as follows:

Department of Water Affairs (Mpumalanga Regional Office)

Department of Mineral Resources (Mpumalanga Regional Office)

Department of Economic Development, Environment and Tourism (Mpumalanga Provincial Office)

Department of Agriculture, Forestry and Fisheries

Department of Land Affairs

Mpumalanga Parks and Tourism Agency

South African Heritage and Resources Agency (SAHRA)

Immediate/adjacent landowners and legal occupiers

Steve Tshwete Local Municipality

Ward Councillor

4.1.2 Scoping Phase

The draft Scoping report was submitted to MDEDET, relevant State Departments, the Steve Tshwete Local municipality, responsible ward councillor and registered I&AP's for comment. The draft Scoping report was also placed in the Middelburg Library for comment. A local newspaper advertisement

(English and Afrikaans) in accordance with Regulation 54 of Government Notice No. R534 under section 24 of the National Environmental Management Act (Act 107 of 1998) was also placed to inform the public of the availability of the draft scoping report in the Middelburg Library for comment. See Appendix 11 for proof of consultation. No comments were received from I&AP's during the Scoping phase.

Once the commenting period lapsed, the final Scoping Report was submitted to MDEDET as no comments were received for the draft Scoping Report.

4.1.3 EIA/EMP Phase

The draft EIA/EMP report was submitted to MDEDET, relevant State Departments, the Steve Tshwete Local municipality, responsible ward councillor and registered I&AP's for comment. The draft Scoping report was also placed in the Middelburg Library for comment. A local newspaper advertisement (English and Afrikaans) in accordance with Regulation 54 of Government Notice No. R534 under section 24 of the National Environmental Management Act (Act 107 of 1998) was also placed to inform the public of the availability of the draft EIA/EMP report in the Middelburg Library for comment. See Appendix 11 for proof of consultation. Once the commenting period lapsed, the final EIA/EMP (this report) including comments from I&AP's, will be made available to registered I&AP's for comment for 21 days, thereafter the final EIA/EMP will be submitted to MDEDET.

4.1.3.1.1. Comments received from registered I&AP's

Registered Interested and affected parties
The Department of Agriculture, forestry and fisheries requested that any form of Natural Agricultural Resource degradation with necessary mitigation measure be considered as well as the mitigation measures stated in the Soil specialist report be implemented
Response
Where necessary, strip topsoil clean from underlying non-topsoil materials such as weathered sandstone, hard or soft plinthite. -Stripping and stockpiling of A horizon (30 cm topsoil) separately from subsoil. -Selection of sites of lower potential soils for development whenever possible. -During rehabilitation, soil amelioration should be done by liming and fertilizer applications based on soil analysis. -Delineation of wetlands by means of pegging before commencement of development is necessary. -Avoid development in wetland zones. -Avoid the dumping of materials, spills and the run-on of polluted water into wetland zones. -Construction of isolative embankments where necessary. -To this, end, design, implement and maintain effective water runoff control measures. -Refrain from disturbing land in the proximities of wetland zones. -After rehabilitation and re-vegetation of the shaft and infrastructure area, regular inspections must be conducted over the area to determine if vegetation cover is successful in order to combat erosion. If bare patches become visible, seeding of the areas must follow. -Inspections must also include the establishment of any declared invader plant species. If they exist in the area an immediate eradication program must be implemented. -Storm water from upslope of the stripped areas should be diverted around these areas to limit the amount of storm water flowing over from these areas. -The timing of the topsoil stripping should be optimised to limit the time between stripping and construction. Where practical constraints exists and areas need to left stripped for long periods, contour ploughing or ripping could reduce runoff and hence reduce erosion.

-Dry season construction is preferable. -Hydro seeding of the topsoil stockpile is recommended to speed up vegetation cover. An appropriate seed mix should be designed by a vegetation specialist. **-The closure objective for vegetation is to restore the area to grazing land and to eradicate all declared invader plant species.**
Registered Interested and affected parties
The South African Heritage Resources Agency (SAHRA) requested that a Desktop Palaeontological Impact Assessment be completed and submitted to SAHRA before Environmental Authorisation is granted.
Response
-A Palaeontological specialist has been appointed to conduct the Desktop Palaeontological Impact Assessment. See Appendix 10 for the Desktop Palaeontological Impact Assessment Report.
Registered Interested and affected parties
The Department of Water Affairs stated the following: Currently the Department of Water Affairs is in possession of Bank Colliery's Access Brown Shaft II Integrated Water Use Licence Application, whereby all water use related issues shall be addressed. The applicant is advised not to commence with any water use activities before prior obtaining a Water Use Licence and the applicant must report any pollution incident from this proposed project to the Regional Head: Mpumalanga Department of Water Affairs within 24 hours. The mine manager or person accountable must at all times adhere to the requirements of the regulations on the use of water for mining and related activities aimed at the protection of water resources as promulgated under the Government notice No.: 704 and published in Government Gazette No.20119 of June 1999
Response
-No water use activities will occur prior to obtaining a Water Use Licence and use of water for mining and related activities will be in accordance to Government notice No.: 704(published in Government Gazette No.20119 of June 1999)

4.1.4 Record of Decision

I&AP's will be notified in writing and by way of advertisements in the local newspaper, of the authority's decision on the EIA/EMP, that is whether environmental authorisation has been granted to the applicant or not, and the conditions of the authorisation. If positive, I&AP's will be advised that the decision may be appealed within 30 days after the date of decision. Notification of the authority's decision will be provided as follows: A letter will be sent out to all registered I&AP's informing them of the authority's decision and explaining how to lodge an appeal should they wish to; and an advertisement to announce the authority's decision will be published in the local newspaper.

SECTION FIVE

Need and Desirability of the Project

5. NEED AND DESIRABILITY OF THE PROPOSED PROJECT

Anglo Operations Proprietary Limited's Bank Colliery underground coal reserves are reaching depletion. A mining right has been granted to Anglo Operations Proprietary Limited's Bank Colliery, to mine coal at the proposed Access Brown Shaft II area via underground mining methods. In order to maintain job employment (approximately 100 people) and coal production rates at Bank Colliery to supply Eskom and the Export market more coal reserves need to be mined. The underground workings at Bank Colliery is flooded closer to the proposed Access Brown Shaft II area and therefore the existing underground workings cannot be used to access the coal reserves at the Access Brown Shaft II area, hence the construction of the Access Brown shaft II and its associated infrastructure.

Anglo Coal expects that substantial benefits from the project and associated infrastructure will accrue to the immediate project area, the sub-region and the province of Mpumalanga. These benefits must be offset against the costs of the project, including the impacts to land owners.

The potential benefits of the proposed project are:

- Long-term, national benefits of reliable power supply and the resultant socio-economic benefits.
- Highly significant benefits to the province of Mpumalanga in terms of the long-term coal supply to Eskom. Long-term coal supply contracts bring about needed job creation and other local, provincial and national socio-economic benefits.
- Potential reduction in crime because of short-term job creation during construction (providing farm safety and security measures are implemented), but also in the long-term in the region, as a result of job creation.
- Local growth in the economy of the towns of Witbank, Middelburg and surrounding areas, and for local businesses including those that supply accommodation, transport etc.
- Economic benefits for contractors and other suppliers of goods and services.
- Economic opportunities and other potential benefits for land owners from compensation for impacts.

Through the implementation of the Social and Labour Plan the mine employees will be developed in terms of skills development and career progression; small businesses will be established and sustained and the mine will support community infrastructure development and poverty eradication.

This EIA recommends that Anglo Coal, and also its contractors, follow the approach of maximising and enhancing benefits rather than merely focussing on reducing or avoiding negative impacts, and that all opportunities for additional benefits to local land owners be actively pursued.

Based on the environmental assessment conducted as described in this Report, there are no environmental impacts associated with the proposed project that cannot be mitigated.

SECTION SIX

Detailed Description of the Project

6. DETAILED DESCRIPTION OF THE PROJECT

6.1 DETAIL DESCRIPTION OF THE PROJECT

6.1.1 Surface Infrastructure

All proposed surface infrastructure in relation to the proposed Access Brown Shaft II Project area is shown in the Surface Infrastructure Layout Plans. See Appendix 12.

6.1.1.1 Roads, railways and power lines

With regard to the proposed project, the existing private access road will be used for access to the Brown Shaft II Shaft Complex. This road is relatively narrow for the purpose it should serve and hence it will need to be upgraded.

No railway line exists and none will be used for the Access Brown Shaft II Underground Mining Project area. Raw coal from the underground workings will be transported by an overland conveyor from the workings to the existing washing plant. Note that the new overland conveyor belt will connect to an existing conveyor belt infrastructure. No R.O.M coal stockpile will be necessary at the Access Brown Shaft II shaft complex.

The Eskom power grid used by another shaft i.e. South Shaft will be used for the supply of electricity to the new mining area. This will however require that a new 22KVA power line be installed from the existing substation to the new substation to be constructed at the proposed Access Brown Shaft II mining area.

6.1.1.2 Non-Mineral Waste Management

This section of the report will describe the type of waste that will be generated at the Access Brown Shaft II site and how the waste will be managed. The different types of both general and hazardous wastes to be generated from the site are discussed below.

Note that all waste generated from the proposed mining area will be transported to the already existing Bank Colliery waste collection system and disposed at registered waste disposal sites. Note that Bank Colliery has an existing contract with a waste collection company for the collection and disposal of the generated waste. The same company will be used for the collection and disposal of waste generated at the shaft complex. If necessary, all necessary space and infrastructure will be made available for the temporary storage of the waste at the Access Brown Shaft II complex.

General Waste Management

General waste to be generated from the Access Brown Shaft OII area will include domestic waste, paper waste, scrap waste, scrap metal and scrap rubber.

Domestic waste will include general waste generated by offices and kitchens. This waste generally consists of plastic, food waste, glass, polystyrene, old stationary, garden waste and discarded PPE.

Paper waste will consist of paper and cardboard.

Recycled waste will consist of material which has a residual monetary value if collected, stored and accumulated in suitable quantities. These include scrap metal and scrap rubber where scrap metal includes all metal objects, equipment, old rollers, roof bolts, screens from the plants, pipes, broken pumps, old pick heads, old tyre rims, gratings, etc. Scrap rubber will include scrap tyres, scrap cable, pieces of conveyor belt and other pieces of rubber.

Hazardous Waste Management

Hazardous waste from the Access Brown Shaft II area will include oil waste, paint, thinners, turpentine, plant chemicals, batteries, fluorescent tubes and hydrocarbon waste (oils, oily rags, oil filters, oil separator sediments and contaminated soils).

The oil waste will be siphoned via oil separators to be constructed on site. The siphoned oils will be removed to the oils storage area that already exists (Bank Colliery main complex) or to be constructed on site. A permitted waste disposal contractor will collect the waste for disposal at a licensed hazardous waste disposal site.

Similar to the oils waste, paint; thinners and turpentine will be removed by a permitted waste disposal contractor for treatment and disposal at a licensed hazardous waste disposal site or incineration.

Any other chemicals waste will also be removed by permitted waste disposal contractor for treatment and disposal at a licensed hazardous waste disposal site.

Batteries will be removed by a permitted waste disposal contractor for recycling or treatment and disposal at a licensed hazardous waste disposal site.

Fluorescent tubes will be crushed with a tube crusher and removed by permitted waste disposal contractor for treatment and disposal at a licensed hazardous waste disposal site.

Hydrocarbon waste will be stored on site for recycling or removal by permitted waste disposal contractor for disposal at a licensed hazardous waste disposal site.

6.1.1.3 Mineral Waste Management Mine residue management

Mineral waste includes the following i.e. overburden material (hards), coarse and fine discards from the coal washing plant.

Overburden (hards)

All hards overburden material removed from the access adit will be stockpiled separate from the other overburden material i.e. sub soils and top soils. The stockpiles will as much as possible be cited on affected ground with the deep groundwater aquifer. The stockpiles will be constructed to have diversion trenches that will collect runoff from the stockpile area.

Mine Residue (Coal discards) management

Refer to the approved Bank Colliery EMPR for the manner in which the mine residue generated from the coal washing plant is disposed off. Note however that, no beneficiation will be conducted at the proposed mining area; all coal will be transported to the existing coal washing facility. Based on the current capacity of the discard dump and the amount of discards to be generated from the coal mined at the proposed extension area, it was determined that the discard dump has enough capacity to handle the additional discards from the mined coal.

6.1.1.4 Water Pollution Management Facilities

Polluted water in the form of sewage effluent, water from the proposed underground workings and dirty storm water runoff from the shaft complex will be generated at the proposed project area. This section of the report will describe the facilities to be used for the management of polluted water to be generated from the site.

Sewage Treatment

All sewage emanating from the Access Brown Shaft II ablution facilities will be collected into a conservancy tank that will be constructed at the Bank Colliery's Access Brown Shaft II area. The conservancy tank has been designed to cater for the approximately 100 employees at the Access Brown Shaft II mining area. The septic tank will be designed and constructed to drain supernatant water (effluent) into a conservancy tank, which together with the septic will be emptied by contractor on a regular basis. In view of the above, no effluent from the sewage package plant will be released into the environment.

Dirty Storm Water

All dirty storm water emanating from the Access Brown Shaft II surface infrastructure area will be drained and captured into a new pollution control dam and re-used for dust suppression underground and the rest will be evaporated. Any excess water from the pollution i.e. water that cannot be evaporated will be pumped via a dirty water pipeline into one of the mine's mined out underground sections i.e. one of South Shaft mined out underground section.

6.1.1.5 Transport

Mine officials and senior skilled employees will use their own vehicles for all transport requirements to and from the shaft. Where necessary a bus service will be made available to transport other employees from their residence, within the mine property, to their working place.

Three conveyor systems will be used i.e. one from underground workings to the feed bin situated at the shaft floor, the second conveyor belt will convey coal from the shaft feed bin to the existing overland conveyor belt and the third will be the existing belt that will convey coal to the Bank Colliery Coal Washing plant.

The existing overland conveyor belt will require some refurbishment and at areas reconstruction since the belt has not been used for a long period.

6.1.1.6 Disturbance of Water Courses

Part of the Access Brown Shaft II infrastructure, namely the ventilation shaft will be constructed within 32 metres of the associated wetland of the tributary of the Spookspruit. It should be noted that although the soil types indicate that of a wetland area, the vegetation has been disturbed by agricultural activity and is now transformed to grazing land. The proposed used- water pipeline, where it will be constructed in the existing conveyor belt area of the defunct South Shaft, is in close proximity of the wetland area of the far eastern tributary of the Bankspruit. Since the pipeline will be constructed within the existing conveyor belt area, no additional wetland areas will be utilised. Soybean cultivation is also taking place in this area.

From the defunct South Shaft, the proposed used- water pipeline will cross the eastern tributary of the Bankspruit and the Bankspruit itself. In this area the pipeline will be constructed within existing water pipeline servitude between maize fields. The proposed raw water pipeline will cross the Spookspruit immediately on the northern side of the dam wall of the Bankfontein dam. This area is in close proximity to the mining activities of Bank Colliery. The dam is utilised for recreational activities.

6.1.1.7 Storm Water

Clean and dirty water will be separated at the Access Brown Shaft II incline shaft complex.

Clean storm water along the route of the overland conveyor belt will be diverted via concrete lined 'v' drain. Excavated drains will be used to divert clean storm water along the access road and around the entire shaft complex. All clean storm water will be diverted to the nearest stream which in this case will be the tributary of the Spookspruit.

Dirty water will be diverted from all dirty water areas of the site, which include areas covered by buildings, overland conveyor belt, access road, access and ramp and box cut. Excavated drains will be used for the diversion of dirty water from the site buildings and access roads with concrete "v" drains long the conveyor belt and access ramp. Diverted water along the conveyor belt, building infrastructure and access road will be collected directly into the pollution control dam. Water collected along the access ramp and within the box cut will be drained into a sump. The sump will be equipped with a pump that will remove the water into the pollution control dam.

SECTION SEVEN

Description of Identified potential alternatives

7. CONSIDERATION OF ALTERNATIVES

7.1 LOCATION ALTERNATIVES

In terms of the Access Brown Shaft II complex area there were no location alternatives that could be considered. The following are the reasons as to why the location was chosen:

The location of the proposed Access Brown Shaft II area is the shallowest area of the reserve. The depth from the surface is proportional to cost, therefore it is cheaper to locate the shaft within the shallowest area of the reserve. The reserve depth increases from north to south.

7.2 SITE LAYOUT ALTERNATIVES

Site layout alternatives permit consideration of different spatial configurations of an activity on a particular site. This may include particular components of a proposed development or may include the entire activity.

In terms of the Access Brown Shaft II complex area there were no site layout alternatives that could be considered. The following are the reasons as to why the location was chosen:

The proposed Access Brown Shaft II area is in the nearest position away from previously undermined areas. It's not a good idea to construct decline shafts over existing mined out areas due to the risk of subsidence. The area ties in closely to the existing infrastructure of Brown Shaft No.1.The shaft area is away from the temporary wetland areas of the tributary of the Spookspruit. The shaft area could not be constructed under the adjacent Eskom 400kV overhead powerline. The alignment/direction of the decline shaft minimises, streamlines and optimises the infrastructure requirements for the future mining layout of the reserve.

7.3 ROUTING ALTERNATIVES

Consideration of alternative routes generally applies to linear developments such as power lines, transport and pipeline routes. There were no routing alternatives considered for the pipelines as the most viable route was to place the pipelines on Anglo Operations (Pty) Ltd's property to avoid impacting on any other land owners' property.

7.4 TRANSPORT ALTERNATIVES

The transportation of coal could occur via conveyor belts or using trucks along roads. In terms of the Access Brown Shaft II the most viable option chosen is conveyor belts for the following reasons:

The existing Bank Colliery plant area will be used to further process the coal from the proposed Access Brown Shaft II. The existing Bank Colliery plant area lies in close proximity to the proposed Access Brown Shaft II. Using a conveyor belt to transport the coal would be the most direct route from Access Brown Shaft II to the existing Bank Colliery plant area as there is an existing conveyor belt servitude. This will result in low maintenance costs in comparison to hauling, minimal impact in terms of dust and noise generation due to no heavy duty vehicles used to transport coal.

SECTION EIGHT

Impact Assessment

8. IMPACT ASSESSMENT

8.1 ASSESSMENT METHODOLOGY

The following prediction and evaluation of impacts is based on the proposed Access Brown Shaft II activities to be conducted at the proposed area.

The evaluation distinguishes between significantly adverse and beneficial impacts and allocates significance against national regulations, standards and quality objectives governing:

Health & Safety

Protection of Environmentally Sensitive Areas

Land use

Pollution levels

Irreversible impacts are also identified.

The significance of the impacts is determined through the consideration of the following criteria:

Probability : likelihood of the impact occurring

Area (Extent) : the extent over which the impact will be experienced.

Duration : the period over which the impact will be experienced.

Intensity : the degree to which the impact affects the health and welfare of humans and the environment (includes the consideration of unknown risks, reversibility of the impact, violation of laws, precedents for future actions and cumulative effects).

The above criteria are expressed for each impact in tabular form according to the following definitions:

Probability	Definition
Low	There is a slight possibility (0 – 30%) that the impact will occur.
Medium	There is a 30 –70% possibility that the impact will occur.
High	The impact is definitely expected to occur (70% +) or is already occurring.
Area (Extent)	Definition
Small	0 – 40 ha
Medium	40 – 200 ha
Large	200 + ha
Duration	Definition
Short	0 – 5 years
Medium	5 – 50 years
Long	51 – 200 years

Permanent	200 + years

Intensity	Definition
Low	Does not contravene any laws, Is within environmental standards or objectives, Will not constitute a precedent for future actions, Is reversible Will have a slight impact on the health and welfare of humans or the environment.
Medium	Does not contravene any laws, Will not constitute a precedent for future actions, Is not within environmental standards or objectives, Is not irreversible Will have a moderate impact on the health and welfare of humans or the environment.
High	Contravene laws, May constitute a precedent for future actions, Is not within environmental standards or objectives, Is irreversible Will have a significant impact on the health and welfare of humans or the environment.

Significance	Definition
Negligible	The impact is insubstantial and does not require management
Low	The impact is of little importance, but requires management
Medium	The impact is important; management is required to reduce negative impacts to acceptable levels
High	The impact is of great importance, negative impacts could render options or the entire project unacceptable if they cannot be reduced or counteracted by significantly positive impacts, and management of these impacts is essential
Positive	The impact, although having no significant negative impacts, may in fact contribute to environmental or economical health

8.2 ASSESSMENT OF THE ENVIRONMENTAL IMPACTS

The tables below describe the assessment of impacts from the proposed activities applied for, for the Access Brown Shaft II mining operation. Note that under the assessment the following abbreviations i.e. E, P and S were used, which stands for Extent, Probability and Significance respectively.

8.2.1 CONSTRUCTION PHASE

ACTIVITY	NATURE OF IMPACT	ASSESSMENT			MITIGATION MEASURES
		E	P	S	
The construction of a dirty water and raw water pipeline exceeding 1000 metres in length for the bulk transportation of water, with a peak throughput of 120 litres per second or more.	Vegetation: The route of the pipelines will be marked, which will result in vegetation being cleared along the route of the pipeline.	S	H	L	Ensure that in all areas where vegetation will be cleared, a layer of at least 300mm of topsoil must be removed and stockpiled separately. The area of land to be disturbed and isolated for the purpose of construction will be limited, as far as practical, to the minimum required for safe and efficient operation. No unnecessary destruction of vegetation will be allowed.
	Soil: A pipeline trench will be constructed using an excavator with a depth of approximately 1.5metres below natural ground level.	S	H	M	Avoid loss of topsoil, soil erosion, soil compaction, soil contamination and use topsoil removed during the construction phase for the rehabilitation of the disturbed areas. If ground water is encountered, the trench invert level should be sloped to a low point to facilitate drainage. Where necessary, strip topsoil clean from underlying non-topsoil materials such as weathered sandstone, hard or soft plinthite. Stripping and stockpiling of A horizon (30 cm topsoil) separately from subsoil. Selection of sites of lower potential soils for development whenever possible. During rehabilitation, soil amelioration should be done by liming and fertilizer applications based on soil analysis.
	Soil: All activities will result in the potential degradation of soils due to the removal of the topsoil layer over the areas to be disturbed during the construction of the infrastructure.	S	H	M	Avoid loss of topsoil, soil erosion, soil compaction, soil contamination and use topsoil removed during the construction phase for the rehabilitation of the disturbed areas.
	Natural Agricultural Resource Land Capability: The clearing of the site will lead to a loss of land of arable and grazing potential and associated general loss of agricultural production potential.	S	M	M	The area of land to be disturbed and isolated for the purpose of construction and mining activities will be limited, as far as practical, to the minimum required for safe and efficient operation.
	Air quality: The activities will generate dust that will impact the immediate air quality. Machinery used will generate fumes and noise that may have detrimental effects on the surrounding air quality and health of the employees.	S	H	M	Conduct dust suppression over the roads. Ensure that the vehicles' exhaust systems are in good repair order. Ensure that employees are issued with protective equipment. All complaints must be addressed.
	Air quality: Construction and Use of maintenance road will result in the generation of dust, which may impact negatively on neighbouring landowners, and employees.	S	M	L	Conduct dust suppression on the roads. Maintain the roads on a regular basis

	Surface water: Further impact on surface water during the construction phase relates to potential spillages from construction vehicles. Increased fuels, oils, cement, dust and other waste from construction activities and vehicles may cause contamination of surface water bodies.	S	M	M	All vehicles should be well maintained and in good working order in order to minimise any impact on watercourses and associated wetland areas.
	Sensitive landscapes: The potential impact of degradation of the Spookspruit and tributaries of the Bankspruit during the construction of the pipelines over the watercourses.	S	M	M	Design and construct the pipeline infrastructure in accordance with the design specifications recommended by a suitably qualified person in order to avoid any impact on the water course and associated wetland. See Appendix 12 for the construction methodology of the pipelines. Construction of pipelines crossing the tributaries of the Bankspruit and Spookspruit and their associated wetland should be conducted during periods where no rainfall is anticipated. Gabion mattresses should be used to reduce erosion.
Interested and affected parties:	The Department of Agriculture, forestry and fisheries requested that any form of Natural Agricultural Resource degradation with necessary mitigation measure be considered as well as the mitigation measures stated in the Soil specialist report be implemented	S	H	M	-Where necessary, strip topsoil clean from underlying non-topsoil materials such as weathered sandstone, hard or soft plinthite. -Stripping and stockpiling of A horizon (30 cm topsoil) separately from subsoil. -Selection of sites of lower potential soils for development whenever possible. -During rehabilitation, soil amelioration should be done by liming and fertilizer applications based on soil analysis. -Delineation of wetlands by means of pegging before commencement of development is necessary. -Avoid development in wetland zones. -Avoid the dumping of materials, spills and the run-on of polluted water into wetland zones. -Construction of isolative embankments where necessary. -To this, end, design, implement and maintain effective water runoff control measures. -Refrain from disturbing land in the proximities of wetland zones. -After rehabilitation and re-vegetation of the shaft and infrastructure area, regular inspections must be conducted over the area to determine if vegetation cover is successful in order to combat erosion. If bare patches become visible, seeding of the areas must follow. -Inspections must also include the establishment of any declared invader plant species. If they exist in the area an immediate eradication program must be implemented. Storm water from upslope of the stripped areas should be diverted around these areas to limit the amount of storm water flowing over from these areas. -The timing of the topsoil stripping should be optimised to limit the time between stripping and construction. Where practical constraints exists and areas need to left stripped for long periods, contour ploughing or ripping

					could reduce runoff and hence reduce erosion. -Dry season construction is preferable. -Hydro seeding of the topsoil stockpile is recommended to speed up vegetation cover. An appropriate seed mix should be designed by a vegetation specialist. **-The closure objective for vegetation is to restore the area to grazing land and to eradicate all declared invader plant species.**
	The South African Heritage Resources Agency (SAHRA) requested that a Desktop Palaeontological Impact Assessment be completed and submitted to SAHRA before Environmental Authorisation is granted.	S	M	M	A Palaeontological specialist has been appointed to conduct the Desktop Palaeontological Impact Assessment. See Appendix 10 for the Desktop Palaeontological Impact Assessment Report. Because important plant fossil localities are known from the Ecca Group the proposed mining development activities may expose fossil bearing rocks of the Karoo Supergroup which are not currently visible as they are covered by soil and vegetation. If construction activities expose extensive mudrocks of the Karoo Supergroup, it will create a unique opportunity to explore the area for fossils. It is thus recommended that, should fossils be exposed, a qualified palaeontologist be contacted to assess the exposure for fossils before further development takes place so that the necessary rescue operations are implemented. Depending on the nature of the fossils discovered this could entail excavation and removal to a registered palaeontological museum collection. A list of professional palaeontologists is available from South African Heritage Resources Agency (SAHRA).

The construction of a pollution control dam for the storage of effluent and the discharge of water into a water resource in terms of the National Water Act 36 of 1998.	Topography: The construction of the pollution control dam will result in the formation of a topographical void. The dam void will cover an area of approximately 30m x 50m and will be 3m deep. The dam was designed by a suitably qualified person (qualified Civil Engineer).	S	L	L	Design and construct the pollution control dam and mine infrastructure in accordance with the design specifications recommended by a suitably qualified person. See Appendix 13.
	Soil: The construction of the pollution control dam will result in the disruption of soil profile as a result of movement of top layer. An area of approximately 0.25 ha will be disturbed during the construction of the pollution control dam; hence approximately 1000m3 of topsoil and 3200 m^3 of subsoil will be stripped.	S	H	L	Removed topsoil will be placed on the topsoil berms around the constructed areas; Removed topsoil will be stockpiled separately from sub soils; The mine will ensure that the topsoil berms/stockpiles does not exceed the height of 4 m; The soil from the topsoil berms will be tested for its fertility and if reduced, fertilizers must be used to increase the fertility of the soil prior to re-use; and the topsoil berms/stockpiles will be seeded. Where necessary, strip topsoil clean from underlying non-topsoil materials such as weathered sandstone, hard or soft plinthite. Stripping and stockpiling of A horizon (30 cm topsoil) separately from

					subsoil. Selection of sites of lower potential soils for development whenever possible. During rehabilitation, soil amelioration should be done by liming and fertilizer applications based on soil analysis.
	Soil: The stripping and stockpiling of the soil (Lichtenburg sandy Loam soil form) from the Pollution control dam may result in loss of soil fertility. Approximately 6000m^3 of topsoil and 3200m3 of subsoil will be stockpiled separately in the form of berms around pollution control dam areas.	S	H	L	The mine will ensure that the topsoil berms/stockpiles does not exceed the height of 4 m; The soil from the topsoil berms will be tested for its fertility and if reduced, fertilizers must be used to increase the fertility of the soil prior to re-use; and The topsoil berms/stockpiles will be seeded.
	Vegetation/Land Capability: Construction of the pollution control dam will result in the disruption of the soil profile and clearance of vegetation, which will reduce the land capability of the area. The small extent of the area to be disturbed will lessen the significance of the impact. Note that land capability is determined as a function of soil physical and chemical properties, thus disruption of the soil profile will reduce land capability. This impact will continue through the operational phase.	S	H	L	Topsoil to be removed and stockpiled separately for the purpose of rehabilitation; and Analyse and replenish fertility by use of fertilizers prior to re-use. The area of land to be disturbed and isolated for the purpose of construction will be limited, as far as practical, to the minimum required for safe and efficient operation. No unnecessary destruction of vegetation will be allowed
	Surface water: The construction of the pollution control dam will result in the formation of voids, which will decrease surface water runoff within the Spook Spruit subcatchment. The voids will cover an area of approximately 1.75ha, which will capture approximately 3000m^3 of rainfall run-off per annum (this constitutes a very little percentage, less than one percent, of the mean annual run-off within the Spookspruit catchment). Loss of MAR within the catchment is therefore considered negligible.	S	H	L	Minimise the footprint area to be covered by the dirty water areas; as well as ensure the implementation of the storm water management plan

The transportation of coal, outside an industrial complex, using a conveyor with a throughput capacity of more than 50 tons per day	Vegetation: The construction of a conveyor belt along servitude, approximately 3.3km long with a throughput capacity of more than 50 tons per day, will result in vegetation clearance.	S	M	L	The area of land to be disturbed and isolated for the purpose of construction will be limited, as far as practical possible, to the minimum requirements for safe and efficient operation. No unnecessary destruction of vegetation will be allowed.

	Soil: Stripping of topsoil along the route of the conveyor belt in order to construct the foundation of the conveyor belt.	S	H	L	Ensure that in all areas where vegetation will be cleared, a layer of at least 300mm of topsoil must be removed and stockpiled separately for future rehabilitation.
	Surface Water: Further impact on surface water during the construction phase relates to potential spillages from construction vehicles. Increased fuels, oils, cement, dust and other waste from construction activities and vehicles may cause contamination of surface water bodies.	S	M	M	All vehicles should be well maintained and in good working order in order to minimise any impact on watercourse and wetland areas.
The physical alteration of undeveloped land to commercial (mining) and industrial (mining) use, where the total area to be transformed is more than 20 hectares.	Topography: There will be an impact on the topography due to the construction of the infrastructure associated with the shaft area. The infrastructure will however have minimal impact since no structure above 10 meters will be constructed. Land capability: The clearing of the site will lead to a loss of land of arable and grazing potential and associated general loss of agricultural production potential. Land-use: The construction and operation of the mine will affect the current land use, as mining will replace agricultural activities.	S S S	L H H	L L M	Ensure that the infrastructure is removed during the decommissioning phase, which must be conducted such that the area approximates its pre-mining topography. The area of land to be disturbed and isolated for the purpose of construction and mining activities will be limited, as far as practical, to the minimum required for safe and efficient operation. Appropriate compensation must be agreed to between the mine and the land owner. The area of land to be disturbed and isolated for the purpose of construction and mining activities will be limited, as far as practical, to the minimum required for safe and efficient operation. Random movement across the field will be prohibited. Vehicles will keep to demarcated and approved access routes at all times. Following closure the site will be rehabilitated.
	Vegetation: There will be a loss of vegetation during the construction of the shaft box cut Fauna: Site clearance, blasting of the shaft areas and construction activities could lead to a disturbance of fauna on site. The herpetofauna, birds, small mammals and insects might be displayed locally but not regionally due to the increase in dust, noise and illumination. However,	S S	H L	M L	The area of land to be disturbed and isolated for the purpose of construction and mining activities will be limited, as far as practical, to the minimum required for safe and efficient operation. No unnecessary destruction of vegetation will be allowed The area of land to be disturbed and isolated for the purpose of construction and mining activities will be limited, as far as practical, to the minimum required for safe and efficient operation. Staff will be instructed that no hunting or unnecessary disturbance of wildlife will be allowed on the mine property. Hunting or poaching by mine personnel on adjoining properties will also be prohibited.

	as the area is already significantly disturbed by both mining and agricultural activities, any wildlife currently occurring on the site is expected to be adapted to such conditions.				
	Surface water: During the construction phase, the clearing of vegetation on site will take place. Earthworks will leave soils bare and exposed to erosion agents. Clearing of vegetation will potentially result in an increase in the volume and flow of rate of surface water runoff entering the surface water bodies on and off the site. This will in turn result in an increase in sediment loads in these water bodies. Should no settlement facilities or storm water diversion works be established prior to the major construction activities commencing, it can be expected that surface water bodies in the area will receive increased silt load.	S	M	M	Storm water drains will be constructed to divert runoff from adjacent areas away from the shaft area. All storm water runoff originating from any potentially contaminated area in the vicinity of the shaft will flow via dirty water drains to retention ponds. These retention ponds will be designed to contain the 1:50 year return period flood event. Water collected in the retention ponds will be pumped to the mine's industrial water circuit for use. Therefore, although this water will be removed from the catchment, it will not be wasted.
	Surface water: Further impact on surface water during the construction phase relates to potential spillages from construction vehicles. Increased fuels, oils, cement, dust and other waste from construction activities and vehicles may cause contamination of surface water bodies.	S	M	M	Areas such as workshops, diesel storage bays and wash down areas are regarded as dirty. These will be placed on concrete slabs and will have a network of concrete lined "v" drains and pipe culverts that will gravitate to an oil trap. Further to this, storage and handling areas of hydrocarbon substances will be paved and bunded with concrete to prevent accidental contamination of the soil. Alternatively, an impermeable liner will be placed beneath above-ground storage tanks. The integrity of the liner is to remain sound for the duration of the contract, until removal. Areas containing chemicals and hazardous material will be fenced and security controlled. Any significant spillage will be contained and cleaned up.
	Air Quality: Once the vegetation has been cleared, construction equipment will generate dust from the exposed surfaces. Excessive dust will impact on the surrounding vegetation. Under adverse wind conditions there is potential for minor impacts on the shops and the provincial road to the west of the main road. However as the shops are upslope and some distance away from, the potential impact would be small	M	M	L	Dust along the gravel access roads and construction areas will be controlled to acceptable levels, by means of spraying with water. The mine will undertake monthly dust monitoring at various locations where it may impact on the interested and affected parties. A priority must be given to continuous monitoring of ambient dust deposition rates (PM 10 and PM2.5) for the full duration of the project. Source monitoring stations should be positioned near the shaft and access roads. A receptor monitoring station should be commissioned at the commercial/residential receivers near the R35/Bank Road intersection. Dust deposition monitoring is essential to determine spatial and temporal trends, and to track progress made by control measures implemented. in collaboration with an air quality specialist. An emissions inventory and annual modelling regime must be maintained throughout the life of the project

	Noise: The construction activities will cause an increase in ambient noise levels. These activities include movement of trucks and vehicles and movement of earthmoving machinery.	M	L	L	Machinery and vehicles silencer units will be maintained in good working order. Non-compliant machinery and/or vehicles will be removed from service until repaired. Should complaints be received from the community regarding the noise generation, the mine management and contractors will, at the discretion of the ECO, commission an independent and registered noise monitor to undertake a survey of noise output levels from the site, and implement measures to reduce noise to legislated levels.
	Air Quality: Wind blowing and movement of mine machinery over exposed areas will result in the generation of dust and diesel fumes. Any dust clouds generated from the mining area may migrate towards the predominant wind direction. The dust generated may increase the dust concentration within and around the mining area, which will settle on the surrounding vegetation cover. This may have an impact on the neighbouring residents.	S	H	M	Conduct dust suppression on a daily basis; Use of water to prevent the generation of dust on access roads; and Ensure that all machinery used on site is maintained in good working order.
	Dust generated will have an impact on the identified wetland of the tributary of the Spookspruit within the mining area. Noise: Machine operators in close proximity to machinery will be exposed to noise levels in excess of 85dB. These noise levels will attenuate to acceptable levels within a short distance (500m). Note that no significant noise increases are expected within a 500m radius of the activities. Visual: The construction phase activities will be visible from R35 provincial road and other farm roads; hence the nearby residents and users of the R35 provincial road may be visually impacted on by the proposed mining operation. The area has already been extensively disturbed by mining and agricultural activities. This will lessen the significance of the visual impact.	S S S	H H M	M M L	Conduct dust suppression on a daily basis; Use of water to prevent the generation of dust on access roads; Contain dirty water within dirty water areas; Divert all clean water into the tributary of the Spookspruit. Vehicles and mine machinery will not be allowed to generate noise exceeding 85 dB; and Blasting areas will be monitored for levels of vibration, which will be limited to legal limits. Use topsoil to construct a berm that will act as visual screen around the visible parts of the mine; and Vegetate the topsoil/subsoil berms.

	Upgrading of the private access and its intersection to the provincial road will create a nuisance and a safety hazard to the provincial road users.	S	M	M	Contractors used to upgrade the private access road will be required to follow relevant transport laws during the upgrading of private access road and construction of the intersection to the provincial road, which will included dust suppression, traffic control and erection of road signs signalling the road works.
	Adjacent landowners may be impacted on by dust and noise generated during the construction phase. Note, however, that due to the short duration of the construction phase and the fact that no houses exist within the proposed mining area, the significance of this is deemed low. These impacts will however continue during the operational phase of the mine. Influx of labourers seeking employment may lead to theft or illegal squattering on surrounding farms.	S	M	L	Conduct dust suppression on a daily basis; Use of water to prevent the generation of dust on access roads; and Development of means to discourage squattering and job seeking at the mine property

The construction of infrastructure (Ventilation Shaft and pipelines) where such construction occurs within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.	The potential degradation of the associated wetland of the tributary of the Spookspruit , the Spookspruit and Bankspruit during the construction of the vent shaft and raw water and dirty water pipelines.	S	M	L	Design and construct the Vent shaft infrastructure and pipelines in accordance with the design specifications recommended by a suitably qualified person in order to avoid any impact on the tributary of the Spookspruit and its associated wetland. The area of land to be disturbed and isolated for the purpose of construction will be limited, as far as practically possible, to the minimum requirements for safe and efficient operation. No unnecessary destruction of vegetation will be allowed. It should be noted that this area has already been disturbed by agricultural activities, and is currently grazing land.
	Surface water: Increased soil sediment loads via surface water runoff into the adjacent wetlands due to the release of storm water from the construction sites. Bank disturbances (will result in increased sediment input from erosion).	S	M	L	Construction of pipelines crossing the tributaries of the Bankspruit and Spookspruit and their associated wetland should be conducted during periods where no rainfall is anticipated. Gabion mattresses should be used to reduce erosion. The area of land to be disturbed and isolated for the purpose of construction activities will be limited, as far as practical, to the minimum required for safe and efficient operation.
	Vegetation: The route of the pipelines will be marked, which will result in vegetation being cleared along the route of the pipeline, as well as the vent shaft site.	S	M	M	Ensure that the pipeline crossings are constructed in accordance with the construction design. All construction practises stipulated by the engineer and any other applicable law must be adhered to by the contractor constructing the crossing. The construction activities at the pipelines crossings, which will include vegetation clearance, will be limited to the construction site. Any sensitive flora habitat on site must be demarcated and fenced off. Ensure that in all areas where vegetation will be cleared, a layer of at least 300mm of topsoil must be removed and stockpiled separately.

	Dust: Generation and transportation of dust particles from the construction sites on the watercourses and associated wetland.	S	H	M	Conduct dust suppression on the roads. Maintain the roads on a regular basis.
	Soil: All activities will result in the potential degradation of soils due to the removal of the topsoil layer over the areas to be disturbed during the construction of the infrastructure.	S	H	M	Avoid loss of topsoil, soil erosion, soil compaction, soil contamination and use topsoil removed during the construction phase for the rehabilitation of the disturbed areas. If ground water is encountered, the trench invert level should be sloped to a low point to facilitate drainage. Where necessary, strip topsoil clean from underlying non-topsoil materials such as weathered sandstone, hard or soft plinthite. Stripping and stockpiling of A horizon (30 cm topsoil) separately from subsoil. Selection of sites of lower potential soils for development whenever possible. During rehabilitation, soil amelioration should be done by liming and fertilizer applications based on soil analysis.
Interested and affected parties:	The Department of Agriculture, forestry and fisheries requested that any form of Natural Agricultural Resource degradation with necessary mitigation measure be considered as well as the mitigation measures stated in the Soil specialist report be implemented	S	H	M	-Where necessary, strip topsoil clean from underlying non-topsoil materials such as weathered sandstone, hard or soft plinthite. -Stripping and stockpiling of A horizon (30 cm topsoil) separately from subsoil. -Selection of sites of lower potential soils for development whenever possible. -During rehabilitation, soil amelioration should be done by liming and fertilizer applications based on soil analysis. -Delineation of wetlands by means of pegging before commencement of development is necessary. -Avoid development in wetland zones. -Avoid the dumping of materials, spills and the run-on of polluted water into wetland zones. -Construction of isolative embankments where necessary. -To this, end, design, implement and maintain effective water runoff control measures. -Refrain from disturbing land in the proximities of wetland zones. -After rehabilitation and re-vegetation of the shaft and infrastructure area, regular inspections must be conducted over the area to determine if vegetation cover is successful in order to combat erosion. If bare patches become visible, seeding of the areas must follow. -Inspections must also include the establishment of any declared invader plant species. If they exist in the area an immediate eradication program must be implemented. Storm water from upslope of the stripped areas should be diverted around

					these areas to limit the amount of storm water flowing over from these areas. -The timing of the topsoil stripping should be optimised to limit the time between stripping and construction. Where practical constraints exists and areas need to left stripped for long periods, contour ploughing or ripping could reduce runoff and hence reduce erosion. -Dry season construction is preferable. -Hydro seeding of the topsoil stockpile is recommended to speed up vegetation cover. An appropriate seed mix should be designed by a vegetation specialist. **-The closure objective for vegetation is to restore the area to grazing land and to eradicate all declared invader plant species.**
	The South African Heritage Resources Agency (SAHRA) requested that a Desktop Palaeontological Impact Assessment be completed and submitted to SAHRA before Environmental Authorisation is granted.	S	M	M	A Palaeontological specialist has been appointed to conduct the Desktop Palaeontological Impact Assessment. See Appendix 10 for the Desktop Palaeontological Impact Assessment Report. Because important plant fossil localities are known from the Ecca Group the proposed mining development activities may expose fossil bearing rocks of the Karoo Supergroup which are not currently visible as they are covered by soil and vegetation. If construction activities expose extensive mudrocks of the Karoo Supergroup, it will create a unique opportunity to explore the area for fossils. It is thus recommended that, should fossils be exposed, a qualified palaeontologist be contacted to assess the exposure for fossils before further development takes place so that the necessary rescue operations are implemented. Depending on the nature of the fossils discovered this could entail excavation and removal to a registered palaeontological museum collection. A list of professional palaeontologists is available from South African Heritage Resources Agency (SAHRA).

8.2.2 OPERATIONAL PHASE

ACTIVITY	IMPACT	IMPACT ASSESSMENT			MITIGATION MEASURES
		E	**P**	**S**	
The operation of a dirty and raw water pipeline exceeding 1000 metres in length for the bulk transportation of water, with a peak throughput of 120 litres per second or more.	Surface water: There is a potential for the pipeline to burst and affect the system of the tributary of the Spookspruit , the Spookspruit and Bankspruit and their associated wetland in terms of surface water quantity.	S	L	L	Regular maintenance checks should be conducted along the pipelines to avoid any pipe bursts. A pipe leak detection system will be installed along the pipeline to allow for the early detection of any leaks.
	Air quality: Use of the maintenance road will result in	M	H	M	Conduct dust suppression on the roads.

	the generation of dust, which may impact negatively on neighbouring landowners, and employees.				Maintain the roads on a regular basis
	Sensitive landscapes: During the use of the pipeline stream crossings, blockages and bad housekeeping can result in the crossings having an impact on the river system (the tributary of the Spookspruit , the Spookspruit and Bankspruit and their associated wetland). If the crossing is not properly designed and constructed spillages can enter the stream. This will result in negative impacts on the river system which include the wetland, fauna and aquatic ecosystems.	S	H	M	Regular maintenance checks should be conducted along the pipeline to avoid any pipe bursts. A pipe leak detection system will be installed along the pipeline.

The operation of a pollution control dam for the storage of effluent and the discharge of water into a water resource in terms of the National Water Act 36 of 1998.	Surface water: Increased rainwater will be captured in the pollution control dam during flood events. If the pollution control dam does not have sufficient capacity, water containing elevated salt concentrations from the dirty water areas of the mine may enter the natural environment.	S	L	L	Design, and construct the pollution control dam and mine infrastructure in accordance with the design specifications recommended by a suitably qualified person. The dam will be lined with a 2000μm HDPE lining A minimum freeboard of 0.8metres should be maintained at all times. This ensures that during high storm events the facilities have enough capacity to handle the extra water captured.
	Surface water: Silt collected during high rainfall events may reduce the capacity of the pollution control dam resulting in the release of polluted water into the clean water environment.	S	L	L	Silt trap should be installed to avoid siltation of the dam.
The transportation of coal, outside an industrial complex, using a conveyor with a throughput capacity of more than 50 tons per day	Surface water: Coal spillages on the conveyor system especially at facilities like the silos and the transfer points can have detrimental impacts if allowed to enter the environment.	S	H	H	The conveyor systems where possible are included into the dirty water containment systems of the mine and runoff arising from these facilities is directed into the dirty water drains. Silt traps are situated at the silos and the water captured pumped to the dirty water dams for use in the plant. Where the conveyor systems water runoff is not included into a dirty water system the potential for coal spillage is considered low and any spillage that does occur under the belt is cleaned up on a regular basis.
	Sensitive Landscapes: During the use of the conveyor belt stream crossing, blockages and bad housekeeping can result in the crossing having an impact on the river systems. If the crossing is not properly designed and constructed, coal spillages can enter the stream. This will result in negative impacts on the river system which include the	S	L	L	The conveyor belt should be covered when crossing any watercourse and wetland to avoid any spillages into sensitive areas.

	wetland, fauna and aquatic ecosystems.				

The physical alteration of undeveloped land to commercial (mining) and industrial (mining) use, where the total area to be transformed is more than 20 hectares.	Geology: The removal of the No. 2 coal seam by underground mining methods will ensure that underground pillars are left intact. The use of safety factors during the determination of the pillar sizing will ensure that no surface subsidence occurs. This will ensure that the overlying strata have a long-term stability thus minimising the possibility of subsidence. The use of mechanical continuous miners during the removal of the coal seam ensures that blasting is kept to a minimum, and only utilised in areas where dolerite dykes or sills are encountered. This again reduces the possibility of fracturing of the overlying strata during mining, hence lessening the significance of the impact.	L	M	L	Use of the Solomon's safety factor of 1,6 for the underground pillars
	Soil: Leaking oils and fluids from trucks will result in the contamination of soils along the haul and access roads.	S	M	M	Constructed spillage control measures such as berms along the roads. All roads to be inspected regularly for any spillages. Any spillages will be removed as soon as is practically possible. Maintain vehicles in good repair order. Maintenance of vehicles to be conducted at the workshops. Emergency repairs to be conducted on protected ground e.g., areas covered with tarpaulins.
	During mining, the development of the incline shafts will have impacts on the geological structure over the shaft area. During this activity the overburden is removed to allow access to the coal seams. These excavations will be open for life of mine but will be sealed at closure. However, the stratigraphy will never be replaced.	S	L	N	Blasting are kept to a minimum and undertaken under controlled conditions. This limits the development of cracks.
	Surface water runoff from the working area around the shaft areas could contaminate surface water, as a result of chemical contamination or, suspended solids.	S	H	M	All dirty surface water runoff are diverted to pollution control facilities and clean water to the clean water environment
	Topography: Overburden stockpiles will create localised high points	S	H	M	Overburden stockpiles will be constructed to an acceptable height so as not to pose any risk to human life.
	Sensitive landscapes: Spillage of coal during transportation via the conveyor belt.	S	L	L	Regular maintenance and inspection during transportation of coal should be conducted. the conveyor belt should be covered at wetland and stream crossing to avoid any potential pollution in the watercourse and wetland

The operation of the Ventilation Shaft and pipelines within 32 metres of the associated wetland of the tributary of the Spookspruit, Spookspruit and Bankspruit	Soil: During maintenance, Leaking oils and fluids from trucks will result in the contamination of soils along the maintenance roads.	S	M	M	Constructed spillage control measures such as berms along the roads. All roads to be inspected regularly for any spillages. Any spillages will be removed as soon as is practically possible. Maintain vehicles in good repair order. Maintenance of vehicles to be conducted at the workshops. Emergency repairs to be conducted on protected ground e.g., areas covered with tarpaulins.
	Air Quality: During maintenance, use of maintenance roads will result in the generation of dust, which may impact negatively on neighbouring landowners, and employees.	M	H	M	Conduct dust suppression on the roads. Maintain the roads on a regular basis
	Surface water: During the use of the Ventilation Shaft and pipelines, blockages and bad housekeeping can result the structures having an impact on the stream systems in terms of silt load.	S	M	M	Regular maintenance checkups should be conducted especially during the rainy season in order to ensure that no siltation occurs around the structure.
	Noise: During the operation of the ventilation shaft, noise from the fan is emitted.	S	M	S	Due to the undulating nature of the topography closer to the stream and the distance from the R545, the impact on surrounding environment will be minimal.
	Visual: The ventilation shaft will cause a topographical high.	S	L	L	Due to the undulating nature of the topography closer to the stream, the visual impact will be minimised.
	Surface water: During the periods of higher than normal storm events increased storm water could potentially affect the structures of the ventilation shaft and pipelines, which will result in debris and water from the pipeline affecting the stream systems and their associated wetland	S	L	L	Design, and construct the ventilation shaft and associated infrastructure and pipelines in accordance with the design specifications recommended by a suitably qualified person. Regular maintenance checks should be conducted along the pipeline to avoid any pipe bursts. A pipe leak detection system will be installed along the pipeline.
Interested and affected parties:	The Department of Agriculture, forestry and fisheries requested that any form of Natural Agricultural Resource degradation with necessary mitigation measure be considered as well as the mitigation measures stated in the Soil specialist report be implemented	S	H	M	-Where necessary, strip topsoil clean from underlying non-topsoil materials such as weathered sandstone, hard or soft plinthite. -Stripping and stockpiling of A horizon (30 cm topsoil) separately from subsoil. -Selection of sites of lower potential soils for development whenever possible. -During rehabilitation, soil amelioration should be done by liming and fertilizer applications based on soil analysis. -Delineation of wetlands by means of pegging before commencement of development is necessary. -Avoid development in wetland zones. -Avoid the dumping of materials, spills and the run-on of polluted water into wetland zones.

					-Construction of isolative embankments where necessary. -To this, end, design, implement and maintain effective water runoff control measures. -Refrain from disturbing land in the proximities of wetland zones. -After rehabilitation and re-vegetation of the shaft and infrastructure area, regular inspections must be conducted over the area to determine if vegetation cover is successful in order to combat erosion. If bare patches become visible, seeding of the areas must follow. -Inspections must also include the establishment of any declared invader plant species. If they exist in the area an immediate eradication program must be implemented. Storm water from upslope of the stripped areas should be diverted around these areas to limit the amount of storm water flowing over from these areas. -The timing of the topsoil stripping should be optimised to limit the time between stripping and construction. Where practical constraints exists and areas need to left stripped for long periods, contour ploughing or ripping could reduce runoff and hence reduce erosion. -Dry season construction is preferable. -Hydro seeding of the topsoil stockpile is recommended to speed up vegetation cover. An appropriate seed mix should be designed by a vegetation specialist. **-The closure objective for vegetation is to restore the area to grazing land and to eradicate all declared invader plant species.**
	The South African Heritage Resources Agency (SAHRA) requested that a Desktop Palaeontological Impact Assessment be completed and submitted to SAHRA before Environmental Authorisation is granted.	S	M	M	A Palaeontological specialist has been appointed to conduct the Desktop Palaeontological Impact Assessment. See Appendix 10 for the Desktop Palaeontological Impact Assessment Report. Because important plant fossil localities are known from the Ecca Group the proposed mining development activities may expose fossil bearing rocks of the Karoo Supergroup which are not currently visible as they are covered by soil and vegetation. If construction activities expose extensive mudrocks of the Karoo Supergroup, it will create a unique opportunity to explore the area for fossils. It is thus recommended that, should fossils be exposed, a qualified palaeontologist be contacted to assess the exposure for fossils before further development takes place so that the necessary rescue operations are implemented. Depending on the nature of the fossils discovered this could entail excavation and removal to a registered palaeontological museum collection. A list of professional palaeontologists is available from South African Heritage Resources Agency (SAHRA).

8.2.3 DECOMMISSIONING/CLOSURE PHASE

ACTIVITY	IMPACT	IMPACT ASSESSMENT			MITIGATION MEASURES
		E	P	S	
Filling of final voids Sealing of underground workings Dismantling/demolishing and removal of the conveyors, pipeline, vent shaft, workshop and administration buildings Rehabilitation of roads and overland conveyor belt areas Rehabilitation of overburden stockpile areas Rehabilitation of the pollution control dams and the diversion trenches/berms Seeding of rehabilitated areas Maintenance and monitoring of rehabilitated and surrounding environments	As the disused infrastructure will be demolished and large excavations backfilled, there is a potential for the creation of dangerous excavations and steep embankments which will need to be backfilled and landscaped.	S	H	M	All backfilled areas must be levelled and levelled areas monitored for any settlement depressions, which must be rectified as soon as possible.
	If the placement of removed overburden material is not done properly, it may impact on the after mining planned soil distribution, which will impact on the functioning of the soils and vegetation distribution after mining. Compaction of soil during replacing, by heavy mechanical equipment may occur.	S	M	M	Construct contours on the placed soil layers at intervals that will help to prevent erosion of the placed soils. Implement a soil management strategy. This will ensure that the soils at the mining area are protected during replacement of the removed soils.

	Generation of dust and noise during the rehabilitation of infrastructure areas.	M	H	M	Conduct dust suppression.
	Hardened bare areas may cause increased run off and erosion gullies.	S	H	L	All hardened areas must be ripped, areas with topsoil scarified and areas without topsoil covered with a layer of topsoil before being seeded.
	Due to prolonged storage of topsoil, the fertility of the topsoil may have been lost, hence resulting poor reestablishment of vegetation on final rehabilitation area.	S	H	M	Undertake fertility tests to determine the ability of the topsoil to support vegetation, if it found that the fertility is reduced fertilisers must be used (under the recommendation of a specialist) to improve the fertility of the topsoil.
	Areas of ponding may result from rehabilitated areas.	S	L	L	Monitor rehabilitated areas. Any signs of ponding must be addressed by levelling as soon as possible
	Rehabilitation areas may show areas of soil erosion, which may remove the replaced topsoil.	S	L	L	Monitor rehabilitated areas. Any signs of ponding must be addressed by levelling as soon as possible
	Ponding and erosion gullies will result in the failure to revert the mined area to recommended land use after mining.	S	L	L	Monitor rehabilitated areas. Any signs of ponding must be addressed by levelling as soon as possible
	Invader species and noxious weeds may colonise the areas prior to the establishment of natural vegetation.	S	M	M	Progress of revegetation must be monitored regularly. Identified invader species or exotic plant species must be removed.

8.3 CUMULATIVE IMPACTS

This section of the environmental impact assessment will attempt to determine if the proposed Access Brown Shaft II area Project will contribute towards any cumulative impacts. For the purpose of this document cumulative impacts will be described as the impacts (including those that has been assessed as being insignificant) that would be significant when combined with the same impact arising from another activity within and around the area of the proposed mining project.

It must however be mentioned that the assessment of the cumulative impacts is a difficult exercise that requires a combined effort from the different role stakeholders (farmers, mines, industries, individuals etc.,) that would contribute to the cumulative impacts identified. Accurate data from the contributing parties will be a key for a thorough and accurate impact assessment.

8.3.1 Topography

Several mining operations are being undertaken in the vicinity of the proposed project. The presence of these mining operations will have an added impact on the regional topography of the area such that the sense of place will be affected. Drainage of the area might also be affected by the presence of other mining operations within and around the proposed project area.

Cumulative impacts on topography over the proposed area are reduced by the undulating nature of the local topography.

8.3.2 Soil, Land Use and Capability

Due to the area being an decline shaft and its on the mining right area, it will be rehabilitated once the mine operation seizes, this therefore reduces the significance of the cumulative impacts.

8.3.3 Natural Vegetation

Due to the area being disturbed already, Rehabilitation of the area would in a sense mitigate against these impacts. The land may be reverted back to agriculture (grazing or crop production) provided good rehabilitation is undertaken.

8.3.4 Surface water

Mining and its associated activities has over the past decades had detrimental effects on the surface water environment. This could be attributed to previous environmentally unfriendly mining practices. The presence of several mining activities within one catchment may have severe effects on the surface water environment. However, due to new technologies and environmental awareness that has been promoted over the last decade, mining and its associated activities can be undertaken such that the impacts on the surface water environment are significantly minimised and controlled.

Agriculture, which currently dominates the area, has also been detrimental to the surface water environment. Several wetlands have been lost due to overgrazing and attempted cultivation. Exposure of ground has also resulted in increased silt entering the water environment resulting in serious consequences to the livelihood of the surface water environment. Based on the above, cumulative impacts on surface water could be serious if no mitigation measures are undertaken.

Anglo Operations Limited will, in view of the seriousness of the potential impacts, continue to undertake the necessary measures to ensure that the proposed mining operation does not contribute to the identified impacts on surface water environment.

8.3.5 Air Quality

The proposed Access Brown Shaft II area falls within the Highveld Priority Area (HPA).The Highveld area in South Africa is associated with poor air quality and elevated concentrations of criteria pollutants due to the concentration of industrial and non-industrial sources. The Minister of Environmental Affairs therefore declared the Highveld Priority Area (HPA) on 23 November 2007.

During the impact assessment it was identified that air quality will be impacted on by the dust and fumes from the proposed Access Brown Shaft II project.

Several activities that may have impacts on the air quality within and around the proposed mining area are currently being conducted i.e. agriculture and mining.

Agricultural related activities require soil to be prepared especially during the planting season. During the preparation of the soils, a substantial amount of dust is produced.

With the above in mind and the fact that the above-mentioned parties will require services e.g. transporting of products to sites and haulage of material in and out of sites, which will result in secondary air pollution, the impacts on air quality might be significant. It must however be mentioned that the magnitude of the impact on air quality from the different parties will not be the same. Some activities will have more significant impact on the air quality than others. It is however not expected that the cumulative impact on air quality would be significant if all parties take reasonable measures to minimise the generation of dust within their operations.

SECTION SIX

Environmental Management Programme

9. ENVIRONMENTAL MANAGEMENT PROGRAMME

9.1 CONSTRUCTION PHASE

Environmental Component	Objectives/specific goals	Action	Technical and Management Options	Time Schedule
Access Brown Shaft II Access and maintenance Roads and the Conveyor belt				
Soils	To ensure that the construction of the access and haul roads and conveyor belt has the least possible effect on the immediate soils.	All topsoil removed from the roads will be used to construct a push up berm along the roads. The push up berm will not be more than one meters high. The topsoil used to construct the berm will be used during rehabilitation of the roads. Use areas of degraded status as much as possible to construct the access and haul roadsDelineation of wetlands by means of pegging before commencement of development is necessary. Avoid the dumping of materials, spills and the run-on of polluted water into wetland zones. Construction of isolative embankments where necessary. To this end, design, implement and maintain effective water runoff control	The mine manager through the environmental co-ordinator will oversee the construction activities and ensure that the above stipulations are adhered to	Immediately after removal of topsoil and while stockpiling the topsoil and during the construction phase

Environmental Component	Objectives/specific goals	Action	Technical and Management Options	Time Schedule
		measures. Refrain from disturbing land in the proximities of wetland zones Where necessary, strip topsoil clean from underlying non-topsoil materials such as weathered sandstone, hard or soft plinthite. Stripping and stockpiling of A horizon (30 cm topsoil) separately from subsoil. Selection of sites of lower potential soils for development whenever possible. During rehabilitation, soil amelioration should be done by liming and fertilizer applications based on soil analysis.		
Vegetation	Ensure that the activities does not impacts detrimentally on the surrounding vegetation	Dust suppression should be done for the prevention of vegetation from being affected by the dust generated from the construction sites	The ECO will ensure that the mine adheres to the condition.	During the construction phase and throughout the life of the mine
Surface Water	Surface water quality: To ensure that the runoff water from the mine access and haul roads during construction does not adversely affect clean water environment.	The roads will be constructed such that the berms are used as diversion structures. The berms will be constructed such that any exit point for the water will have silt trap that will settle the silt from the roads before allowing the water to enter the clean water environment.	The Mine manager or his representative will inspect the positioning and construction of the push-up walls and the storm water diversion structures, and ensure that the monitoring inspections are conducted, and maintenance is conducted timeously.	During the construction of the access and maintenance roads and conveyor belt.
Air Quality	To ensure that the air quality of the mine and surroundings is not unduly affected by the construction of the access and haul roads	A water cart will be used to wet all affected areas during the construction phase. Watering for dust suppression will be undertaken twice daily.	The Mine manager will appoint a responsible person to oversee the watering of all affected areas.	Twice daily
Sensitive	Ensure that the construction of	The mine manager will inform all	The Mine manager will appoint a	During the construction of the

Environmental Component	Objectives/specific goals	Action	Technical and Management Options	Time Schedule
Landscape	maintenance road and the conveyor belt infrastructure does not have a negative impact on wetland areas.	personnel and new recruitment's of the importance of the wetlands as indicated in this document. All wetland areas will be avoided. A buffer zone as recommended by a wetland specialist will be adhered to during the construction of the access and haul roads. No access or haul roads will be constructed within the buffer zone. If the above cannot be attained, all affected wetlands will be marked and soils removed from such areas will be stockpiled separately and used for rehabilitation after mining. A water use licence will also be obtained from the Department of Water Affairs for Shaft Complex and associated Infrastructure falling within 500 from the edge of the identified wetland areas. In addition to the above, the following must be undertaken: Minimize the removal of/damage to vegetation in riparian and wetland areas The construction of roads and the conveyor belt in or adjacent to the wetland/riparian zone is to be managed and strictly controlled to minimize damage to wetlands Wetlands disturbed during construction should be re-vegetated using site-appropriate indigenous vegetation and/or seed mixes	responsible person to comply with the requirements as set out in the action plan.	access and maintenance roads and conveyor belt. .

Environmental Component	Objectives/specific goals	Action	Technical and Management Options	Time Schedule
		Alien vegetation should not be allowed to colonize the disturbed wetland areas Rehabilitation of disturbed wetland habitat should commence immediately after construction is completed Debris and sediment trapping, as well as energy dissipation control structures, should be put in place where storm water enters the wetland		
Visual Aspects	To ensure that the mining activities have the least possible impact on the visual surroundings.	All surface mining activities will be performed on the smallest possible areas. The construction activities will be undertaken during day time. If any work must be done during night time, arrangements will be made with the relevant land owners.	The Mine manager will ensure that the mining activities conform to the stipulations as set out in this document.	During the construction of the access and maintenance roads and conveyor belt.
Excavation of the Shaft and Construction of associated Infrastructure				
Geology	To ensure that the construction of the Shaft does not have detrimental impacts on the geology	No mitigation measures can be undertaken for the predicted impact. However the mine will use removed material to backfill the shaft. All remaining carbonaceous material will be placed at the bottom of the Shaft and should be backfilled with the rest of the overburden material. This will reduce the exposure of the carbonaceous material to free oxygen, hence limiting the formation of acid mine generation. If construction activities expose extensive	The mine manager and ECO will ensure that the removed material are properly stockpiled and used for rehabilitation.	During the construction phase of the mine

Environmental Component	Objectives/specific goals	Action	Technical and Management Options	Time Schedule
		mudrocks of the Karoo Supergroup, it will create a unique opportunity to explore the area for fossils. It is thus recommended that, should fossils be exposed, a qualified palaeontologist be contacted to assess the exposure for fossils before further development takes place so that the necessary rescue operations are implemented. Depending on the nature of the fossils discovered this could entail excavation and removal to a registered palaeontological museum collection. A list of professional palaeontologists is available from South African Heritage Resources Agency (SAHRA).		
Topography	To ensure that the construction of the Shaft does not have detrimental impacts on the topography	The Most suitable location for the Shaft area has been chosen in terms of the Geology so as to have a minimal footprint as possible.	The mine manager and ECO will ensure that the removed material are properly stockpiled and used for rehabilitation.	During the construction phase of the mine
Soils	To ensure that the construction of the shaft and associated infrastructure does not have detrimental impacts on the soils	Stockpile topsoil to appropriate height hence reducing loss of fertility. Avoid activity at stockpiles. Use of topsoil for rehabilitation of the backfilled opencast pits, hence rehabilitated areas can be used for other purposes. Where necessary, strip topsoil clean from underlying non-topsoil materials such as weathered sandstone, hard or soft plinthite. Stripping and stockpiling of A horizon (30 cm topsoil) separately from subsoil. Selection of sites of lower potential soils for development whenever possible.	The ECO will ensure that the topsoil is stockpiled separately from other overburden and that it is stockpiled in terms of recommendation from the soil specialist	During the construction phase of the mine

Environmental Component	Objectives/specific goals	Action	Technical and Management Options	Time Schedule
		During rehabilitation, soil amelioration should be done by liming and fertilizer applications based on soil analysis.		
		Topsoil removed must be stockpiled as per the recommendation from the soil specialist. Use the stockpiled topsoil or soils remove from successive cuts cover the backfilled area. The topsoil used to cover the areas must be seeded with the recommended seed mix to ensure natural vegetation remaining in the soil (seed bank) is re-established.	The mine manager and ECO will ensure that the removed materials are properly used during rehabilitation.	During the construction phase of the mine
Natural vegetation	Ensure that the activity does not impacts detrimentally on surrounding vegetation	Dust suppression should be done for the prevention of vegetation from being affected by the dust generated from the construction sites	The ECO will ensure that the mine adheres to the condition.	During the construction phase and throughout the life of the mine
Animal Life	To ensure that the construction of the shaft and associated infrastructure does not have detrimental impacts on the animal life	The rehabilitation of the disturbed areas must be conducted such the rehabilitated areas will encourage the migration of animals back into the rehabilitated areas.	The mine manager and ECO will ensure that the removed materials are properly used during rehabilitation.	During the construction phase of the mine
Surface water	To ensure that the construction of the shaft and associated infrastructure does not have detrimental impacts on the surface water	Divert clean runoff water away from the initial box cuts. Construct a pollution control dam in which all dirty water from the underground workings will be pumped into.	The mine manager and ECO will ensure that the water management structures are constructed and that they are well maintained.	During the construction phase of the mine
Air Quality	To ensure that the construction of the shaft and associated infrastructure does not have detrimental impacts on the air quality	Conduct dust suppression daily. Enforce appropriate speed limits for the mine vehicles. Implement a dust and noxious gas	The ECO must keep records of the monitoring data and will ensure that any recommendations from the monitoring reports are adhered to.	During the construction phase of the mine

Environmental Component	Objectives/specific goals	Action	Technical and Management Options	Time Schedule
		minimisation strategy.		
Noise	To ensure that the construction of the shaft and associated infrastructure does not have detrimental impacts on the noise	Direct line of sight from receptors, as illustrated in the noise report, to be obscured by a berm/barrier for both day and night-time operations. The material, location, and dimensions of the barrier must be constructed as per recommendation by the noise specialist.	The ECO must ensure compliance of the condition.	During the construction phase of the mine
Vibration and Blasting	To ensure that the construction of the shaft and associated infrastructure does not have detrimental impacts on the noise and vibration	Best practises must be used during blasting to ensure that the ground vibration and air blast pressure is within acceptable limits. Undertake a full risk assessment in order to address the aspects and to put proper controls in place.	The mine manager will ensure that a suitably qualified and competent blaster is employed at the mine	During the construction phase of the mine
		Proper stemming and use of stemming material. Blasts can be delayed when prevailing wind is blowing towards the area of concern and not leaving blasts standing for long periods of time.	The mine manager will ensure that a suitably qualified and competent blaster is employed at the mine	During the construction phase of the mine
		Ensure that the mine employees are issued with earplugs and that they are instructed to use them. Educate employees on the dangers of hearing loss due to mine machinery noise. Undertake an ambient noise monitoring programme and any deviation from the normal and acceptable levels should be addressed promptly	The mine manager and safety officer will ensure that the action plan is adhered to	During the construction phase of the mine

Environmental Component	Objectives/specific goals	Action	Technical and Management Options	Time Schedule
Visual Effects	To ensure that the construction of the shaft and associated infrastructure does not have detrimental impacts on the visual effects	A perimeter berm will be constructed around the shaft to shield the shaft away from the nearby traffic and farm owners. Ensure that the shaft and associated infrastructure are removed or rehabilitated during the decommissioning phase.	The mine manager and opencast manager will ensure that the perimeter berms is constructed	During the construction phase of the mine
Sensitive Landscape	To ensure that the construction of the shaft and associated infrastructure does not have detrimental impacts on the sensitive	Ensure that all temporary wetland zones are identified and demarcated. No mining will be allowed within a distance specified by the wetland specialist from the wetland zones i.e. a maximum of one hundred metres from the edge of the wetlands. On addition to the above, the following will be undertaken: Minimize the removal of/damage to vegetation in riparian and wetland areas No stockpile areas should be located in within any wetland areas During the construction and operation phases erosion and siltation measures should be implementedDelineation of wetlands by means of pegging before commencement of development is necessary. Avoid the dumping of materials, spills and the run-on of polluted water into wetland zones.	The ECO must ensure that all sensitive landscapes are identified and their functionality determined. The ECO will ensure that a rehabilitation plan for all wetlands to be affected is put in place	During the construction phase of the mine

Environmental Component	Objectives/specific goals	Action	Technical and Management Options	Time Schedule
		Construction of isolative embankments where necessary. To this end, design, implement and maintain effective water runoff control measures. Refrain from disturbing land in the proximities of wetland zones		
Construction of workshops/offices complex at the mine				
Topography	To ensure that the buildings in the complex do not have detrimental impacts on the local topography of the area	The workshop/office buildings will be constructed to have heights that are within acceptable standards and that will not have detrimental effects on the surrounding land users.	The buildings will be designed and approved by the mine management and technical team before construction. The mine manager and safety officer will be responsible for ensuring that the buildings are constructed according to design specifications.	Before and during the construction of the buildings
Soils	Ensure that the construction of the complex do not have detrimental impacts on the soils of the affected area	Where necessary, strip topsoil clean from underlying non-topsoil materials such as weathered sandstone, hard or soft plinthite. Stripping and stockpiling of A horizon (30 cm topsoil) separately from subsoil. Selection of sites of lower potential soils for development whenever possible. During rehabilitation, soil amelioration should be done by liming and fertilizer applications based on soil analysis.All removed soils will be stockpiled separately and used during the rehabilitation of the complexes. The height of the stockpiles will be such	The height of the stockpile will be determined before construction and this will be conveyed to the construction team. The Environmental Co-ordinator (ECO) will monitor the construction of the complexes.	Before and during the construction of the buildings

Environmental Component	Objectives/specific goals	Action	Technical and Management Options	Time Schedule
		that the fertility and seed bank of the soils are sustained.		
Land Use and Capability	Ensure that the construction of the complex do not have detrimental impacts on the after mining land use and capability	The area will be rehabilitated such that it approximate the pre-mining land use and capability	The rehabilitation of the area will be planned during its construction phase. The ECO will ensure that the rehabilitation plan for the area is compiled.	Before the construction of the buildings
Surface Water	Ensure that the construction of the complex does not have detrimental impacts on the surface water environment	Divert all dirty water within the construction site to a temporary storage dam for settling of the silt. Divert all clean water away from the workshop area to the nearby stream. All waste generated during the construction activities either from the site or the construction crew camp will be collected in bins and disposed properly. A temporary area will be dedicated for the emergency repair of vehicles until a proper workshop is constructed	The positions and size of the temporary dams will be determined before the construction of the complexes. The ECO will ensure that the construction undertaken as per action plan.	Before the construction of the buildings
Air Quality	Ensure that the construction of the complex does not have detrimental impacts on the air quality	Water carts will be used or the suppression of dust from the construction site.	The ECO will ensure that dust suppression is conducted during construction activities and that the dust suppression efficiency is ensured.	Dust suppress at least twice daily
Noise	Ensure that the construction of the complex does not have detrimental impacts on the nose levels within the vicinity of the construction site	Well serviced vehicles will be used on site. Work will be conducted during the day and will be stopped at night time. Arrangements will be made with the land owner if work will be continued at night.	The mine manager will ensure that competent contractors are employed for the construction of the complexes	Before and during construction of the complex.

Environmental Component	Objectives/specific goals	Action	Technical and Management Options	Time Schedule
	Ensure that the construction of the complex does not have detrimental impacts on the noise levels within the vicinity of the construction site	Direct line of sight from receptors, as illustrated in the noise report, to be obscured by a berm/barrier (pink line in figure) for both day and night-time operations. The material, location, and dimensions of the barrier must be constructed as per recommendation by the noise specialist.	The ECO must ensure compliance of the condition.	During the construction and operational phases of the mine
Sensitive Landscapes	Ensure that the construction activities do not have detrimental impacts on the wetland areas	The complexes will be sited such that they are away from the recommended buffer zones of the identified wetland areas. Note that the currently sited complexes are away from the wetland zones. Operation & storage of equipment in the riparian and wetland zones to be prevented No construction camps should be allowed within any wetland area Construction should preferably take place during the low flow/winter months in order to minimise the risk of sediment and debris being washed into wetlands	The mine manager and ECO must ensure that the sitting of the complexes for the contractors avoids the identified wetland areas	Before and during construction of the complex
Construction of the Overburden Stockpiling Areas and Associated Water Management Structures, PCD, Ventilation Shaft and the dirty water and raw water pipeline				
Topography	To ensure that the Overburden Stockpiling Areas, pollution control dam, ventilation shaft and pipelines do not have detrimental impacts on the local topography patterns.	Ensure that the structures are constructed to have heights that are within acceptable standards and that will not have detrimental effects on the surrounding land users and owners.	The overburden stockpiling areas, water management structures and pipelines will be designed by suitably qualified persons before their construction. The ECO and the mine manage will ensure that the structures are constructed to design specifications	Before and during construction of the complex

Environmental Component	**Objectives/specific goals**	**Action**	**Technical and Management Options**	**Time Schedule**
Soils	Ensure that the construction of the overburden stockpiling areas, associated water management structures, pollution control dam, ventilation shaft and pipelines do not have detrimental impacts on the soils of the affected area and its surrounds.	All removed soils will be stockpiled separately and used during the rehabilitation of the disturbed areas. The height of the stockpiles will be such that the fertility and seed bank of the soils are sustained. Where necessary, strip topsoil clean from underlying non-topsoil materials such as weathered sandstone, hard or soft plinthite. Stripping and stockpiling of A horizon (30 cm topsoil) separately from subsoil. Selection of sites of lower potential soils for development whenever possible. During rehabilitation, soil amelioration should be done by liming and fertilizer applications based on soil analysis.	The height of the stockpile will be determined before construction and this will be conveyed to the construction team. The Environmental Coordinator (ECO) will monitor the construction of the structured.	Before and during the construction of the buildings
		Activities should be limited to area of disturbance. Where required the compacted soils should be disked to an adequate depth and re-vegetated with indigenous plants. Soil from the pipeline trench and pollution control dam should be used for the rehabilitation of disturbed areas. Delineation of wetlands by means of pegging before commencement of development is necessary. Avoid the dumping of materials, spills and the run-on of polluted water into wetland zones. Construction of isolative embankments		

Environmental Component	Objectives/specific goals	Action	Technical and Management Options	Time Schedule
		where necessary. To this end, design, implement and maintain effective water runoff control measures. Refrain from disturbing land in the proximities of wetland zones.		
	Ensure that during construction hydrocarbon contamination of the soils is minimised or prevented	Truck, machinery and equipment will be regularly serviced to reduce risk of leaks. Any leakages should be reported and treated immediately in a reputable manner with spill kits which should be provided for on site. For large spills a hazardous materials specialist will called in.		
Land Capability	Ensure that the construction of the overburden stockpiling areas, associated water management structures, pollution control dam, ventilation shaft and pipelines do not affect the ability of the mine to revert the land to decide after mining land use	The area will be rehabilitated such that it approximate the pre-mining land use and capability is achieved	The ECO will ensure that during construction all necessary measures are undertaken to ensure that the disturbed areas is protected.	Before and during construction of such structures
Surface Water	Ensure that the construction of the structures do not have detrimental impacts on the surface water environment	Divert all dirty water within the construction site to a temporary storage dams for settling of the silt. Divert all clean water away from the construction sites area to the nearby stream. All waste generated during the construction activities either from the site or the construction crew camp will be	The positions and size of the temporary dams will be determined before the construction of the complexes. The sizes of the waste collection and management facilities will be determined. The ECO will ensure that the construction undertaken as per action plan.	Before and during the construction of the structures

Environmental Component	Objectives/specific goals	Action	Technical and Management Options	Time Schedule
		collected in bins and disposed properly. Facilities for the management of sewage waste (conservancy tanks) and grey water will be installed on site A temporary area will be dedicated for the emergency repair of vehicles until a proper workshop is constructed Construct the pollution control facilities as per the mining plan. These facilities will be constructed to be in compliance with the designs specifications of a suitably qualified civil engineer. Design and construct the pipeline infrastructure in accordance with the designs specifications recommended by the qualified engineer in order to avoid any negative impacts on the tributaries of the Bankspruit. Gabion mattresses should be used to avoid erosion. Design and construct the Vent shaft infrastructure in accordance with the designs specifications recommended by the qualified engineer in order to avoid any negative impacts on the tributary of the Spookspruit.		
Groundwater	Ensure that the future use of the area does not have a detrimental impacts on the groundwater regime	Use suitably qualified engineers to design the overburden stockpiles, pollution control facilities and pipelines. These structures must also be constructed according to the design specifications. If groundwater is encountered during the	The Mine Manager and the ECO will ensure that the designs and construction undertaken as per action plan.	Before and during the construction of the structures

Environmental Component	Objectives/specific goals	Action	Technical and Management Options	Time Schedule
		construction of the pipeline trench, the trench invert level should be sloped to facilitate drainage.		
Air Quality	Ensure that the construction of the structures do not have detrimental impacts on the air quality	Water carts will be used or the suppression of dust from the construction site.	The ECO will ensure that dust suppression is conducted during construction activities and that the dust suppression efficiency is ensured.	Dust suppress at least twice daily
Noise	Ensure that the construction of the structures do not have detrimental impacts on the noise quality	Well serviced vehicles will be used on site. Work will be conducted during the day and will be stopped at night time. Arrangements will be made with the land owner if work will be continued at night. It is recommended that no mining activity takes place 250m within a receptors property. If mitigation of noises at certain receptors is not technical feasible or possible, the receptor must either be relocated or the boundary of noisy activity moved.	The mine manager will ensure that competent contractors are employed for the construction of the complexes	During the construction and operation of the complex.
	To ensure that the construction of the shaft and associated infrastructure does not have detrimental impacts on the noise	Direct line of sight from receptors, as illustrated in the noise report, to be obscured by a berm/barrier (pink line in figure 7-12) for both day and night-time operations. The material, location, and dimensions of the barrier must be constructed as per recommendation by the noise specialist.	The ECO must ensure compliance of the condition.	During the construction phase of the mine
Sensitive Landscapes	Ensure that the construction activities (Pipelines and ventilation shaft) do not have detrimental impacts on the identified wetland areas	The structures will be sited such that they are away from the recommended buffer zones of the identified wetland areas.	The mine manager and ECO must ensure that the construction of the structures is at the designed positions and that all legal requirements are met before construction of the structures.	Before and during construction of the complex

Environmental Component	Objectives/specific goals	Action	Technical and Management Options	Time Schedule
		If the structures are within the wetland areas, a water use licence will obtained before construction of such structures. Minimize the removal of/damage to vegetation in riparian and wetland areas Operation & storage of equipment in the riparian and wetland zones to be prevented. No construction camps should be allowed in or within 50 m of the wetlands Construction should preferably take place during the low flow/winter months in order to minimise the risk of sediment and debris being washed into wetlands. During the construction and operation phases erosion and siltation measures should be implemented (e.g. temporary silt traps downstream of construction areas should be employed) Design and construct the pipeline infrastructure in accordance with the designs specifications recommended by the qualified engineer in order to avoid any negative impacts on the tributaries of the Bankspruit and Spookspruit. Gabion mattresses should be used to avoid erosion.		

ISSUES RAISED BY INTERESTED AND AFFECTED PARTIES	Action
The Department of Agriculture, forestry and	-Where necessary, strip topsoil clean from underlying non-topsoil materials such as weathered sandstone, hard or soft

fisheries requested that any form of Natural Agricultural Resource degradation with necessary mitigation measure be considered as well as the mitigation measures stated in the Soil specialist report be implemented	plinthite. -Stripping and stockpiling of A horizon (30 cm topsoil) separately from subsoil. -Selection of sites of lower potential soils for development whenever possible. -During rehabilitation, soil amelioration should be done by liming and fertilizer applications based on soil analysis. -Delineation of wetlands by means of pegging before commencement of development is necessary. -Avoid development in wetland zones. -Avoid the dumping of materials, spills and the run-on of polluted water into wetland zones. -Construction of isolative embankments where necessary. -To this, end, design, implement and maintain effective water runoff control measures. -Refrain from disturbing land in the proximities of wetland zones. -After rehabilitation and re-vegetation of the shaft and infrastructure area, regular inspections must be conducted over the area to determine if vegetation cover is successful in order to combat erosion. If bare patches become visible, seeding of the areas must follow. -Inspections must also include the establishment of any declared invader plant species. If they exist in the area an immediate eradication program must be implemented. Storm water from upslope of the stripped areas should be diverted around these areas to limit the amount of storm water flowing over from these areas. -The timing of the topsoil stripping should be optimised to limit the time between stripping and construction. Where practical constraints exists and areas need to left stripped for long periods, contour ploughing or ripping could reduce runoff and hence reduce erosion. -Dry season construction is preferable. -Hydro seeding of the topsoil stockpile is recommended to speed up vegetation cover. An appropriate seed mix should be designed by a vegetation specialist. **-The closure objective for vegetation is to restore the area to grazing land and to eradicate all declared invader plant species.**
The South African Heritage Resources Agency (SAHRA) requested that a Desktop Palaeontological Impact Assessment be completed and submitted to SAHRA before Environmental Authorisation is granted.	A Palaeontological specialist has been appointed to conduct the Desktop Palaeontological Impact Assessment. See Appendix 10 for the Desktop Palaeontological Impact Assessment Report. Because important plant fossil localities are known from the Ecca Group the proposed mining development activities may expose fossil bearing rocks of the Karoo Supergroup which are not currently visible as they are covered by soil and vegetation. If construction activities expose extensive mudrocks of the Karoo Supergroup, it will create a unique opportunity to explore the area for fossils. It is thus recommended that, should fossils be exposed, a qualified palaeontologist be contacted to assess the exposure for fossils before further development takes place so that the necessary rescue operations are implemented. Depending on the nature of the fossils discovered this could entail excavation and removal to a registered palaeontological museum collection. A list of professional palaeontologists is available from South African Heritage Resources Agency (SAHRA).

The Department of Water Affairs stated the following: Currently the Department of Water Affairs is in possession of Bank Colliery's Access Brown Shaft II Integrated Water Use Licence Application, whereby all water use related issues shall be addressed. The applicant is advised not to commence with any water use activities before prior obtaining a Water Use Licence and the applicant must report any pollution incident from this proposed project to the Regional Head: Mpumalanga Department of Water Affairs within 24 hours. The mine manager or person accountable must at all times adhere to the requirements of the regulations on the use of water for mining and related activities aimed at the protection of water resources as promulgated under the Government notice No.: 704 and published in Government Gazette No.20119 of June 1999	-No water use activities will occur prior to obtaining a Water Use Licence and use of water for mining and related activities will be in accordance to Government notice No.: 704(published in Government Gazette No.20119 of June 1999).

9.2 OPERATIONAL PHASE

Environmental Component	Objectives/specific goals	Action	Technical and Management Options	Time Schedule	Annual Cost
Systematic Removal of the Target Coal Seams by Underground Mining Methods					
Topography	To ensure that the removal of coal by underground mining methods do not detrimentally affect the topographical patterns of the area mined.	The Solomon's safety factor of 1,6 for the underground pillars will be used for the pillar. This will prevent the disruption of the overlaying geological structure hence limiting the impact on the coal seam strata and preventing subsidence of the area. No areas with surface infrastructure will	The mine manager through the safety officer, surveyor and mining operators and the environmental co-ordinator will ensure that the action is adhered to.	During mining using underground mining methods	

Environmental Component	Objectives/specific goals	Action	Technical and Management Options	Time Schedule	Annual Cost
		be undermined. If the areas cannot be avoided, a higher safety factor approved by a suitably qualified person e.g., qualified and competent rock engineer. The use of mechanical continuous miners during the removal of the coal seam will ensure that blasting is kept to a minimum, and only utilised in areas where dolerite is encountered. This reduces the possibility of fracturing of the overlying or underlying strata during mining. All undermined areas with surface infrastructure will be monitored for subsidence. If subsidence does occur despite the use of the recommended safety factor, Anglo will ensure that the incident is investigated and cause of the incident found. Based on the findings, measures such as increasing the safety factor will be undertaken to prevent reoccurrence of pillar failure. Areas with subsidence will be identified and reshaped to free draining topography. The rehabilitated areas will then be monitored on a regular basis.			
Natural vegetation	Ensure that the activity does not impact detrimentally on the natural vegetation	Dust suppression should be done for the prevention of the vegetation from being affected by the dust generated from the construction sites	The ECO will ensure that the mine adheres to the condition.	During the construction phase and throughout the life of the mine	

Environmental Component	Objectives/specific goals	Action	Technical and Management Options	Time Schedule	Annual Cost
Groundwater/ Sensitive Landscapes	To minimise impacts of mining on groundwater	Static groundwater levels of boreholes around the proposed mining operation, including existing boreholes within a zone of two kilometres from the mine, will be measured on a quarterly basis. If it can be proven that the mining operation is indeed affecting the quantity of groundwater available to certain users, the affected parties will be compensated. If it can be proven that the mining operation is indeed affecting the quantity of groundwater available to wetland areas, Anglo Operations will be liable for rehabilitation of the affected wetland.	The Mine manager or his representative will keep record of the monitoring data for the proposed mine.	During the mining of the proposed underground reserves	
Air Quality	To ensure that the employees' health is not affected by the dust generated at the mine workings.	Dust suppression will be undertaken in the mine workings. The employees will be issued with dust masks and instructed to use them.	The Mine manager will appoint a responsible person to oversee the action plan is adhered to.	Dust suppression should done as when necessary and the employees must use their dust masks when working in dusty areas	
Noise	To ensure that the employees' health is not affected by the noise levels generated at the mine workings.	The employees will be issued with earplugs and instructed to use them. A buffer distance of 900 meters for a directional ventilation fan facing any receptor during the night-time (data taken from a reasonably "loud" fan, facing a receptor i.e. a worst case scenario) must be adhered to. If a directional ventilation fan is proposed closer than this distance, other mitigation options need to be	The Mine manager and safety officer will appoint a responsible person to oversee the action plan is adhered to.	The employees must use their earplugs when working is noisy areas During the construction and operational phase of the mine	

Environmental Component	Objectives/specific goals	Action	Technical and Management Options	Time Schedule	Annual Cost
		investigate including, changing the direction, implementing an acoustical shielding or implementing a berm/barrier.			
Sites of archaeological and cultural importance	Based on the Heritage Impact Assessment Report, no site of significant archaeological or cultural interest has been identified over the proposed Access Brown Shaft II area.				
Use of Conveyor belt for the Transportation of Coal					
Soils and Natural Vegetation	To ensure that during the transportation of coal contamination of soils and vegetation is minimised.	All conveyors used for the transportation of coal must be covered during coal transportation. All spilled coal along the conveyors will be cleared within one day of spillage.	The mine manager and safety officer will ensure that the length of the conveyor is inspected regularly.	Trucks will be covered when transporting coal and spillages will be cleared within one day of spillage	
Natural vegetation	Ensure that the activity does not impacts detrimentally on the vegetation	All spilled coal along the conveyors will be cleared within one day of spillage.	The ECO will ensure that the mine adheres to the condition.	During the construction phase and throughout the life of the mine	
Noise	Ensure that the use of the access and haul roads do not have detrimental impacts on the nearby receptors	All conveyors to be used during the night-time should be routed as far as possible away from a receptor.	The mine manager and safety officer will ensure that the vehicles obey the recommendations made in this action plan.	During the operational phase of the mine	
Noise and vibration	Ensure that the property and owners of such properties are not detrimentally affected by the blasting conducted at the mine.	A qualified blasting expert will be employed to design the blasting such that nearby residents are not affected by vibration, air blast and fly rock.	The mine manager, safety officer, environmental co-ordinator and qualified blaster will ensure that the mine comply with the recommendations made in this action plan.	During the construction and operational phases of the mine	
Sensitive landscape	Ensure that the use and maintenance of the roads do not result in detrimental	Any wetlands that could have been disturbed should be re-vegetated using site-appropriate indigenous vegetation	The mine manager and environmental co-ordinator will ensure that the mine comply with the recommendations made in this	During the construction and operational phase of the mine	

Environmental Component	Objectives/specific goals	Action	Technical and Management Options	Time Schedule	Annual Cost
	impacts of the identified wetland areas	and/or seed mixes Alien vegetation should not be allowed to colonize the disturbed wetland areas Rehabilitation of disturbed wetland habitat should commence immediately after construction is completed Where vegetation removal has occurred adjacent to the new roads, monitoring should take place to ensure successful re-establishment of natural vegetation. Alien vegetation should be removed from these disturbed areas on an on-going basis to ensure the successful re-vegetation by indigenous species	action plan.		
Use of Workshop Buildings, Office and Other Associated Infrastructure					
Surface Water	Ensure that the use of the buildings do not result in the contamination of the environment by the waste generated from the site.	Solid waste generated from the buildings will be collected at three bins (foods, paper and cardboard) and either recycled or collected by contractor for disposal to a registered municipal landfill site. Sewage from the ablution facilities at the offices will be drained into a septic tank that will be connected to a conservancy tank. A contractor will be employed to collected and dispose of the waste into a municipal sewage treatment plant. Used oil from the workshops will separated via oil separators and stored	The ECO will ensure that the workshops and offices have the waste collection system in place in order to adhere to the action plan.	During the operational phase of the mine	

Environmental Component	Objectives/specific goals	Action	Technical and Management Options	Time Schedule	Annual Cost
		in drums for collection by a contractor, who will either recycle or properly dispose of the oils. The water from the separated oils will be re-used at the workshops. All areas to be used for the handling of hydrocarbon waste will have concreted walls and floors. Used rags and filters will be stored in drums dedicated for such waste. Other recyclable waste such as tyres and scrap metal will be sorted in the scrap yards and sold to recycling companies.			
Operation of the Water Management Structures (Pollution control dam and pipelines)					
Topography	Ensure that the operation of the pollution control dam, pipelines and diversion structures do not have detrimental effect on the local topography	The pollution control dam will be designed, constructed and operated to have profile that will easily blend with the surrounding topography	The mine manager and the mine engineer with the assistance of the ECO will ensure that the dam and diversion trenches are constructed and operated in accordance with the designs approved by the Department of Water Affairs.	During the operational phase of the mine	
Natural vegetation	Ensure that the operation of the pollution control dam, pipelines and diversion structures do not have detrimental effect on the surrounding natural vegetation	Limit the operation of the pollution control dam and diversion structures to area of disturbance and re-vegetate impacted areas as soon as possible.	The mine manager and the mine engineer with the assistance of the ECO will ensure that the pollution control dam and diversion structures is constructed and operated in accordance with the action plan	During the operational phase of the mine	
Soils	Ensure that the operation of the pollution control dam, pipelines and diversion structures do not have detrimental effect on the	The pollution control dam and its associated structures should be limited to area of disturbance. Where required the compacted soils should be disked to an adequate depth and re-vegetated	The mine manager and the mine engineer with the assistance of the ECO will ensure that the pollution control dam and diversion structures is constructed and operated in accordance with the action	During the operational phase of the mine	

Environmental Component	Objectives/specific goals	Action	Technical and Management Options	Time Schedule	Annual Cost
	surrounding soils	with indigenous plants.	plan. The pipelines will be installed with leak detection systems.		
Surface Water	Ensure that the transportation of water through the pipeline does not detrimentally impact on the surrounding water environment.	The pipelines will be installed with a leak detection system. Any spillages should be reported and treated immediately in a reputable manner.	The mine manager and the mine engineer with the assistance of the ECO will ensure that the dam and pipelines are operated according to the approved design reports.	During the operational phase of the mine	
Surface Water	Ensure that the operation of the pollution control dam, pipelines and diversion structures do not have detrimental effect on the surrounding water environment	The mine will ensure that water management facilities are operated adequately in accordance with GN704. All silt build up will be cleaned out over dry season preferably at the silt traps to be constructed at the entrance point of the dam. The integrity of lining and management structures will be tested regularly.	The mine manager and the mine engineer with the assistance of the ECO will ensure that the action plan is adhered to.	During the operational phase of the mine	
Groundwater	Ensure that the operation of the pollution control dam, pipelines and diversion structures do not have detrimental effect on the surrounding groundwater environment	The pollution control dam and diversion structures will be designed, constructed and operated to have a lining and an emergency subsurface drain that will capture seepage water. Any leakage will be returned to the pollution control dam and the leaking area repaired. The pollution control dam and diversion structures will be operated in accordance with GN704 requirements	The mine manager and the mine engineer with the assistance of the ECO will ensure that the action plan is adhered to.	During the operational phase of the mine	
Topography	Ensure that the operation of the pollution control dam, pipelines and diversion structures do not have detrimental effect on the local topography	The pollution control dam and pipelines will be designed, constructed and operated to have profile that will easily blend with the surrounding topography	The mine manager and the mine engineer with the assistance of the ECO will ensure that the dam, pipelines and diversion trenches are constructed and operated in accordance with the designs approved by the Department of Water Affairs.	During the operational phase of the mine	

Environmental Component	Objectives/specific goals	Action	Technical and Management Options	Time Schedule	Annual Cost
Natural vegetation	Ensure that the operation of the pollution control dam, pipelines and diversion structures do not have detrimental effect on the surrounding natural vegetation	Limit the operation of the pollution control dam and diversion structures to area of disturbance and re-vegetate impacted areas as soon as possible.	The mine manager and the mine engineer with the assistance of the ECO will ensure that the pollution control dam, pipelines and diversion structures is constructed and operated in accordance with the action plan	During the operational phase of the mine	
Sensitive landscape	Ensure that the use of the pipelines do not result in detrimental impacts of the identified wetland areas	The pipelines will be installed with a leak detection system to detect spillages early. The pipelines should be regularly inspected and maintained. Any spillages should be reported and treated immediately in a reputable manner.	The mine manager and the mine engineer with the assistance of the ECO will ensure that the pipelines are constructed and operated in accordance with the action plan	During the operational phase of the mine	

ISSUES RAISED BY INTERESTED AND AFFECTED PARTIES	Action
The Department of Agriculture, forestry and fisheries requested that any form of Natural Agricultural Resource degradation with necessary mitigation measure be considered as well as the mitigation measures stated in the Soil specialist report be implemented	-Where necessary, strip topsoil clean from underlying non-topsoil materials such as weathered sandstone, hard or soft plinthite. -Stripping and stockpiling of A horizon (30 cm topsoil) separately from subsoil. -Selection of sites of lower potential soils for development whenever possible. -During rehabilitation, soil amelioration should be done by liming and fertilizer applications based on soil analysis. -Delineation of wetlands by means of pegging before commencement of development is necessary. -Avoid development in wetland zones. -Avoid the dumping of materials, spills and the run-on of polluted water into wetland zones. -Construction of isolative embankments where necessary. -To this, end, design, implement and maintain effective water runoff control measures. -Refrain from disturbing land in the proximities of wetland zones. -After rehabilitation and re-vegetation of the shaft and infrastructure area, regular inspections must be conducted over the area to determine if vegetation cover is successful in order to combat erosion. If bare patches become visible, seeding of the areas must follow. -Inspections must also include the establishment of any declared invader plant species. If they exist in the area an immediate eradication program must be implemented. Storm water from upslope of the stripped areas should be diverted around these areas to limit the amount of storm water flowing over from these areas. -The timing of the topsoil stripping should be optimised to limit the time between stripping and construction. Where practical

	constraints exists and areas need to left stripped for long periods, contour ploughing or ripping could reduce runoff and hence reduce erosion. -Dry season construction is preferable. -Hydro seeding of the topsoil stockpile is recommended to speed up vegetation cover. An appropriate seed mix should be designed by a vegetation specialist. **-The closure objective for vegetation is to restore the area to grazing land and to eradicate all declared invader plant species.**
The South African Heritage Resources Agency (SAHRA) requested that a Desktop Palaeontological Impact Assessment be completed and submitted to SAHRA before Environmental Authorisation is granted.	A Palaeontological specialist has been appointed to conduct the Desktop Palaeontological Impact Assessment. See Appendix 10 for the Desktop Palaeontological Impact Assessment Report. Because important plant fossil localities are known from the Ecca Group the proposed mining development activities may expose fossil bearing rocks of the Karoo Supergroup which are not currently visible as they are covered by soil and vegetation. If operational activities expose extensive mudrocks of the Karoo Supergroup, it will create a unique opportunity to explore the area for fossils. It is thus recommended that, should fossils be exposed, a qualified palaeontologist be contacted to assess the exposure for fossils before further development takes place so that the necessary rescue operations are implemented. Depending on the nature of the fossils discovered this could entail excavation and removal to a registered palaeontological museum collection. A list of professional palaeontologists is available from South African Heritage Resources Agency (SAHRA).
The Department of Water Affairs stated the following: Currently the Department of Water Affairs is in possession of Bank Colliery's Access Brown Shaft II Integrated Water Use Licence Application, whereby all water use related issues shall be addressed. The applicant is advised not to commence with any water use activities before prior obtaining a Water Use Licence and the applicant must report any pollution incident from this proposed project to the Regional Head: Mpumalanga Department of Water Affairs within 24 hours. The mine manager or person accountable must at all times adhere to the requirements of the regulations on the use of water for mining and related activities aimed at the protection of water resources as promulgated under the Government notice No.: 704 and published in Government	-No water use activities will occur prior to obtaining a Water Use Licence and use of water for mining and related activities will be in accordance to Government notice No.: 704(published in Government Gazette No.20119 of June 1999).

Gazette No.20119 of June 1999	

9.3 DECOMMISSIONING PHASE

Most of the impacts identified for the operational phase will continue during the decommissioning phase, hence all mitigation and environmental management programmes planned for the operational phase will be continued throughout the decommissioning phase.

However new impacts will emanate from the areas that has been removed of the surface infrastructure. These will virtually involve the entire mining area where rehabilitation is either been done or has been done. Below is the programme to manage any new impacts that may arise from the mining area either being rehabilitated or area that has just been rehabilitated. Note that some of the mitigation measures will be applicable for the areas being rehabilitated during the operational phase.

9.3.1.1 Infrastructure Areas

All concrete, steel works and structures will be removed so that the land can be returned to as near as practically possible to its original state. Concrete work that extends below ground level will be removed to a metre below the surface. Concrete, brick and mortar will be used as backfilling material in the shaft area. Steel will be sold as scrap metal.

All rehabilitated areas will be shaped to be free draining without concentrating flow such that erosion occurs, fertilised and a mixture of indigenous and pasture grasses will be planted. Following this rehabilitation the infrastructure areas will have a capability similar to the pre-mining environment.

All rehabilitated areas will be maintained for a period of 3 years, where after the frequency will be reassessed. Vegetation cover will be maintained by annual application of fertiliser combined with biennial cutting or burning for the first three years. After this period, fertilizer will be applied as and when required.

Maintenance with respect to erosion will be conducted on a minimum three monthly basis if and where required. This frequency will be reassessed after a 3-year period. The final rehabilitated surface will be stable, self-sustaining and erosion-free.

All roads not required for residential or farming purposes, and overland conveyors will be removed and the ground restored as above.

9.3.1.2 Roads, Railways and Overland Conveyors

All infrastructure associated with the mining operation will be removed and the surface on which it was situated to be returned, as close as is practically possible, to the original land use.

6.3.1.2.1 Roads

- Access and maintenance roads will be rehabilitated. All gravel roads will be graded to remove foundation material to the final voids or a facility for disposal. The roads will be cross-ripped to 300 mm at right angles to the natural slope, fertiliser added as per soil requirements and vegetated with a seed mix of indigenous and pasture grasses. Maintenance will be conducted on the rehabilitated areas.

9.3.1.3 Workshops and Stores

The bulk of the activity in removing the workshops, stores and administration buildings will be the demolition and disposal of concrete structures. Metal will be removed and sold. Rubble will either be removed to the co-disposal facility or used as shaft backfill and all scrap metal will be cleared from the area and sold.

If any soils are contaminated with hydrocarbons, they will be bio-remediated.

9.4 MINE CLOSURE

Objective :	To minimise all impacts of mining on the environment during and after closure.
Specific Goals :	Ensure that surface water exiting the property will not have a significant increase in water born pollutants measured against the incoming surface water. Maintain post mining land use as grazing land. Ensure that the area is free of erosion and have a sustainable vegetation cover. Ensure that the ground water within the surrounding areas is fit for use. Ensure that the interested and affected parties are not detrimentally affected by the mine

9.4.1 Spread of Groundwater Pollution Post mining

Predictions in the previous sections regarding groundwater pollution have been based on the assumption that the rehabilitated pit will be a constant source of sulphate pollution of 2000 mg/l, representing a worst-case scenario. With appropriate measures, the oxidation rate of pyrite can be limited, resulting in lower starting concentrations. Furthermore, the migration of the pollution plume from the void can also be limited by surface rehabilitation measures preventing excessive infiltration of groundwater to the mined area. Thus, , further reduction is achievable.

To minimise the effect of groundwater pollution on the receiving environment, the following measures are suggested:

The final mine topography should be engineered such that runoff is directed away from the rehabilitated area.

Mining should remove all coal and as little as possible should be left in the underground.

Coal bearing mining wastes must be placed in the lowest practical areas and flooded as soon as possible for similar reasons.

Furthermore, the underground should be flooded as soon as possible to bar oxygen from reacting with remaining pyrite.

Quarterly groundwater sampling must be done to establish a database of plume movement trends and to aid eventual mine closure. It is essential to provide a reliable database to facilitate eventual closure of the mining operation.

Leaving a final void in the underground areas must be investigated. Once final mining plans are available, it will be essential to model this option.

Regular sampling and chemical analyses of the groundwater is imperative to establish a sound database:

Groundwater in all boreholes within a distance of less than two kilometres must be sampled regularly to establish a database against which future groundwater levels can be compared.

Sampling must be preferably quarterly, but at least twice annually, following the dry – and rainy seasons.

If it is found during such a sampling event that groundwater from any extraction borehole is polluted beyond acceptable standards, alternative water will have to be supplied to the affected party.

9.4.2 Final Rehabilitation (Erosion and Dust Control)

All rehabilitated areas will have been seeded with a recommended seed mix. No erosion is expected to occur following vegetation establishment, thus no dust control will be necessary.

9.4.3 Final Rehabilitation (Roads and Final Voids)

No roads will remain in place after the decommissioning phase. Note that the roads will be graded during this phase, in order to remove any fine carbonaceous material build-up from the roads. These will then be ripped to 150mm, at 90° to the inherent slope, and seeded with a seed mix recommended in this document.

Volumetric modelling of the material to be removed from the opencast pit indicates that the shaft will be rehabilitated to surface and subsequent shaping of the pit will allow for the re-establishment of natural runoff patterns, thus the area will be free draining.

No final voids or water management dams will remain after mining.

9.4.4 Final Land Use

All topsoil material removed from the mining area will be replaced during the rehabilitation of the area. It is not normally immediately possible to restore arable land to its former capability. However, it is possible to upgrade disturbed land to grazing land. In view of the above, the final land use for the Access Brown Shaft II will be grazing land.

9.4.5 Interested and affected parties

In addition to the above, Anglo Operations Limited will on a regular basis communicate with the interested and affected parties. A most efficient way of communication with the interested and affected parties will be determined on commencement of mining and will be used by the mine during operational and closure phase of the mine. Records of such communication will be kept at the mine offices.

SECTION SEVEN

Environmental Awareness Plan

10. ENVIRONMENTAL AWARENESS PLAN

10.1 ENVIRONMENTAL AWARENESS PLAN

In terms of section 33(j) of the National Environmental Management Act, 107 of 1998, Environmental Impact Assessment Regulations 2010, Anglo Operations (Pty) Limited must compile and implement an environmental awareness plan. The above-mentioned environmental awareness plan must describe the manner in which the mine (in this case Access Brown Shaft II) will inform their employees of any environmental risk which may result from their work and the manner in which the environmental risks will be addressed to avoid pollution or/and degradation of the environment. This document, therefore concerns the details of the environmental awareness plan for Anglo Operations Limited at Access Brown Shaft II as required by the National Environmental Management Act, 107 of 1998. In view of the above, Anglo Operations Limited has developed an environmental awareness plan for the proposed Access Brown Shaft II, which is explained in more detail below.

Note that the responsible person will revise these environmental awareness procedures from time to time. The date of commencement of the revised procedure will always be indicated to prevent confusion, in this case after the issuing of environmental authorization to Anglo Operations (Pty) Limited.

This Environmental Awareness (Standard Training Procedure) sets out the mine's training objectives regarding to environmental awareness. It is a stand-alone procedure, which serves to improve awareness, training and competency in the environmental field. It contains no detail on the actual training initiatives but rather serves to ensure that a responsible person is appointed to deal with and increase environmental awareness on the mine.

10.1.1 Environmental Awareness Plan

10.1.1.1 Definitions and Abbreviations

The following standard definitions and abbreviations can be found in this procedure

Table 18:Standard definitions and abbreviations for the environmental awareness plan

Term	Definition
EMS	Environmental Management System
STD	Standard
SHE	Safety, Health & Environmental
ISO	International Standard of Organisations
	All definitions in ISO 14001 Standard
HOD	Head of Department
PTO	Planned Task Observation

10.1.1.2 Purpose

- To ensure that staff are competent through Environmental training. Competence will only be proven through assessment by relevant line supervisors/management.
- Training is essential to ensure that the responsibilities in EMS can be fulfilled at each relevant function and level, and to meet the challenge of continual improvement. It is essential that key personnel whose work may create a significant impact on Environment be trained.
- Resources for training should ensure that adequate competent personnel are available to cover any eventuality.
- To explain and aid the personnel involved in training with regards to EMS.
- To clarify the EMS training and ensure that all employees are correctly instructed with regards the environment.

10.1.1.3 Scope

This procedure sets out the mine's training objectives with regard to environmental awareness and EMS. It is a stand-alone procedure which serves to improve awareness, training and competency in the environmental field. It contains no detail on the actual training initiatives, but rather serves to ensure that a responsible person is appointed to deal with and increase environmental awareness on the mine.

10.1.1.4 Description of Activity

No	Activity / Procedure	Roles and responsibility
1.	**GENERAL** Awareness training must include the potential consequences of departure from specified operating procedures as well as significant environmental impacts, actual or potential, of their work activities. Training will be appropriate to the activity of individual employees.	
2.	**INDUCTION PROGRAMME**	
	Training programmes shall, be established and maintained for colliery personnel contractors and visitors, refer to Training Standard Procedures PT007 & PT008 – Induction procedures.	Training Manager
	Training shall include the following: • Administrative requirements and procedures which will include the EMS and Emergency Procedures. • The computer system and the	Environmental Coordinator & Training Manager

	operation of the computer (inputs and outputs) as relevant to the tasks of the trainee (where applicable). • Resource conservation and environmental reporting and general environmental awareness for mine related environmental issues.	
	Contractors that are employed on the colliery must, prior to any starting of working activities, complete the contractor's pack. This package requires the contractor to perform SHE Risk assessments on the activities to be undertaken. The entire risk assessment process and the applicable EMS procedures are referenced within the contractor's package.	Environmental Coordinator
	Environmental Induction slides/presentation shall be revised annually.	Training Manager
	Induction is valid for the period of year hence refresher shall be done after 365 days. Oil Spill Response training shall be part of induction program..	
3.	**TRAINING NEEDS**	
	Training and awareness needs shall be identified as per the significant impact impact per job category.	Training Manager and Section Heads
	Training needs shall be identified through: • Performance appraisal; • Analysis of non-conformances and incidents; • Audit findings and recommendations; • At time of recruitment (in the work place); • Training needs analysis; • Impact/Aspect Register • Additions to scope in services provided; • The updating of procedures (quality, technical and administrative).	Training Manager and Section Heads
	Training needs will also be identified through work performance, request by employee and work area review as per Training Procedure 004 – Identification of Training Needs. Once training needs have been established it is up to the supervisor to notify the Training	Section Heads

4.	Department of the requirements. The training department will then identify pertinent and relevant courses (if not already done so by employee/supervisor) and schedule training accordingly. A training matrix will be generated from Training needs analysis. Monthly Environmental Theme will be distributed to all in the mine including contractors. Environmental Days celebrations are done to enhance awareness to employees and local communities (water week, environmental Week, Arbor week etc.). Daily Safety, Health and Environmental bulletin is used to communicate environmental tips to all employees. **TRAINING PLANNING** Identified and agreed training needs shall be included in budgets and processed as described below. Course attendance (other than at the internal induction courses) shall be scheduled on the basis of the importance of task contribution to the maintenance, effectiveness and improvement of the objectives. Training expenses, including conferences and symposia would be checked and approved by the Head of Department. The Training Department shall complete a course authorisation form and ensure that the procedures are followed regarding course bookings, confirmations and payments. Planning of training for job specific training (done through training needs analysis) will be co-ordinated between the Training Manager and the relevant Section Heads. This will result with on time training schedule for job specific training on the mine. The Trainee shall : Obtain approval from the Head of Department Request Training Department to make official booking. External training courses shall be accessed through : Attendance by, and the formal reports and recommendations of, staff Recommendation by known competent	 Training Manager Environmental Coordinator Section Heads HODs Training Manager Training Manager And Section Heads Employees

	external personnel Review of course content, presenters, location and facilities by knowledgeable personnel	
5.	**EMS TRAINING**	
	Colliery Personnel:	Training Manager
	All employees, current and new, and contractors will undergo induction, a part of which is environmental awareness training and includes the environmental policy. Depending on a person's job category training will be performed on significant aspects pertinent to his/her area of work. The job category is linked to the environmental training needs analysis matrix of Bank Colliery. At the end of this training, personnel will be required to complete the awareness test and the level of awareness assessed by the Training Department. Re-testing or induction may be required if test was failed.	
	All personnel performing tasks which can cause significant or major environmental impacts shall be competent on the basis of training, education and/or experience.	Training Manager
	Visitors:	
	All visitors to any controlled access areas of the Colliery will undertake a shorter "visitors induction", which highlights the main safety and environmental aspects relevant to short term visitors at the mine.	
	EMS Representatives:	
	The EMS Representatives shall have additional EMS knowledge requirements. The EMS Representatives shall receive the training required to manage the EMS efficiently in their areas of responsibility. Such skills include the operation of the SHE legal register and the electronic database (PIVOT V6-Training Manual 1.03), as well as thorough knowledge of the environmental procedures.	Section Heads
	Standard Procedures:	
	Employees and contractors shall be made aware of Environmental Standard Operating procedure related to their activities which might have environmental impacts e.g. waste management, oil management etc.	Section Heads

	Evaluation and Competence:	
	Definition: The Training Department and Line Management's role is to ensure that all mine regulations and procedures required by the various indicated legislation (paragraph 6) are such that theoretical knowledge and operational skills all pivot around competency. A competent person means a person who: 1). a) is qualified by virtue of his/her knowledge, training, skills and experience to organise the work and its performance; b) is familiar with the provisions of legislation applicable to his/her work; c) has been trained to recognise any potential or actual danger (significant aspects) to the environment, but also safety and health, in the performance of the work; and/or 2) is in the possession of the appropriate certificates of competency where such certificate is required by these regulations or legislations.	Environmental Coordinator
	Competency does not merely mean showing or training an employee on a task so that he knows how to do it. Proving competency, the employee must know the Who, What, When, How and Why pertaining to the task as well as the hazards and risks associated with performing the task.	Section Heads
	Capacity and awareness training will be carried out by Environmental Coordinator and Training Manager and evaluation of awareness and competency training (implementation of training in the work place) will be carried out by the Line Managers through PTOs or through approved accredited training providers. Awareness and competence will also be reviewed during audits, events of an emergency, and incident. Typical competence assessments include training programmes both formal and informal, PTOs, questioning employees, experience, checklists, qualifications and ability to do the work. Gaps identified shall be referred to Training department.	Section Heads
	This awareness plan shall be kept up to date.	Training Manager and Environmental Coordinator

10.1.1.5 Legal Requirements

- Employment Equity Act 55 of 1998 – AREAS WHERE EMPLOYMENT EQUITY ARE DEFINED, INCLUDING TRAINING & DEVELOPMENT

- National Environmental Management Act 77 of 1998 – RECOMENDATIONS FOR INSTITUTIONAL CO-OPERATION

- Mine Health & Safety Act 29 of 1996 – COMPETENT PERSON TRAINING

- Section 39(3) (c) of the MPRDA- Environmental Awareness Plan

10.1.1.6 Records

The following records shall be maintained by the Training Department:

- Personnel qualifications

- Training needs and Training Matrix

- Certificates

- Licenses

- Training programmes/courses attended

- Staff induction

Performance appraisals are kept by the Human Resources Department due to their sensitive nature.

Copies of checklists and PTO's will be kept by the relevant sections and the training department.

All foregoing records will be maintained in the employee's personnel files, Training Department records section and Site Manager's records where applicable. Induction training is the responsibility of the Training Manager as well as all other forms of external training facilities/courses/venues etc. EMS training is co-responsibility shared with the Environmental Co-ordinator.

11. CONCLUSION AND RECOMMENDATIONS

The purpose of this final chapter is to:

Summarise the main recommendations of the impact assessment to mitigate significant negative impacts and enhance benefits,

Briefly discuss how the objectives of the report have been met,

Provide an indication of how complete the information in this report is for decision-making purposes.

11.1 KEY RECOMMENDATIONS

The key recommendations = relate to significant impacts and potential significant impacts of the proposed project. These recommendations are outlined below.

11.1.1 Recommendations Relating to Impacts on Soils

Topsoil from the overburden stockpiling site, access/haul roads and pollution control dam sites should be stripped prior to use of the area and the stripped topsoil must be used for rehabilitation after the use of the sites.

As far as possible, stripped topsoil should be stockpiled upslope of the each site.

The topsoil stockpiles must be placed upslope or outside the dirty water areas.

The broad soil groups suitable for rehabilitation purposes should be stockpiled separately from less suitable broad soil groups and all topsoil must be stockpiled separately from the subsoil material.

Soil depth and volumes to be used during rehabilitation must comply with the rehabilitation budget.

Wetland degradation should be prevented. All infrastructures should be constructed and designed by a qualified engineer. Where necessary, strip topsoil clean from underlying non-topsoil materials such as weathered sandstone, hard or soft plinthite.

Stripping and stockpiling of A horizon (30 cm topsoil) separately from subsoil.

Selection of sites of lower potential soils for development whenever possible.

During rehabilitation, soil amelioration should be done by liming and fertilizer applications based on soil analysis.

11.1.2 Recommendations Relating to Impacts on vegetation and fauna (biodiversity)

The land use of the area is dominated by cultivation and grazing and old mined out areas. Infrastructure will be placed on a historically disturbed area hence impacts on the natural vegetation will not be extensive.

11.1.3 Recommendations Relating to Impacts on Sensitive landscapes

Wetland degradation should be prevented. All infrastructures (Pipelines and ventilation shaft) should be constructed and designed by a qualified engineer.

Regular maintenance checks should be conducted along the pipelines to avoid any pipe bursts. A pipe leak detection system will be installed along the pipeline.

Constant monitoring of infrastructures (maintenance roads, pipelines and ventilation shaft) close to all sensitive landscape such as wetlands and streams to allow for the early detection of any impacts that could potentially occur.

Delineation of wetlands by means of pegging before commencement of development is necessary.

Avoid the dumping of materials, spills and the run-on of polluted water into wetland zones.

Construction of isolative embankments where necessary.

To this end, design, implement and maintain effective water runoff control measures.

Refrain from unnecessarily disturbing land in the proximities of wetland zones.

11.1.4 Recommendations Relating to Impacts on surface water

It is recommended that all dirty water emanating from the infrastructure area be contained, clean water be diverted away from the dirty water areas of the infrastructure area. All dirty water management structures must be designed to handle water from flood events (1:50 and 1:100 year flood event).

11.1.5 Recommendations Relating to Impacts on Groundwater

Since it is inevitable that a mining operation of this scale will impact on the groundwater regime, measures to manage and reduce these impacts to the absolute minimum must be considered. The identified negative impacts of reduction of the groundwater levels during mining and the spread of groundwater pollution after closure of the underground will be addressed in the following paragraphs.

Lowering of Groundwater Levels during Mining

Since the drawdown or the groundwater levels during mining could influence some boreholes, the following measures are recommended:

In the event of groundwater encountered during the adit development, precementation can and should be used to restrict inflow thereby negating excessive drawdown.

The static level of groundwater in all boreholes within a distance of less than one kilometre must be measured regularly to establish a database against which future groundwater levels can be compared.

Such measurements must be made preferably quarterly, but at least twice annually, following the dry and rainy seasons.

In the event of unacceptable decrease of the yield of any affected boreholes, alternative water supply should be supplied to the affected parties until such time that the groundwater recovers following closure of the pit.

It is highly recommended that board-and-pillar mining be used in the construction phase with the pillars being left intact with sufficient strength to keep the overlying strata from collapsing in the decommissioning phase.

Spread of Groundwater Pollution Post-mining

Predictions regarding groundwater pollution have been based on the assumption that the rehabilitated pit will be a constant source of sulphate pollution of 2000 mg/l, representing a worst-case scenario. With appropriate measures, the oxidation rate of pyrite can be limited, resulting in lower starting concentrations. Furthermore, the migration of the pollution plume from the void can also be limited by surface rehabilitation measures preventing excessive infiltration of groundwater to the mined area. Thus, further reduction in sulphate pollution is achievable.

To minimise the effect of groundwater pollution on the receiving environment, the following measures are suggested:

The final mine topography should be engineered such that runoff is directed away from the rehabilitated area.

Mining should remove all coal and as little as possible should be left in the underground.

Coal bearing mining wastes must be placed in the lowest practical areas and flooded as soon as possible for similar reasons.

Furthermore, the underground should be flooded as soon as possible to bar oxygen from reacting with remaining pyrite.

Quarterly groundwater sampling must be done to establish a database of plume movement trends and to aid eventual mine closure. It is essential to provide a reliable database to facilitate eventual closure of the mining operation.

Leaving a final void in the underground areas must be investigated. Once final mining plans are available, it will be essential to model this option.

Regular sampling and chemical analyses of the groundwater is imperative to establish a sound database:

- Groundwater in all boreholes within a distance of less than two kilometres must be sampled regularly to establish a database against which future groundwater levels can be compared.
- Sampling must be preferably quarterly, but at least twice annually, following the dry – and rainy seasons.

If it is found during such a sampling event that groundwater from any extraction borehole is polluted beyond acceptable standards, alternative water will have to be supplied to the affected party.

Impacts Indirectly Related to Mining

During all phases of mining, vehicles and personnel will be operative in the underground. Minor spills such as diesel, petrol and oil could results from machinery operations. Also, domestic water and waste disposal could also affect the groundwater quality. The following is thus recommended:

It must be ensured that a credible company removes used oil after vehicle servicing.

A sufficient supply of absorbent fibre should be kept at the site to contain accidental spills.

Used absorbent fibre must be land-farmed, using approved methodologies.

Domestic waste water, especially sewage, must either be treated at site according to accepted principles, or removed by credible contractors.

Solid waste must similarly either be stored at site on an approved waste dump, or removed by credible contractors.

11.1.6 Recommendations Relating to Impacts on Noise

With all mitigation options adhered to, an acceptable ***Low significance*** during construction and operational phase will be achieved. Therefore it is recommended that mitigation options are implemented or adhered to.

Quarterly noise monitoring should also be conducted by an acoustic consultant for the first year of operation. This monitoring is to take place over a period of 24 hours in 10 minute bins, with the resulting data co-ordinated with wind speeds as measured on site. These samples should be collected at **NSD03** - **NSD06** receptors, taking into consideration the current ambient soundscape.

Annual feedback regarding noise monitoring should be presented to all stakeholders and other Interested and Affected parties in the area. Noise monitoring must be continued as long as noise complaints are registered.

11.1.7 Recommendations Relating to Impacts on Palaeontology

Because important plant fossil localities are known from the Ecca Group the proposed mining development activities may expose fossil bearing rocks of the Karoo Supergroup which are not currently visible as they are covered by soil and vegetation.

If construction activities expose extensive mudrocks of the Karoo Supergroup, it will create a unique opportunity to explore the area for fossils. It is thus recommended that, should fossils be exposed, a qualified palaeontologist be contacted to assess the exposure for fossils before further development takes place so that the necessary rescue operations are implemented. Depending on the nature of the fossils discovered this could entail excavation and removal to a registered palaeontological museum collection. A list of professional palaeontologists is available from South African Heritage Resources Agency (SAHRA).

11.1.8 Recommendations Relating to Impacts on Air Quality

Careful consideration must be given to the relationship of activities on-site to sensitive areas beyond the property boundary. Some of the factors that should be taken into account in the process layout to reduce dust impacts are:

placing dust generating activities where maximum protection can be obtained from natural features;

locating dust generating activities where prevailing winds will blow dust away from the receiving community; and minimising the need to transport and handle materials by placing adequate storage facilities close to processing areas.

The location of dust generating activities will change during the different phases of the project and therefore, the relationship with receivers around the site. It is important that the minimisation of dust through site design is addressed at each phase of the operation.

Dust control at processes and plant could be affected through installation of mechanical ventilation systems, wet suppression systems and vacuum sweeping to name but a few.

Control measures essential to ensure the health of employees will have a dual effect in that it will also mitigate the environmental impact.

11.1.9 Recommendations Relating to Interested and Affected Parties

Most impacts on interested and affected parties that may result from the proposed project are related to environmental components such as surface water, air quality, noise etc, which have been addressed above. Any issues received further will be addressed in the final EIA/EMP.

11.2 Objectives of this Report

The objectives for this report were outlined in Section 1.4. These objectives were as follows:

Present information to the authorities about the proposed project.

Provide information regarding alternatives that have been considered by Anglo Operations (Pty) Limited.

Show how interested and affected parties will be afforded the opportunity to contribute to the project, to comment on the findings of the impact assessment and show that their issues were considered.

Describe the baseline environment. A description of the receiving environment is given in Section 3.

Describe the extent of environmental consequences for the construction, operating and closure phases. A summary of the impact assessment findings, for construction, operation and decommissioning, is given in Section 8.

Proposed Mitigation Measures for impacts that are considered significant. Mitigation Measures are outlined in Section 8 . A summary of recommendations is given in Section 11.1 above.

Describe the environmental feasibility of the proposed project – the potential negative impacts relating to environment can be mitigated appropriately while significant socio-economic benefits to the country could be realised if the project proceeds.

Present findings of the EIA/EMP in a manner that facilitates decision-making. The completeness of information for decision-making is outlined in Section 8.4 below.

11.3 Environmental Feasibility of the Proposed Project

Based on the environmental assessment conducted as described in this Report, there are no significant environmental impacts associated with the proposed project that cannot be mitigated.

11.4 Completeness of Information

The environment that is likely to be affected by the proposed Access Brown Shaft II project was detailed in section 3. Due the area being disturbed by mining activity and is currently a mining area, the approved EMPR was used to determine what had existed in the area as well as all relevant specialist studies were conducted to determine the status quo of the environment within and around the proposed Access Brown Shaft II project area.

Hence no knowledge gaps exist in terms of the current state of the environment. There is however some limitations with regard to the determination of the future state of the studied environmental aspects.

SECTION EIGHT

Statutory Requirements

12. STATUTORY REQUIREMENTS

All activities within the proposed area has been evaluated and activities listed in terms of the EIA Regulations and Section 24 (7) of the National Environmental Management Act, 1998 (Act 107 of 1998) have been identified and relevant authorisation have been applied for.

Any other statuary requirements identified by the interested and affected parties will be verified and if necessary relevant authorisations applied for.

ATTACHMENT 1

Figure 1: Regional Setting

ATTACHMENT 2

Figure 2: Typical Stratigraphic Column of Access Brown Shaft II

ATTACHMENT 3

Figure 3: Soil Land form map for the Access Brown Shaft II area

ATTACHMENT 4

Figure 4: Land Capability map for the Access Brown Shaft II area

ATTACHMENT 5

Figure 5: Location of the Access Brown Shaft II area within the DWEA drainage regions

ATTACHMENT 6

Figure 6: Catchment Delineation for the Proposed Brown Shaft II underground mining project

ATTACHMENT 7

Figure 7: The delineated wetland areas for Bank Colliery

ATTACHMENT 8

Figure 8: The HGM units associated with Bank Colliery

ATTACHMENT 9

Figure 9: Positions of Hydrocensus Monitored Points

ATTACHMENT 10

Figure 10: Correlation Graph between static water level and topography

ATTACHMENT 11

Figure 11: Static Groundwater levels – Pre mining

ATTACHMENT 12

Figure 12: Groundwater Flow Directions - Pre mining

ATTACHMENT 13

Figure 13: Results of Major Cation and Anion Analyses

ATTACHMENT 14

Figure 14: Pie Diagrams

ATTACHMENT 15

Figure 15: Stiff Diagram

ATTACHMENT 16

Figure 16: Piper diagram

ATTACHMENT 17

Figure 17: Site map indicating the regional locality of the proposed development

ATTACHMENT 18

Figure 18: Aerial image indicating potentially noise-sensitive receptors near proposed development

ATTACHMENT 19

Figure 19: Conceptual construction layout