ANGLO OPERATIONS PROPRIETARY LIMITED: GREENSIDE COLLIERY: NEW DISCARD FACILITY

Environmental Impact Assessment and Environmental Management Programme

DARDLEA Reference number: 17/2/3N-205

Date: March 2015

SHANGONI
Management Services (Pty) Ltd

www.shangoni.co.za

ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAMME

ANGLO OPERATIONS PROPRIETARY LIMITED: GREENSIDE COLLIERY: NEW DISCARD FACILITY

ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAMME

Date: March 2015

Unit C8, Block @ Nature
472 Botterklapper Street
Pretoria

Office: + 27 (0)12 807 7036
Fax: +27 (0)12 807 1014

Shangoni Management Services (Pty) Ltd

PROJECT DETAILS

Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs. (MDARDLEA)

Reference No.: 17/2/3N-205

Project Title: Greenside Colliery: New Discard Facility: Environmental Impact Assessment and Environmental Management Programme

Project Number: ANG-GRE-14-02-18

Compiled by: Minnette Le Roux

Date: March 2015

Technical Reviewer: Jan Nel

Jan Nel

EXECUTIVE SUMMARY

The Applicant:

Greenside Colliery is a coal mine that is managed by Anglo American Thermal Coal, a Division of Anglo Operations Proprietary Limited (AOPL).

Historically, this Colliery was acquired by Anglo American Thermal Coal in 1998 from Gold Fields Coal Limited. This acquisition forms part of Anglo American Thermal Coal's overall strategy to rationalise mining related to the Greenside, Kleinkopje and Navigation Collieries.

The Greenside underground mining operation was established to supply coal via the Richards Bay Coal Terminal to various overseas markets. In accordance with Anglo American Thermal Coal Policy, Greenside Colliery also supplies a small amount of coal to the inland markets. Greenside Colliery produces steam and metallurgical coal for the export and domestic markets (from the No. 4 Seam) using the bord-and-pillar underground mining method.

Background description:

The acquisition in 1998 resulted in changes to the planned Life of Mine (LOM), upon which it became necessary to upgrade and extend the current discards disposal facility to accommodate the updated LOM, that was forecasted to 2035 (i.e. 37 years from 1998). A feasibility study was conducted during 2000 by the consulting engineers, Wates, Meiring and Barnard. This study concluded that the current discard facility would not be able to accommodate the discards for the full LOM; the best option would be to extend the existing facility as far as possible.

The current LOM is 10 years at full production with an average of 4.8 Million tons (Mt) Run of Mine (ROM) annually, delivering an average of 2.8 saleable Mt per annum until 2021 and 2.3 Mt in 2022. The current active coal discard disposal facility is situated above the old and future underground workings.

During a recent reassessment of the LOM design of the discard facility it was ascertained that historical mining methods in the areas beneath the facility had not taken into account the planned extent and height of the discard facility, as well as the impact of the facility on the stability of pillars in the mined areas. Subsequently an extensive exercise was completed to accurately ascertain the safety factors of the pillars underneath the discard facility. It was determined that the current safety factors of the pillars would not be able to support the discard facility should it be raised to full height according to the design.

The discard facility has minimal potential for further increases in height. The design was based on a maximum discards deposition rate of 110 000 tonnes per month, and a maximum fines deposition rate of 27 000 tonnes per month. However, the quantity of fines exceeded these predictions, requiring additional containment to be built up by upstream impoundment construction methods. In order to continue with discards disposal operations, the mine has extended the dump into the old housing areas to the south west.

The proposed new discard facility project was initiated as a result of limited volumetric air space remaining on the current active coal discard disposal facility.

Location:

The Greenside Colliery is situated approximately 15 km southwest of eMalahleni in the eMalahleni Local Municipality of the Nkangala District Municipality in the Mpumalanga Province.

The proposed new discard facility and associated infrastructure will be mainly located on Portion 0, 2 and 3 of the farm Groenfontein 331 JS.

Project description:

The new discard facility is required to accommodate the LOM discard tonnages, as well as possible LOM extension tonnages. The discard facility will be able to accommodate some 35 Mt of discards.

The designs of the facility will require the following associated infrastructure:

- An Overland Conveyor System;
- Bridge crossing;
- Discard Silo;
- Haul roads;
- Dirty and Clean Water Separation Systems;
- The Workshop and associated Offices Complex;
- Power Lines; and
- Water supply.

High level designs have been developed for the proposed new discard facility and the associated infrastructure, these designs are presented in Appendix A. The objectives of these designs are to produce an environmentally acceptable, economically constructed and operated disposal facility. The specific goals for developing high level designs for the new discard facility and associated infrastructure are listed as follows:

- Positioned as close as possible to the coal beneficiation plant.
- Require minimum capital expenditure.
- Be simple and economical to operate.

- Minimise surface and ground water pollution.
- Minimise the impact on the environment during the entire facility life cycle.

Process:

As part of the proposed new discard facility project listed activities defined under the National Environmental Management Act, Act 107 of 1998 (NEMA, 1998) and the regulations thereunder will take place.

In order to obtain environmental authorisation, a Scoping Report and an Environmental Impact Assessment Report (EIR) must be compiled as described in terms of Regulations 26 to 35 of the Environmental Impact Assessment Regulations, 2010 promulgated in terms of Section 24(5), 24M and 44 of the NEMA, 1998.

It is the intention of this EIR (which has been compiled in terms of the NEMA, 1998) to provide the necessary information pertaining to the proposed activities associated with the project, as required in terms of the Environmental Impact Assessment Regulations (EIA Regulations R543: EIA Regulations in terms of Chapter 5 of the NEMA, 1998, dated June 2010) under the NEMA, 1998. This EIR intends to highlight all information relevant to the proposed new discard facility only, since the existing operations has been fully described in the approved Environmental Impact Assessment (EIA) and Environmental Management Programme (EMP) Reports under the NEMA, 1998 and the Mineral and Petroleum Resources Development Act, Act 28 of 2002 (MPRDA, 2002) respectively.

Anticipated impacts:

Regulation 31 (of Regulation 543) of the EIA Regulations, 2010, under NEMA, 1998, requires that an EIR includes an assessment of the status, extent, duration, probability, reversibility, replaceability of resources, and mitigatory potential of the major potential environmental impacts of the proposed project be undertaken.

The identification and prediction of the nature of each impact, the evaluation of each impact by rating its significance and the management and mitigation measures adopted to address each impact, have been assessed during the EIR.

The activities associated with the proposed project are described in full in Part 3 and the anticipated impacts of the proposed project are described in Part 7.

The major impacts that are expected to occur as a result of the anticipated activities as part of the proposed project within the existing mine boundary area, may combine with impacts resulting from surrounding activities and land uses to form cumulative impacts, or to contribute to cumulative impacts that already exist. Regulation 28 (g) (of Regulation 543) of the EIA Regulations dated 2010, under the NEMA, 1998 requires that cumulative impacts are also considered. Refer to Part 7.4 for a description of the Cumulative impacts.

The table below provides a summary of significant environmental impacts that after mitigation, will remain of high significance.

TOPOGRAPHY	
Permanent change in topography: The proposed new discard dump will reach a maximum height of 55 metres. The facility will be developed from the lowest point adjacent to the N12 highway and progressively developed towards the south As the development of the discard facility progress this will cause a permanent change in the topography. This change in topography will continue until post closure.	H
SURFACE WATER	
Receiving Surface Environment: Impacts on surface water quality due to erosion, affected water runoff and loss of catchment. If not mitigated the impact may be irreversible.	H
GROUNDWATER	
Utilisation of the discard dump A range of scenarios involving alternative measures for seepage flux control during the operation of the 3A North discard dump. These options have included simulation of the effects of a basal liner, plus a range of covers of variable efficiency. The conclusion drawn from this exercise is that basal liner emplacement, while forming the only viable measure for infiltration control during active operations, is likely to result in adverse geotechnical stability conditions, in conjunction with underground mining. It is therefore considered preferable to defer infiltration/seepage control to closure, at which time a low permeability engineered cover should be installed. In the absence of a basal liner, an alternative approach to impact mitigation during operations may viably involve gradient reversal via the construction of a pumping well curtain down-gradient of the dump. This would effectively isolate the contaminant plume associated with operational phase seepage to the immediate vicinity of the dump footprint.	H
AIR QUALITY	
Mine Operation Greenside Colliery is primarily an underground bord and pillar mine, minimising surface dust fallout. However, the inherent air quality of the area is considered poor and is impacted on by the activities of adjacent collieries, industry, and vehicle use and veld fires. Furthermore, dust generation occurs from the discard existing discard dump on-site. Under the assumption of background conditions remaining the same as for the construction phase (low PM concentrations) the operational phase would result in mainly incremental	H

impacts as the progressive development of the discard dump will add to the impacts on the air quality of the area.	

The project will result in a number of positive impacts that relate primarily to economic growth and job creation as reflected in the table below.

SOCIO-ECONOMIC	
The products from the mining operations at Greenside Colliery are sold to the South African and international markets. SACE employs more than 600 people at Greenside Colliery. The existing education programme implemented at the mine comprises of the following elements: • New schools. • Adult education. • Vegetable garden. • Life skills inclusive of sewing, cooking, health, environmental awareness and entrepreneurial skills. • Community schools. The safe continuation of the mining and related activities at the Greenside Colliery continues employment of staff at the Greenside Colliery as well as the continued supply of coal to the local market. As a result of the multiplier effect, the continued operation of the existing Greenside Colliery will benefit the local, regional and national economy. Should Greenside Colliery not construct the new Discard Dump they may be forced to cease operation. Should this have occurred, jobs of personnel currently employed will be lost and the local, regional and national economic benefits of the continuation of the mining and related activities would have been lost. Mine closure will raise unemployment levels in the region, and would increase significantly as more mines close down.	Positive

Content of the report:

This EIR (compiled in terms of the NEMA, 1998) is divided into the following parts:

- Part 1: Introduction.
- Part 2: Governance framework
- Part 3: Description of the project
- Part 4: Description of the existing environment.
- Part 5: Public Participation Process.

- Part 6: Description of alternatives.
- Part 7: Environmental Impact Assessment and Environmental Impact Statement.
- Part 8: Environmental Management programme
- Part 9: Emergency and Remediation Procedure
- Part 10: Monitoring and Auditing
- Part 11: Mine Closure and Financial Provisioning
- Part 12: Environmental Awareness Plan
- Part 13: Assumptions, Uncertainties and Knowledge Gaps.
- Part 14: Discussion and Conclusion.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

APPENDIX F:

REFERENCES

AGIS Comprehensive Atlas. www.agis.agric.za/agismap_atlas/AtlasViewer.

Anglo Operations Ltd (2010). Social and Labour Plan Greenside Colliery.

Clean Stream Environmental Consultants, 2011: Greenside Colliery IWWMP.

Clean Stream Scientific Services, 2010. Greenside Colliery: Surface and Groundwater Quality Assessment Report. November 2010.

Conservation of the Agricultural Resources Act, 1983 (Act 43 of 1989), Republic of South Africa.

Constitution of South Africa, 1996 (Act No. 108 of 1996).

Department of Agriculture & Land Administration Mpumalanga Province (2005) Resource Information Report: Mpumalanga.

Department of Agriculture and Land Administation (DALA) (2005). Integrated Resource Information Report: Emalahleni, Resource management and land use planning. Ermelo: DWAF.

Department of Environmental Affairs and Tourism, 2006: *Guideline 5: Assessment of Alternatives and Impacts in support of the Environmental Impact Assessment Regulations, 2006. Integrated Environmental Management Guideline Series*, Department of Environmental Affairs and Tourism, Pretoria.

Department of Water Affairs (2007). Best Practice Guideline A4: Pollution Control Dams, dated August 2007.

Department of Water Affairs and Forestry (1996). South African Water Quality Guideline Series. Second edition, 1996.

Department of Water Affairs and Forestry (1999) a. Resource Directed Measures for Protection of Water Resources. Volume 4. Wetland Ecosystems Version 1.0, Pretoria.

Department of Water Affairs and Forestry (1999)b. Resource Directed Measures for Protection of Water Resources. Volume 1. River Ecosystems Version 1.0, Pretoria.

Department of Water Affairs and Forestry (DWAF) (1996). South African Water Quality Guidelines (second edition). Volume 6: Agricultural water use: Aquaculture.

Department of Water Affairs and Forestry and the Department of Health, 1998, Quality of Domestic Water Supplies, Volume 01: Assessment Guide.

Department of Water Affairs and Forestry, 1996. South African Water Quality Guidelines, Volume 01: Domestic Use.

Department of Water Affairs and Forestry, 1996. South African Water Quality Guidelines, Volume 07: Aquatic Ecosystems.

Department of Water Affairs and Forestry, 1996: South African Water Quality Guidelines (second edition). Volume1: Domestic Use.

Department of Water Affairs and Forestry, 1996: South African Water Quality Guidelines. 2ndEdition. Volume1: Domestic Use.

Department of Water Affairs and Forestry, 2000: Best Practice Guideline No. 1.2. Storm Water Management.

Department of Water Affairs and Forestry, 2000: Guideline for the implementation of Regulations on use of water for mining and related activities aimed at the protection of water resources: Operational Guideline No. M6.1. 2nd Edition.

Department of Water Affairs and Forestry, 2000: Water Use Authorisation process (individual applications). Edition 1: Final draft for implementation and use, Revision 3.

Department of Water Affairs and Forestry, 2000: Water Use Authorisation Process (Individual Applications). Edition 1: Final draft for implementation and use.

Department of Water Affairs and Forestry, 2004: Best Practice Guideline No. 1.1. Integrated Mine Water and Waste Management.

Department of Water Affairs and Forestry, 2006. Best Practice Guideline G1 Storm Water Management.

Department of Water Affairs and Forestry, 2006. Best Practice Guideline H3: Water Reuse and Reclamation.

Department of Water Affairs and Forestry, 2006. Best Practice Guideline G2: Water and Salt Balances.
Department of Water Affairs and Forestry, 2006. Best Practice Guideline G3. Water Monitoring Systems.

Department of Water Affairs and Forestry, 2006: Best Practice Guideline G1: Storm Water Management. August 2006.

Department of Water Affairs and Forestry, 2006: Best Practice Guideline G2: Water and Salt Balances. August 2006.

Department of Water Affairs and Forestry, 2006: Best Practice Guideline G3: Water Monitoring Systems. July 2007.

Department of Water Affairs and Forestry, 2006: Best Practice Guideline G1: Water Reuse and Reclamation. June 2006.

Department of Water Affairs and Forestry, 2007. Best Practice Guideline H2: Pollution Prevention and Minimisation of Impacts.

Department of Water Affairs and Forestry, 2007: Best Practice Guideline A3: Water management for hydrometallurgical plants. July 2007.

Department of Water Affairs and Forestry, 2008. Licence in terms of Chapter 4 of the National Water Act, 1998 (Act 36 of 1998). Licence No. 10080315.

Department of Water Affairs and Forestry. 1999. Government Notice 704, dated June 1999, under the National Water Act, 1998 (Act 36 of 1998). June 1999.

Department of Water Affairs and Forestry. Best Practice Guidelines Series G3: General Guidelines for Water Monitoring Systems.

Department of Water Affairs, Sub-directorate Groundwater Reserve Requirements, 2010. http://www.dwa.gov.za/Groundwater/GroundwaterOffices/ResourceDirectedMeasures_RDM/Current Research Development Projects Programmes RDM.pdf

Development Facilitation Act, 1995 (Act 67 of 1995), Republic of South Africa.

Digby Wells Environmental, 2013: An ecological assessment of wetland areas associated with the proposed new discard disposal facility at Greenside Colliery: Anglo American Thermal Coal.

Emalahleni Local Municipality (2008). Integrated Development Plan. 2008.

Emalahleni Local Municipality (2008). Municipal Housing Development Plan Final Report. July 2008.

Environment Conservation Act, 1989 (Act 73 of 1989), Republic of South Africa.

Environmental Potential atlas, Department of Environment and Tourism, www.environment.gov.za/Maps/EnvAtlas/Maps_EnvAtlas_contents.htm.

General Authorisations GN 399, 2004. Revision of General Authorisations in terms of Section 39 of the National Water Act, 1998 (Act 36 of 1998).

Geohydrological Study at Greenside Colliery as input to the development and impact assessment for a new discard dump", dated April 2013 and compiled by Groundwater Complete.

Government Gazette No 20526, 8 October 1999. Government Notice No 1191. General Authorisations in terms of Section 39 of the National Water Act, 1998 (Act 36 of 1998).

Groundwater Complete, 2010. Comprehensive assessment of groundwater monitoring program: Anglo Coal Greenside Colliery. November 2010

Groundwater Complete, 2013: Geohydrological study at Greenside Colliery as input to the development and impact assessment for a new discard dump.

Health Act, 1977 (Act 63 of 1977), Republic of South Africa.

ISO 5667-1: 2006 Part 1: Guidance on the design of sampling programs and sampling techniques.

ISO 5667-11: 1993 Part 11: Guidance on sampling of groundwaters.

ISO 5667-3: 2003 Part 3: Guidance on preservation and handling of samples.

ISO 5667-6: 2005 Part 6: Guidance on sampling of rivers and streams.

IUCN (2001) IUCN Red List Categories and Criteria: Version 3.1. IUCN Species Survival Commission,

IUCN (2003) Guidelines for Application of IUCN Red List Criteria at Regional Levels: Version 3.0.

IUCN Species Survival Commission, IUCN, Gland, Switzerland and Cambridge, UK.

IUCN, Gland, Switzerland and Cambridge, UK.

Low, A.B. & Rebelo, A.G., 1998: *Vegetation of South Africa, Lesotho and Swaziland.* Sterlitzia 19.

Mine Health and Safety Act, 1996 (Act 26 of 1996), Republic of South Africa.

Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002), Republic of South Africa.

Mineral and Petroleum Resources Development Regulations, 2004 (R.527, Government Gazette No 26275 of 23 April 2004), Republic of South Africa.

Mpumalanga Department of Agriculture, Conservation and Environment. (2003). 2003 Mpumalanga State of the Environment Report. Mpumalanga Department of Agriculture, Conservation and Environment, Nelspruit.

Mpumalanga Nature Conservation Act, 1998 (Act 10 of 1998), Republic of South Africa.

Mpumalanga Province, State of the Environment Report, 2003.

Mucina, L. & Rutherford, C, 2006. *The Vegetation of South Africa, Lesotho and Swaziland*. Strelitzia 19. Pretoria: National Biodiversity Institute.

National Environmental Laws Amendment Act, 2008 (Act 44 of 2008), Republic of South Africa.

National Environmental Management Act, 1998 (Act 107 of 1998).

National Environmental Management Act, 1998 (Act 107 of 1998) Environmental Impact Assessment Regulations, 2010 (R.543, Government Gazette No. 33306 of 18 June 2010), Republic of South Africa.

National Environmental Management Act, 1998 (Act 107 of 1998) Listing Notice 1: List of activities and competent authorities identified in terms of Section 24(2) and 24D, 2010 (R.544, Government Gazette No. 33306 of 18 June 2010), Republic of South Africa.

National Environmental Management Act, 1998 (Act 107 of 1998) Listing Notice 2: List of activities and competent authorities identified in terms of Section 24(2) and 24D, 2010 (R.545, Government Gazette No. 33306 of 18 June 2010), Republic of South Africa.

National Environmental Management Act, 1998 (Act 107 of 1998) Listing Notice 3: List of activities and competent authorities identified in terms of Section 24(2) and 24D, 2010 (R.546, Government Gazette No. 33306 of 18 June 2010), Republic of South Africa.

National Environmental Management Act, 1998 (Act 107 of 1998), Republic of South Africa.

National Environmental Management: Air Quality Act, 2004 (Act 39 of 2004), Republic of South Africa.

National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004), Republic of South Africa.

National Environmental Management: Waste Act, 2008 (Act 59 of 2008) List of Waste Management Activities that have, or are likely to have a detrimental effect on the environment, 2009 (R.718, Government Gazette 32368of 3 July 2009), Republic of South Africa.

National Environmental Management: Waste Act, 2008 (Act 59 of 2008), Republic of South Africa.
National Water Act, 1998 (Act 36 of 1998), Republic of South Africa.

Natural Heritage Resources Act, 1999 (Act 25 of 1999), Republic of South Africa.

Palmer, R. W., Turpie, J., Marnewick, G.C. & Batchelor, A. L. (2002). Ecological and economic evaluation of wetlands in the Upper Olifants River Catchment, South Africa. WRC Report No. 1162/1/02.

Promotion of Access to Information Act, 2000 (Act 2 of 2000), Republic of South Africa.

Promotion of Administrative Justice Act, 2002 (Act 3 of 2000), Republic of South Africa.

Regulations on Use of Water for Mining and Related Activities Aimed at the Protection of Water Resources Act, 1999 (Act 704 of 1999) under National Water Act, 1998 (Act 36 of 1998).

Schlumberger Water Services, 2014: Greenside Colliery 3A North Discard Dump: Seepage flux and chemical quality prediction.

Standards South Africa (SABS), 2006. South African National Standard: Drinking Water. (SANS241:2006).

The Constitution of the Republic of South Africa, 1996 (Act 108 of 1996), Republic of South Africa.
Wates, Meiring and Barnard, 2002. Block 3A North Extension. June 2002.

World Health Organization, 2006. Guidelines for drinking water quality, Volume 01.

DEFINITIONS

Environment

The surroundings (biophysical, social and economic) within which humans exist and that are made up of

- the land, water and atmosphere of the earth;
- micro-organisms, plant and animal life;
- any part or combination of (i) and (ii) and the interrelationships among and between them; and
- the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing.

Environmental Aspects

Elements of an organisation's activities, products or services that can interact with the environment.

Environmental Degradation

Refers to pollution, disturbance, resource depletion, loss of biodiversity, and other kinds of environmental damage; usually refers to damage occurring accidentally or intentionally as a result of human activities.

Environmental Impacts

Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's activities, products or services.

Environmental Impact Assessment

Means a systematic process of identifying, assessing and reporting environmental impacts associated with an activity and includes basic assessment and S&EIR;.

Environmental Impact Report

A report assessing the potential significant impacts as identified during the environmental impact assessment.

Environmental impact

An environmental change caused by some human act.

Land use

The various ways in which land may be employed or occupied. Planners compile, classify, study and analyse land use data for many purposes, including the identification of trends, the forecasting of space and infrastructure requirements, the provision of adequate land area for necessary types of land use, and the development or revision of comprehensive plans and land use regulations.

Pollution Prevention

Any activity that reduces or eliminates pollutants prior to recycling, treatment, control or disposal.

Public Participation Process

A process of involving the public in order to identify needs, address concerns, in order to contribute to more informed decision making relating to a proposed project, programme or development.

Topography

Topography, a term in geography, refers to the "lay of the land" or the physio-geographic characteristics of land in terms of elevation, slope and orientation.

Vegetation

All of the plants growing in and characterising a specific area or region; the combination of different plant communities found there.

Waste

'waste' means—

a) any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 to the National Environmental Management: Waste Amendment Act, 2014; or
b) any other substance, material or object that is not included in Schedule 3 that may be defined as a waste by the Minister by notice in the Gazette

Residue Stockpile

Residue stockpile means any debris, discard, tailings, slimes, screening, slurry, waste rock, foundry sand, beneficiation plant waste, ash or any other product derived from or incidental to a mining operation and which is stockpiled, stored or accumulated for potential re-use, or which is disposed of, by the holder of a mining right, mining permit, production right or an old order right.

Residue Deposit

Residue deposit means any residue stockpile remaining at the termination, cancelation or expiry of a prospecting right, mining right, mining permit, exploration right, production right or an old order right.

ABBREVIATIONS

AMD	Acid Mine Drainage
ADT	Articulated Dump Trucks
AOPL	Anglo Operations Proprietary Limited
AEMC	Attainable Ecological Management Classes
ARC	Agricultural Research Council
BID	Background Information Document
CBD	Central Business District
CRR	Comments and Response Report
DARDLEA	Department of Agriculture, Rural Development, Land and Environmental Affairs
DWA	Department of Water Affairs
DWS	Department of Water and Sanitation
DMR	Department of Mineral Resources
DoA	National Department of Agriculture
EAP	Environmental Assessment Practitioner
EA Plan	Environmental Awareness Plan
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EIR	Environmental Impact Report
ELM	Emahlaleni Local Municipality
EMC	Ecological Management Class
EMF	Environmental Management Framework
EMP	Environmental Management Programme
GN	Government Notice
IDP	Integrated Development Plan
IWULA	Integrated Water Use Licence Application
IWWMP	Integrated Water and Waste Management Plan
ISCW	Institute for Soil Climate and Water
I&AP	Interested and Affected Party
KM	Kilometres
KV	Kilovolts
LOM	Life of Mine
MAMSL	Metres Above Mean Sea Level
MAP	Mean Annual Precipitation
MAE	Mean Annual Evaporation
MM	Millimetres
MDEDET	Mpumalanga Department of Economic Development, Environment and Tourism
MPRDA	Mineral and Petroleum Resources Development Act, Act 28 of 2002
MPRDR	Mineral and Petroleum Resource Development Regulations R 527, dated April 2004
MPTA	Mpumalanga Tourism and Parks Agency
MT	Million Tons
MWP	Mining Works Programme

NEMA	National Environmental Management Act, Act 107 of 1998 as amended
PES	Present Ecological State
PPP	Public Participation Process
R	Regulation
RE	Remaining Extent
RLT	Rapid Loading Terminal
ROM	Run of Mine
SASS	South African Scoring System
S&EIR	Scoping and Environmental Impact Report

1. INTRODUCTION

Greenside Colliery is a coal mine that is managed by Anglo American Thermal Coal, a Division of Anglo Operations Proprietary Limited (AOPL).

Historically, this Colliery was acquired by Anglo American Thermal Coal in 1998 from Gold Fields Coal Limited. This acquisition forms part of Anglo American Thermal Coal's overall strategy to rationalise mining related to the Greenside, Kleinkopje and Navigation Collieries.

The Greenside underground mining operation was established to supply coal via the Richards Bay Coal Terminal to various overseas markets. In accordance with Anglo American Thermal Coal Policy, Greenside Colliery also supplies a small amount of coal to the inland markets. Greenside Colliery produces steam and metallurgical coal for the export and domestic markets (from the No. 4 Seam) using the bord-and-pillar underground mining method.

The acquisition in 1998 resulted in changes to the planned Life of Mine (LOM), upon which it became necessary to upgrade and extend the current discards disposal facility to accommodate the updated LOM, that was forecasted to 2035 (i.e. 37 years from 1998). A feasibility study was conducted during 2000 by the consulting engineers, Wates, Meiring and Barnard. This study concluded that the current discard facility would not be able to accommodate the discards for the full LOM; the best option would be to extend the existing facility as far as possible.

In order to continue with discards disposal operations, the mine has needed to extend the existing dump into the old housing areas to the south west.

The proposed new discard disposal facility project was initiated as a result of limited volumetric air space remaining on the active dump.

It is the intention of this EIA and EMP (which has been compiled in terms of the NEMA, 1998) to provide the necessary information pertaining to the proposed activities associated with the new discard facility, as required in terms of the EIA Regulations (EIA Regulations R543: Environmental Impact Assessment Regulations in terms of Chapter 5 of the NEMA, 1998, dated June 2010) under the NEMA, 1998. This EIA and EMP intends to highlight all information relevant to the proposed new discard facility only, since the existing operations has been fully described in the current approved Environmental Impact Assessment (EIA) and Environmental Management Programme (EMP) under the Mineral and Petroleum Resources Development Act, Act 28 of 2002 (MPRDA, 2002) and NEMA, 1998.

The EIA process, which is undertaken subsequent to the Scoping Process, is conducted in accordance with Regulations 31 of the Environmental Impact Assessment Regulations, (2010) under the NEMA, 1998. The Environmental Impact Assessment (EIA) for the proposed project include detailed information pertaining to anticipated or potential impacts that may be associated with the proposed project.

1.1 PROCESS TO BE FOLLOWED

1.1.1 Objectives of the EIA Process and the EIA

EIA is the procedure, which is undertaken during the final stages of the Planning Phase of a project, and is used to identify, predict and assess the potential environmental impacts of the proposed project on the environment. The EIA is used to inform decision-making. This process is required for the proposed project in terms of the NEMA (1998) and the Environmental Impact Assessment Regulations (2010) there under.

The objectives of the EIA Process are to:

- Provide an opportunity for the Applicant, relevant Authorities and Interested and Affected Parties (I&Aps) to exchange information and express their views and concerns regarding the proposed project before the EIA is undertaken.
- Focus the study on relevant anticipated impacts, propose management and mitigatory action for these anticipated impacts (in the form of an Environmental Management Programme (EMP), record and address issues and concerns generated by Authorities and I&APs (during the required public review period), as well as the provision of reasonable alternatives. This should ensure that the resulting EIA is useful to the Authorities for decision-making, and addresses the impacts, issues and concerns as identified.
- Facilitate an efficient assessment process that saves time, resources and costs.

The objectives of the EIA Report is to provide:

- Provide the Regulatory Authorities with sufficient information to inform decision-making with regards to the proposed project.
- Develop an integrated document for implementation that will aim at efficient environmental management, including the management of possible long-term impacts and the carrying out of rehabilitation-, mitigation- and management measures in such a manner to ensure the long-term sustainability of the rehabilitated surface.

1.1.2 Methodology applied to conducting the EIA process

The EIA Process for the project is carried out in terms of the NEMA (1998). The EIA Process therefore consists of the following:

- After approval of the Scoping Report by the DARDLEA, the EIA process proceeds with the tasks contemplated in the plan of study for environmental impact assessment and prepare an EIR.
- An EIR describing all relevant activities associated with the discard facility and related activities.
- The EIR must be made available to the public for comment for a period of 60 days.

- All comments received from the public during the public consultation period must be noted and recorded as part of the EIR.
- The EIR must be finalised taking all public comments into consideration.
- The EIR must be submitted to the DARDLEA and the I&APs for review.

1.1.3 The EIA in terms of the requirements of the NEMA (1998)

Regulation 31(2) of the EIA Regulations (2010) under the NEMA (1998), lists aspects that must be included in EIR. Table 1 below indicates where the information has been provided as part of the EIR:

Table 1: The EIR in terms of the EIA Regulations (2010), under the NEMA (1998)

Regulation No:		Description	EIA Part
R543 Regulation 31(2)(a)		Details of the Environmental Assessment Practitioner (EAP).	Part 3.2 & Appendix C
	(i)	Details of the EAP who prepared the report.	
	(ii)	Details of the expertise of the EAP to carry out scoping procedures.	
R543 Regulation 31(2)(b)	(b)	A description of the proposed activity.	Part 3.5
R543 Regulation 31(2)(c)		A description of the property on which the activity is to be undertaken and the location of the activity on the property.	Part 3.3
R543 Regulation 31(2)(d)		A description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity.	Part 4
R543 Regulation 31(2)(e)		Details of the public participation process conducted in terms of sub regulation (1), including-	Part 5
	(i)	Steps undertaken in accordance with the plan of study.	
	(ii)	A list of persons, organisations and organs of state that were registered as interested and affected parties;	Part 5
	(iii)	A summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; and	Part 5
	(iv)	Copies of any representations an documents received from registered interested and affected parties;	Part 5
R543 Regulation 31(2)(f)		A description of the need and desirability of the proposed activity.	Part 3.6
R543 Regulation 31(2)(g)		A description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or	Part 6

Regulation No:		Description	EIA Part
		alternatives may have on the environment and the community that may be affected by the activity;	
R543 Regulation 31(2)(h)		An indication of the methodology used in determining the significance of potential environmental impacts;	Part 7
R543 Regulation 31(2)(i)		A description and comparative assessment of all alternatives identified during the impact assessment process;	Part 6
R543 Regulation 31(2)(j)		A summary of the findings and recommendations any specialist report or report on a specialised process;	Part 4 and Part 7
R543 Regulation 31(2)(k)		A description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures;	Part 7
R543 Regulation 31(2)(l)		An assessment of each identified potential significant impact including-	Part 7
	(i)	Cumulative impacts;	
	(ii)	The nature of impacts;	
	(iii)	The extent and duration of the impact;	
	(iv)	The probability of the impact occurring;	
	(v)	the degree to which the impact can be reversed;	
	(vi)	The degree to which the impact may cause irreplaceable loss of resources;	
	(vii)	The degree to which the impact can be mitigated.	
R543 Regulation 31(2)(m)		A description of any assumptions, uncertainties and gaps in knowledge.	Part 13
R543 Regulation 31(2)(n)		A reasoned opinion as to where the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.	Part 14
R543 Regulation 31(2)(o)		An environmental impact statement which contains-	Part 7.5
	(i)	A summary of the key findings of the environmental impact assessment; and	
	(ii)	A comparative assessment of the positive and negative implications of the proposed activity and identified alternatives;	
R543 Regulation 31(2)(p)		A draft environmental management programme containing the aspects contemplated in regulation 33.	Refer to Part 1.1.4 below.
R543 Regulation 31(2)(q)		Copies of any specialist reports and reports on specialised processes complying with regulation 32.	Appendix E*

Regulation No:	Description	EIA Part
R543 Regulation 31(2)(r)	Any specific information required by the competent authority.	Appendix B
R543 Regulation 31(2)(s)	Any other matters required in terms of Section 24(4) (a) and (b) of the Act.	Noted

1.1.4 The EMP in terms of the requirements of the NEMA (1998)

Regulation 33(2) of the EIA Regulations (2010) under the NEMA (1998), lists aspects that must be included in EMP. Table 2 below indicates where the information has been provided as part of the EMP:

Table 2: The EMP in terms of the EIA Regulations (2010), under the NEMA (1998)

Regulation No:		Description	EIA Part
R543 Regulation 33(a)	(a)	Details of	Part 2 & Appendix C
	(i)	the person who prepared the environmental management programme; and	
	(ii)	the expertise of that person to prepare an environmental management programme;	
R543 Regulation 33(b)	(b)	Information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified in a report contemplated by these Regulations, including environmental impacts or objectives in respect of—	Part 8
	(i)	planning and design;	
	(ii)	pre-construction and construction activities;	
	(iii)	operation or undertaking of the activity;	
	(iv)	rehabilitation of the environment; and	
	(v)	closure, where relevant.	
R543 Regulation 33(c)		A detailed description of the aspects of the activity that are covered by the draft environmental management programme;	Part 8
R543 Regulation 33(d)		An identification of the persons who will be responsible for the implementation of the measures contemplated in paragraph (b);	Part 8
R543 Regulation 33(e)		Proposed mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon;	Part 8 and 10
R543 Regulation 33(f)		As far as is reasonably practicable, measures to rehabilitate the environment affected by the	Part 8 and 11

Regulation No:		Description	EIA Part
		undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development, including, where appropriate, concurrent or progressive rehabilitation measures;	
R543 Regulation 33(g)		A description of the manner in which it intends to—	Part 8
	(i)	modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation	
	(ii)	remedy the cause of pollution or degradation and migration of pollutants;	Part 8
	(iii)	comply with any prescribed environmental management	Part 8
	(iv)	comply with any applicable provisions of the Act regarding closure, where applicable;	Part 11
	(v)	comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;	Part 11
R543 Regulation 33(h)		Time periods within which the measures contemplated in the environmental management programme must be implemented;	Part 8
R543 Regulation 33(i)		The process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking a listed activity;	Part 8
R543 Regulation 33(j)		An environmental awareness plan describing the manner in which—	Part 12
	(i)	The applicant intends to inform his or her employees of any environmental risk which may result from their work; and	
	(ii)	Risks must be dealt with in order to avoid pollution or the degradation of the environment;	
R543 Regulation 33(k)		Where appropriate, closure plans, including closure objectives.	Part 11 includes the closure objectives of Greenside Colliery

2 GOVERNANCE FRAMEWORK

According to the NEMA, 1998 authorisation is required prior to the commencement of the proposed new Discard Facility.

As stated, the lead authority will be DARDLEA who will be responsible for granting authorisation for the project. As the proposed project triggers activities outlined in the National Water Act (No. 36 of 1998) and further requires authorisation under the MPRDA, the following additional provincial departments will be consulted:

- DWS; and
- DMR.

As part of the project, and to ensure all relevant South African legislation is taken into cognisance, the following legislation will be considered as part of the environmental authorisation process to ensure legal compliance and best practice.

2.1 NATIONAL ENVIRONMENTAL MANAGEMENT ACT (NO. 107 OF 1998), AS AMENDED

The Act provides for the right to an environment that is not harmful to the health and well-being of South African citizens; the equitable distribution of natural resources, sustainable development, environmental protection and the formulation of environmental management frameworks.

The principles of the Act include:

- Environmental management must place people and their needs at the forefront of its concern;
- Development must be socially, environmentally and economically sustainable;
- Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated;
- Environmental justice must be pursued;
- Equitable access to environmental resources to meet basic human needs and ensure human well-being must be pursued;
- Responsibility for environmental health and safety consequences of a project or activity exists throughout its life cycle;
- The participation of all interested and affected parties in environmental governance must be promoted;
- Decisions must take into account the interests, needs and values of all interested and affected parties;
- The social, economic and environmental impacts of activities, must be considered, assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment;

- Decisions must be made in an open and transparent manner, and access to information must be provided in accordance with the law;
- The environment is held in a public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage;
- The cost of remedying pollution, environmental degradation and consequent adverse health effects must be paid for by the parties responsible for harming the environment; and
- Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar eco-systems require specific attention in management and planning procedures, specifically where they are subject to significant human resource usage and development pressure.

The NEMA, 1998 ensures that specific activities are designed and implemented in a sustainable and environmentally friendly manner, thereby assisting in achieving South Africa's constitutional goal for a better quality of life for all now and in the future. Therefore, it is essential that industries (including mines) improve the efficiency and use of resources, and improve on the level of integration of social, economic and governance systems.

As part of the proposed new discard facility project listed activities defined under the National Environmental Management Act, Act 107 of 1998 (NEMA, 1998) and the regulations thereunder will take place.

The proposed activities would involve the following listed activities as identified in terms of Section 24 and 24D of the NEMA, 1998:

Table 3: Listed Activities in terms of NEMA, 1998

Number and date of the relevant notice	Activity No	Activity Description	Project Description
Government Notice R 544 18 June 2010 Listing Notice 1	9 (i) (ii) a & b	*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*	The dirty water and potable water pipelines, fire water reticulation system for the conveyor, clean and dirty water channels and the sewage water pipeline will be constructed within 32m from the edge of the wetland (defined as a watercourse in the NWA, 1998).

Number and date of the relevant notice	Activity No	Activity Description	Project Description
		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.*	
Government Notice R 544 18 June 2010 Listing Notice 1	11 (ii) (iii) (iv) (x) (xi)	*The construction of:* *(ii) channels;* *(iii) bridges;* *(iv) dams;* *(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.*	The clean and dirty water channels, sewage pipelines, potable water pipelines, pollution control dam, discard silo, workshop, and office complex ,overland conveyor, haul roads, road over the dam wall and parts of the discard facility and access road will be constructed within the 500 metres buffer zone of the wetland areas (within a watercourse). The construction of the silo and the upgrading of the dam wall will take place within 32m of the Greenside Spruit.
Government Notice R 544 18 June 2010 Listing Notice 1	13	*The construction of facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic metres;*	The construction of diesel storage tanks at the workshop/office complex with a capacity to store more than 80 000 litres, but less than 500 000 litre of diesel.
Government Notice R 544 18 June 2010 Listing Notice 1	18 (i)	*The infilling or depositing of any material of more than 5 cubic metres into, or the excavation, removal or moving of soil, sand, or rock from of more than 5 cubic metres from;* *(i) a watercourse;*	The construction of the clean and dirty water channels, sewage pipelines, potable water pipelines, pollution control dam, discard silo, workshop, and office complex, overland conveyor, haul roads, road over the dam wall and parts of the discard facility may result in the infilling or depositing of any material of more than 5 cubic metres into, or the excavation,

Number and date of the relevant notice	Activity No	Activity Description	Project Description
			removal or moving of soil, sand, or rock from more than 5 cubic metres from a watercourse.
Government Notice R 544 18 June 2010 Listing Notice 1	22 (ii)	*The construction of a road, outside urban areas,* *(ii) where no reserve exists where the road is wider than 8 metres,*	The construction of haul roads for haul trucks to transport discard from the silo to the discard facility. The tarred access roads to the site will also be constructed which is wider than 8 metres.
Government Notice R 544 18 June 2010 Listing Notice 1	28	*The expansion of or changes to existing facilities for any process or activity where such expansion or changes will result in the need for a new permit or license in terms of national or provincial legislation governing the release of emissions or pollution, excluding where the facility, process or activity is 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 dam wall upgrade and the upgrading of the existing access road within a watercourse constitutes a Section 21 Water Use that requires a Licence in terms of the NWA, 1998.
Government Notice R 544 18 June 2010 Listing Notice 1	39 (iii)	*The expansion of* *(iii) bridges;* *within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, where such expansion will result in an increased development footprint but excluding where such expansion will occur behind the development setback line.*	The existing road over the dam wall (which act as a bridge) will be expanded to accommodate haul trucks to transport discard from the silo to the discard facility. This dam wall is located within the Greensidespruit.
Government Notice R 544 18 June 2010 Listing Notice 1	47 (ii)	*The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre -* *(ii) where no reserve exists, where the existing road is wider than 8 metres –*	The upgrading of the existing road over the Greensidespruit to accommodate for hauling of discard from the silo to the discard dump. The access roads to the site will also be lengthened and/or widened.

Number and date of the relevant notice	Activity No	Activity Description	Project Description
		excluding widening or lengthening occurring inside urban areas.	
Government Notice R 544 18 June 2010 Listing Notice 1	55 (i)	*The expansion of a dam where: (i) the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, was originally 5 metres or higher and where the height of the wall is increased by 2,5 metres or more;*	Expansion of the road on the dam wall at Greensidespruit to be used for haul trucks, the dam wall will be increased in height by more than 2, 5 meters.
Government Notice R 545 18 June 2010 Listing Notice 2	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 discard facility and related infrastructure constitutes a Section 21 Water Use that requires a Licence in terms of the NWA, 1998. Refer to Part 2.3 for a detailed description of each activity.
Government Notice R 546 18 June 2010 Listing Notice 3	16 (iii) (iv) (a) (ii) (dd)	*The construction of: (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) In Eastern Cape, Free State, KwaZulu-Natal, Limpopo, Mpumalanga and Northern Cape:*	The clean and dirty water channels, sewage pipelines, potable water pipelines, pollution control dam, discard silo, workshop, and office complex ,overland conveyor, haul roads, road over the dam wall, parts of the access road and discard facility may be constructed within the 500 metres buffer zone of the wetland areas. The John Cairn reserve was declared as a private nature reserve in 1970 under the old Transvaal Nature

Number and date of the relevant notice	Activity No	Activity Description	Project Description
		ii. Outside urban areas, in: *(dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;*	Conservation Ordinance, Ordinance 17 of 1967. The reserve covers Portion 2 of the Farm Groenfontein 331 JS.
Government Notice R 546 18 June 2010 Listing Notice 3	19 (ii) (cc) (gg)	*The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre. (a) In Eastern Cape, Free State, KwaZulu-Natal, Limpopo, Mpumalanga and Northern Cape provinces: ii. Outside urban areas, in: (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core of a biosphere reserve.*	The existing haul road on the dam wall in the Greensidespruit is to be upgraded for haul trucks and the access road is being upgraded both these are situated in an approximate distance of 1 km from protected areas (.Ezemvelo, Witbank and Loskopdam Nature Reserves) the wetlands in which these activities are taking place are identified as national Freshwater Ecosystem Priority Areas.

In order to obtain environmental authorisation, a Scoping Report and an Environmental Impact Assessment (EIA) have been compiled as described in Regulations 26 to 35 of the EIA Regulations, 2010 promulgated in terms of Section 24(5), 24M and 44 of the NEMA, 1998.

2.2 MINERALS AND PETROLEUM RESOURCES DEVELOPMENT ACT (NO. 28 OF 2002)

In terms of the previous mining legislation in South Africa, mineral rights were held privately and in some instances by the state. The Mineral and Petroleum Resources Development Act (MPRDA) now vests all mineral rights in the state.

The MPRDA has a number of objectives, including to:

- Promote equitable access to the nation's mineral and petroleum resources to all the people of South Africa;
- Substantially and meaningfully expand opportunities for historically disadvantaged persons, including women, to enter the mineral and petroleum industries and to benefit from the exploitation of the nation's mineral and petroleum resources;

- Promote economic growth and mineral and petroleum resources development in the country;
- Provide for security of tenure in respect of prospecting, exploration, mining and production operations;
- Give effect to section 24 of the Constitution of South Africa by ensuring that the nation’s mineral and petroleum resources are developed in an orderly and ecologically sustainable manner while promoting justifiable social and economic development; and
- Ensure that holders of mining and production rights contribute towards the socio-economic development of the areas in which they are operating.

Although Greenside Colliery has received a mining right under the MPRDA, the proposed activities need to be addended to the authorised environmental management programme report EMPR and authorised by the Mpumalanga DMR. The financial provision has been included in Appendix F and will also be included as part of the EMP addendum. Shangoni Management Services (Pty) Ltd will submit the EMP addendum to the DMR for authorisation in accordance with the MPRDA.

2.3 NATIONAL WATER ACT (NO. 36 OF 1998)

The National Water Act (NWA) provides for fundamental reformation of legislation relating to water resources and use.

The preamble to the Act recognizes that the ultimate aim of water resource management is to achieve sustainable use of water for the benefit of all users and that the protection of the quality of water resources is necessary to ensure sustainability of the nation’s water resources in the interests of all water users. The purpose of the Act is stated, in
Section 2 as, *inter alia:*

- Promoting the efficient, sustainable and beneficial use of water in the public interest;
- Facilitating social and economic development;
- Protecting aquatic and associated ecosystems and their biological diversity;
- Reducing and preventing pollution and degradation of water resources; and
- Meeting international obligations.

The Act presents strategies to facilitate sound management of water resources, provides for the protection of water resources, and regulates use of water by means of Catchment Management Agencies, Water User Associations, Advisory Committees and International Water Management.

As this Act is founded on the principle the government has overall responsibility for and authority over water resource\ management, including the equitable allocation and beneficial use of water in the public interest, an industry (including mines) can only be entitled to use water if the use is permissible under the NWA.

The following water use activities are applicable to the proposed Discard Facility project and is summarised below.

Section 21(b): Storage of clean water

- Water will be stored in the Potable Water Tank for domestic use at the offices and workshop areas.
- Clean water will be stored in the Washbay JoJo Tank for use at the washbay.

Section 21(c): Impeding or diverting the flow of water in a watercourse and Section 21(i): Altering the bed, banks, course or characteristics of a watercourse

- Offices and workshops will be situated within 500m of a wetland but outside the 100m buffer zone set by the Department of Water and Sanitation (DWS).
- The Discard Silo will be situated within 100m of a wetland.
- A conveyor transporting discard to the Discard Silo, a fire water pipeline and potable water pipeline will be constructed within 500 meters of a wetland but outside the 100m buffer zone set by the DWS.
- The proposed Discard Facility will be situated within 500m of a wetland but outside the 100m buffer zone set by the DWS.
- The 3A North Pollution Control Dam (PCD) will be constructed within 500m of a wetland but outside the 100m buffer zone set by the DWS.
- A return water pipe from the 3A North PCD to the current return water dam will be constructed within 100m of a wetland.
- A haul road from the Discard Silo to the Discard Facility will be constructed within 100 meters of a wetland.
- The dam wall over the Greensidespruit will be upgraded and used for access to the proposed Discard Facility.
- An existing access road between Kleinkopje mining activities and the Discard Facility project will be upgraded. The access road will be situated within 500 meters of a wetland area.

Section 21(g): Disposing of waste or water containing waste in a manner which may detrimentally impact on a water resource,

The following activities may detrimentally impact on a water resource:

- Dust suppression – Mine affected water will be used for dust suppression activities on site.
- Proposed Discard Facility – Coarse and fine discard will be deposited on this facility.
- 3A North Pollution Control Dam (PCD) – The 3A North PCD will be constructed to collect all the dirty water run-off from the proposed Discard Facility.
- Conservancy Tank – A conservancy tank will be constructed to collect domestic wastewater at the offices and workshops.
- Workshop Pollution Control Dam – The Workshop PCD will be constructed to contain dirty water from the offices and workshops.
- Dust Suppression Tank – The Dust Suppression Tank will store affected water to be used for dust suppression.

- Discard Silo – The Discard Silo will temporarily store discard before being disposed on the proposed Discard Facility.

Greenside Colliery is committed to the protection of water resources, and therefore compliance with the regulations GN 704, dated 4 June 1999, under the NWA, 1998 is essential. A GN 704 audit will be conducted on a two yearly basis and accordingly incorporated into the update of the IWWMP for the mine. In addition to this, monitoring programmes will be implemented and reviewed to assess the level of impact for areas of non-compliance as identified.

The following activities require exemption to regulation GN704 as motivated within the Water and Waste Management Plan (WWMP):

- In terms of Regulation 4(a) of the GN704, dated 4 June 1999, no person may locate or place any residue deposit, dam, reservoir, together with any associated structure or any other facility within the 1:100 year flood-line or within a horizontal distance of 100 metres from any watercourse. Greenside Colliery will be constructing the discard silo, return water pipeline and a haul road within 100 meters of a wetland. The mine will also upgrade the dam wall over the Greensidespruit.
- In terms of Regulation 4(c) of the GN704, dated 4 June 1999, no person may place or dispose of any residue or substance which causes or is likely to cause pollution of a water resource, in the workings of any underground or opencast mine excavation, prospecting diggings, pit or any other excavation. The disposal of discard will be partly in an old pit situated on Kleinkopje mining area, resulting in the potential of polluting a water resource.
- In terms of Regulation 6(a) of the GN704, dated 4 June 1999, every person in control of a mine must confine any unpolluted water to a clean water system, away from any dirty area. The return water pipeline from the 3A North PCD will cross under the N12 highway in a culvert conveying clean water.
- In terms of Regulation 6(c) of the GN704, dated 4 June 1999, every person in control of a mine must collect the water arising within any dirty area, including water seeping from mining operations, outcrops or any other activity, into a dirty water system. Although measures will be put in place to limit the amount of seepage from the proposed Discard Facility to the groundwater resource, not all seepage will be collected in the dirty water system.

Shangoni Management Services (Pty) Ltd has compiled and will submitted the Water Use Licence Application (WULA) and Water and Waste Management Plan (WWMP) to the DWS.

2.4 NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE AMENDMENT ACT (ACT NO. 26 OF 2014)

According to the National Environmental Management: Waste Amendment Act (Act No. 26 of 2014) (NEMWAA) that came into effect on 2 September 2014, all Mine Residue Stockpiles and Residue Deposits (MRSRD) must be considered for Waste Management Licence (WML). The inclusion of MRSRD into the definition of waste also implies that the MRSRD are subject to the licensing requirements in terms of the NEMWAA. This implies that prior to construction, expansion or decommissioning of any facility relating to MRSRD (e.g. tailings disposal facility, waste rock dump, recovery / reworking plant, etc.) or undertaking any other waste management activity listed in GNR 921, a waste management licence may need to be applied for (depending on whether the proposed activity / facility triggers the stipulated thresholds or not) supported by the relevant environmental impact assessment and public consultation process. The Department of Mineral Resources (DMR) will be responsible for issuing a decision on licence applications.

Potential waste licensing requirements for waste management activities associated with the proposed Discard Facility are discussed in the table below:

Activity	Requirement for waste licence
Disposal of waste to land (Category B)	The following waste management activities may therefore be relevant: **Category B** (7) – The disposal of any quanity of hazardous waste to land. (8) – The disposal of general waste to land covering an area in excess of 200m^2 and with a total capacity exceeding 25 000 tons. A Waste Management Licence is required for any activity under Category B.It is also proposed that a waste characterisation assessment on the discard material be undertaken to determine the pollution potential of the material and to determine if the discard is general or hazardous waste.

2.5 THE CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA (NO. 108 OF 1996)

The Constitution of South Africa provides for an environmental right (contained in the Bill of Rights, Chapter 2). In terms of Section 7, a positive obligation is placed on the State to give effect to the environmental right. The environmental right states that:

'Everyone has the right -

- To an environment that is not harmful to their health or well-being; and
- To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:
  - Prevent pollution and ecological degradation
  - Promote conservation
  - Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

2.6 NATIONAL ENVIRONMENTAL MANAGEMENT: AIR QUALITY ACT (NO 39 OF 2004)

The NEMA Air Quality Act (NEM: AQA) states the following as its primary objective: "To reform the law regulating air quality in order to protect the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development while promoting justifiable economic and social development; to provide for national norms and standards regulating air quality monitoring, management and control by all spheres of government, for specific air quality measures, and for matters incidental thereto.

Whereas the quality of ambient air in many areas of the Republic is not conducive to a healthy environment for the people living in those areas, let alone promoting their social and economic advancement, whereas the burden of health impacts associated with polluted ambient air falls most heavily on the poor, whereas air pollution carries a high social, economic and environmental cost that is seldom borne by the polluter, and whereas atmospheric emissions of ozone-depleting substances, greenhouse gases and other substances have deleterious effects on the environment both locally and globally, and whereas everyone has the constitutional right to an environment that is not harmful to their health or well-being, and whereas everyone has the constitutional right to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:

- Prevent pollution and ecological degradation;
- Promote conservation; and
- Secure ecologically sustainable development and use of natural resources.

And whereas minimisation of pollution through vigorous control, cleaner technologies and cleaner production practices is key to ensuring that air quality is improved, and whereas additional legislation is necessary to strengthen the Government's strategies for the protection of the environment and, more specifically, the enhancement of the quality of ambient air, in order to secure an environment that is not harmful to the health or well-being of people."

2.7 NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT (NO. 10 OF 2004)

In line with the Convention on Biological Diversity, the Act aims to legally provide for biodiversity conservation, sustainable use and equitable access and benefit sharing. The Act establishes the South African National Biodiversity Institute (SANBI). NEM: BA creates a basic legal framework for the formation of a national biodiversity strategy and action plan and the identification of biodiversity hotspots and bio-regions which will then be given legal recognition. It imposes obligations on landowners (state or private) governing alien invasive species as well as regulates the introduction of genetically modified organisms. Furthermore, the Act serves to regulate bio-prospecting, making provision for communities to share the profits of any exploitation of natural materials involving indigenous knowledge.

2.8 THE NATIONAL HERITAGE RESOURCES ACT (NO. 25 OF 1999)

The National Heritage Resources Act established the South African Heritage Resources Agency (SAHRA) in 1999. SAHRA is tasked with protecting heritage resources of national significance. Under Section 38 of this Act, all new developments with a site exceeding 5 000m², are subject to assessment by SAHRA. A Heritage Impact Assessment must be carried out by a heritage specialist approved by SAHRA to enable them to make an informed decision.

2.9 CONSERVATION OF AGRICULTURAL RESOURCES ACT (NO 43 OF 1983)

The Conservation of Agricultural Resources Act aims to provide for control over the utilisation of natural agricultural resources in order to promote the conservation of the soil, water resources and vegetation and to combat weeds and invader plants. Section 6 of the Act makes provision for control measures to be applied in order to achieve the objectives of the Act, these measures relate to *inter alia*:

- Cultivation of virgin soil;
- Utilization/protection of wetlands, marshes, water sponges, water course/sources;
- The regulating of the flow pattern of run-off water;
- The utilization and protection of the vegetation;
- The grazing capacity of the veld and the number and type of animals;
- The control of weeds and invader plants; and
- The restoration or reclamation of eroded land or land which is disturbed or denuded.

These provisions have implications for all developments and these aspects are implemented via regulations to the Act.

2.10 HAZARDOUS SUBSTANCES ACT (NO. 15 OF 1973)

The object of the Act is *inter alia* to 'provide for the control of substances which may cause injury or ill health to or death of human beings by reason of their toxic, corrosive, irritant, strongly sensitising or flammable nature or the generation of pressure thereby in certain circumstances; for the control of electronic products; for the division of such substances or products into groups in relation to the degree of danger; for the prohibition and control of such substances.

In terms of the Act, substances are divided into schedules, based on their relative degree of toxicity, and the Act provides for the control of importation, manufacture, sale, use, operation, application, modification, disposal and dumping of substances in each schedule.

2.11 DEPARTMENT OF WATER AFFAIRS' BEST PRACTICE GUIDELINES, SERIES A4

The objective of the guideline is to ensure that a best practice approach is adopted by all industry stakeholders involved with the design, operations and closure of water uses on a mine site within South African and to enable DWS personnel to establish that best practice has been applied.

2.12 EMALAHLENI MUNICIPAL BYLAWS

Please note that no municipal by-laws compiled for the eMalahleni Municipality were considered applicable.

3. DESCRIPTION OF THE PROJECT

3.1 DETAILS OF THE PROJECT APPLICANT

The details of the applicant proposing the project are given in Table 4.

Table 4: Details of the applicant

Name of Mine	Greenside Colliery
Applicant	Anglo Operations Proprietary Limited
Postal Address	PO Box 2851 Blackhill 1032
Responsible Person	Frank Glaeser
Telephone Number	(013) 690 4297
Facsimile Number	(013) 690 4355
Cell Phone Number	082 611 7354
E-Mail Address	Frank.glaeser@angloamerican.com
Company Registration No.	1921/006730/07

3.2 DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER

Shangoni Management Services (Pty) Ltd was appointed by AOPL to compile this EIA and EMP for the proposed project. Shangoni Management Services (Pty) Ltd details are provided in Table 5 below.

Table 5: Details of the Environmental Assessment Practitioner

Name	Shangoni Management Services (Pty) Ltd
Postal address:	P.O. Box 74726 Lynwood Ridge 0040
Contact person:	Minnette Le Roux
Affiliations:	Founding member of EAPSA, SACNASP Registered
Tel:	+27 (0)12 807 7036
Fax	+27 (0)12 807 1014
Cell:	+27 (0)83 660 0622
E-mail:	minnette@shangoni.co.za

As required by Regulation 28(1) (a) (ii) of the EIA Regulations, 2010 under the NEMA, 1998, a summary of the CV of the EAP involved in the conducting of the Scoping and EIA Process and compiling the EIR is given below, the full CV is also attached hereto in **Appendix C.**

Minnette completed a M.Sc. Environmental Management programme at the North West University (Potchefstroom). She also holds a Certificate in Implementing Environmental Management Systems (ISO 14001), Registered with the South African Council for Natural Scientific Professions and is a Founding member of the Environmental Assessment Practitioner Association of South Africa. Minnette has experience in completing the Environmental Assessment Processes for various projects, in the construction and large scale mining sectors, including amongst other; Environmental Impact Assessments, Scoping Reports, Basic Assessment Reports, Environmental Management Plans, Environmental Management Programmes, Integrated Water Use Licence Applications, Integrated Water and Waste Management Plans, Regulation GN 704 Audits, Water Use Licence Audits, Waste Licence Applications and various Application Forms as part of the Environmental Application Process.

3.3 PROPERTY DESCRIPTION

The mining right area for Greenside Colliery is indicated in Plan 2 and 4 in Appendix A and includes Portion 1, 2, 3 and the Remaining Extent (RE) of the farm Groenfontein 331 JS, Portion 1, 29 and the RE of the farm Blaauwkrans 323 JS, the RE of the farm Weltevreden 324 JS and Portion 7, 9, 10, 12, 13, 14, 15, 16 and 17 of the farm Vlaklaagte 330 JS.

The new discard facility and associated infrastructure is proposed to be located on Portion RE, 2 and 3 of the farm Groenfontein 331 JS (indicated in Plan 2, 3 and 4 in Appendix A).

Portion 2 of the Farm Groenfontein 331JS is declared as a private nature reserve (Refer to Plan 6 and 7 in Appendix A). The John Cairn reserve was declared as a private nature reserve in 1970 under the old Transvaal Nature Conservation Ordinance, Ordinance 17 of 1967.

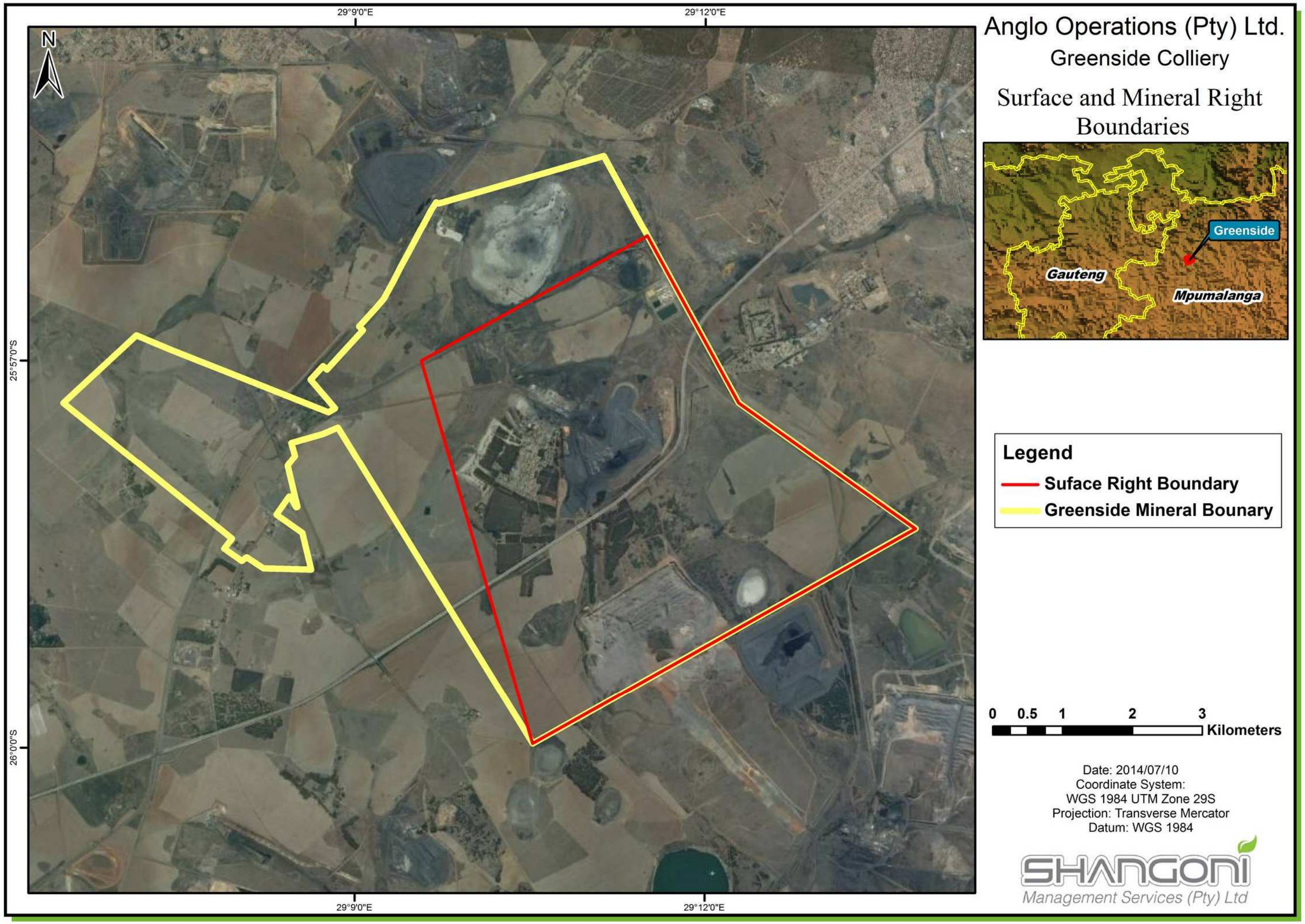


Figure1: Mining and surface right areas for Greenside Colliery

3.3.1 Mineral rights holders

Anglo Operations Proprietary Limited (formerly Anglo Operations Limited) is the mineral rights holder for the following properties, which are associated with Greenside Colliery:

- Portion 1, 2, 3 and the RE of the farm Groenfontein 331 JS.
- Portion 1, 29 and the RE of the farm Blaauwkrans 323 JS.
- The RE of the farm Weltevreden 324 JS.
- Portion 7, 9, 10, 12, 13, 14, 15, 16 and 17 of the farm Vlaklaagte 330 JS.

The mineral rights holder for the Greenside Colliery is listed in Table 6.

Table 6: Mineral rights owners to Greenside Colliery

Farm Name	Holder's Details
Portion 1, 2, 3 and the RE of the farm Groenfontein 331 JS	Anglo Operations Proprietary Limited
Portion 1, 29 and the RE of the farm Blaauwkrans 323 JS	
The RE of the farm Weltevreden 324 JS	
Portion 7, 9, 10, 12, 13, 14, 15, 16 and 17 of the farm Vlaklaagte 330 JS	

3.3.2 Surface rights holders

AOL is the surface rights owner for the following properties, which are associated with Greenside Colliery:

- Portion 1, 2, 3 and the RE of the farm Groenfontein 331 JS.
- Portion 29 and the RE of the farm Blaauwkrans 323 JS.

The surface rights owners in the mining right area for the Greenside Colliery are listed in Table 7.

Table 7: Surface rights owners to Greenside Colliery

Farm Name	Owners Details
Groenfontein 331 JS Portion RE,1,2,3	Anglo Operations Limited
Blaauwkrans 323 JS Portion RE, 29	Anglo Operations Limited
Blaauwkrans 323 JS Portion 1	Transnet Ltd.
Weltevreden 324 JS Portion RE	Truter Boerdery Trust
Vlaklaagte 330 JS Portion 16, 17	Uitspan Uitbreidings
Vlaklaagte 330 JS Portion 7, 14	Rudolf Martinus Botha
Vlaklaagte 330 JS Portion 9	Madeleine Louw
Vlaklaagte 330 JS Portion 10	Morne Stander
Vlaklaagte 330 JS Portion 12	Stephanus Johannes Petrus Duvenhage
Vlaklaagte 330 JS Portion 13	Adistra 96 CC

Farm Name	Owners Details
Vlaklaagte 330 JS Portion 15	Marie Liebenberg

The contact information of the landowners is available from the mine on request.

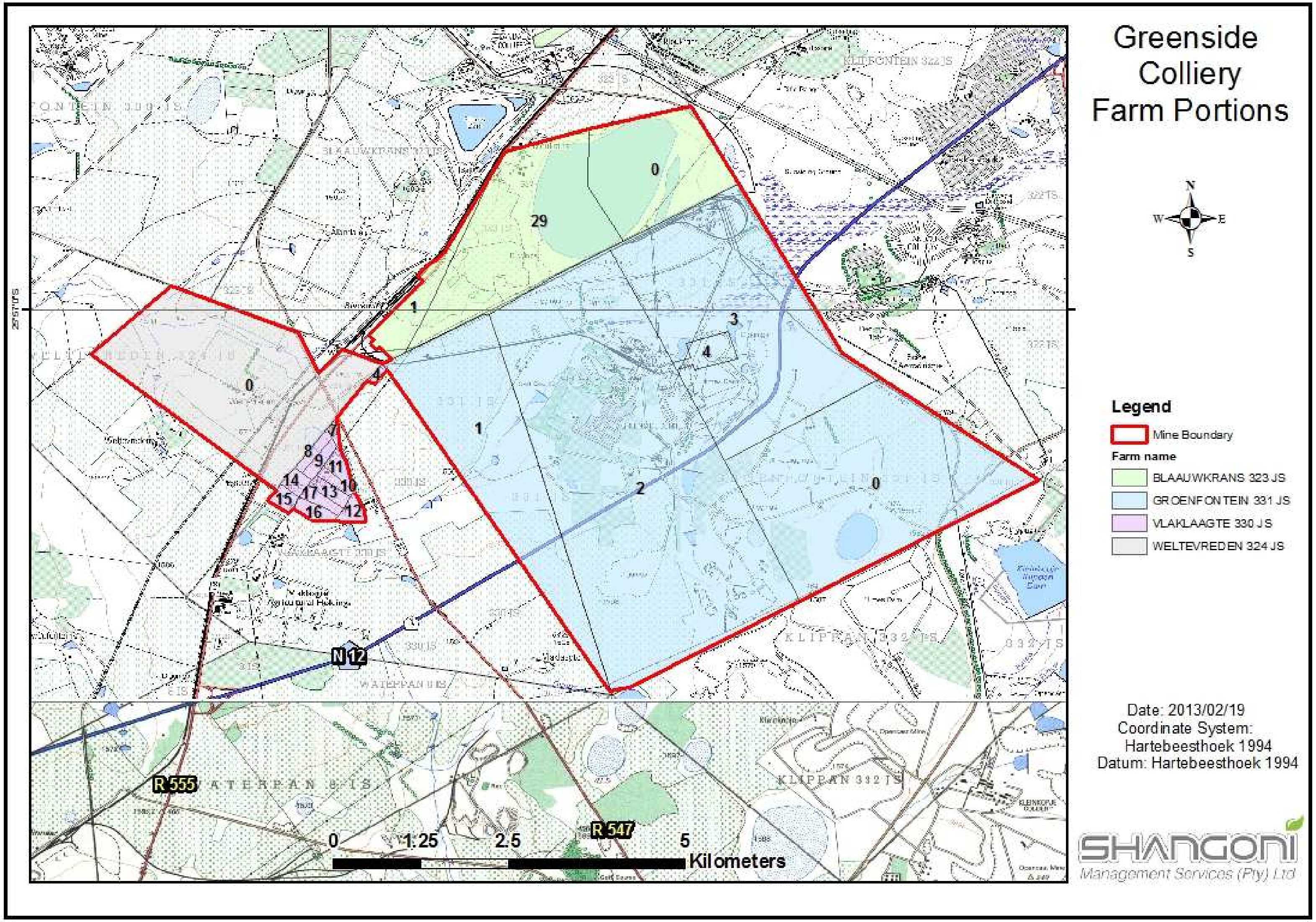


Figure 2: Greenside Colliery Farm Portions

3.3.3 Land tenure and use of immediately adjacent land

Land use adjacent to the mining right area of the Greenside Colliery is predominantly agricultural and mining. The surface owners of all farm portions immediately adjacent to the Greenside Colliery are listed in Table 8.

Table 8: Adjacent Surface Rights Owners to Greenside Colliery

Farm Name	Owners Details
Klippan 332 JS Portion 0, 2, 6, 7	Anglo Operations Limited
Klipfontein 323 JS Portion 0, 9, 145	Anglo Operations Limited
Blaauwkrans 323 JS Portion 0, 2, 7, 10, 14, 15	Anglo Operations Limited
Blaauwkrans 323 JS Portion 4, 17	Transnet Ltd.
Elandsfontein 209 JS Portion 2	Anglo Operations Limited
Weltevreden 324 JS Portion 3, 4	National Department of Land Affairs
Vlaklaagte 330 JS Portion 0, 1, 3, 4	Uitspan Uitbreidings Pty Ltd.
Vlaklaagte 330 JS Portion 2	Jacobus Theodorus du Preez
Vlaklaagte 330 JS Portion 5, 6	Republic of South Africa
Vlaklaagte 330 JS Portion 8	Barend Johannes Venter
Vlaklaagte 330 JS Portion 11	Ludwig Paul van Schalkwyk
Waterpan 8 IS Portion 0	Duiker Mining Pty Ltd.
Tweefontein 13 IS Portion	Duiker Mining Pty Ltd.

The contact information of the landowners is available from the mine on request.

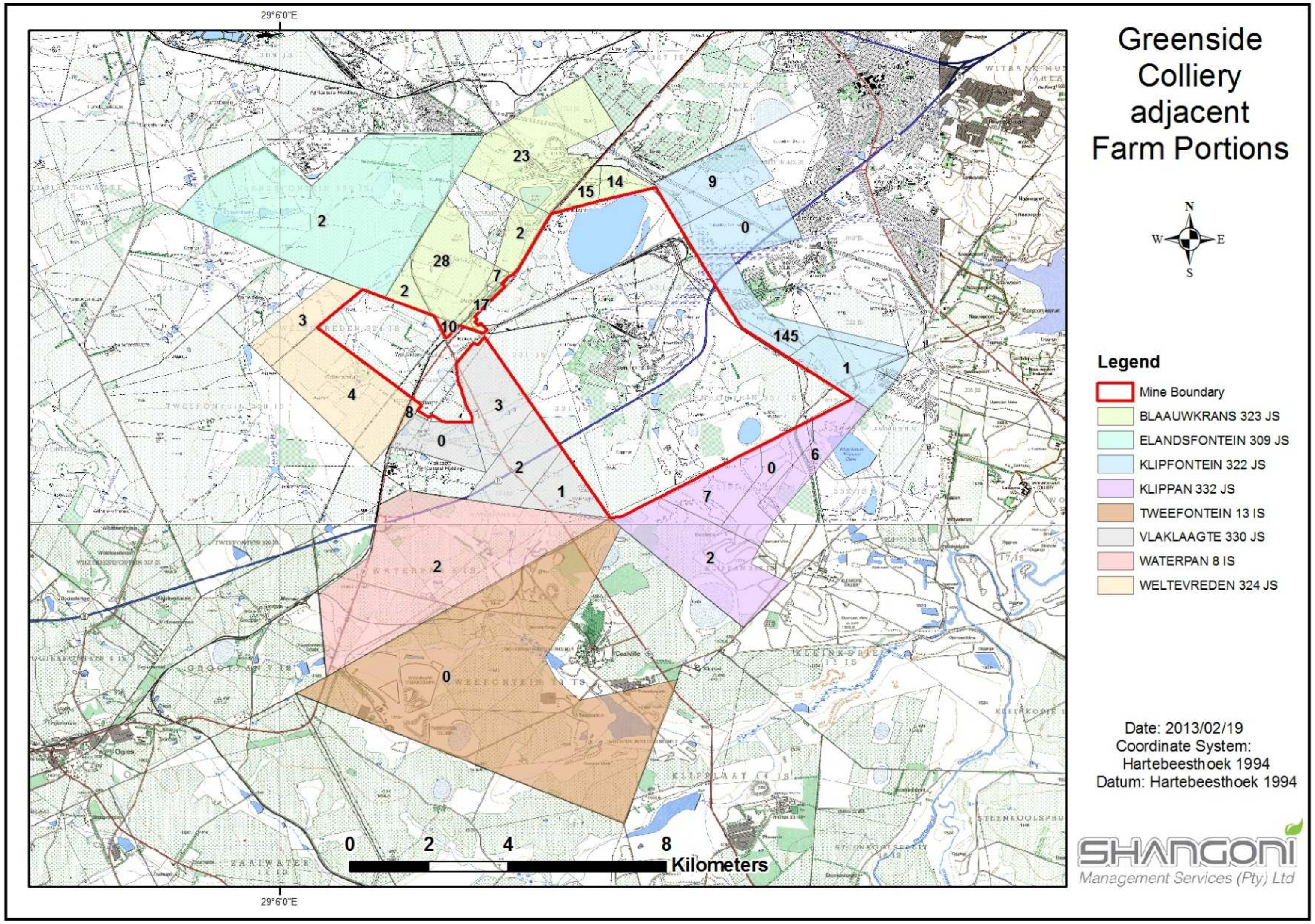


Figure 3: Adjacent Farm Portions to Greenside Colliery

3.4 REGIONAL SETTING AND LOCATION OF ACTIVITY

3.4.1 Magisteral District and Administrative boundaries

Greenside Colliery falls within the administrative boundaries presented in Table 9. Refer also to Plan 1 in Appendix A, which indicates the regional setting of Greenside Colliery.

Table 9: Administrative boundaries of Greenside Colliery

Province	Mpumalanga Province
District Municipality	Nkangala District Municipality
Local Municipality	Emalahleni Local Municipality
Ward	30
Department of Mineral Resources (DMR) Local Office	DMR (Emalahleni)
Department of Water Affairs (DWA) Local Office	DWS (Bronkhorstspruit)
Department of Environmental affairs (DEA) Local Office	DARDLEA (Mpumalanga)
Catchment Zone	Quaternary catchment s B20G, B11G and B11F
Rainfall Zone	B1A, B1C and B2C
Water Management Area	Olifants River Catchment area
Water Forums	Olifants River Catchment Forum

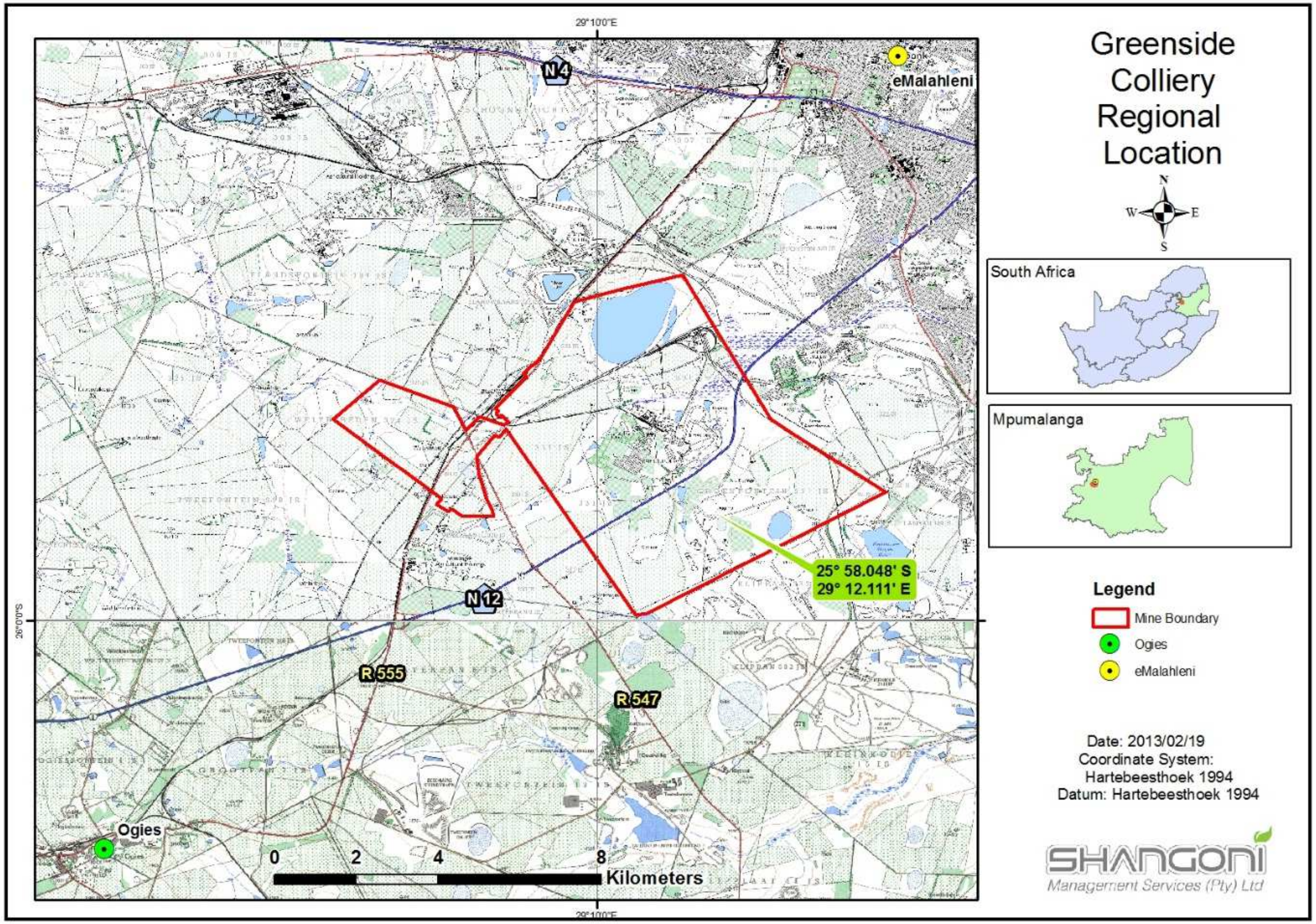


Figure 4: Regional Setting of Greenside Colliery

3.4.2 Location of the Mine

The closet major town to Greenside Colliery is eMalahleni, located 15 km to the north east. Blackhill Siding and an associated village are situated 2 km northwest of the mine infrastructure area. The Landau Colliery village is situated 1 km east of Greenside Colliery. The town of Ogies is located 20 km southwest of Greenside Colliery. The N12 highway linking Johannesburg to eMalahleni runs northeast-southwest along the south eastern boundary of Greenside Colliery. The regional setting of Greenside Colliery is indicated in Plan 1 in Appendix A.

3.4.3 Location of the Site

The proposed new discard facility project and associated infrastructure will be located on Portion 0, 2 and 3 of the farm Groenfontein 331JS.

The centre co-ordinates of the site are as follows:

- 25º 58.048' S;
- 29º 12.111' E.

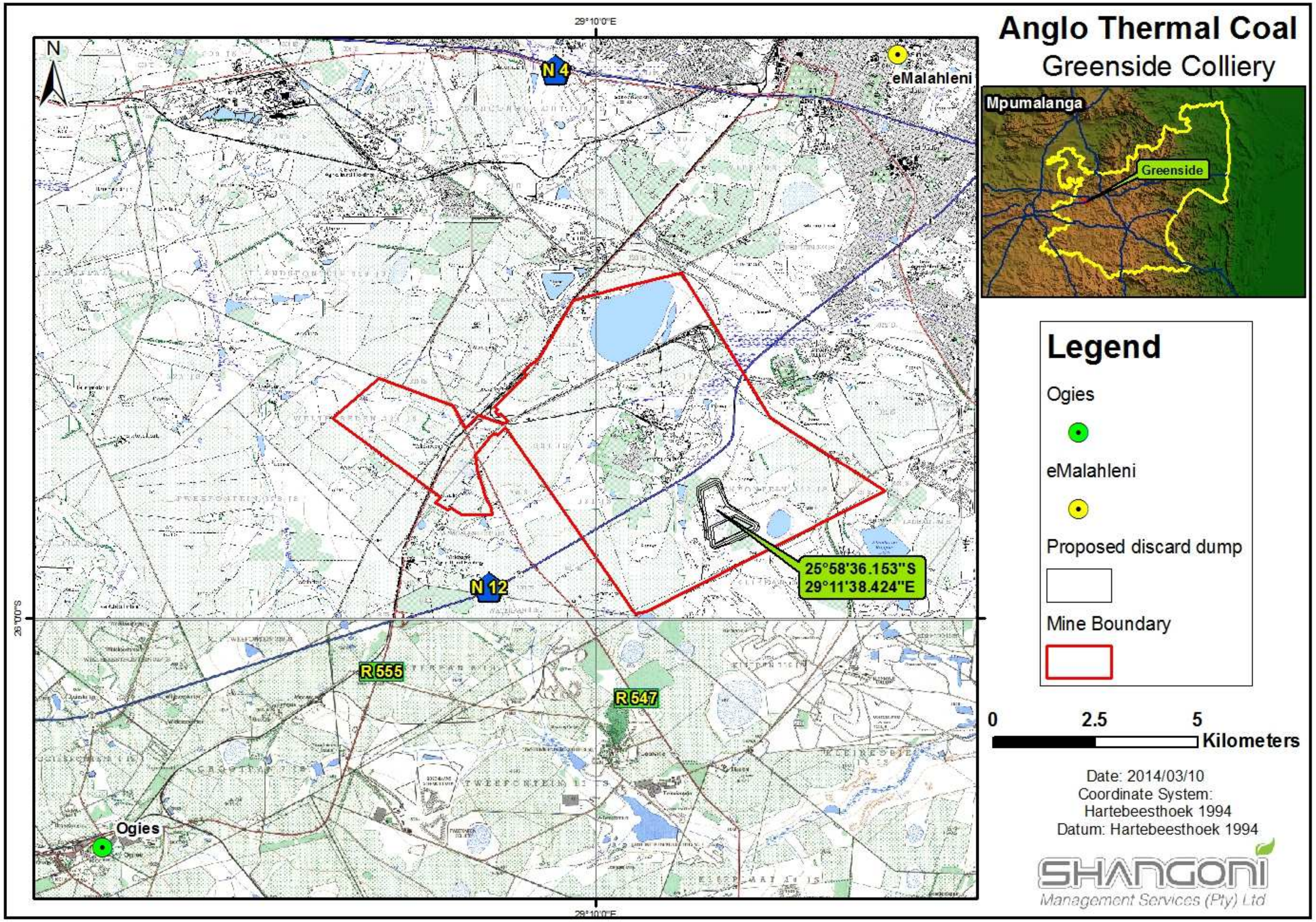


Figure 5: Location of Greenside Colliery

3.4.4 Site description

Currently, only the No. 4 Seam is mined by the bord-and-pillar mining method. Coal obtained from the number 4 Seam is currently treated in the Greenside Colliery no. 4 Seam plant, which is located north of the main offices. The coal discard from the No 4 Seam beneficiation plant is deposited on the consolidated coal discard dump at Greenside Colliery. Coal is conveyed from the plant to the Rapid Loading Terminal (RLT) for distribution to the markets. Greenside Colliery produces coal for both export and local markets. The utilisation of the surface infrastructure at Greenside Colliery, including the coal beneficiation plant, will continue up to 2023. Surface infrastructure pertaining to the Greenside Colliery is depicted in **Plan 8** in **Appendix A**.

The N12 highway connecting Gauteng with Mpumalanga crosses the Greenside Colliery mine. The mine is linked by district road number 193 to eMalahleni. A number of gravel roads connect the mine shafts with the mine complex. Potable water to Greenside Colliery is supplied from the eMalahleni Water Treatment Plant. Electrical power to the mine is supplied by Eskom from its national grid. Power lines cross the mine connecting eMalahleni to the national grid.

Three overland conveyors connect Greenside, Landau and Kleinkopje Collieries to the RLT located at the north eastern portion of the Greenside Colliery. The RLT is managed as an industrial operation by Anglo American Thermal Coal and handles all export coal. The RLT is serviced by Blackhill Station. In total, 18 vertical and inclined shafts are located on the Greenside Colliery. These shafts access the number 2, 4 and 5 Seams.

The greenside discard dump will be situated in 3A North that falls within the surface- and mining rights of Greenside. 3A North pit has been opencast mined by Kleinkopje Colliery.

3.5 DESCRIPTION OF THE PROPOSED ACTIVITY

3.5.1 Nature of the activity / development

The proposed new discard dump project and associated infrastructure will be located on Portion 0, 2 and 3 of the farm Groenfontein 331JS.

The new discard facility is required to cater for the LOM discard tonnages as well as possible LOM extension tonnages and accommodate some 35 million tons of discards. Table 10 below details the expected production figures for the life of mine and the required volumes based on an in-situ density of 1.6 t/m3 for coarse discard and 1.0 t/m3 for fines/slimes.

Table 10: Production Figures

Stage	Discard (Tons)	Slimes (Tons)	Discard (m3)	Slimes (m3)	Total (m3)
Jan 2015 - Dec 2017	8 661 285	2 101 028	5 413 303	2 101 028	7 514 331

Jan 2018 - Dec 2020	8 621 759	2 089 735	5 388 599	2 089 735	7 478 334
Jan 2021 - Dec 2023	5 717 174	1 686 304	3 573 234	1 686 304	5 259 538
Jan 2024 - Dec 2027	4 348 386	1 747 887	2 717 741	1 747 887	4 465 628
Total	**27 348 603**	**7 624 953**	**17 092 877**	**7 624 953**	**24 717 830**

The design of the facility will require the following associated infrastructure:

- An Overland Conveyor System.
- Bridge crossing.
- Discard Silo.
- Haul roads.
- Dirty and Clean Water Separation Systems.
- The Workshop and associated Offices.
- Power Lines.
- Water supply

High level designs have been developed for the proposed new discard facility and the associated infrastructure; these designs are attached in Appendix A. The objectives of these designs are to produce an environmentally acceptable, economically constructed and operated disposal facility. The specific goals for developing high level designs for the new discard facility and associated infrastructure are listed as follows:

- Positioned as close as possible to the coal washing plant.
- Require minimum capital expenditure.
- Be simple and economical to operate.
- Minimise surface and ground water pollution.
- Minimise the impact on the environment during the entire facility life cycle.

3.5.2 Reason for project

The proposed new discard disposal facility project was initiated as a result of limited volumetric air space remaining on the active dump.

The new discard facility is required to cater for the LOM discard tonnages as well as possible LOM extension tonnages and accommodate some 35 million tons of discards

AOPL requires the necessary environmental authorisations for the construction of the proposed new discard facility

3.5.3 Extent of activity

The footprint area of the new discard facility will be approximately 115 hectares in size and the proposed new discard dump and associated infrastructure will be located on Portion 0, 2 and 3 of the farm Groenfontein 331JS (refer to Plan 2, 3 and 4 in Appendix A)

3.5.4 Activity infrastructure description

The design of the new discard facility will require the following associated infrastructure and can be seen on Figure Plan 3 in Appendix A:

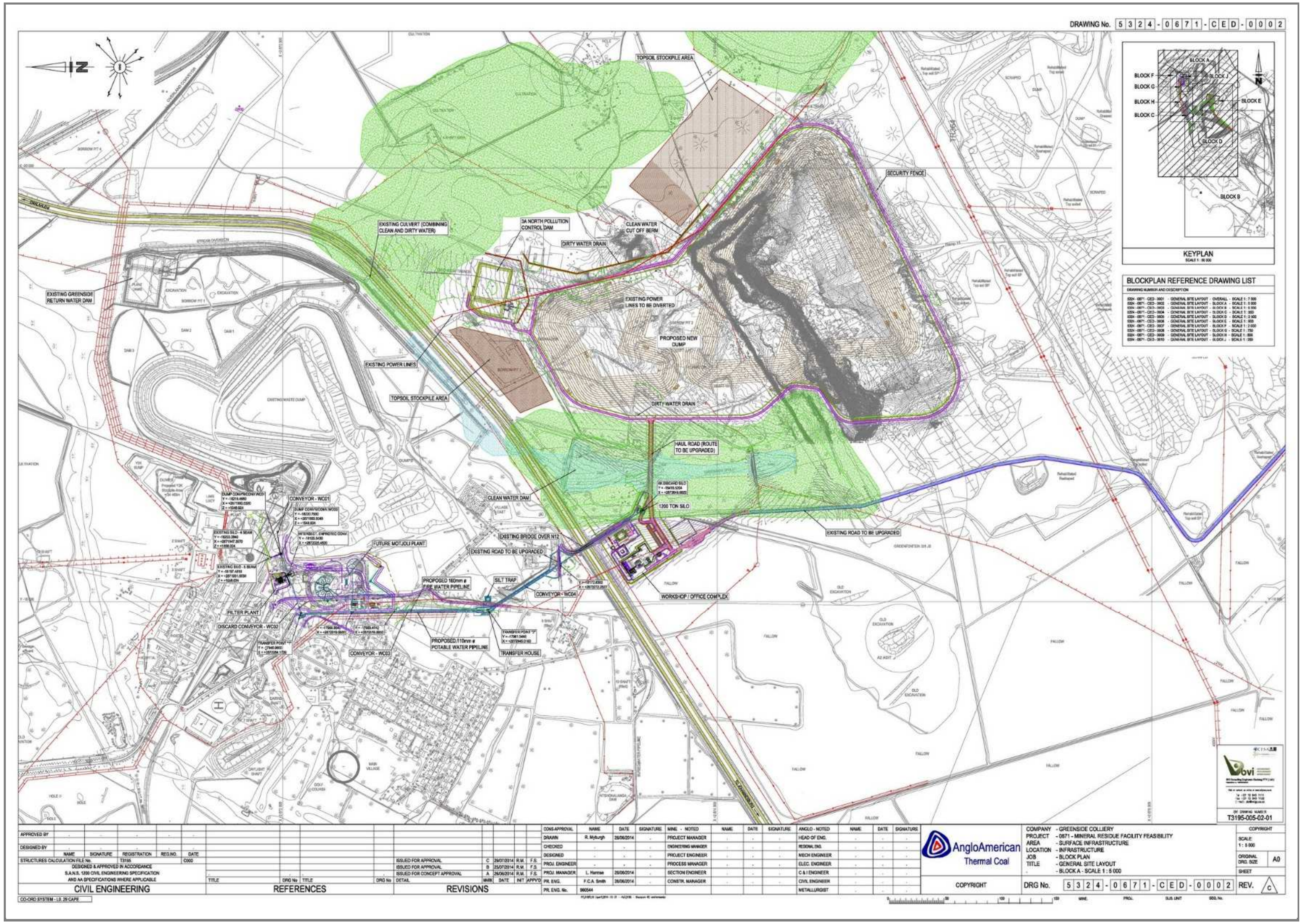


Figure 6: Master Layout Plan of the Greenside Colliery Proposed New Discard Facility Project

- An Overland Conveyor System.
- Bridge crossing.
- Discard Silo.
- Haul roads.
- Dirty and Clean Water Separation Systems.
- The Workshop and associated Offices.
- Power Lines.
- Water supply

3.5.4.1 Overland Conveyor System

The overland conveyor system will transport discard from the existing Greenside processing facilities and the proposed discard re-treatment processing plant. Dewatered fines from both of these plants will also be transported on this conveyor to the discard silo at the new discard dump. Sufficient controls will be in place at the conveyor loading facilities to ensure no more than 30% of the combined material on the conveyor is fines. The expected length of the overland conveyor will be approximately 2 kilometres.

3.5.4.2 Bridge Crossing

The overland conveyor will cross over the N12 on an existing bridge (bridge number 3785 and constructed in 1980) historically used to transport coal from underground workings beneath the proposed discard facility footprint to the Greenside processing plant. The overland conveyor will run along one side of the bridge with the other side reserved for light vehicles. To prevent dust from the conveyor obscuring traffic, a suitable covering will be placed over the conveyor. A fire deluge system will be included on the conveyor. The bridge will also be used for potable water and power supply infrastructure from Greenside Colliery to the discard facility office complex.

3.5.4.3 Discard Silo

The 1200t load-out is founded on a conventional raft foundation. The silo will be 12m in diameter and approximately 30m high. An access stairway and overflow chute opening have been provided. The silo ground floor has been reinforced with cast-in-rails to provide protection during cleaning by a front-end loader. A stockpile area has been provided adjacent to the silo including a ground slab and side walls to contain overflow from the silo. The silo has been positioned on top of an existing column in the underground mining.

3.5.4.4 Haul Routes

The combined discard material will be hauled from the discard silo across a dam wall in the Greensidespruit and deposited systematically to build up the discard dump. These vehicles will also have to pass over Kleinkopje Colliery’s land to reach the discard facility and existing haul roads will need to be maintained for this. Fuel deliveries for the operation will also be along these routes. An additional haul road will be required to join the existing routes to the workshop and office complex.

3.5.4.5 Dirty and Clean Water Separation System

Stormwater management at the study area should be conducted in accordance to the Stormwater management plan compiled by Shangoni Management Services (Pty) Ltd entitled: “*Anglo American Thermal Coal Greenside Colliery Storm Water Management Plan*”, dated March 2014 (Attached hereto in Appendix E). The following is extracted from the above mentioned study with regards to the management of the different areas.

Each management area is provided with a map indicating the main drainage lines anticipated using contour data and the current/proposed runoff control strategies. A more detailed description of the storm water environment as well as the proposed measures to control clean runoff and retain affected runoff is also provided using the maps as reference.

The management areas are determined using the geographic location of infrastructure and distinct catchment boundaries. Regional contours (5 m) were used to define the drainage regime associated with each focus area. Blue and red arrows indicate the location of clean and affected runoff respectively as well as direction. The figure below indicates the anticipated runoff directions within the sub-catchments towards the natural watercourse and do not indicate if the directions is controlled or not. Reference should be made to the discussion with regards to existing and proposed storm water control measures.

Efficiency and practicality is a key aspect to a successful storm water management plan. Good management is based on separating clean and dirty water and therefore incorporates the fundamental principle of pollution prevention. All proposed measures prioritise the use of gravity and natural drainage lines to provide cost-effective solutions with minimum maintenance requirements. Where such measures are not possible and the use of mechanical equipment is required (e.g. pumping infrastructure in sumps), it is the responsibility of the operation to do a risk assessment with regards to control, maintenance and standby equipment in case of down time.

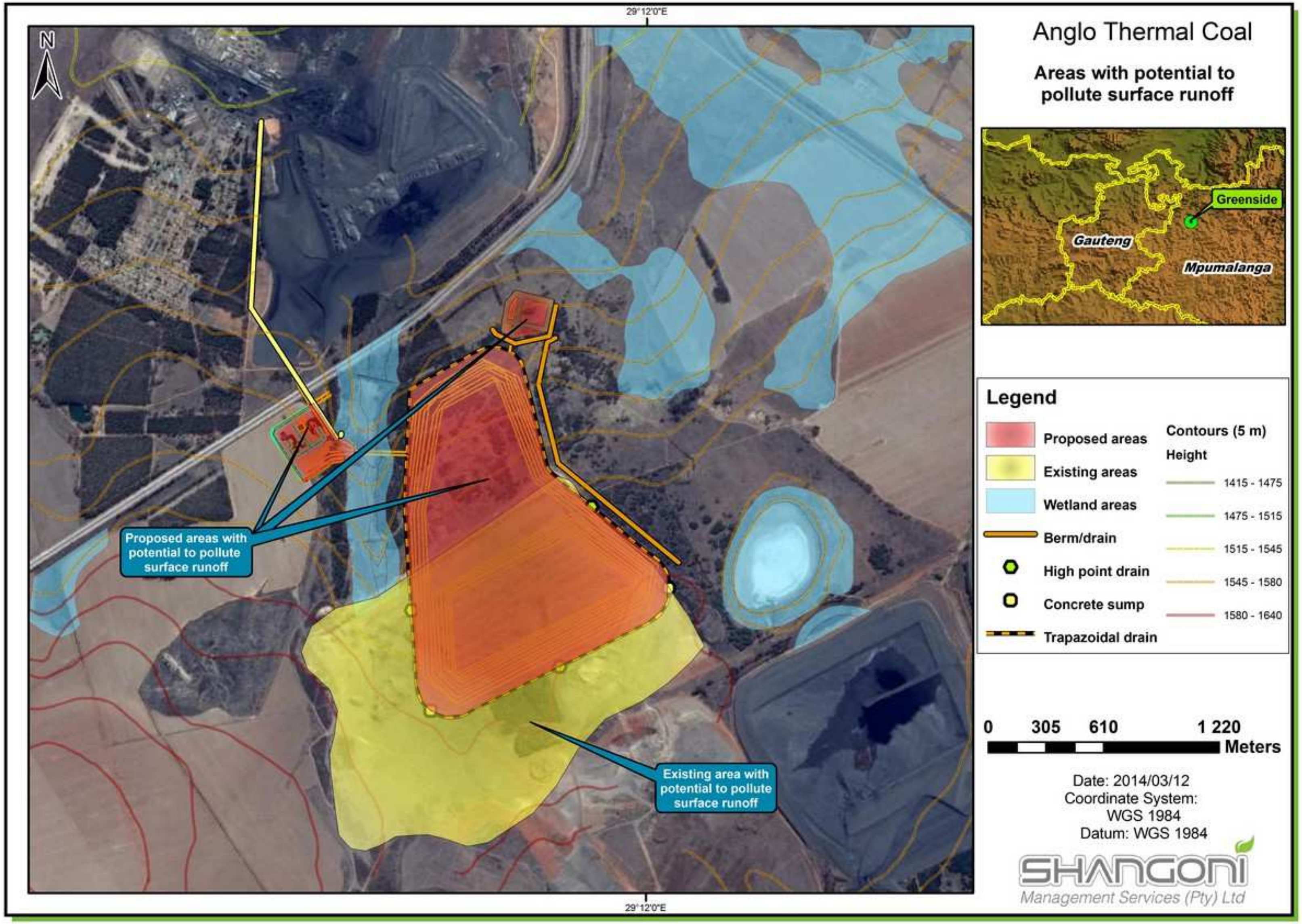
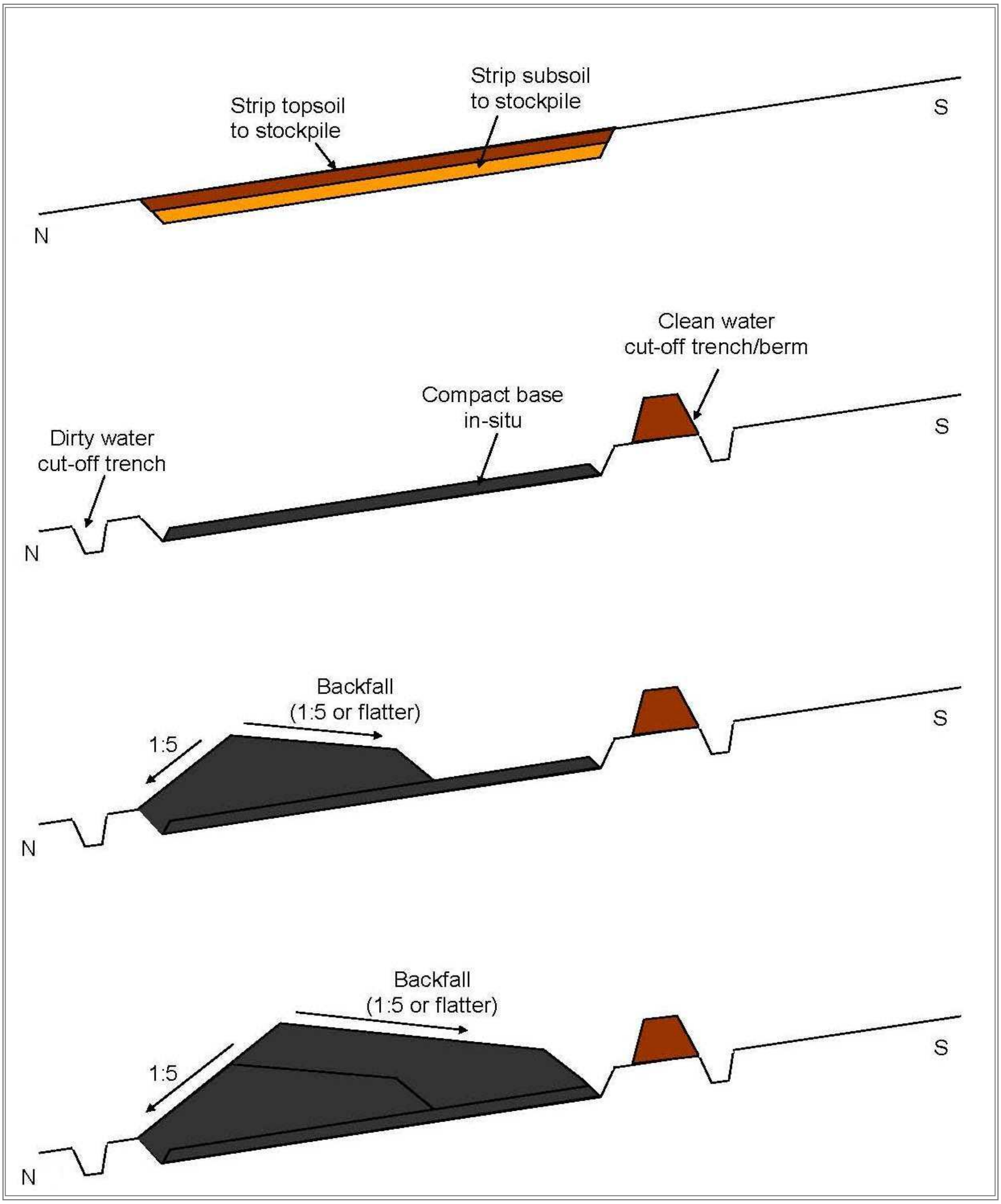


Figure 7: Areas with the potential to pollute

3.5.4.5.1 Discard dump

Ingress of water will be minimised by shaping the facility into a smooth domed “whale back” form thereby encouraging run-off and reducing infiltration. Maintaining a small pool on top of the discard dump reduces the phreatic flow both through the fines and discard embankments. These measures reduces the risk of acid mine drainage (AMD), however, practical constraints in some cases have led to significant AMD being generated on some facilities.

The figure below illustrates the concurrent rehabilitation planned for the discard dump. The side slopes will be built at an incline of 1v:5h and progressively rehabilitated with 500 mm of compacted sub soil and 300 mm of un-compacted top soil. Vegetation growth will be encouraged on the slopes as the discard dump develops to limit areas with the potential to contaminate clean runoff. The discard sump will be developed from the lowest point adjacent to the N12 and progressively developed towards the south. This will keep the dirty water run-off length to a minimum and allow clean water to be diverted clear of the developing footprint. Civil designs have been done for the surface water management of the proposed discard facility (See Plan 3 i,j,k in Appendix A).


Strip topsoil
to stockpile
Strip subsoil
to stockpile
N
S
Clean water
cut-off trench/berm
Compact base
in-situ
Dirty water
cut-off trench
N
S
Backfall
(1:5 or flatter)
1:5
N
S
Backfall
(1:5 or flatter)
1:5
N
S

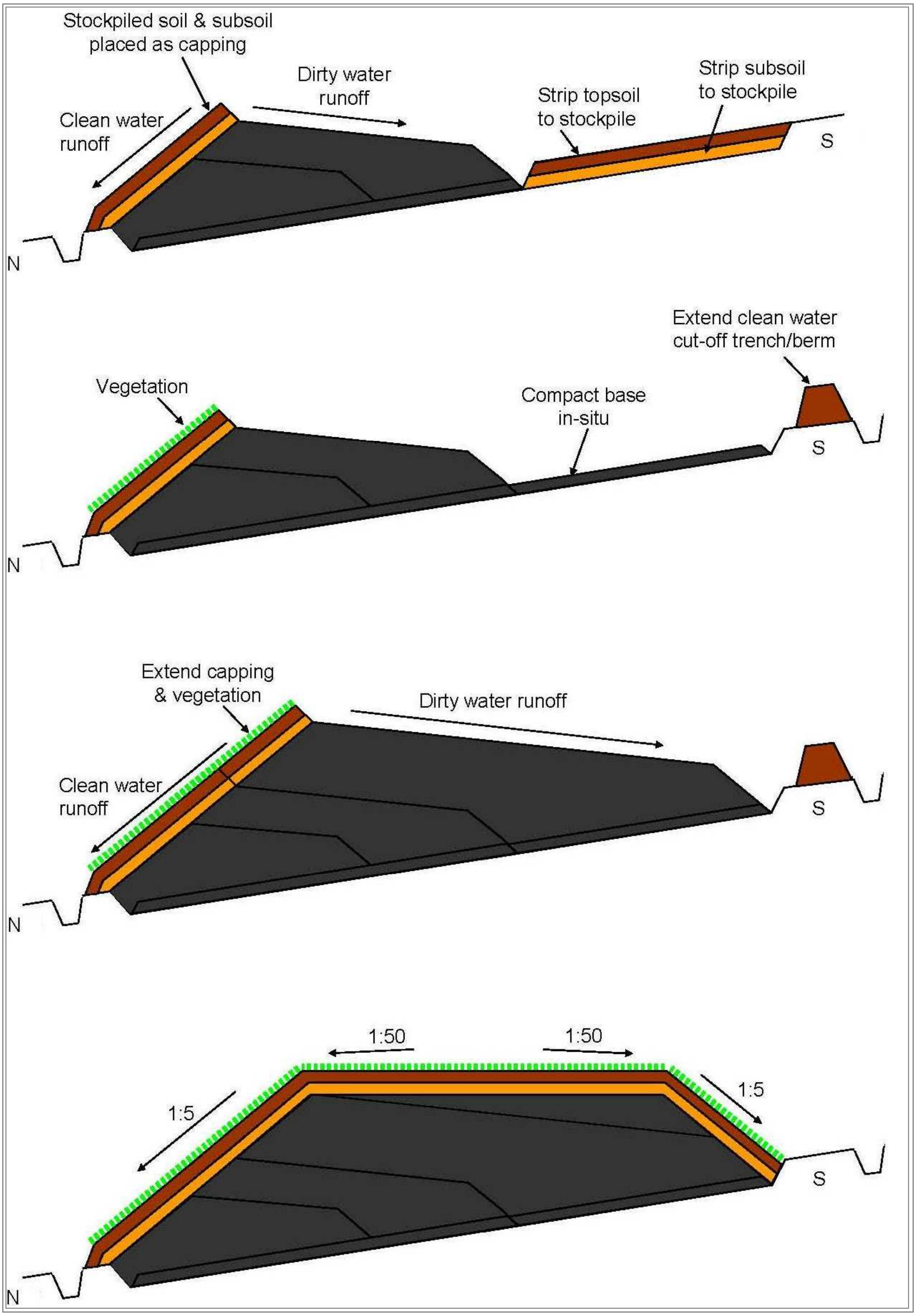


Figure 8: Concurrent rehabilitation planned for the discard dump

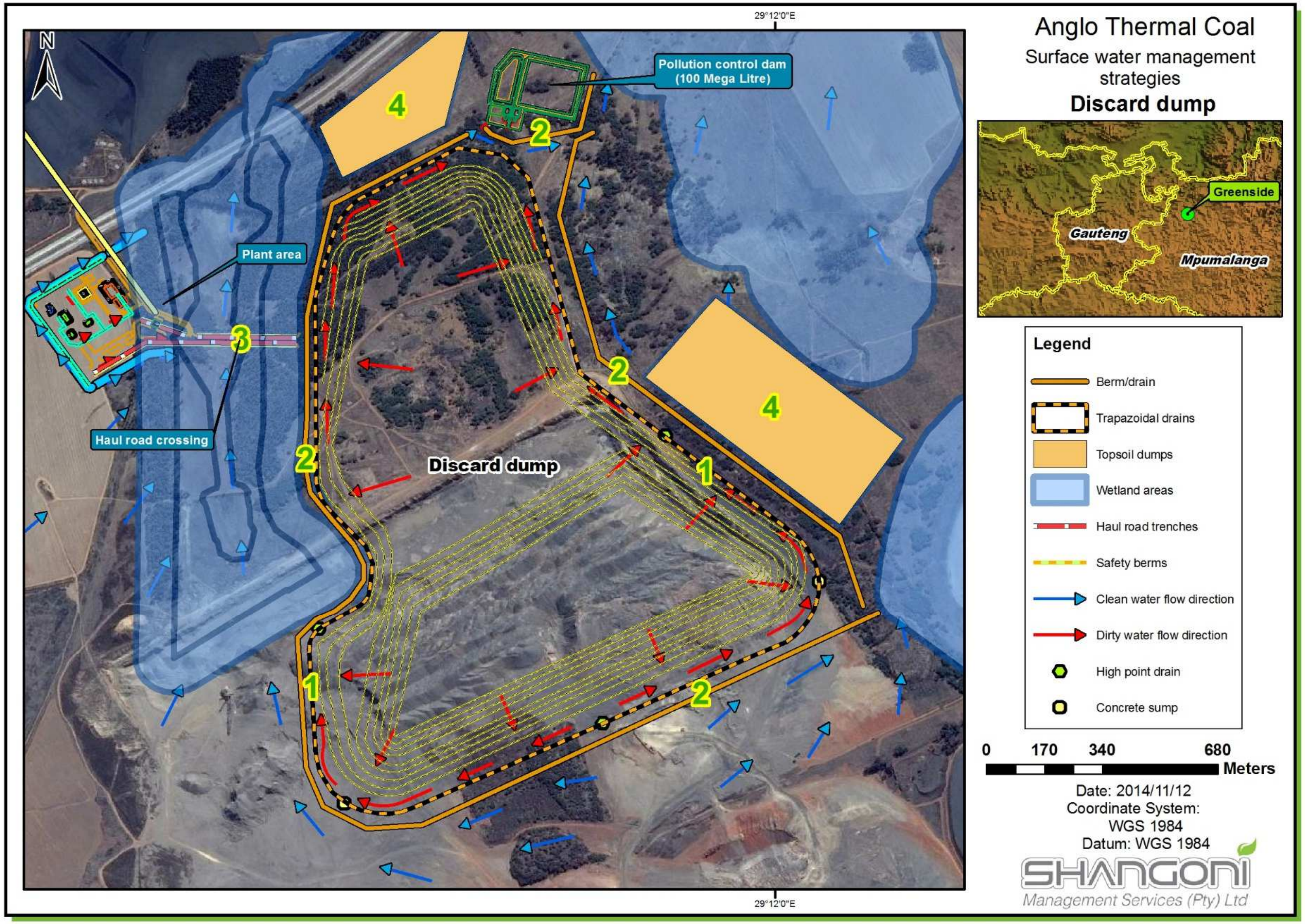


Figure 9: Storm Water Management at the proposed discard dump

Table 11: Storm Water measures at the proposed discard dump

Number corresponding to Figure 9	Description
1	Surface runoff from the slopes of the discard dump and possible toe seepage will be intersected and conveyed via the trenches towards the 100 ML pollution control dam located at the lowest point below the dump (See Plan 3i,j and k in Annexure A)
2	Diversion berms and clean water cut-off trenches will be constructed at the outset and moved every three years as the dump footprint extends. The clean water will be diverted into the existing wetlands areas to the east and west of the facility. This water will then in return pass under two existing culverts below the N12 highway registered as the Greenside spruit stream diversion. The berms will prevent excess water from flowing into the trenches thereby compromising the capacity of the pollution control dam.
3	Dirty water drains (1.5 m wide) will be constructed along the haul road wetland crossing and will tie into the dirty water system of the discard dump leading to the pollution control dam (See Plan 3i,j and k in Annexure A).
4	It is recommended that all usable soil be stripped and stockpiled in advance of the dumping activities that might contaminate the soil. It is good practise to stockpile stripped soil upslope of areas of disturbance or development to prevent contamination of stockpiled soils by dirty runoff or seepage. All topsoil stockpiles should also be protected by berms to prevent erosion of stockpiled material and to divert surface water runoff around the material. Topsoil stockpiles should not have steep slopes that encourage the possibility of erosion gullies on the dumps.

3.5.4.5.2 Workshop and office complex

The workshop and office complex area will consist of a refuelling bay, workshops, offices and parking bays. Suitable bunding and oil/water separation will be required at the refuelling bay and workshop areas. The offices will consist of change rooms, ablution facilities, meeting rooms and lunch/rest rooms. Septic tanks will be used for the ablution facilities. Parking bays will be provided for both heavy and light vehicles. All dirty water from the workshop and office complex area will be routed through a silt trap into the dirty water containment dam. Clean water cut-off trenches will route surface runoff away from the workshop and office complex into the adjacent wetland areas. Civil designs has been done for the workshop and office complex area to separate clean and dirty water (See Plan 3i,j and k in Annexure A). The strategies illustrated in Figure 10 is based on the civil designs.

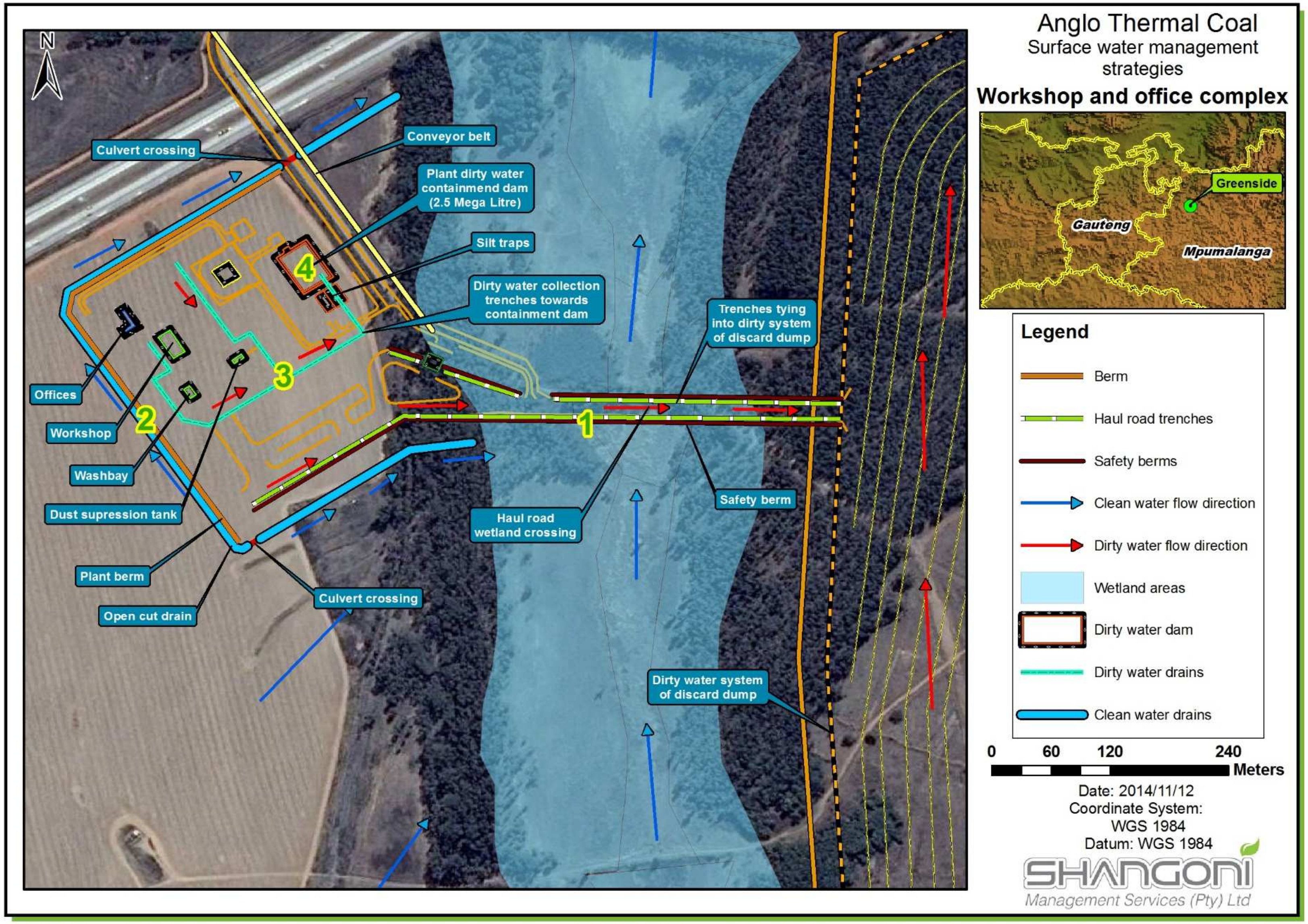


Figure 10: Storm water measures at workshop and office complex

Table 12: Storm water measures at the workshop and office complex

Number corresponding to Figure 10	Description
1	Dirty water cut-off trenches (1.5 meter wide) will be constructed along the safety berms of the haul road and will tie with the dirty water system of the discard dump. Runoff on the haul road will drain in an eastern direction towards the discard dump and eventually into the pollution control dam.
2	An open cut drain will convey clean surface runoff away from the workshop and office complex towards the wetland area. The workshop and office complex berm will prevent dirty water from the workshop and office complex area from entering the clean water open cut drains. The culvert crossings should be inspected regularly for obstructions that may compromise the integrity of the clean water system.
3, 4	Dirty water collection trenches will convey affected water from the workshop and office complex into the dust suppression tank and the dirty water containment dam either for dust suppression or to be re-used in the process.

3.5.4.5.3 Pollution control dam

The pollution control dam will be located at the lowest point beneath the proposed discard dump and will contain all dirty water arising from the discard dump and the access haul road crossing the wetland area. According the flood calculations, the dam (100 ML) should be able to contain the volume of water expected during a 1:50 year flood event. Surface runoff will be diverted via berms away from the facility to drain freely towards the Greenside spruit.

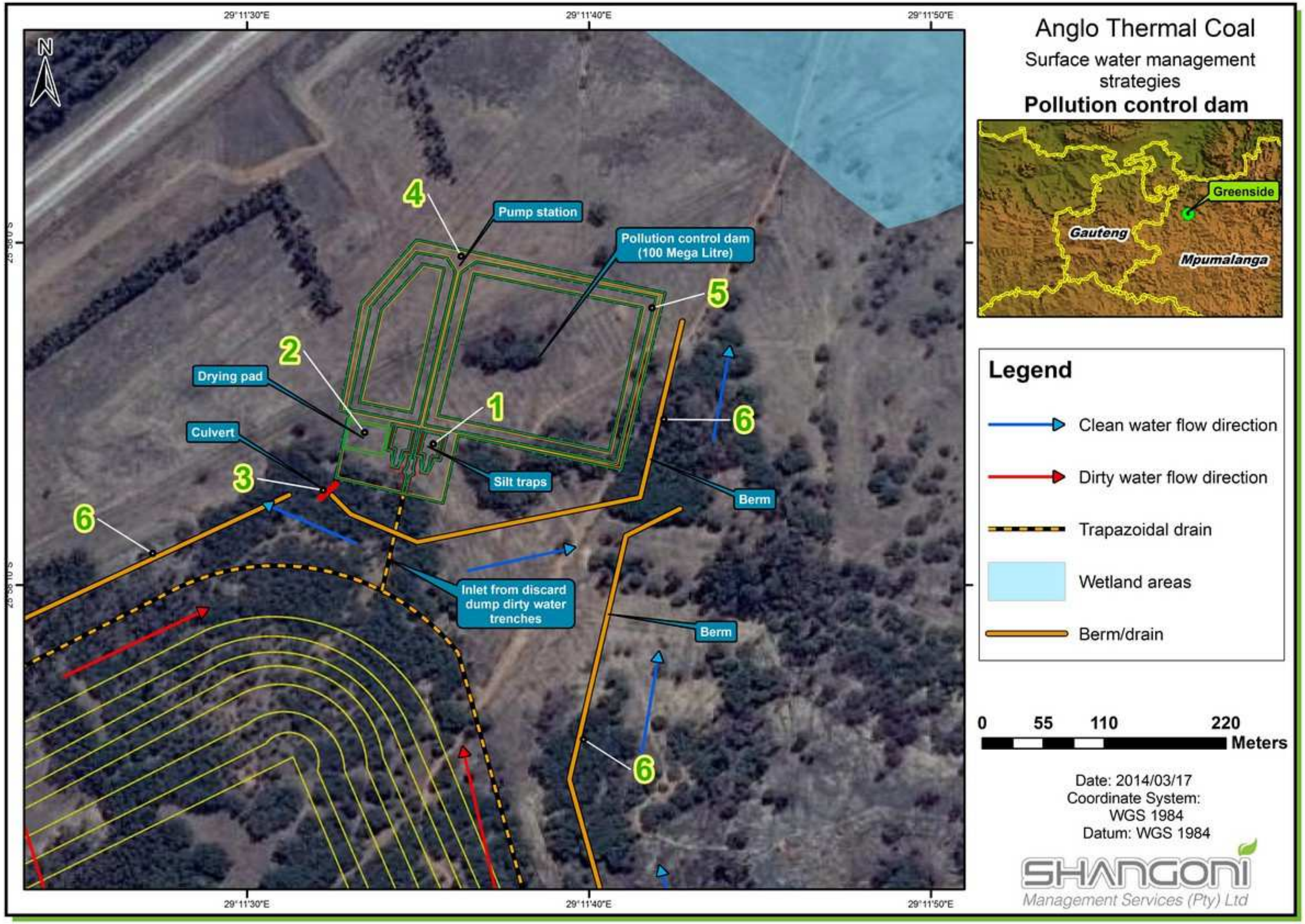


Figure 11: Storm water measures at the pollution control dam

Table 13: Storm water measures at the pollution control dam

Number corresponding to Figure 11	Description
1, 2	Excess silt from the trenches will be contained within the silt traps before entering the pollution control dam thereby ensuring the capacity of the dam. During maintenance, silt will be removed from the traps and placed on the drying pad that will be located next to the silt traps.
3	A culvert will allow clean water runoff diverted from the berm to pass freely under the access road towards the natural drainage line.
4	A pump station will be installed and water will be pumped from the pollution control dam to the return water dam located across the N12 highway for process purposes.
5	The outer face of the pollution control dam will have a 100 mm thick layer of topsoil to be hydro-seeded in order to encourage vegetation growth.
6	Diversion berms will prevent clean water from entering the dirty water system.

3.5.4.6 Workshop Complex

The workshop complex will consist of refuelling bays, workshops, offices and parking bays. Suitable bunding and oil/water separation will be required for the refuelling bays and workshop areas. The offices will consist of offices, change rooms, ablution facilities, meeting rooms and lunch/rest rooms. Septic tanks and soak ways will be required for the ablution facilities. Parking bays will be provided for both heavy and light vehicles. A brake test ramp and a dust suppression water tank and filling point will also be required. Sufficient lighting will be required around the workshop complex for 24 hour operations. All dirty water from the workshop complex will be routed through a silt trap into the discard dump dirty water collection trenches. The total footprint of the workshop complex will be approximately 14 000 square meters.

3.5.4.7 Power Lines and Electricity

The power shall be sourced from one of the following reticulation networks:
Power will be reticulated at 6.6kV by means of buried cable from existing Greenside 2 Substation for overland conveyor and silo supply, workshops, wash bay and office complex infrastructure and pollution control dam infrastructure.

The 22kV overhead line is to be fed off existing Eskom overhead line within 100m of proposed affected water pumping infrastructure.

3.5.4.8 Water Supply

3.5.4.8.1 Water Demand

Water demand was determined based on a staff complement of 27 persons each using 90l of water per person per day.

3.5.4.8.2 Potable Water

Potable water will be provided from the existing water supply at Greenside Colliery. A pipeline laid adjacent to the new overland conveyor will supply potable water to a new 33m^3 elevated header tank at the office/workshop complex, which provides sufficient storage for two days.

The potable water from the elevated tank feeds into the reticulation system supplying the office complex, ablution facilities, workshop area and wash-bay facility.

3.5.4.8.3 Fire Water

Fire water will be provided from the existing fire water system at Greenside Colliery. A pipeline laid adjacent to the new overland conveyor will supply Fire Water to the deluge systems as well as at transfers on the new conveyor, to the new silo and to the Office/workshop complex. Fire protection on the conveyor and load-out silo (including deluge systems) to be by others and only a T-connection and valve will be provided at these points.

Fire reticulation and area hydrants will be provided in the workshop area and to all buildings in accordance with the Anglo Fire Specifications. Pressure reduction will be required for the workshop area reticulation.

3.5.4.8.4 Dust Suppression

Raw water for dust suppression will be pumped from the 2.5Ml Pollution Control Dam to an elevated dust suppression water storage tank on the workshop and office complex terrace.

3.5.4.9 The New Discard Disposal Facility

The footprint area of the new discard facility will be approximately 115 hectares with a maximum height of 55m. The sides slopes will be built following a whale back profile at an incline of 1v:5h and progressively rehabilitated with 500mm of compacted sub soil and 300mm of uncompacted top soil and vegetated. The facility will be developed from the lowest point adjacent to the N12 and progressively developed towards the south. This will keep the dirty water run-off length to a minimum and allow clean water to be diverted clear of the developing footprint.

Combined coarse and fine discards will be deposited by ATD haul trucks and built up in layers. Should compaction be necessary this will be accomplished with a vibratory roller. Performance criteria are currently being developed pending the results of geotechnical testing. The criteria will be to minimize voids so as to reduce the propensity for spontaneous combustion (SponCom) and reduce the potential for acid mine drainage (AMD).

3.6 NEED AND DESIRABILITY IN TERMS OF THE GUIDELINE ON NEED AND DESIRABILITY DATED 20 OCTOBER 2014.

On the 20th of October 2014, the Department of Environmental Affairs published a Guideline on Need and Desirability in terms of the Environmental Impact Assessment (EIA) Regulations, 2010, in Government Notice 891 of 2014. The following table indicates how the guideline requirement were considered in this EIA and EMP.

Table 14: Need and Desirability of the Proposed Project

Requirement		Part where requirement is addressed/response
1.	How will this development (and its separate elements/aspects) impact on the ecological integrity of the area?[1]	Refer to Part 4.7, 4.13 and Part 7.
1.1	How were the following ecological integrity considerations taken into account?	
1.1.1	*Threatened Ecosystems.*[2]	
1.1.2	*Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.*[3]	
1.1.3	*Critical Biodiversity Areas ("CBAs") and Ecological Support Areas ("ESAs").*	Refer background description as contained in Part 4.7.
1.1.4	*Conservation targets.*	
1.1.5	*Ecological drivers of the ecosystem.*	
1.1.6	*Environmental Management Framework.*	No EMF or SDF existis for the area.
1.1.7	*Spatial Development Framework.*	
1.1.8	*Global and international responsibilities relating to the environment (e.g. RAMSAR sites, Climate Change, etc.).*[4]	No impact.
1.2	How will this development disturb or enhance ecosystems and/or result in the loss or protection of biological diversity? What measures were explored to firstly avoid these negative impacts, and where these negative impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?[5]	Refer to Part 7 and Part 14.
1.3	How will this development pollute and/or degrade the biophysical environment? What measures were explored to firstly avoid these impacts, and where	Refer risk table, Part 7.3

[1] Section 24 of the Constitution and section 2(4)(a)(vi) of NEMA refer.

[2] Must consider the latest information including the notice published on 9 December 2011 (Government Notice No. 1002 in Government Gazette No. 34809 of 9 December 2011 refers) listing threatened ecosystems in terms of Section 52 of National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).

[3] Section 2(4)(r) of NEMA refers.

[4] Section 2(4)(n) of NEMA refers.

[5] Section 24 of the Constitution and Sections 2(4) (a) (i) and 2(4) (b) of NEMA refer.

Requirement		Part where requirement is addressed/response
	impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?[6]	
1.4	What waste will be generated by this development? What measures were explored to firstly avoid waste, and where waste could not be avoided altogether, what measures were explored to minimise, reuse and/or recycle the waste? What measures have been explored to safely treat and/or dispose of unavoidable waste?[7]	Types of non-mineral wastes, as typically expected to be generated are discussed in Part 3.5. Measures to avoid waste, minimise, reuse and/or recycle wastes are included as commitments for the mine.
1.5	How will this development disturb or enhance landscapes and/or sites that constitute the nation's cultural heritage? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?[8]	Refer Part 7 and Part 14.
1.6	How will this development use and/or impact on non-renewable natural resources? What measures were explored to ensure responsible and equitable use of the resources? How have the consequences of the depletion of the non-renewable natural resources been considered? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?[9]	Refer to the project description in Part 3.5.
1.7	How will this development use and/or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and/or impact on the ecosystem jeopardise the integrity of the resource and/or system taking into account carrying capacity restrictions, limits of acceptable change, and thresholds? What measures were explored to firstly avoid the use of resources, or	Refer to Part 3.5, Part 7 and Part 14.

[6] Section 24 of the Constitution and Sections 2(4)(a)(ii) and 2(4)(b) of NEMA refer.
[7] Section 24 of the Constitution and Sections 2(4)(a)(iv) and 2(4)(b) of NEMA refer.
[8] Section 24 of the Constitution and Sections 2(4)(a)(iii) and 2(4)(b) of NEMA refer.
[9] Section 24 of the Constitution and Sections 2(4)(a)(v) and 2(4)(b) of NEMA refer.

Requirement		Part where requirement is addressed/response
	if avoidance is not possible, to minimise the use of resources? What measures were taken to ensure responsible and equitable use of the resources? What measures were explored to enhance positive impacts?[10]	
1.7.1	*Does the proposed development exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e. de-materialised growth)? (note: sustainability requires that settlements reduce their ecological footprint by using less material and energy demands and reduce the amount of waste they generate, without compromising their quest to improve their quality of life)*	Refer to Part 14.
1.7.2	*Does the proposed use of natural resources constitute the best use thereof? Is the use justifiable when considering intra- and intergenerational equity, and are there more important priorities for which the resources should be used (i.e. what are the opportunity costs of using these resources this the proposed development alternative?)*	Refer to Part 14.
1.7.3	*Do the proposed location, type and scale of development promote a reduced dependency on resources?*	Reefer to Part 14
1.8	How were a risk-averse and cautious approach applied in terms of ecological impacts?[11]	Refer to Part 4.7
1.8.1	*What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?*	Refer to Part 13
1.8.2	*What is the level of risk associated with the limits of current knowledge?*	Medium risk due to knowledge gaps.
1.8.3	*Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?*	Refer to Part 14
1.9	How will the ecological impacts resulting from this development impact on people's environmental right in terms following:[12]	Part 4.7

[10] Section 24 of the Constitution and Sections 2(4)(a)(vi) and 2(4)(b) of NEMA refer.

[11] Section 24 of the Constitution and Section 2(4)(a)(vii) of NEMA refer.

[12] Section 24 of the Constitution and Sections 2(4)(a)(viii) and 2(4)(b) of NEMA refer.

Requirement		Part where requirement is addressed/response
1.9.1	*Negative impacts: e.g. access to resources, opportunity costs, loss of amenity (e.g. open space), air and water quality impacts, nuisance (noise, odour, etc.), health impacts, visual impacts, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?*	Refer to Part 7
1.9.2	*Positive impacts: e.g. improved access to resources, improved amenity, improved air or water quality, etc. What measures were taken to enhance positive impacts?*	Refer to Part 7
1.10	Describe the linkages and dependencies between human wellbeing, livelihoods and ecosystem services applicable to the area in question and how the development's ecological impacts will result in socio-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.)?	Refer to Part 7
1.11	Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives/targets/considerations of the area?	Refer to Part 7 and Part 14
1.12	Considering the need to secure ecological integrity and a healthy biophysical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the "best practicable environmental option" in terms of ecological considerations?[13]	Refer Part 6.
1.13	Describe the positive and negative cumulative ecological/biophysical impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and existing and other planned developments in the area?[14]	Refer to Part 7.4
2.1	What is the socio-economic context of the area, based on, amongst other considerations, the following considerations?:	
2.1.1	*The IDP (and its sector plans' vision, objectives, strategies, indicators and targets) and any other*	Refer to Part 4.16, Part 7 and Part 14.

[13] Section 2(4)(b) of NEMA refer.

[14] Regulations 22(2)(i)(i), 28(1)(g) and 31(2)(1) in Government Notice No. R. 543 refer.

Requirement		Part where requirement is addressed/response
	strategic plans, frameworks of policies applicable to the area,	
2.1.2	*Spatial priorities and desired spatial patterns (e.g. need for integrated of segregated communities, need to upgrade informal settlements, need for densification, etc.),*	Refer to Part 4.16, Part 7 and Part 14
2.1.3	*Spatial characteristics (e.g. existing land uses, planned land uses, cultural landscapes, etc.), and*	Refer to Part 4.16, Part 7 and Part 14
2.1.4	*Municipal Economic Development Strategy ("LED Strategy").*	Refer to Part 4.16, Part 7 and Part 14
2.2	Considering the socio-economic context, what will the socio-economic impacts be of the development (and its separate elements/aspects), and specifically also on the socio-economic objectives of the area?	Refer to Part 4.16, Part 7 and Part 14
2.2.1	*Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programs?*	Refer to Part 4.16, Part 7 and Part 14
2.3	How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?[15]	Refer to Part 4.16, Part 7 and Part 14
2.4	Will the development result in equitable (intra- and inter-generational) impact distribution, in the short- and longterm?[16] Will the impact be socially and economically sustainable in the short- and long-term?	Refer to Part 4.16, Part 7 and Part 14
2.5	In terms of location, describe how the placement of the proposed development will:[17]	
2.5.1	*result in the creation of residential and employment opportunities in close proximity to or integrated with each other,*	Refer to Part 4.16, Part 7 and Part 14
2.5.2	*reduce the need for transport of people and goods,*	Refer to Part 4.16, Part 7 and Part 14
2.5.3	*result in access to public transport or enable non-motorised and pedestrian transport (e.g. will the development result in densification and the achievement of thresholds in terms public transport),*	None

[15] Section 2(2) of NEMA refers.

[16] Sections 2(2) and 2(4)(c) of NEMA refers.

[17] Section 3 of the Development Facilitation Act, 1995 (Act No. 67 of 1995) ("DFA") and the National Development Plan refer.

Requirement	Part where requirement is addressed/response
2.5.4 compliment other uses in the area,	Refer to Part 4.16, Part 7 and Part 14
2.5.5 be in line with the planning for the area,	Refer to Part 4.16, Part 7 and Part 14
2.5.6 for urban related development, make use of underutilised land available with the urban edge,	Refer to Part 4.16, Part 7 and Part 14
2.5.7 optimise the use of existing resources and infrastructure,	Refer to Part 4.16, Part 7 and Part 14
2.5.8 opportunity costs in terms of bulk infrastructure expansions in non-priority areas (e.g. not aligned with the bulk infrastructure planning for the settlement that reflects the spatial reconstruction priorities of the settlement),	
2.5.9 discourage "urban sprawl" and contribute to compaction/densification,	Refer to Part 4.16, Part 7 and Part 14
2.5.10 contribute to the correction of the historically distorted spatial patterns of settlements and to the optimum use of existing infrastructure in excess of current needs,	Refer to Part 4.16, Part 7 and Part 14
2.5.11 encourage environmentally sustainable land development practices and processes,	Refer to Part 4.16, Part 7 and Part 14
2.5.12 take into account special locational factors that might favour the specific location (e.g. the location of a strategic mineral resource, access to the port, access to rail, etc.),	Refer to Part 4.16, Part 7 and Part 14
2.5.13 the investment in the settlement or area in question will generate the highest socio-economic returns (i.e. an area with high economic potential),	Refer to Part 4.16, Part 7 and Part 14
2.5.14 impact on the sense of history, sense of place and heritage of the area and the socio-cultural and cultural-historic characteristics and sensitivities of the area, and	Risk assessment table in part 7
2.5.15 in terms of the nature, scale and location of the development promote or act as a catalyst to create a more integrated settlement?	Refer to socio economic impact in Part 7
2.6 How were a risk-averse and cautious approach applied in terms of socio-economic impacts?:	Refer to Part 5 and 7.
2.6.1 What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?[18]	Refer to Part 13.

[18] Section 24(4) of NEMA refers.

Requirement		Part where requirement is addressed/response
2.6.2	*What is the level of risk (note: related to inequality, social fabric, livelihoods, vulnerable communities, critical resources, economic vulnerability and sustainability) associated with the limits of current knowledge?*	Refer to Part 7.
2.6.3	*Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?*	Refer to Part 6.
2.7	How will the socio-economic impacts resulting from this development impact on people's environmental right in terms following:	Refer to the socio-economic impacts in Part 7.
2.7.1	*Negative impacts: e.g. health (e.g. HIV-Aids), safety, social ills, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?*	Refer risk assessment table in Part 7.
2.7.2	*Positive impacts. What measures were taken to enhance positive impacts?*	Refer mitigation as per risk assessment table in Part 7.
2.8	Considering the linkages and dependencies between human wellbeing, livelihoods and ecosystem services, describe the linkages and dependencies applicable to the area in question and how the development's socioeconomic impacts will result in ecological impacts (e.g. over utilisation of natural resources, etc.)?	Refer to the socio-economic impacts in Part 7.
2.9	What measures were taken to pursue the selection of the "best practicable environmental option" in terms of socio-economic considerations?[19]	Refer to alternative assessment in Part 6.
2.10	What measures were taken to pursue environmental justice so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons (who are the beneficiaries and is the development located appropriately)?[20] Considering the need for social equity and justice, do the alternatives identified, allow the "best practicable environmental option" to be selected, or is there a need for other alternatives to be considered?	Refer to Part 4 and 7. I

[19] Section 2(4)(b) of NEMA refers.

[20] Section 2(4)(c) of NEMA refers.

Requirement	Part where requirement is addressed/response
2.11 What measures were taken to pursue equitable access to environmental resources, benefits and services to meet basic human needs and ensure human wellbeing, and what special measures were taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination?[21]	Refer to the socio-economic impacts in Part 7.
2.12 What measures were taken to ensure that the responsibility for the environmental health and safety consequences of the development has been addressed throughout the development's life cycle?[22]	Specialist assessments, recommendations, risk assessments and proposed mitigation measures
2.13 What measures were taken to:	Refer to Part 5.
2.13.1 ensure the participation of all interested and affected parties,	
2.13.2 provide all people with an opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation,[23]	
2.13.3 ensure participation by vulnerable and disadvantaged persons,[24]	
2.13.4 promote community wellbeing and empowerment through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means,[25]	
2.13.5 ensure openness and transparency, and access to information in terms of the process,[26]	
2.13.6 ensure that the interests, needs and values of all interested and affected parties were taken into account, and that adequate recognition were given to all forms of knowledge, including traditional and ordinary knowledge[27]*, and*	
2.13.7 ensure that the vital role of women and youth in environmental management and development were	Refer to Part 7

[21] Section 2(4)(d) of NEMA refers.
[22] Section 2(4)(e) of NEMA refers.
[23] Section 2(4)(f) of NEMA refers.
[24] Section 2(4)(f) of NEMA refers.
[25] Section 2(4)(h) of NEMA refers.
[26] Section 2(4)(k) of NEMA refers.
[27] Section 2(4)(g) of NEMA refers.

Requirement		Part where requirement is addressed/response
	recognised and their full participation therein were be promoted?[28]	
2.14	Considering the interests, needs and values of all the interested and affected parties, describe how the development will allow for opportunities for all the segments of the community (e.g.. a mixture of low-, middle-, and high-income housing opportunities) that is consistent with the priority needs of the local area (or that is proportional to the needs of an area)?[29]	Refer to the socio-economic impacts in Part 7.
2.15	What measures have been taken to ensure that current and/or future workers will be informed of work that potentially might be harmful to human health or the environment or of dangers associated with the work, and what measures have been taken to ensure that the right of workers to refuse such work will be respected and protected?[30]	Refer to awareness programme in Part 12.
2.16	Describe how the development will impact on job creation in terms of, amongst other aspects:	Refer to the socio-economic impacts in Part 7.
2.16.1	*the number of temporary versus permanent jobs that will be created,*	
2.16.2	*whether the labour available in the area will be able to take up the job opportunities (i.e. do the required skills match the skills available in the area),*	
2.16.3	*the distance from where labourers will have to travel,*	
2.16.4	*the location of jobs opportunities versus the location of impacts (i.e. equitable distribution of costs and benefits), and*	
2.16.5	*the opportunity costs in terms of job creation (e.g. a mine might create 100 jobs, but impact on 1000 agricultural jobs, etc.).*	
2.17	What measures were taken to ensure:	
2.17.1	*that there were intergovernmental coordination and harmonisation of policies, legislation and actions relating to the environment, and*	Continued consultation with all relevant departments, covering DMR, DARDLEA, DWS, SAHRA through authorities meetings, site visits and providing draft Scoping Report and future provision of the draft and final EIR. All registered as

[28] Section 2(4)(q) of NEMA refers.
[29] Section 2(4)(g) of NEMA refers.
[30] Section 2(4)(j) of NEMA refers.

Requirement	Part where requirement is addressed/response
	stakeholders and informed as per public participation chapter.
2.17.2 that actual or potential conflicts of interest between organs of state were resolved through conflict resolution procedures?	No known conflict
2.18 What measures were taken to ensure that the environment will be held in public trust for the people, that the beneficial use of environmental resources will serve the public interest, and that the environment will be protected as the people's common heritage?[31]	Refer to Part 7.
2.19 Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?[32]	Mitigation measures are realistic. However, not all will necessarily result in reversible impacts or in low significance. Rehabilitation strategies aimed at mine closure have been proposed but the effectiveness of implementation will determine long term environmental legacy. Refer to Part 14.
2.20 What measures were taken to ensure that he costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects will be paid for by those responsible for harming the environment?[33]	Closure cost assessment and financial provisioning in Part 11.
2.21 Considering the need to secure ecological integrity and a healthy bio-physical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the best practicable environmental option in terms of socio-economic considerations?[34]	Refer to alternative assessment in Part 6.
2.22 Describe the positive and negative cumulative socio-economic impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area?[35]	Refer to cumulative assessment in Part 7.4

[31] Section 2(4)(o) of NEMA refers.
[32] Section 240(1)(b)(iii) of NEMA and the National Development Plan refer.
[33] Section 2(4)(p) of NEMA refers.
[34] Section 2(4)(b) of NEMA refers.
[35] Regulations 22(2)(i)(i), 28(1)(g) and 31(2)(1) in Government Notice No. R. 543 refer.

The proposed new discard facility project was initiated as a result of limited volumetric air space remaining on the current active coal discard disposal facility. With this opportunity to construct a new discard facility Greenside Colliery intends to improve their coal fines recovery and develop a coal discard facility that will be an environmentally acceptable, economically constructed and operated disposal facility.

A number of methods to dispose coal fines and discards have been developed due to the challenging nature of the material. The particle specific density of coal fines is low; consequently the air dried density of the material can be lower than 1 resulting in the propensity for the material to float away. Forming self-impounding stable, drained and consolidated coal fines waste piles is therefore restricted to very arid areas. The most common means of managing coal discard in South Africa is to impound the fines within either earth embankments or discard embankments.

Oxidation of carbonaceous and pyretic coal fines and discards due to the ingress of water and air, results in an increased risk of SponCom and AMD. A proven means to manage SponCom has been to spread and compact the material in thin layers when forming the embankments. Ingress of water is minimized by shaping the facility into a smooth domed whale-back fashion thereby encouraging run-off and reducing infiltration. Maintaining a small pool around the penstock reduces the phreatic flow both through the fines and discard embankments. The risk of AMD is reduced by these two activities however practical constraints have led to significant AMD being generated on some facilities.

Improved coal fines recovery at the plant has decreased the economic value of fines – a major driver in the past for keeping discard and fines separate. Further improved efficiency of dewatering equipment is now able to produce a semi-dry fines material that can be combined with discards. As such the quantity of water within the deposit can be controlled upfront reducing the need for management at the point of deposition. The conceptual design therefore envisages a mixed product of gravel sized discard and fines being spread in layers to form a “Combined Dump”. It may also be possible that less compaction effort will be required as fines naturally fill the voids between the coarse discards particles. The risk of AMD and SponCom are therefore reduced.

To date this method has not had wide spread use in South Africa, with the method implemented at Klipspruit Colliery and piloted at Mafube Coal Mine. Difficulties have been experienced mainly associated with the discharge from the silo. In addition, deposition requires close management as the ratio of fines and discards varies along with the water content of the product.

More recently, bulk solids flow analysis test work was carried out in association with the Blaauwkrans expansion project at Landau Colliery resulting in a modified silo discharge design that can handle the combined product.

Further laboratory work is currently underway on the Greenside discards material (coarse and dewatered fines) to establish a conceptual geotechnical model for the behaviour of the combined product.

Should the discard facility project not be implemented, Greenside Colliery would run out of space to place their discard, and the Colliery will not be able to continue to supply coal to the existing markets at the current rate of demand. In return the jobs of workers that are currently employed at the Greenside Colliery may be lost. Positive impacts of the proposed project and improving the method of disposal of coal discard would also be lost if the project is not carried out.

Expected indirect benefits of the proposed project include:

- Continued employment of staff.
- Potential for the creation of additional jobs.
- Continued upliftment of the surrounding communities.
- Rehabilitation of environmental issues within the wetland areas.
- Continued supply of coal to the local, national, and international markets, and therefore contribution to local, provincial and national economy.

4. DESCRIPTION OF THE EXISTING ENVIRONMENT

This chapter provides an overview of the baseline environmental situation of the Greenside Colliery in terms of the Climate, Geology, Topography, Soil, Land capability and Land use, Fauna and flora, Surface water, Groundwater, Air quality, Noise and vibration, Sites of historical and archaeological significance, Sensitive landscapes, Visual aspects and the Socio-economic environment, which may directly or indirectly be affect the immediate and surrounding environment.

This section merely summarises the information obtained from existing documents with their supporting specialist studies. Information from various studies regarding the pre-mining environmental status as well as the changes to the environment due to existing mining activities have been conducted and pertinent information is included in this section.

The following terminology has been used throughout this document to describe the relevant surface areas that apply to this Report.

Table 15: Terminology

Area	Definition
Mining area	Actual mine boundary area as defined in terms of the new order Mining Right under the MPRDA, 2002 for the Greenside Colliery.
Surface area	Surface rights owned by Greenside Colliery.
Study/project area	The extent of the study area is determined by the area of influence of the different environmental components relevant to each aspect. Thus, the study area referred to within the text applies to the specific component under description. The extent of the study area is therefore not influenced by the mine boundary area, but rather by the specific activity relative to the environmental component.
Area of surface disturbance	This refers to the area where the soil and vegetation is physically disturbed due to activities, i.e. the discard facility and the infrastructure associated with the discard facility.
Dirty water management area	Surface area where polluted water is managed and will impact on receiving environment if not contained.

4.1 GEOLOGY

The background to the geology of the study area described below was obtained from the report titled '*Geohydrological Study at Greenside Colliery as input to the development and impact assessment for a new discard dump",* dated April 2013 and compiled by Groundwater Complete (Attached in Appendix E).

The study area is underlain by rocks of the Karoo Supergroup. The Karoo Supergroup comprises a sedimentary succession of sandstones, siltstones, shales and coal measures. The coal measures are contained within the Vryheid Formation from the Middle Ecca Group. The Karoo sediments are underlain by the Dwyka formation, comprising of diamictites and tillites that form the basement of the Karoo

Supergroup. Igneous intrusions of late Karoo Supergroup age in the form of dolerite dykes and sills also occur through the sedimentary succession and the study area is no exception.

Some minor dolerite dykes, sills and normal faulting have been recorded in the study area, of which the most prominent is a dolerite sill in the western part of the lease area. Structural geological features like dykes and faults can have a measurable influence on groundwater flow and mass transport. A 1:250 000 scale geological map of the study area is provided in Figure 12**.**

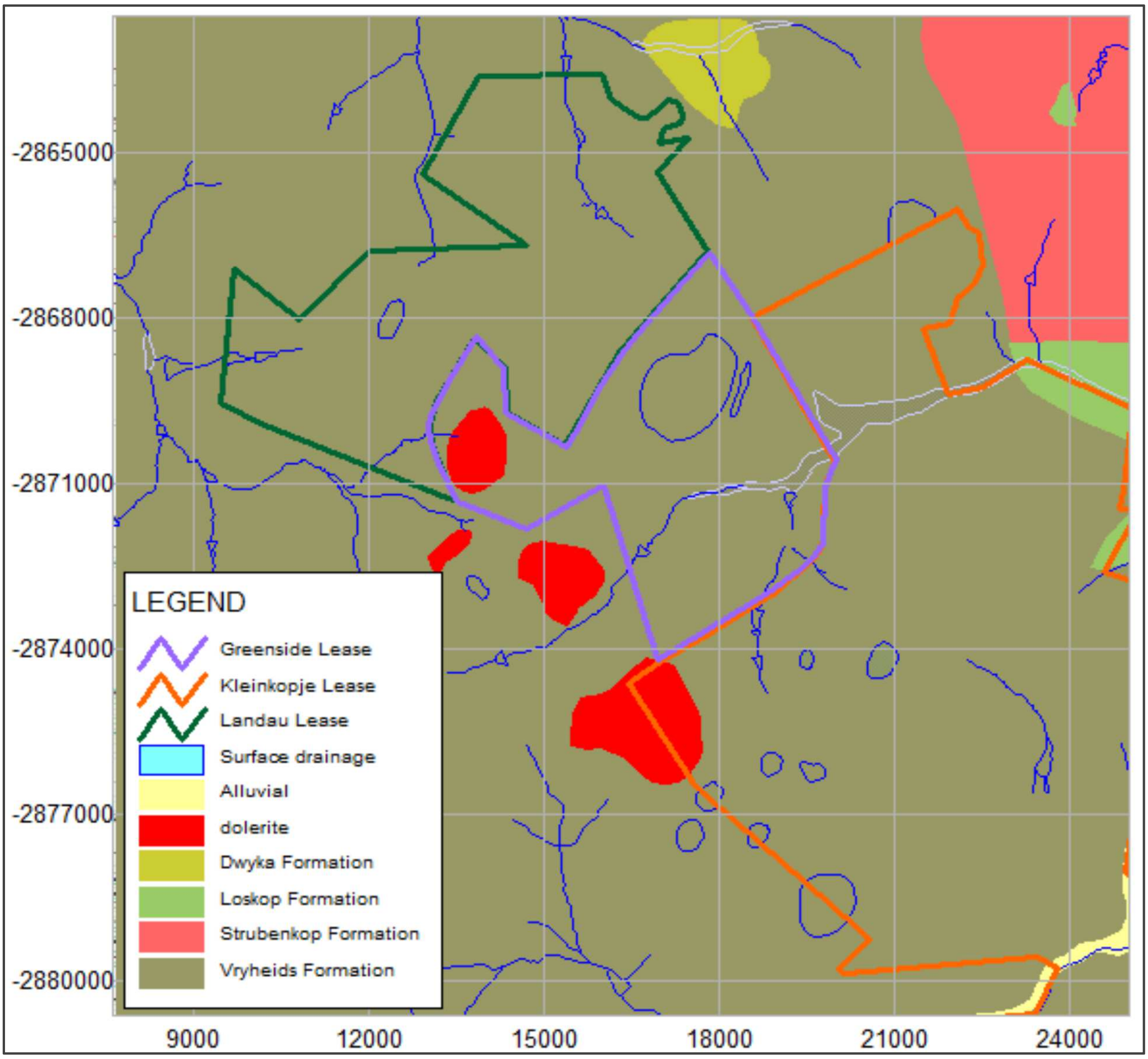


Figure 12: Simplified geological map of the mining area

4.2. CLIMATE

4.2.1 Regional climate

The study area lies in the summer rainfall region (Highveld) of Southern Africa, with cold and dry winters, and warm and wet summers. Temperatures range from 9°C to 32°C in summer and from 6°C to 22°C in winter. Frost occurs frequently between May and September. During summer months prevailing winds are northerly or easterly and during the winter months prevailing winds are north westerly to south westerly.

4.2.2 Mean monthly maximum and minimum temperatures

Temperature information from the Witbank Weather Station is presented in Figure 16 below (South African Weather Service, 2006). The highest average maximum daily temperatures occur from November to March ranging from 25.2ºC to 27.5ºC. June, July and August are the coldest months of the year with the average minimum temperatures ranging from 5ºC to 6ºC.

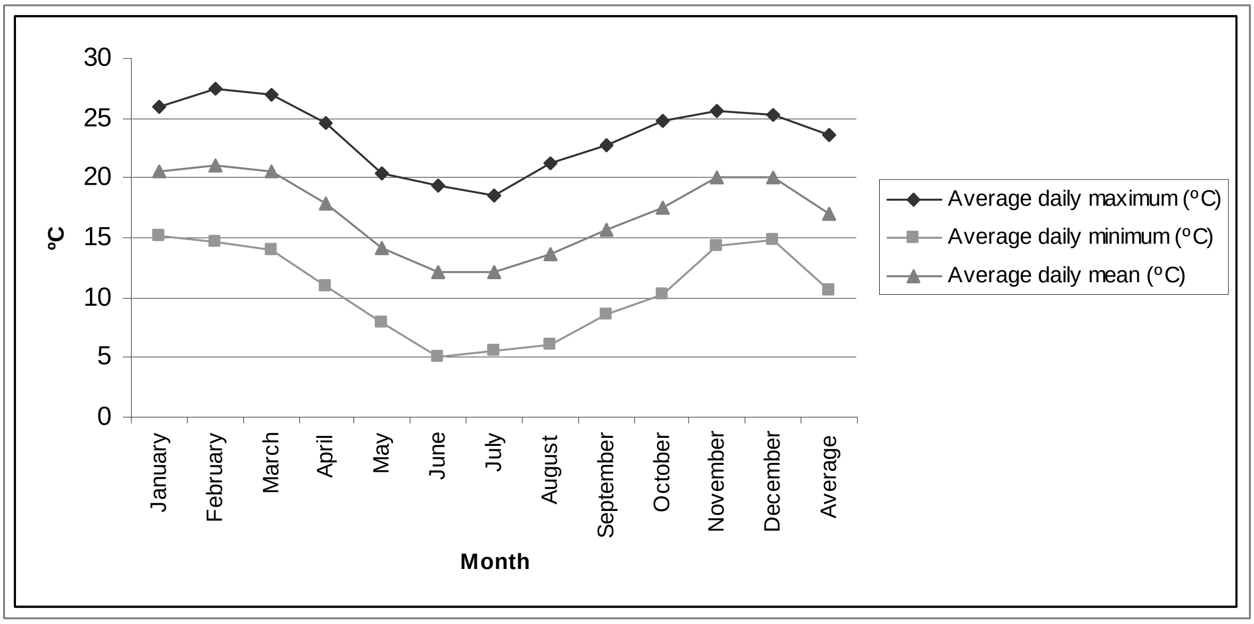


Figure 13: **Average monthly maximum and minimum temperatures (Witbank weather station)**

4.2.3 Precipitation and evaporation

Precipitation in the area is highly seasonal with a mean annual rainfall of 702.7 mm according to the rainfall data from the DWA hydrological datasets collected at station B1E001 (1963-2009). Most of the rainfall occurs during the summer months with the majority of rain events between October and April. The region receives the highest rainfall in January and the lowest in July. Evaporation is measured at station B1E001 for an S class pan located approximately 14 km east of the proposed discard facility.

Table 16: Average annual precipitation and evaporation

Date	Rainfall (mm)	Evaporation (mm)
January	131.5	164.5
February	91.8	138.4
March	73.8	129.6
April	39.3	97.4
May	13.4	79.8
June	7.0	65.3
July	2.9	72.5

Date	Rainfall (mm)	Evaporation (mm)
August	7.9	98.8
September	20.7	137.3
October	78.3	163.7
November	123.8	158.5
December	116.7	163.6
Annual	**702.7**	**1476.2**

Table 17 below lists the design rainfall depths measured at Station 0515355 W Landau Mine located approximately 8 km north of the site where the proposed discard facility will be located. Data is collected over a period of 35 years.

Table 17: Design rainfall depths (mm) at 0515355 W Landau Mine

Duration (days)	Return Period (years)						
	2	**5**	**10**	**20**	**50**	**100**	**200**
1	47	63	74	86	102	115	128
2	57	76	89	102	120	134	148
3	64	85	99	113	132	146	161
4	70	92	107	122	142	157	173
5	77	100	116	132	153	169	185
6	81	106	122	138	159	176	192
7	85	111	127	144	165	181	197

4.2.4 Maximum rainfall intensities

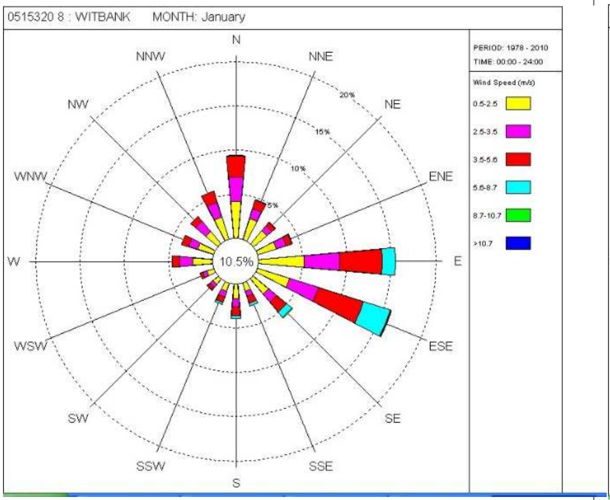
Maximum rainfall intensities recorded for the KwaMthunzi Vilikazi weather station are presented in Table 18.

Table 18: Maximum Rainfall Intensities in 24 hours (KwaMthunzi Vilikazi Weather Station)

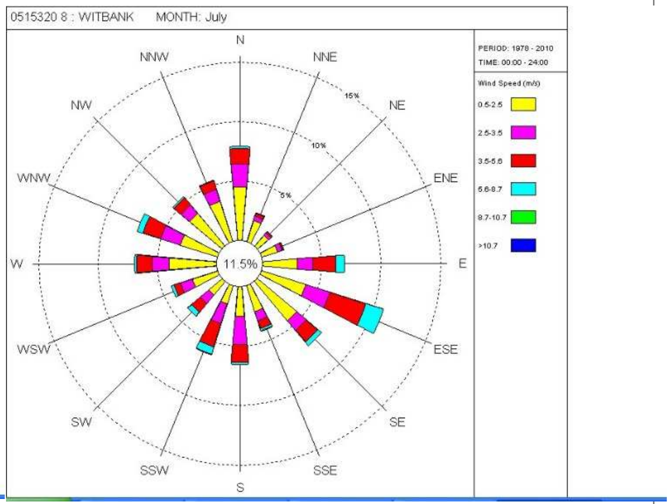
Years of record	Maximum in 24 hours (mm)	Recurrence Interval (mm)	
		50 years	100 years
52	150	119	136

4.2.5 Mean monthly wind direction and speed

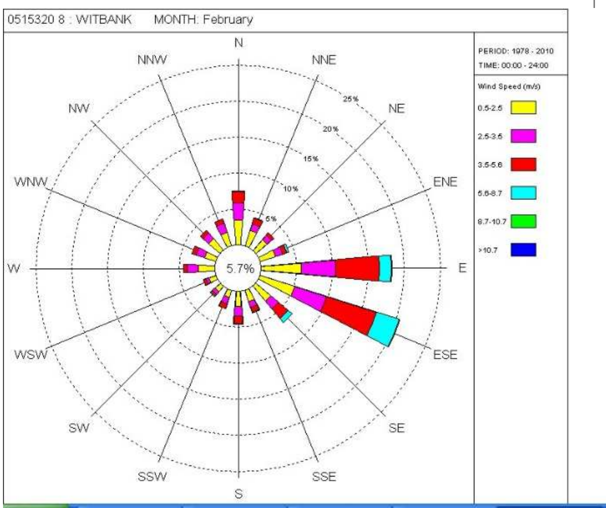
Wind in the Greenside Colliery area blows predominantly in a northerly direction during winter and spring, and predominantly in a south easterly direction during summer and autumn (refer to Figure 14 below).



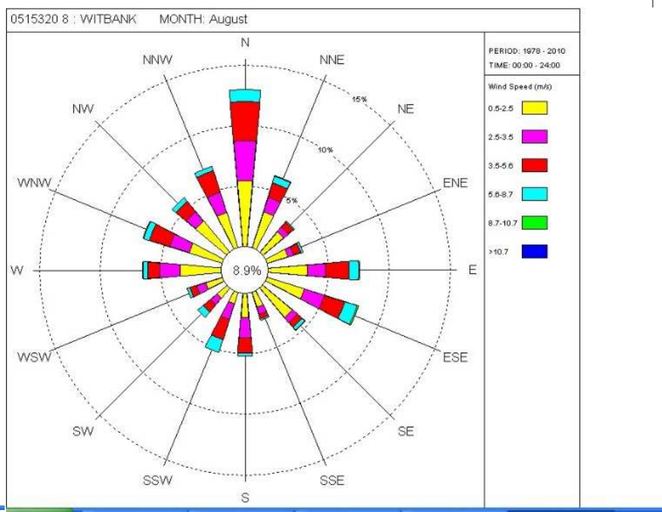
January



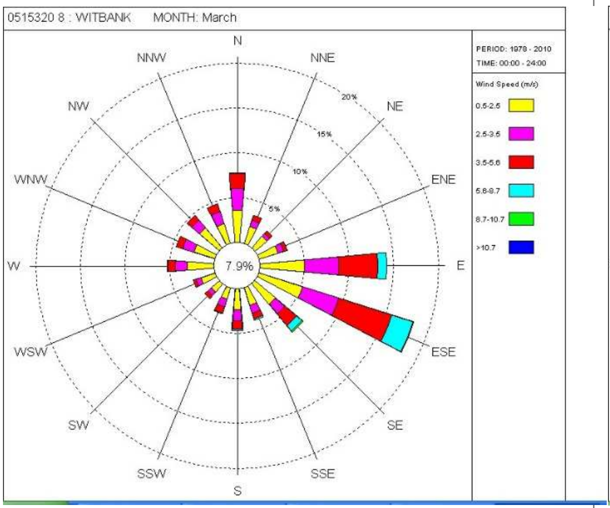
July



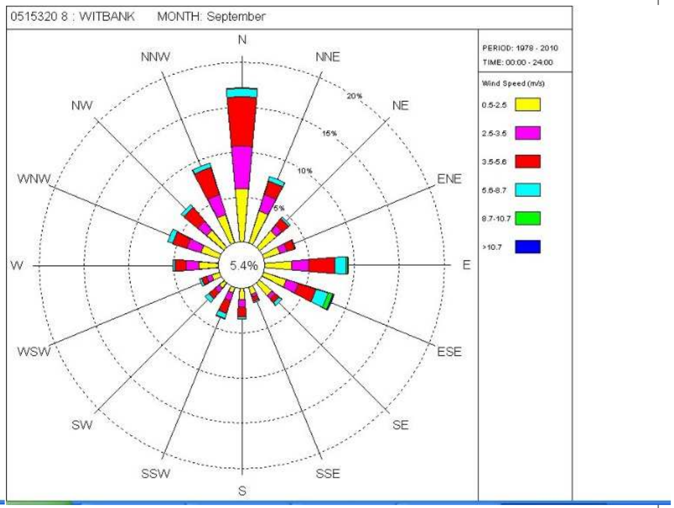
February



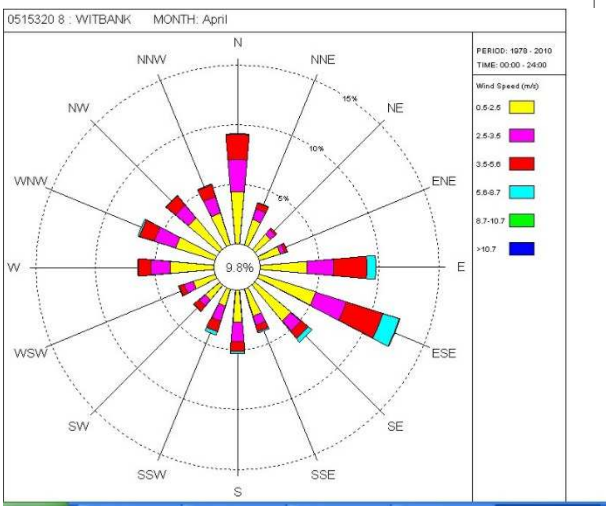
August



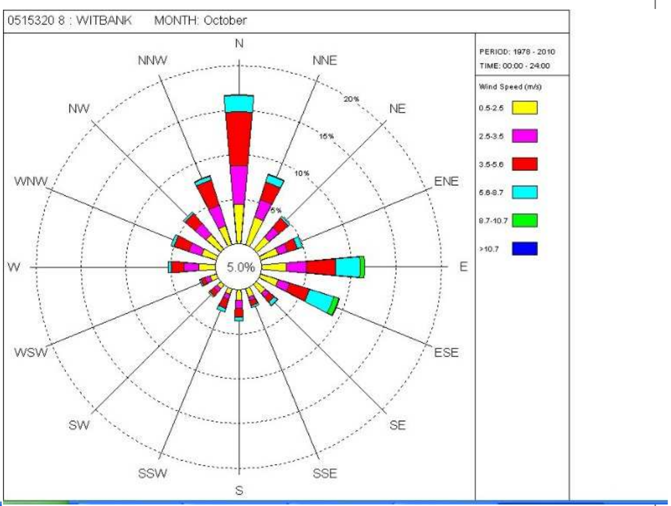
March



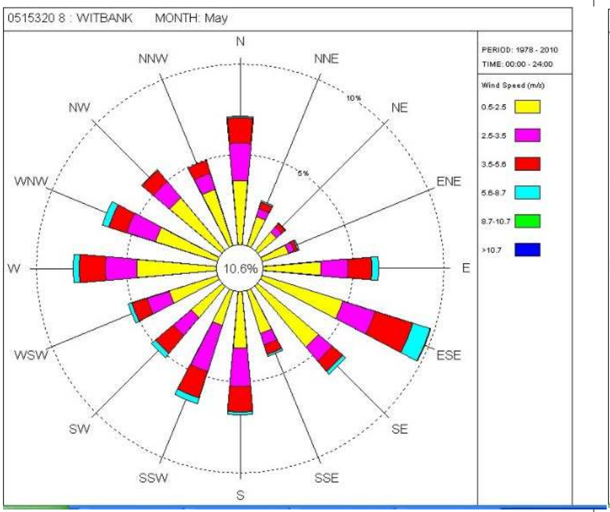
September



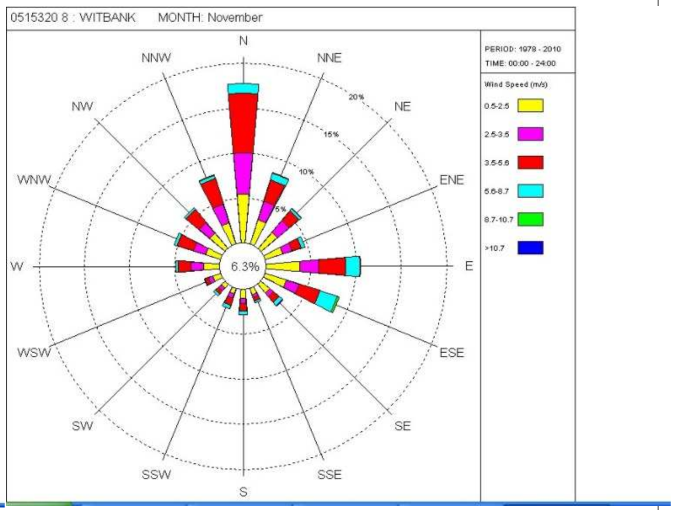
April



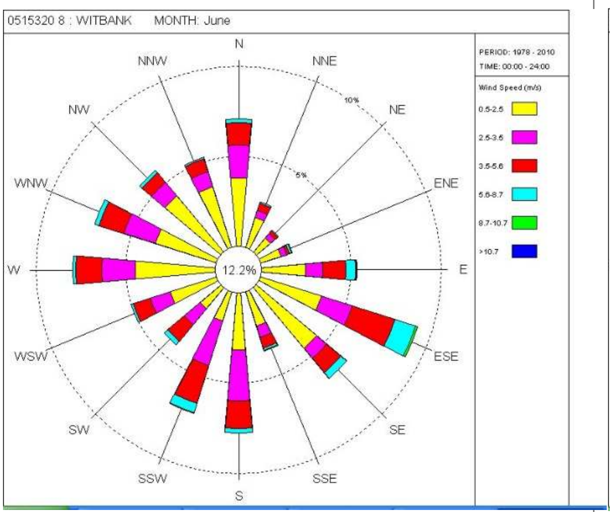
October



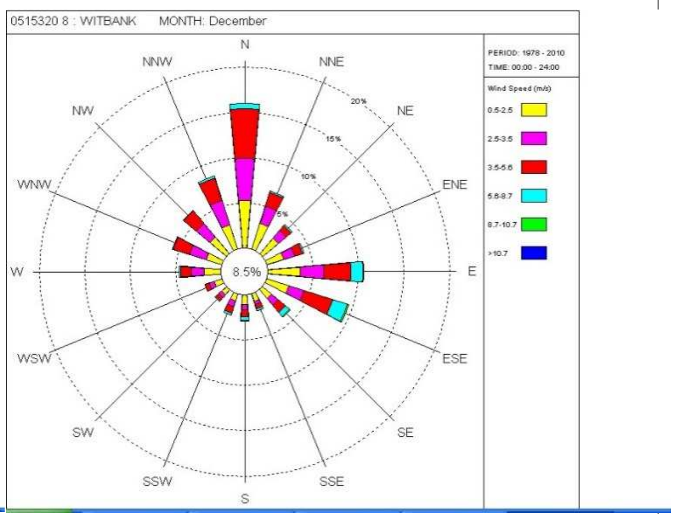
May



November



June



December

Figure 14: Seasonal wind roses as modelled for Ogies (South African Weather Service, 2009)

The average monthly wind speed for the period 1993 - 2003 was 10.26 m/s. The maximum wind speed of 13.6 m/s was measured in October 1995 and the minimum wind speed of 8 m/s was experienced in June and July 2000.

4.2.7 Incidence of extreme weather conditions

Rainfall occurs mainly as thunderstorms during the summer months. These are accompanied by lightning and usually occur with strong winds, heavy rains and occasionally hail. These storms are localised and rainfall can vary markedly within a short distance. On average, hail occurs six times per year.

Frost is common in the winter months (May to September), with an average occurrence of 58 frost days per year. Of these frost days, a maximum monthly average of nine days occurs in July.

4.3 TOPOGRAPHY

The topography for the Province of Mpumalanga is predominantly characterised by an undulating plateau with several valleys incising the plateau. (Mucina & Rutherford 2006) The average elevation of this area varies between that of 1400 to 1600 metres above mean sea level (mamsl).

Greenside Colliery is situated on the Mpumalanga Highveld. The proposed site for the new discard facility is located to the south of the existing operations and abuts onto the existing 3A open pit of Kleinkopje Colliery. The North area of the proposed site is characterised by gentle undulating platue which varies between 1600 mamsl in the south and 1540mamsl in the north. The lowest point is at 1540 mamsl where the extreme north of pit 3A of Kleinkopje approaches the Greensidespruit.

The southern edge of the proposed site runs roughly along a minor watershed. The proposed site thus has no streams running onto the site. The Greensidespruit does however begin on the site and bisects the site, flowing from the south to the north. The Greensidespruit begins at a stream that feeds a small wetland area and the three constructed dams before passing under the N12 and into a steam diversion on the existing operations at Greenside Colliery. The Greensidespruit flows into the Naauwpoortspruit within approximately four kilometres. The Naauwpoortspruit in return flows into the upper section of the Witbank Dam.

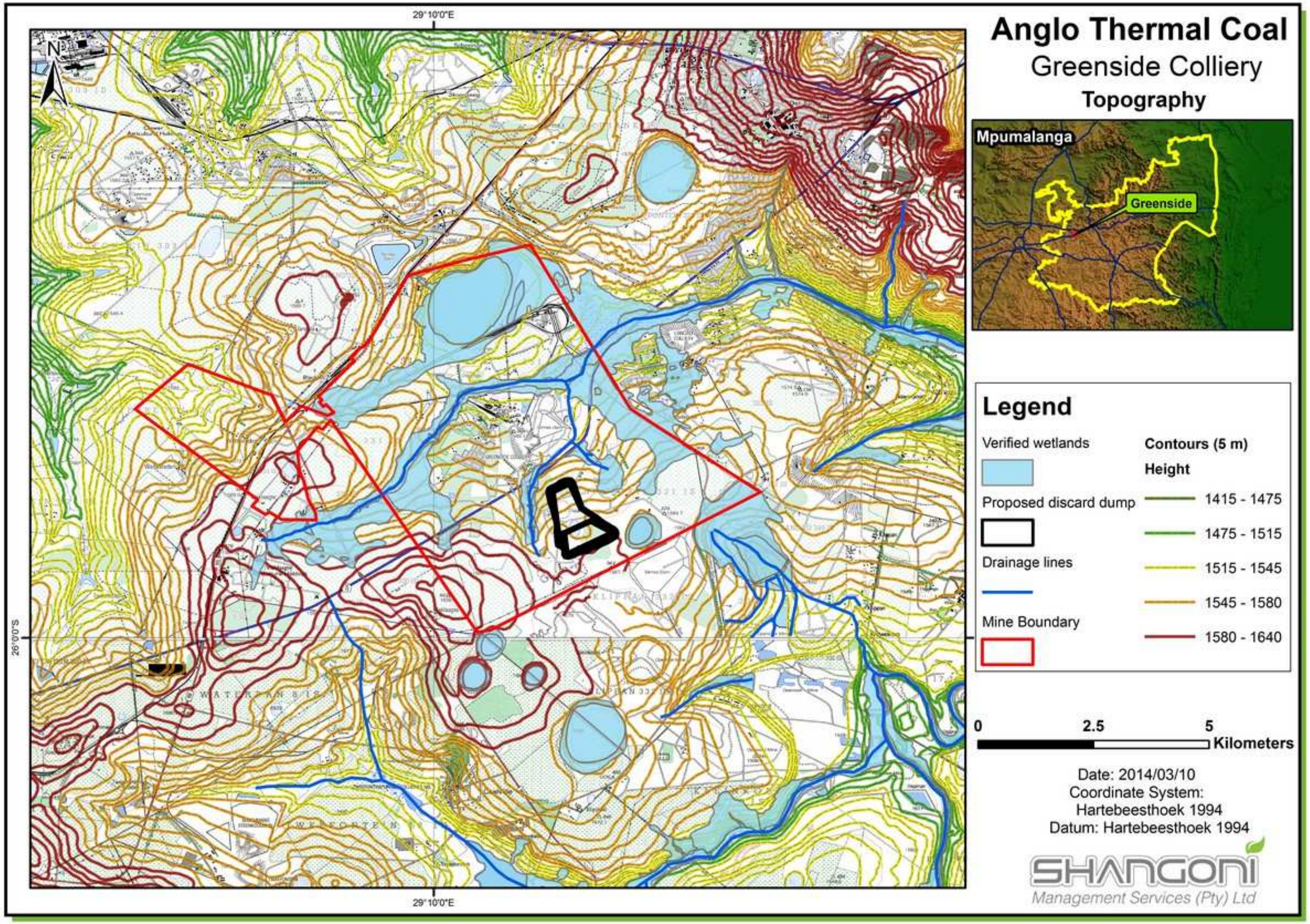


Figure 15: Topography of Greenside Colliery

4.4 SOIL

Ten types of soils have been identified at the Greenside Colliery. These soils were identified through the analysis of the historic open cast pits on site. The ten soil types identified are:

- Hutton
- Clovelly
- Glencoe
- Griffin
- Dresden
- Avalon
- Longlands
- Witbank
- Westleigh
- Mespah

A grid base soil survey of the proposed site was completed in September 2001 (ARC ISCW Report No. GW/A/2001/43). The survey was carried out on a 150x150 meter grid using a hand held auger to a maximum depth of 1.5 metres. Soils were classified according to the South African Soil Classification System (1991).

The soils presented on the site are typical of the Highveld catena with deep red apedal strctureless soils (Hutton, Bainsvlei) present on the upper slope with an average dept of 1000mm, yellow and brown soils (Clovelly, Griffen, Glencor, Avalon) of shallower depth (approximately 750mm), on the mid and lower slopes. Soils towards the base slope become beached sandier and grey (Dresden, Mispah) with an average dept of 500mm.

4.5 LAND CAPABILITY

The pre-mining land capability of the surface area of Greenside Colliery was pre-dominantly that of agriculture and grazing. 61% of the surface area was capable of arable production (the growing of crops) with a further 25% of the surface area having grazing potential. The remaining 14% was classified as that of wilderness and wetland areas (WMB, 2002).

The pre-mining land capability of the study area was pre-dominantly that of agriculture. 63% of the surface area was capable of arable production (the growing of crops) with a further 7% of the surface area having grazing potential. The remaining 30% was classified as that of wilderness and wetland areas (WMB, 2002).

4.6 LAND USE

4.6.1 Pre-mining Land Use

The pre-mining land use of the site was predominantly that of agriculture with 13% of the land being occupied with wetlands, dams and pans. The arable areas to the east and west of the proposed site are actively cropped, with dry land maize constituting the principle crop. Open grassland areas (both natural veld and rehabilitated areas) are grazed at a low intensity. The south central portion of the site is derelict on account of past, unrehabilitated, opencast activity. A large portion of the area within the eastern portion of the site is currently under a mixed wattle / grassland community. To the south, the density of wattle is such that the grazing value of the land is currently lost. About 72% of the proposed site has arable potential. Much of the arable land within the site will be lost due to the proposed new discard facility project.

4.6.2 Evidence of Misuse

As noted in the original EMPR, evidence of minor soil erosion in the cultivated areas exists. The central and eastern portion of the site is however heavily infested with black wattle. A large portion of the site has been impacted on by past opencast mining.

4.7 VEGETATION

A Flora study was conducted by Digby Wells Environmental in October 2013 entitled:" *A Fauna and Flora Report for Greenside Mineral Residue Discard Facility*". The aim of the floral study was to describe the location and ecological state of floral communities associated within the new discard facility by means of undertaking a literature review of the available specialist studies which have been completed for the operations, as well as by incorporating site specific field information and is described below.

4.7.1 Vegetation Communities

The study area has been described according to the classification of various communities which exist within the Greenside Colliery project area. The area comprises largely of grassland which is typical of the area, as well as seasonal wetlands and 'wet' vegetation surrounding the dams. Areas which have previously been developed have poor vegetation which can be described as secondary plant community. A proportion of the land is currently under crop cultivation. Furthermore there exists an alien vegetation community (Eucalyptus stand). Vegetation communities which were delineated for the Greenside Project area are as follows;

- Remnant Natural Grassland Community;
- Secondary Grassland Community;
- Wetland Community;
- Dam Vegetation Community;
- Transformed Areas; which comprise of Agricultural fields (predominantly maize), Alien Vegetation (plantations of Eucalyptus etc.), and Development (Mining infrastructure and residential buildings).

4.7.1.1 Remnant Natural Grassland

This vegetation community is a medium to tall grassland with relatively high aerial cover, as illustrated in Figure 16 below. Dominant species include *Hyparrhenia hirta*, *Themeda triandra* and *Setaria sphacelata*. Other common and conspicuous species include *Elionurus muticus*, *Cymbopogon excavatus*, *Aristida bipartita*, *Scabiosa columbaria*, *Senecio inornatus*, *Justicia anagalloides*, *Ranunculus multifidus*, *Eragrostis plana*, *Oenothera rosea*, *Brachiaria eruciformis*, *Hyparrhenia dregeana*, The community is found adjacent to the marsh wetlands in the study area and consists of those areas of terrestrial vegetation that have not been cultivated. In many cases it contains species that suggest that these grasslands are ephemeral wetlands or hydrophytic grasslands, occurring within areas with periodically wet soils. It is the most widespread natural vegetation type remaining in the study area.

Figure 16: Primary Grassland Community, Greenside Colliery

The species richness of terrestrial grasslands is moderate low for grasslands and is 26.5 species per 100 m^2, which is also fairly typical of grasslands in floodplain areas. The grasslands are in relatively poor condition due to the high disturbance regime in the study area as well as apparent overgrazing. Some exotic species occur in these grasslands, including *Verbena bonariensis*, but these usually occur at low frequency and density. These grasslands are considered to have a moderate sensitivity and conservation value. This is due primarily to the high rates of transformation of this vegetation at a national scale and the poor rates of conservation as well as the important buffer role they play adjacent to the seasonal marsh wetlands. Only a few fragmented areas of untransformed grassland remain within the region of the highveld within which the study area is situated.

4.7.1.2 Secondary Grassland Community

Past cultivation and mining activities have led to the disturbance of the original natural grassland vegetation. Secondary grassland has developed in areas where cultivation has ceased or an effort toward land rehabilitation has occurred where mining previously occurred. These areas are dominated by species such as *Cynodon dactylon*, *Eragrostis curvula* and **Cyperus esculentus*. Common and conspicuous species include **Verbena bonariensis*, *Pseudognaphalium oligandrum*, *Gomphocarpus fruticosus*, *Bidens bipinnata* and *Tagetes minuta*, many of which are weeds of disturbed places or typical of post-disturbance succession. Some of these species are illustrated in Figure 17 below.

Figure 17: Alien invasive flora species which have colonised in degraded grasslands at Greenside Colliery; (left to right) Wild Verbena (*Verbena bonariensis*), Khakhi Bush (*Tagetes minuta*) and Brown Nut Sedge (*Cyperus esculentis)*

Species richness is 11.0 species per 100 m^2, the lowest of all the natural plant communities in the study area. Due to the low species richness, high proportion of alien weeds and indigenous species that are indicative of disturbance, and disturbed nature of these areas which is therefore regarded to have a low ecological sensitivity and low conservation value.

4.7.1.3 Wetland Vegetation

Wetland vegetation exists along the shallow drainage lines that drain the study area. The vegetation of is composed primarily of tall reed stands dominated by bulrushes (*Typha capensis)* and Common Reeds (*Phragmites australis)* as seen in Figure 18 below. In seasonal wetland areas the vegetation cover is composed of a typical variety of grasses and sedges which thrive in moist conditions.

Figure 18: Wetland Vegetation (left to right) Common Reed (*Phragmites australis)* and Bulrushes *(Typha capensis)*, Greenside Colliery

Two major vegetation zones were distinguished by De Castro and Brits (2006) in the wetland area based on the vegetation structure (e.g. vegetation physiognomy, life form structure and floristic composition) of the constituent plant communities. The major factors influencing the distribution of the zones include frequency and duration of inundation and/or elevated soil moisture levels. The major zones are as follows:

Zone A:

This is the central zone of the drainage lines, where the soils are usually permanently inundated. This zone consists of dense 'reedbeds' of *Typha capensis*, with smaller patches of *Phragmites australis*. The species diversity is 5.0 species per 100 m^2 in this zone. Common and conspicuous species that occur amongst the reedbeds and especially near the margins of these reedbeds include *Leersia hexandra, Cotula anthemoides* and *Verbena bonariensis*.

Zone B:

This is the zone of transition between wetland vegetation and terrestrial grassland and the plant community contains floristic elements of both vegetation units. The soils are probably only briefly inundated and then only during very wet years, but are likely to have seasonally saturated soils. Dominant grasses include *Andropogon appendiculatus*, *Hemarthria altissima* and *Cynodon dactylon*. Common and conspicuous species include *Senecio inornatus, Pennisetum sphacelatum, Eragrostis plana, *Oenothera rosea, Hypoxis acuminata, Setaria nigrirostris, *Verbena bonariensis, *Paspalum urvillei* and *Typha capensis*. The species diversity is 24.0 species per 100 m^2 in this zone.

The overall species richness of the wetlands is 14.9 species per 100 m^2. This compares favourably with species richness in wetlands within grassland areas of other parts of the country. The wetlands have been affected by canalisation and damming in various parts of the study area and are not always in pristine condition.

However, they have a high sensitivity and conservation due to the fact that they perform an important ecological function, e.g. maintaining water purity and supply and reducing soil erosion. In addition to this they provide habitats for various wild animal and bird populations and contain many plant species that are restricted to this habitat such as the near threatened (NT) (SANBI, 2012) plant *Nerine gracilis,* illustrated in Figure 19 below, which is known to occur in similar habitats in the region.

Figure 19: *Nerine gracilis* (NT), which could potentially occur within the wetland areas within Greenside Colliery

The wetlands are linear systems and as a result any disturbance will affect the quality of the system and subsequent ecological functioning further downstream.

4.7.1.4 Transformed areas

4.7.1.4.1 Agriculture

Agriculture consists of a variety of crops, primarily maize. Cultivation is considered to be a complete transformation of natural vegetation. The cultivated areas were not studied in detail, but are considered to have a low ecological sensitivity and low conservation value.

4.7.1.4.2 Alien vegetation

According to the Conservation of Agricultural Resources Act (Act No. 43 of 1983) a number of plant species recorded on site are exotics and six are declared aliens Species include; *Eucalyptus camaldulensis*, *Pinus* sp., *Populus deltoides* and *Salix babylonica* (declared invaders category 2), *Cirsium vulgare* (declared weed category 2) and *Pennisetum clandestinum* (proposed declared weed). Outside of the Alien Vegetation Unit the majority of these are found within wetland environments. It is likely that there are other Declared Weeds or Alien Invasive species occurring at the Mine that were not recorded in the April 2006 survey ((De Castro and Brits (2006)). Photographs of transformed vegetation is presented Figure 20.

Parts of the study area exotic trees, primarily *Eucalyptus* species. Most of these have been planted as formal woodlots or plantations to harvest commercially. Other exotic species occurring in the study area, primarily as invasive species along parts of the drainage lines include *Pinus* species, *Populus* x *canescens* and *Salix babylonica*. The areas dominated by alien trees are considered to have a low ecological sensitivity and low conservation value, except where they may provide important habitat for birds or other animals.

Figure 20: Transformed Vegetation (left to right); Agricultural crop; Maize (*Zea mays*), Weeping Willow (*Salix babylonica*) and River Gum (*Eucalyptus camaldulensis*)

4.7.1.4.3 Developed areas; Mine infrastructure, urban areas, homesteads

Areas within the project area of Greenside Colliery have undergone complete transformation of natural vegetation as a result of development. 'Development' describes buildings, infrastructure, roads, mining operations (including open-cast pits and dumps), railways, etc. and has largely resulted in degradation of the surrounding surface ecology, with a high number of exotic and alien invasive species colonising in these area.

4.7.2 Red List Plant Species

No threatened species were encountered during the field survey of the study area. Lists of historical occurrences of Red List plant species obtained from the PRECIS Database of the SANBI for the quarter degree square 2529CC as well as for three adjacent grids in which similar habitats are found (2529CD, 2629AA and 2629AB), this is presented in Table 19.

This information was supplemented with expert knowledge, of additional species that potentially occur in this part of Mpumalanga, gained through a number of previous studies done in this region, as well as from the threatened species Database of the Mpumalanga Parks Board, the Red Data list for South Africa (Golding, 2002), regional flora treatments, atlases and taxonomic treatments of relevant groups.

Table 19: Red Data flora species which could occur within the Greenside Colliery project area (SANBI, 2012)

Family	Species	Status
APOCYNACEAE	*Aspidoglossum validum*	Threatened
ASTERACEAE	*Callilepis leptophylla*	Declining
MESEMBRYANTHEMACEAE	*Frithia humilis*	Endangered
AMARYLLIDACEAE	*Crinum bulbispermum*	Declining
AMARYLLIDACEAE	*Crinum macowanii*	Declining
APOCYNACEAE	*Pachycarpus suaveolens*	Vulnerable

AQUIFOLIACEAE	*Ilex mitis*	Declining

Four species are listed to be declining, (*Callilepis leptophyll , Crinum bulbispermum, Crinum macowanii, Ilex mitis). Aspidoglossum validum* is threatened, *Pachycarpus suaveolens* is *listed to be vulnerable. Frithia humilis* is listed as endangered*. Ilex mitis* listed as Declining is not likely to occur on the site since it is found on substrates and habitats not found within the study area.

Callilepis leptophyll, Crinum bulbispermum, Crinum macowanii , *and Aspidoglossum validum* could occur within the study area within the Seasonal Wetland vegetation unit and adjacent areas of moist grassland. *Frithia humilis* has previously been found in an area between Bronkhorstspruit and Witbank, and occurs on shallow, sandy soils associated with sheets of bedrock. Within the study area, there is no potentially suitable habitat for this species and it is therefore considered unlikely that this species occurs within the study area.

Outlined below (Figure 21) are the flora regions associated with the Discard Facility. Planned infrastructure as well as delineated wetlands are also present.

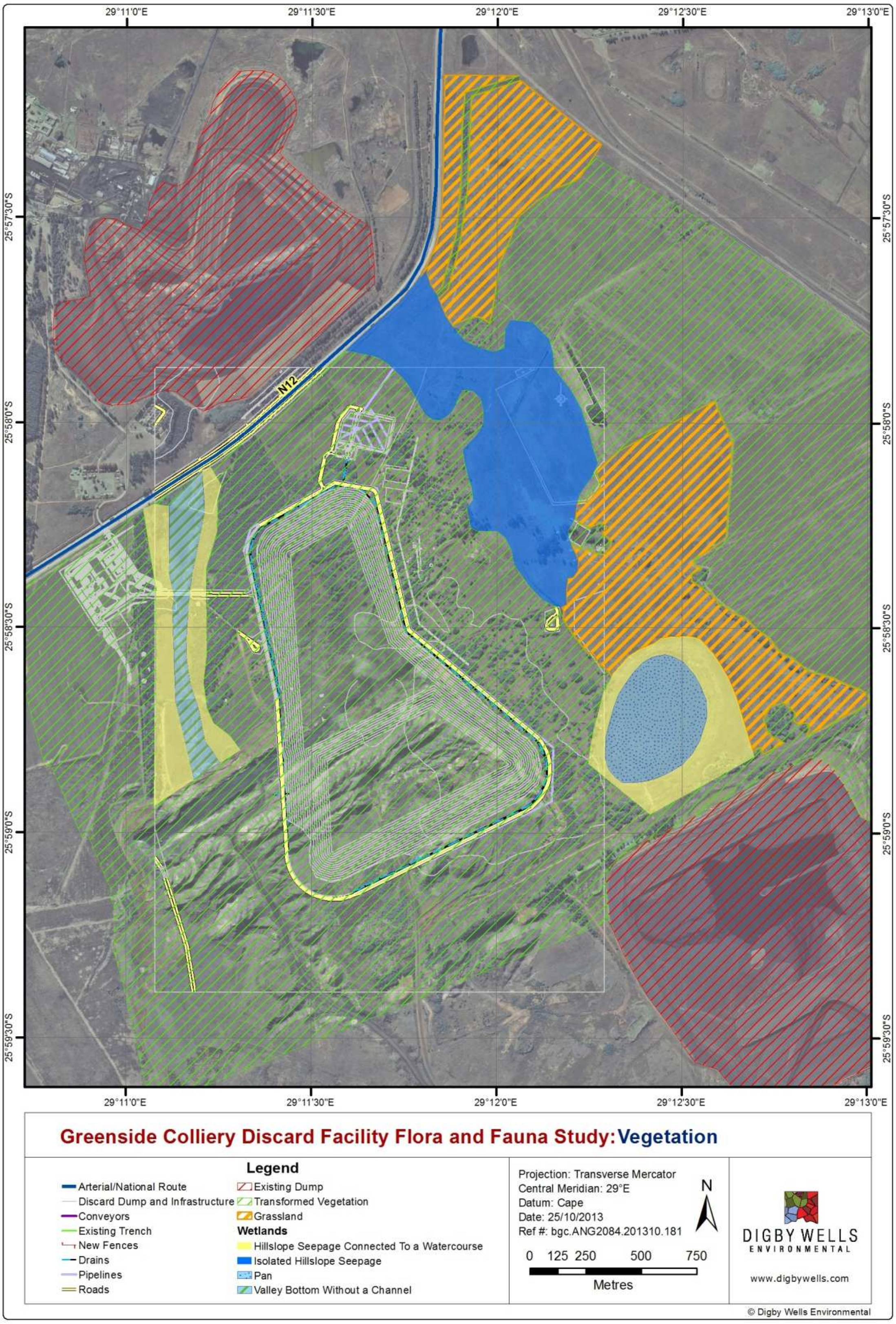


Figure 21: Vegetation map associated with the Discard Facility

4.8 ANIMAL LIFE

A fauna study was conducted by Digby Wells Environmental in October 2013 entitled:" *A Fauna and Flora Report for Greenside Mineral Residue Discard Facility*". The aim of the fauna assessment was to determine the faunal composition of the project and in so doing, establish its ecological integrity. This was achieved with the following objectives:

- To determine fauna species that occur on site including mammals, birds, reptiles and amphibians;
- To identify Red Data, threatened, protected or keystone species found within the project area;
- To determine important habitat areas for Species of Concern; and
- To describe the different habitats which occur within the area of concern and evaluate their conservation importance and significance with reference to the possible presence of threatened species at the collieries.

The environment at Greenside Colliery is largely disturbed. Large parts of the project area have been modified and disturbed as a result of mining and agriculture. Few small patches of natural vegetation in the form of what can be termed primary grassland and secondary grassland have not been transformed, or are in a state of rehabilitation. These lie fragmented throughout the area. These patches support higher levels of biodiversity and provide suitable habitat which contrasts their largely modified, inhospitable surrounds. Other natural areas which are not considered modified are wetlands, which lie along the drainage lines which provide varied habitat for a number of species and the Dam areas, which are similarly host to a number of species surrounding the open water.

The following habitat types were identified within the project area;

- Natural Grassland Habitat;
- Natural Secondary Grassland Habitat
- Wetland Habitat;
- Dam Habitat; and
- Transformed habitat (Including Residential and mining development).

Various natural and introduced species were identified within these habitats during the field survey undertaken by De Castro and Brits (De Castro Brits, 2006), Two mammal species, 75 bird species, two reptile and one frog species were recorded at Greenside Colliery and has also been confirmed from additional reconnaissance surveys conducted in 2013.

These low species numbers reflect the habitat modification and disturbance which has occurred within the Greenside project area.

4.8.1 Mammals

A number of mammals were expected to exist within the Greenside Colliery, with only two species being identified. These are listed in Table 20 below.

Table 20: Expected and identified mammals at Greenside Colliery, Mpumalanga

Scientific Names	Common Names	Status	Identified
Aonyx capensis	Cape Clawless Otter	LC	
Atelerix frontalis	Southern African Hedgehog	LC	
Atilax paludinosus	Water Mongoose	LC	
Canis mesomelas	Black-backed Jackal	LC	
Civettictus civetta	African Civet	LC	
Cryptomus hottentotus	Common Mole-rat	LC	x
Cynictus penicillata	Yellow mongoose	LC	x
Genetta genetta	Small-spotted Genet	LC	
Genetta tigrina	Large-spotted Genet	LC	
Hyaena brunnea	Brown Hyena	VU	
Hystrix africaeaustralis	Porcupine	LC	
Ictonyx striatus	Striped Polecat	LC	
Lepus saxatilis	Scrub Hare	LC	
Mellivora capensis	Honey Badger	LC	
Orycteropus afer	Aardvark	LC	
Otomys irroratus	Vlei Rat	LC	
Proteles cristatus	Aardwolf	LC	
Raphicerus campestris	Steenbok	LC	
Rhinolophus clivosus	Geoffroy's Horseshoe Bat	LC	
Slender mongoose	Slender mongoose	LC	
Sylvicapra grimmia	Common Duiker	LC	
Tatera brantsii	Highveld Gerbil	LC	
Thryonomys swinderianus	Greater Cane Rat	LC	

The natural areas which exist within the project area potentially provide the most optimum habitat for these species, while the transformed areas provide a source of food. Transformed areas are less suitable for permanent inhabitation by these species. Expected species are illustrated in Figure 22 below.

Figure 22: Mammals, Greenside Colliery (Left to right) Yellow Mongoose (*Cynictus penicillata*), *Scrub Hare (Lepus saxatilis)* and *Steenbok (Raphicerus campestris)*

4.8.1.1 Red Data Mammals

Brown Hyena (*Hyaena brunnea),* listed as Vulnerable (VU) could potentially occur on site, or move through the area.

4.8.2 Birds

The remnant natural vegetation patches provide habitat for numerous bird species which were identified throughout the survey. The diversity and density numbers can be directly linked to these areas. The species observed in these habitat types are considered to be typical reflection of what would be expected to be found in these areas.

Due to the alteration of the natural hydrology of the wetland by the construction of dams in the upper reaches of the river there has been an increase in the open surface water. This attracts a number of waterfowl which have a preference for this habitat type; such as Red-knobbed Coot *(Fulica cristata*). However it has also resulted in the loss of species which were attracted to the 'marsh' habitat of the wetland. The integrity of this system has been altered however this has resulted in the transformation of habitat type and resulting species transformation. Biodiversity levels remain good. A sample of the birds observed at the Greenside Colliery is visible in Figure 23.

Figure 23: Birds at Greenside Colliery (left to right); Blacksmith Plover (*Vanellus armatus), Red Knobbed Coot (Fullica cristata) and* Black-sparrow Hawk (*Accipiter melanoleucus).*

The alien vegetation which exists within the area also supports relatively rich bird diversity. The *Eucalyptus* stand offers ideal habitat for species occupying different niches and vertical strata, e.g. leaf-litter, scrub and canopy areas. Several primary and secondary cavity nesting species such as Black-collared Barbet (*Lybius torquatus*) and Red-throated Wryneck (*Jynx ruficollis*) were recorded during the survey. These species create habitat for several other cavity nesting/roosting species. A Black-sparrow Hawk (*Accipiter melanoleucus*) was observed in the southern corner of the study area. These birds habitually nest in stands of exotic trees and the study area almost certainly forms part of a breeding territory.

The mine infrastructure including office buildings, operational and residential areas were surveyed. Species observed in these areas were typical urban exploiters such as House Sparrow (*Passer domesticus*), Cape Glossy Starling (*Lamprotornis nitens*) and Laughing Dove (*Spilopelia senegalensis*).

The species identified on site and their threat Status according to the International Union of Conservation of Nature (IUCN) are listed in Table 21: Birds observed during the field survey below.

Table 21: Birds observed during the field survey

Scientific Names	Common Names	Status
Accipiter melanoleucus	Black Sparrowhawk	LC
Acridotheres tristis	Common Myna	LC
Acrocephalus gracilirostris	Lesser Swamp-Warbler	LC
Alopochen aegyptiaca	Egyptian Goose	LC
Amaurornis flavirostris	Black Crake	LC
Anas capensis	Cape Teal	LC
Anas erythrorhyncha	Red-billed Teal	LC
Anas smithii	Cape Shoveler	LC

Scientific Names	Common Names	Status
Anhinga rufa	African Darter	LC
Anthus cinnamomeus	African Pipit	LC
Apus affinis	Little Swift	LC
Ardea cinerea	Grey Heron	LC
Ardea melanocephala	Black-headed Heron	LC
Ardeola ralloides	Squacco Heron	LC
Asio capensis	Marsh Owl	LC
Bostrychia hagedash	Hadeda Ibis	LC
Bradypterus baboecala	Little Rush-Warbler	LC
Bubulcus ibis	Cattle Egret	LC
Burhinus capensis	Spotted Thick-knee	LC
Charadrius tricollaris	Three-banded Plover	LC
Cinnyris talatala	White-bellied Sunbird	LC
Cisticola fulvicapilla	Neddicky	LC
Cisticola juncidis	Zitting Cisticola	LC
Cisticola textrix	Cloud Cisticola	LC
Colius striatus	Speckled Mousebird	LC
Columba guinea	Speckled Pigeon	LC
Columba livia	Rock Dove	LC
Cossypha caffra	Cape Robin-Chat	LC
Cypsiurus parvus	African Palm-Swift	LC
Elanus caeruleus	Black-shouldered Kite	LC
Estrilda astrild	Common Waxbill	LC
Euplectes afer	Yellow-crowned Bishop	LC
Euplectes orix	Southern Red Bishop	LC
Euplectes progne	Long-tailed Widowbird	LC
Fulica cristata	Red-knobbed Coot	LC
Gallinula chloropus	Common Moorhen	LC
Hirundo fuligula	Rock Martin	LC
Jynx ruficollis	Red-throated Wryneck	LC
Lanius collaris	Common Fiscal	LC
Larus cirrocephalus	Grey-headed Gull	LC
Lybius torquatus	Black-collared Barbet	LC
Macronyx capensis	Cape Longclaw	LC
Malaconotus blanchoti	Grey-headed Bush-Shrike	LC
Megaceryle maximus	Giant Kingfisher	LC
Mirafra africana	Rufous-naped Lark	LC
Motacilla capensis	Cape Wagtail	LC
Numida meleagris	Helmeted Guineafowl	LC
Onychognathus morio	Red-winged Starling	LC
Ortygospiza atricollis	African Quailfinch	LC
Passer domesticus	House Sparrow	LC
Passer melanurus	Cape Sparrow	LC
Phalacrocorax africanus	Reed Cormorant	LC
Phylloscopus trochilus	Willow Warbler	LC
Platalea alba	African Spoonbill	LC
Plectropterus gambensis	Spur-winged Goose	LC
Plegadis falcinellus	Glossy Ibis	LC
Ploceus velatus	Southern Masked-Weaver	LC
Porphyrio madagascariensis	African Purple Swamphen	LC
Pternistis swainsonii	Swainson's Spurfowl	LC
Pycnonotus tricolor	Dark-capped Bulbul	LC
Quelea quelea	Red-billed Quelea	LC
Saxicola torquatus	African Stonechat	LC
Scopus umbretta	Hamerkop	LC
Sporaeginthus subflavus	Orange-breasted Waxbill	LC
Spreo bicolor	Pied Starling	LC
Streptopelia semitorquata	Red-eyed Dove	LC
Streptopelia senegalensis	Laughing Dove	LC
Tachybaptus ruficollis	Little Grebe	LC
Telophorus zeylonus	Bokmakierie	LC
Threskiornis aethiopicus	African Sacred Ibis	LC
Trachyphonus vaillantii	Crested Barbet	LC
Upupa africana	African Hoopoe	LC

Scientific Names	Common Names	Status
Vanellus armatus	Blacksmith Lapwing	LC
Vanellus coronatus	Crowned Lapwing	LC
Vidua macroura	Pin-tailed Whydah	LC
Zosterops virens	Cape White-eye	LC

4.8.2.1 Red Data Birds

No Red Data bird species were identified on site, however it is possible that Red Data birds do move into the vicinity of the Greenside and Kleinkopje Collieries.

4.8.2.2 Alien Invasive Birds

Large numbers of the Common Myna (*Acridotheres tristis*) listed as one of the Top 100 World's Worst Invaders by the Invasive Species Specialist Group, have been recorded on site. The species is known to impact negatively upon indigenous fauna by competing with native avifauna and small cavity nesting mammals for nest-hollows and by breaking eggs and eating nestlings.

4.8.3 Reptiles

Only one reptile was identified during the field survey, namely the Striped Skink, however it is expected that a number of reptiles exist within the Greenside Colliery project area. The expected and identified species are listed in Table 22 below.

Table 22: Expected and identified reptiles at Greenside Colliery, Mpumalanga

Scientific Names	Common Names	Conservation status	Identified
Acontias gracilicauda	Thin-tailed Legless Skink	Endemic	
Aparallactus capensis	Cape Centipede Eater	LC	
Bitis arietans	Puff Adder	LC	
Cordylus vittifer	Transvaal Girdled Lizard	Endemic	
Crotaphopeltis hotamboeia	Herald Snake	LC	
Dasypeltis scabra	Common Egg Eater	LC	
Duberria lutrix	Common Slug Eater	LC	
Elapsoidea sunderwallii	Sundevall's Garter Snake	Endemic	
Gerrhosaurus flaviguaris	Yellow-throated Plated Lizard	LC	
Hemachatus haemachatus	Rinkhals	LC	
Homoroselaps lacteus	Spotted Harlequin Snake	Endemic	
Lamprophis aurora	Aurora House Snake	Endemic	
Lamprophis fuliginosus	Brown House Snake	LC	
Lamprophis guttatus	Spotted House Snake	Endemic	
Leptotyphlops conjunctus	Cape Thread Snake	LC	
Leptotyphlops scutifrons	Peter's Thread Snake	LC	
Lycodonomorphus rufulus	Common Brown Water Snake	Endemic	
Lycophidion capense	Cape Wolf Snake	LC	
Mabuya striata	Striped Skink	LC	x
Mabuya varia	Variable Skink	LC	
Nucras ornata	Delelande's Sandveld Lizard	Endemic	
Pachydactylus affinis	Transvaal Thick-toed Gecko	Endemic	
Pelomedusa subrufa	Marsh Terrapin	LC	
Philothamnus hoplogaster	Green Water Snake	LC	
Psammophis brevirostris	Short-snouted Grass Snake	LC	
Psammophis crucifer	Montane Grass Snake	LC	
Psammophylax rhombeatus	Spotted Skaapsteker	LC	
Pseadaspis cana	Mole Snake	LC	
Typhlops bibronii	Bibron's Blind Snake	Endemic	

Varanus albigularis	Rock Monitor	LC	
Varanus niloticus	Water Monitor	LC	

4.8.4 Amphibians

Only one frog was identified during the field survey, namely the common River Frog. It is expected that a large number of amphibians occur within the area, especially in the vicinity of the wetland and other habitat in close proximity to water. The expected and identified species are listed in Table 23 below.

Table 23: Expected and identified amphibians at Greenside Colliery, Mpumalanga

Scientific name	Common name	Conservation status	Identified
Afrana angolensis	Common River Frog	LC	x
Bufo guttaralis	Guttural Toad	LC	
Cacosternum boettgeri	Boettger's Caco	LC	
Kassina senegalensis	Bubbling Kassina	LC	
Phrynobatrachus natalensis	Snoring Puddle Frog	LC	
Ptychadena porosissima	Striped Grass Frog	LC	
Pyxicephalus adspersus	Giant Bullfrog	NT	
Schismaderma carens	Red-backed Toad	LC	
Semnodactylus wealii	Rattling Frog	LC	
Strongylopus fasciatus	Striped Stream Frog	LC	
Tomopterna cryptosis	Tremolo Sand Frog	LC	
Tomopterna natalensis	Natal Sand Frog	LC	
Xenopis laevis	Common Platanna	LC	

4.9 SURFACE WATER

A report titled '*Greenside Colliery: Surface and groundwater quality assessment report',* dated November 2010 and compiled by Clean Stream Scientific Services and attached hereto in Appendix E1, describes the sampling methodology, procedures as well as water quality results for the Greenside Colliery. Water samples obtained from the various sampling localities at Greenside Colliery is analysed by the Anglo Coal Central Laboratory situated in Emalahleni.

4.9.1. Water Management Area

In general, the mine boundary area is located in the headwaters of the Naauwpoortspruit, the origin about 2 km west of the mine boundary area. The Naauwpoortspruit flows into the eMalahleni Dam 15 km east of the mine boundary area. A tributary of the Naauwpoortspruit, the Greensidespruit, originates in the mine boundary area. Greenside Colliery is situated within the, primary catchment B (Olifants River Catchment area), secondary catchment B1 and B2, quaternary catchments B11F, B20G and B11G.

The Upper Olifants River Catchment is located on the eastern Mpumalanga Highveld and drains a total catchment area of 3 446 km² to the eMalahleni dam. The catchment is characterised by diverse land use including urban development, agriculture, power generation and coal mining. The catchment mainly drains along the river valleys of the Olifants River and Steenkoolspruit. Several tributaries including the Trichardtspruit, Vaalbankspruit, Rietspruit, Saaiwaterspruit, Boesmanskransspruit and the Naauwpoortspruit drain into these two major drainage valleys. Greenside Colliery falls within Management Unit 6 of the Olifants Water Management Area.

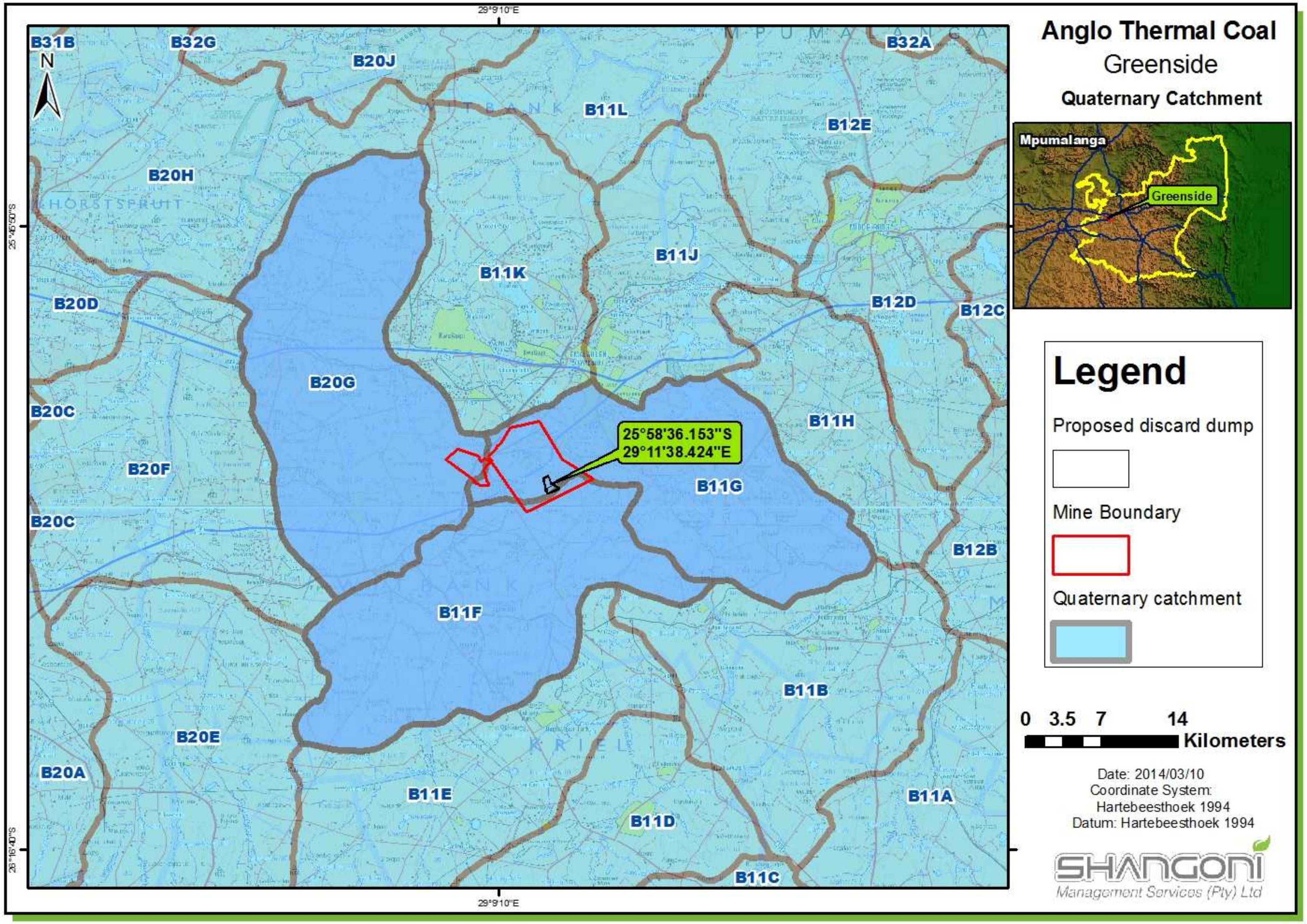


Figure 24: Quaternary catchment

Table 24 below summarises the information pertaining to these quaternary catchments (WRC, 1994).

Table 24: Quaternary catchment information for the catchments associated with the proposed Greenside Colliery (WRC, 1994)

Catchment	B11F	B11G	B20G
Gross area (km^2)	428	368	522
Net area (km^2)	428	368	522
Irrigation area (km^2)	0.7	-	4.6
Evaporation Zone	4A	4A	4A
MAE (mm)	1600	1600	1700
Rain Zone	B1A	B1C	B2C
MAP (mm)	692	693	669
MAR (mm)	34	36	44
MAP-MAR Resp	8	8	7
NET MAR (10^6m^3)	14.7	13.2	23.0
Gross MAR (10^6m^3)	14.7	13.2	23.0
CV	0.849	0.772	0.586
Hydro zone	L	L	J

4.9.2 Surface Water Hydrology

The mine is located in the headwaters of the Naauwpoortspruit and drains a catchment area of 36.51 km2. The origin of the Naauwpoortspruit is about 2 km west of the mine. The Naauwpoortspruit flows into eMalahleni Dam some 15 km east of the mine. The Greensidespruit is a tributary of the Naauwpoortspruit, and originates on the mine site. The majority of the area contributing runoff to the Greenside catchment lies upstream of the mine complex.

The Naauwpoortspruit sub catchment contains various pans and small dams which have a major impact on the natural flow of water within the catchment. The construction of the N12 highway between Johannesburg and eMalahleni across the sub catchment modified the natural flow routes of two tributaries located at the headwaters of the Naauwpoortspruit sub catchment. The natural flow of water is channelled through culverts and during floods water will dam up behind the elevated highway.

The Greensidespruit was diverted in 1983 to flow around the waste dump at Greenside Colliery. Two pans are located in the mine boundary area, one in the northern corner (Clydesdale pan) and one in the south of the mine boundary area (Berry's Pan). The surface infrastructure area for Greenside Colliery does not affect these pans, although Greenside Colliery proposes to undermine the Clydesdale Pan and have obtained regulatory approval. The Greenside Colliery mine infrastructure area and its locality relative to these pans can be seen in Plan 8 in Appendix A.

4.9.3 Surface Water Quality

In the development of the Water Quality Management Plan for the Upper Olifants River Catchment, water quality guidelines and objectives have been set at various control points in the Management Units. The water quality guidelines and sulphate water quality objective for the Naauwpoortspruit Management Unit 6 is given in Table 25.

Table 25: Water Quality Guidelines and Sulphate Water Quality Objective

Water quality variable Units Guideline	
pH (mS/m)	6.5-9
Boron (mg B/l)	2
Fluoride (mg F/l)	1
Potassium (mg K/l)	50
Iron (mg Fe/l)	1
Water quality variable Units Guideline	
Manganese (mg Mn/l)	0.5
Aluminium (mg Al/l)	0.1
Sulphate water Quality management objective	
50 percentile (mg SO_4/l)	260
95 percentile (mg SO_4/l)	380

Sampling at Greenside Colliery is performed according to recognised procedures as prescribed in the Minimum Requirements for Water Monitoring at Waste Management Facilities (DWAF, 1998). Surface water monitoring localities identified on relevant surface watercourses and at sewage treatment sites on and within the vicinity of the mine are sampled once every month.

The positions of the surface water quality monitoring points are shown in Table 26 and Figure 25.

Table 26: Surface water monitoring localities at Greenside Colliery

Surface Water Monitoring Localities - Greenside					
Site Name	**X**	**Y**	**Z**	**Site**	**Description**
Potable Water Monitoring Localities					
POT02	17506.46	-2872548.23	1606.50	S	Potable water from Municipal tank
POT06	18437.09	-2872904.06	1557.13	S	Potable water from House in village
WP126	17595.27	-2872227.25	1551.64	S	Village swimming pool
Soap, Oil and Grease Water Monitoring Localities					
Railway 1	17662.50	-2871586.78	1540.48	S	Stormwater runoff from plant into trench
Railway 2	17611.78	-2871614.80	1542.90	S	Runoff from workshops and stores into trench
Railway 3	17677.68	-2871663.55	1543.34	S	Shaft runoff into trench

WP122	17493.40	-2871904.17	1547.32	S	Daylight shaft oil trap
WP123	18288.79	-2871641.33	1542.79	S	Bulkmech oil trap
WP124	18095.06	-2871714.37	1543.33	S	Transport workshop silt trap
WP125	18491.50	-2871802.94	1542.90	S	Fitter shop oil trap
WP127	18315.27	-2871619.67	-	S	Oiltrap behind Salvage Yard
WP128	17642.07	-2871789.60	-	S	Oiltrap at Lamproom
Receiving Water Monitoring Localities					
WP012a	19560.93	-2870692.09	1530.23	S	Surface water leaving Greenside
WP012b	19915.79	-2870500.62	1531.50	S	Surface water leaving Greenside
WP100	16461.22	-2872530.49	1548.52	S	Upper reaches of Naauwpoortspruit
WP101	16846.30	-2872450.56	1550.38	S	Smaller golf course dam
WP102	17366.09	-2871346.87	1541.09	S	Naauwpoortspruit crosses access road to G/S
WP109	19628.88	-2871365.20	1538.40	S	Naauwpoortspruit crossing N12 stream diversion
WP119	16806.41	-2872297.92	1547.27	S	Big golf course dam in Naauwpoortspruit
Process Water Monitoring Localities					
WP110A	19238.17	-2871675.84	1538.58	S	Pollution control dam 1
WP110B	19225.05	-2871214.02	1534.13	S	Pollution control dam 3
WP111	18267.79	-2871610.58	1542.55	S	Plant Erickson dam 1
WP112	18293.48	-2871608.35	1542.40	S	Plant Erickson dam 2
WP113	19560.91	-2870692.08	1530.23	S	2 Seam water supply to dam 1
WP114	17023.99	-2873495.16	1565.99	S	Inflow from 2 Seam into Ntshonolanga dam
WP115	17040.57	-2873449.56	1566.20	S	Outflow from Ntshonolanga to Shaft Erickson dam
WP116	19094.17	-2872656.94	1546.23	S	Penstock outflow into trench
WP117	18517.75	-2871928.63	1546.93	S	Erickson dam at the shaft
WP118	17481.47	-2871928.36	1546.98	S	Treated sewage water holding dam
WP120	18671.94	-2871319.72	1536.87	S	Lake Lucy (Plant area pollution control dam)
WP121	18546.29	-2871634.85	1541.41	S	Y2K (Dam catching overflow from Lake Lucy)

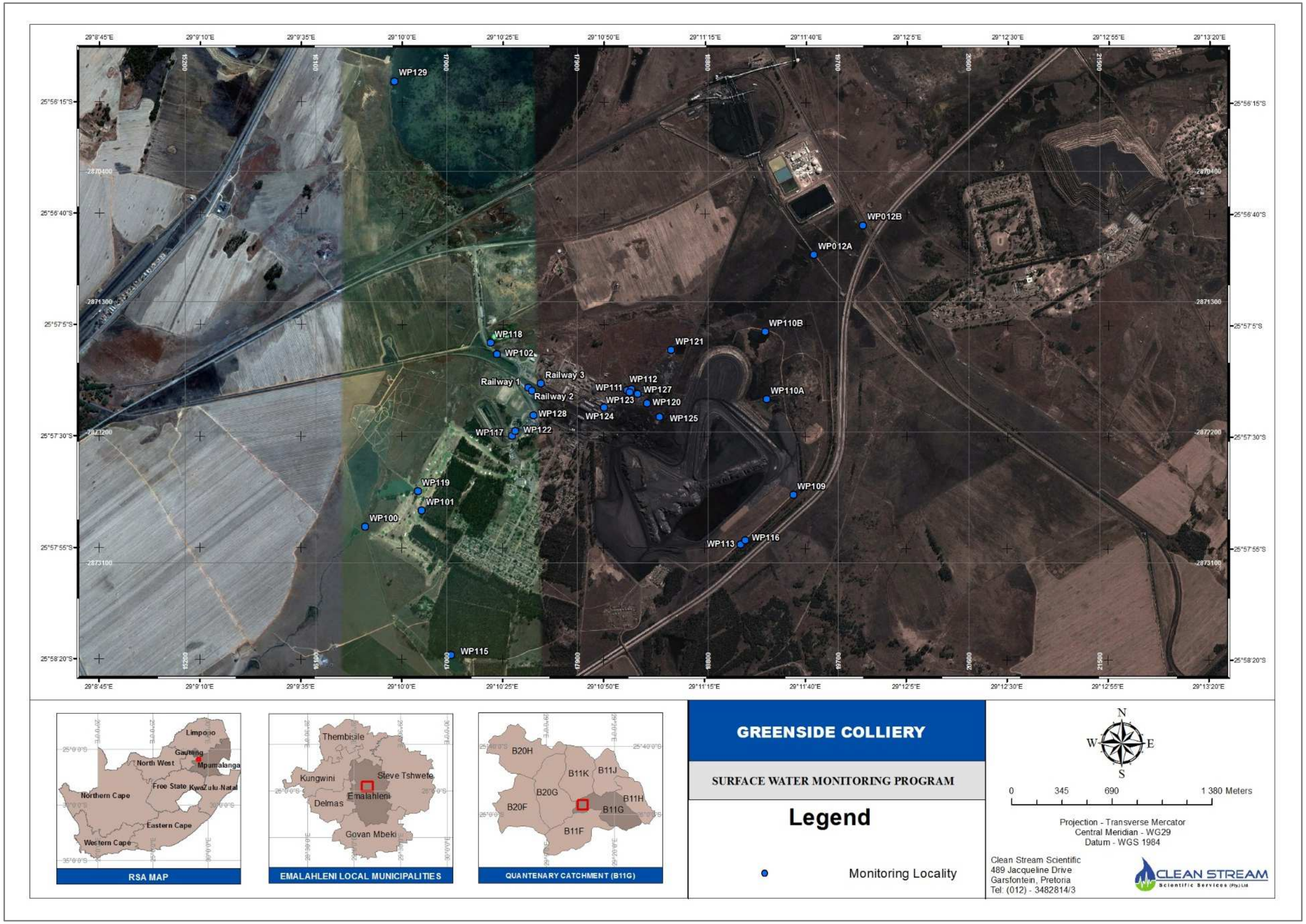


Figure 25: Surface water monitoring localities at Greenside Colliery

According to the Quarterly Water Quality Assessment, Quarter 1 for 2014 prepared by Aquatico Scientific, Greenside has a history of good quality drinking water and that trend has continued during the first quarter of 2014. The physical water quality at both localities can be described as neutral, non-saline and moderately soft. **POT02** and **POT06** can be classified as Ideal water quality in terms of chemical variables analysed while bacteriologically the water is also classified as Ideal water quality as no coliforms or *E.coli* were detected.

All of the sampled surface water localities at Greenside Colliery can be described as neutral while only locality WP101 could be classified as non saline and soft in terms of TDS concentration and total hardness respectively. The remaining localities could be described as very hard or extremely hard when analysing water hardness. Additionally, localities WP012A, WP100 and WP102 could be classified as very saline while locality WP129 fell into the extremely saline category.

None of the surface water localities could be classified as Ideal water quality when analysing the concentrations of the chemical variables. Localities WP012B and WP101 can be classified as Marginal water quality due to elevated concentrations of sulphate and manganese. Localities WP012A, WP100 and WP102 can all be classified as Poor water quality due to high levels of sulphate and slightly elevated concentrations of manganese and magnesium. Locality WP129 was the most problematic locality with a classification of Unacceptable water quality. This was mainly due to an extremely high concentration of sulphate and high concentrations of manganese, magnesium, sodium, calcium and potassium.

The majority of process water localities at Greenside Colliery can be described as neutral when studying their respective pH values. The only exception was locality WP113 which could be described as acidic. Most of the localities could also be described very saline or extremely saline in terms of the dissolved solids concentrations in the sampled water. The only non saline localities were WP117, WP124 and WP128 while localities RAILWAY1, WP118, WP119, WP122 and WP127 could be classified as saline. When analysing water hardness, the majority of localities could be classified as extremely hard. The only locality which was moderately soft was locality WP117.

Locality WP117 was the only process water locality which could be classified as Ideal water quality while localities RAILWAY1, WP118, WP119 and WP124 could all be classified as Good water quality. Manganese and sulphate were the variables which prevented these localities from being classified as Ideal water quality. The remainder of the localities could all be classified as Marginal water quality, Poor water quality or Unacceptable water quality due to high concentrations of sulphate, magnesium, calcium and manganese. The most problematic locality was WP113 which had extremely high levels of sulphate and the metals, iron and manganese. This locality should be investigated to ensure concentrations are reduced during future sampling occasions.

Additionally, water from the treated sewage water holding dam (WP118) was also analysed for microbiological components. Bacteriologically, this water can be classified as Marginal water quality as both coliforms and E.coli were detected.

Soap, Oil and Grease (SOG) measurement is an indication that there are levels of oil and grease, surfactants (soaps), petroleum hydrocarbons and a variety of other substances from chemical manufacturing and industrial processes present in water. Certain constituents, as calculated by the Oil and Grease measurements, may influence wastewater treatment systems. If present in excessive amounts, SOG components interfere with aerobic and anaerobic biological processes and lead to decreased wastewater treatment efficiency. SOG, when discharged in wastewater or treated effluents may cause surface films and shoreline (or riverbank) deposits leading to environmental degradation. The film-forming properties of SOG are also responsible for coating the gill surfaces of aquatic organisms, interfering or altogether preventing the gill-based respiration of these organisms. Certain components of SOG, or degraded constituents thereof, may have toxic effects and are also believed to be carcinogenic in humans. Following the General Limit specifications, SOG concentrations should be below 2.5 mg/l. The General Limit guideline value was exceeded at localities WP118, WP122, WP123, WP124, WP127 and WP128. It is recommended that the water originating from the above mentioned localities not be discharged into any water source whatsoever.

4.9.4 Mean Annual Runoff (MAR)

As indicated in the Water Use Licence Application dated 2004 and compiled by Golder Associates, the Mean Annual Runoff (MAR) for the whole Upper Olifants River Catchment was estimated at 122 million m^3 per annum with the use of a calibrated Pitman model.

The MAR from the Catchments was calculated from the yearly output and is given in Table 27 below.

Table 27: Mean Annual runoff computed

Location	Area (km^2)	Winter base flow (10^6 m^3/ annum)	MAR (10^6 m^3/ annum)
Witbank Dam	3302	31,07	122,14
Naauwpoortspruit	91	0,85	3,08
Greenside Colliery	37	0,34	1,24
Upstream of mine	32	0,30	1,08

The dry weather flow (April to September) for the Olifants River catchment was calculated 31, 07 million m^3 per annum (26% of the MAR). The corresponding base flow for the Greenside sub catchment is estimated at 0.34 million m^3 per annum.

The flood peaks and associated flood volumes were calculated for a point on the Naauwpoortspruit immediately downstream of the Greenside Colliery and are as listed in Table 28.

Table 28: Calculated flood Peaks and Volumes

Return Period	1:20	1:50	1:100

Catchment	Peak m^3/s	Vol. m^3	Time min	Peak m^3/s	Vol. m^3	Time min	Peak m^3/s	Vol. m^3	Time min
Naauwpoortspruit	25	343 200	393	55	660 200	340	75	762 500	304

4.9.5 Resource Class and River Health

In South Africa, a river health classification scheme is used to standardise the output of different river systems. The document titled "*Resource Directed Measures for Protection of Water Resources: River Ecosystems Version 1.0.24*", dated September 1999, compiled by the DWA, provides the indexes of Attainable Ecological Management Classes (AEMC) as shown in Table 29 below.

Each index is calibrated so that its results can be expressed in terms of ecological and management perspectives.

Table 29: Resource classes as set out by the DWA

River Health Class	Ecological perspective	Management perspective
Natural / Excellent (Class A)	No or negligible modification of in-stream and riparian habitats and biota.	Protected rivers; relatively untouched by human hands; no discharges or impoundments allowed.
Good (Class B)	Ecosystems essentially in good state; biodiversity largely intact.	Some human-related disturbance but mostly of low impact potential.
Fair (Class C)	A few sensitive species may be lost; lower abundances of biological populations are likely to occur, or sometimes, higher abundances of tolerant or opportunistic species occur.	Multiple disturbances associated with need for socio-economic development, e.g. impoundment, habitat modification and water quality degradation.
Poor (Class D)	Habitat diversity and availability have declined; mostly only tolerant species present; species present are often diseased; population dynamics have been disrupted (e.g. biota can no longer reproduce or alien species have invaded the ecosystem).	Often characterised by high human densities or extensive resource exploitation. Management intervention is needed to improve river health – e.g. to restore flow patterns, river habitats or water quality.

The DWA initiated the design and implementation of a National River Health Programme in 1994. The programme was designed to expand the ecological information available for managing rivers in South Africa. It provides a systematic framework for quality controlled collection and assessment of river health data, and for reporting on the results.

Information on the resource class and river health of water resources in the receiving environment of the Greenside Colliery is not yet available.

4.9.6 Receiving Water Quality objectives and the reserve

Each ecological class, as indicated in Table 29 above, has a set of flow and water quality eco-specifications, which define its objectives. Different user impacts are associated with each ecological class. The final management class objectives are Resource Quality Objectives (RQO's), which are made up of eco-specifications and appropriate user-specifications. Sustainability is achieved when management actions result in the in stream RQO's for the selected class being met.

According to the document titled: "*Environmental water quality in water resource management*", dated 2004, compiled by the WRC, a detailed ecological Reserve assessment for water quality of the Olifants River was conducted.

There are some 40 monitoring points in the upper Olifants catchment. Of these, 25 are situated in the Olifants and Klein Olifants River catchments upstream of the Wilge River confluence. Eleven are situated in the Wilge River catchment, and one monitoring station is situated between the Wilge River confluence and the inflow into the Loskop Dam (WRC, 2004).

The DWA Target Water Quality Guidelines for aquatic ecosystems provided guidelines for single-substance toxicants on the basis of toxicity test results, but for salinity the guideline was that it should not exceed 15 % of the "natural" range.

A reference or "natural site" and an impacted or "present day" site in each water quality reach in the Olifants River was identified as part of the afore-mentioned assessment. The median monthly TDS concentration was compared between the reference and the impacted site and the percentage difference noted. A preliminary guide was suggested that the percentage difference (as indicated in Table 30 below), would relate to specific classes.

Table 30: Percentage deviation from the natural condition i.t.o. salinity

Ecological Health Class		**Salinity - % deviation from the natural (Class A) condition**
A	Excellent	15
B	Good	20
C	Fair	30
D	Poor	40

When this was applied to the Olifants River salt data, nearly all the reaches had to be classified as "Poor". Most of the recorded salinities at impacted sites had been more than 40 % higher on average than they would have been in the natural state.

South African Scoring System (SASS) scores (biomonitoring) were also related to classes for the Olifants River (refer to Table 31 below for the results thereof).

Table 31: Total SASS score and average per taxon (ASPT) related to river classes

Class	SASS score	ASPT
Excellent	> 175	> 7
Good	120 - 175	6 - 7
Fair	60 - 120	4.8 – 5.9
Poor	< 60	< 4.8

When the biomonitoring results were assessed, it was clear that while there were reaches in which the biological indicators showed a “Poor” class, there were also reaches in each of the other classes. This indicated that 40 % salinity increases above the natural were within the tolerance limits of many fish and invertebrates. In addition, a large number of nymphs of the mayfly *Tricorythus discolour* were collected from a reference site in the Upper Olifants River and, using sodium sulphate as a model for mining-influenced salinisation, a series of salt tolerance tests were undertaken. Refer to Table 32 below for the results.

Table 32: Relationship between river class and salinity for river reaches in the Olifants study area

Assessment class	Electrical conductivity (mS/m)	Total dissolved salts (mg/l)
A	20 - 35	130 - 195
B	35 - 45	195 - 295
C	45 - 80	295 - 520
D	80 - 120	520 - 780
E/F	> 120	> 780

It was apparent that there were a few resource units where the biomonitoring indicated a “Poor” condition even though the salinity was “Good” (WRC, 2004). The land use around the resource units with a “Poor” biomonitoring status was assessed and those units where mining or intensive agriculture activities were / are undertaken were noted. The toxicity of the river water in those resource units was tested, and in two instances the river water was found to be toxic.

It was suggested as part of the afore-mentioned document that a combination of water chemistry, biomonitoring and eco-toxicology be routinely used as part ecological Reserve assessments.

Greenside Colliery will comply with all requirements of the DWS regarding the class objectives for the river systems and streams situated within and surrounding the Greenside Colliery mine boundary area.

4.9.7 Flloodline determination

A report titled ‘*Greenside Colliery 3AN Discard Facility: Floodline Determinationt’,* dated April 2013 compiled by Digby Wells Environmental and attached in Appendix E3, delineate the 1 in 100 year floodline for the Greensidespruit. The Greensidespruit flows to the North and West of the proposed location for their 3AN Discard facility. The floodlines was used as part of the environmental impact assessment and integrated water use license application, where this assessment presented the proximity of the proposed facility in relation to the delineated floodline.

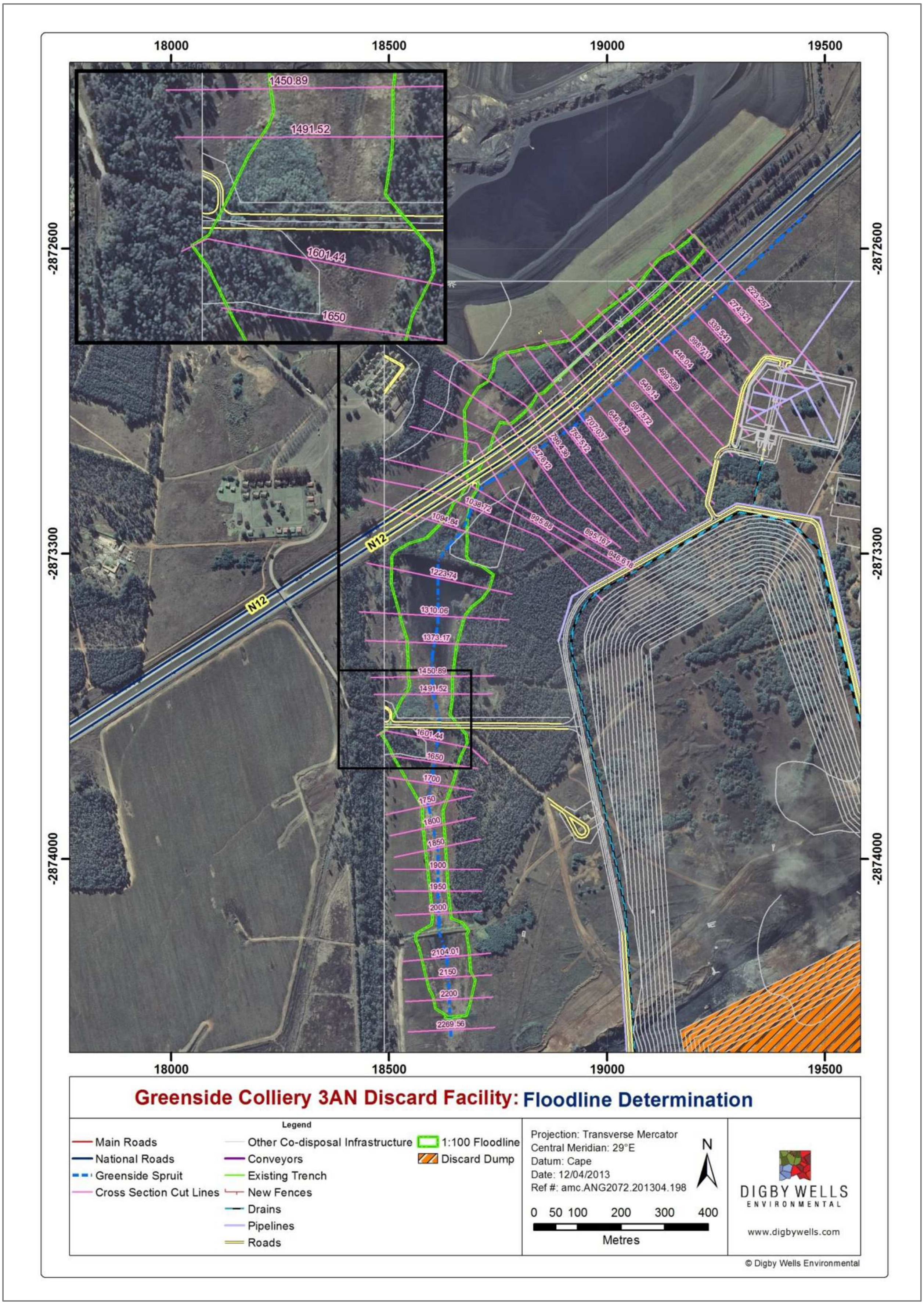


Figure 26: 1 in 100 year floodlines for the Greensidespruit.

4.10 GROUNDWATER

A report titled '*Geohydrological study at Greenside Colliery as input to the development and impact assessment for a new Discard Dump*' dated February 2013 and compiled by Groundwater Complete, (attached in Appendix E6). This geohydrological report was compiled for the proposed new dump addressing the geohydrological baseline conditions of the entire area, including hydrocensus/user survey results and groundwater flow and quality analysis. Groundwater information was also used to conduct a geohydrological impact assessment for the proposed discard dump and is described below.

4.10.1 Ambient Groundwater Conditions

4.10.1.1 Groundwater Use (User Survey/Hydrocensus results)

Clean Stream Scientific Services (CSSS) conducted two hydrocensus/user surveys in the Greenside area. The first was in May/June 2010 and it was repeated in December 2011/January 2012. During these studies all groundwater users and uses in the Greenside area were identified, described, water levels measured where possible and groundwater qualities analysed. A total of 101 localities were surveyed and their positions are indicated in Figure 28.

It was established that the majority (66%) of the boreholes located are not used at all. Most of the boreholes that are in use are utilised for domestic purposes (Figure 27) and widespread pollution or depletion of the groundwater resource will therefore impact negatively on:

- The groundwater resource itself and interrelations with other natural resources (e.g. streams, pans and wetlands), and
- The users that depend on groundwater as sole source of domestic water as well as for livestock and gardening.

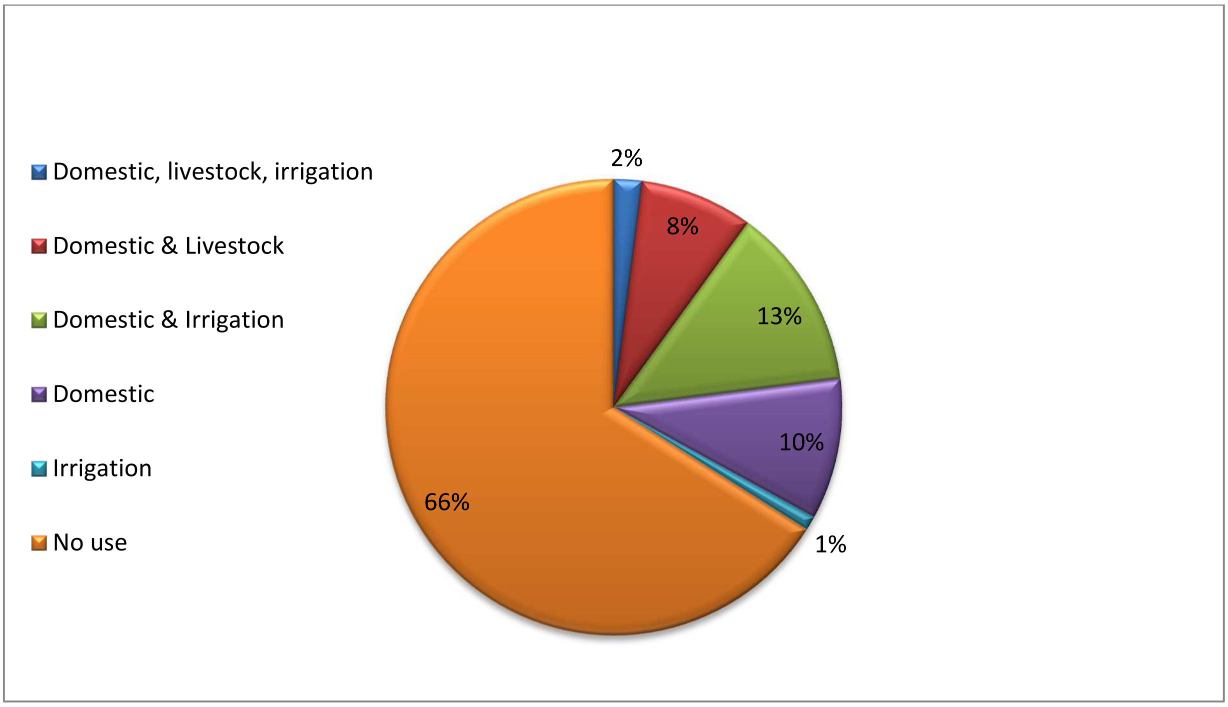


Figure 27: Water usage within the Greenside hydrocensus area

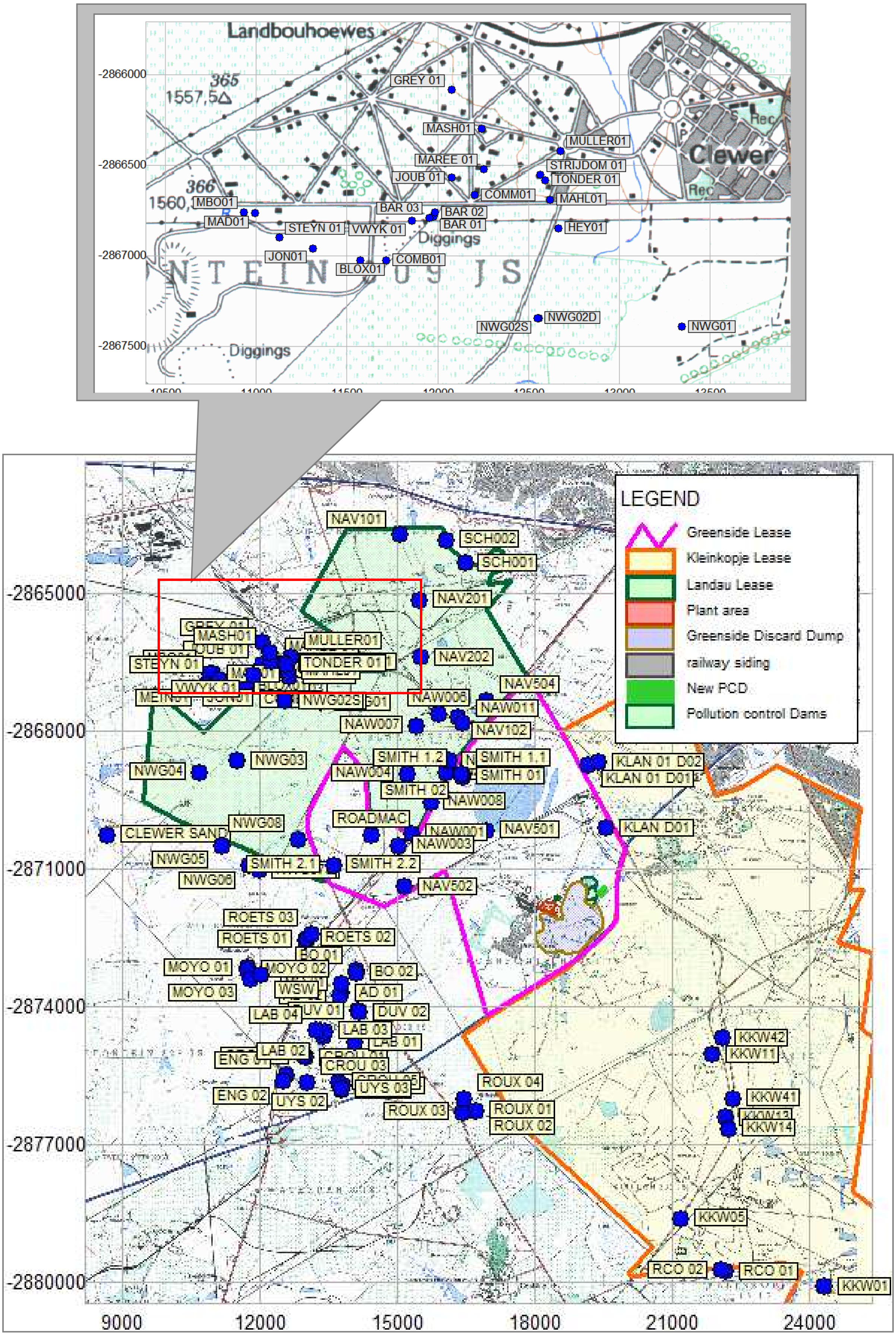


Figure 28: Localities surveyed during the hydrocensus within the Greenside area.

4.10.1.2 Unsaturated zone

The permeability and thickness of the unsaturated zone are some of the main factors determining the infiltration rate, the amount of runoff and consequently the effective recharge percentage of rainfall to the aquifer. The type of material forming the unsaturated zone as well as the permeability and texture will significantly influence the mass transport of surface contamination to the underlying aquifer(s). Factors like ion exchange, retardation, biodegradation and dispersion all play a role in the unsaturated zone.

The thickness of the unsaturated zone was determined by subtracting the undisturbed static water levels in the study area from the topography. Water level measurements showed that the depth to water level, and thus the unsaturated zone, generally varies between 0 and 29 meters below ground level.

4.10.1.3 Generalized Conceptual Model

In an attempt to characterize and predict the movement of water in the subsurface, a conceptual geohydrological model of the Greenside area was postulated. The basis of such a model is the structural geological make-up, water strikes, yields and water level depths of the study area.

From experience in similar geological and geohydrological environments it is expected that the geohydrological regime in the Greenside mining area is made up of two aquifer systems, although they are regarded as the same type of aquifer (double porosity aquifer). For the purpose of this study an aquifer is defined as a geological formation or group of formations that can yield groundwater in economically useable quantities. According to this definition of an aquifer, only the weathered-fresh interface or fractures in the hard rocks below the weathered zone could be defined as aquifers. The shallow aquifer in the weathered zone is however very important from the perspective of environmental water balance and water movement through the landscape. The weathered zone and its interaction with the unsaturated zone (e.g. soil water and vadose) is an important contributor to water problems at Greenside.

Figure 29 has been included to illustrate the concept of primary porous media aquifers and secondary fractured rock media aquifers.

In porous aquifers, flow occurs through voids between unconsolidated rock particles. In double porosity aquifers, the host rock is partially consolidated and flow occurs through the pores as well as fractures in the rock. In secondary aquifers the host rock is totally consolidated and porosity is nearly fully restricted to fractures that have formed after consolidation of the rock.

The weathered zone aquifer and secondary rock aquifer in the area could be classified as double porosity aquifers.

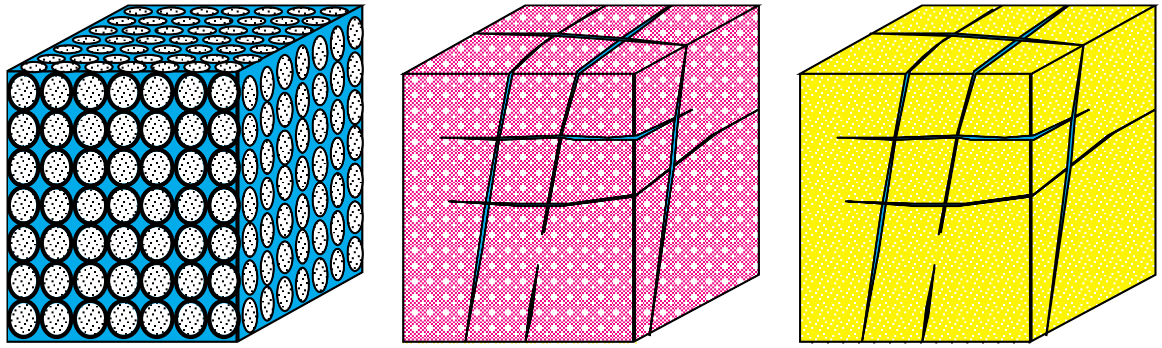


Figure 29: Types of aquifers based on porosity

The first aquifer system is expected to be a shallow aquifer that occurs in the transitional soil and weathered bedrock zone or sub-outcrop horizon. This aquifer generally has a low yield with phreatic water levels sometimes occurring on un-weathered bedrock or clayey layers. Yields in this aquifer are usually low (generally less than 0.3 l/s) and the aquifer is generally not usable as a groundwater supply source on a continuous basis. Where consideration of the shallow aquifer system becomes important is during seepage estimations into voids and mass transport simulations from mine-induced contamination sources, because a lateral seepage component in the shallow water table zone in the weathered zone often occurs. According to the Parsons Classification system, the aquifer is usually regarded as a minor or even a non-aquifer system. By definition, an aquifer is a geological formation or group of formations that can yield groundwater in economical exploitable quantities.

Drilling and testing of the monitoring boreholes in the area will be needed to confirm whether the shallow weathered zone aquifer is poorly developed, in which case it will mainly manifest during the wetter summer months when significant seepage in the shallow weathered zone occurs. Because of its shallow position and direct interaction with the surface, this aquifer has most characteristics of a primary type aquifer.

The second aquifer system is the fractured Karoo rock-type aquifer where groundwater yields, although more heterogeneous, can be expected to be higher than the weathered zone aquifer. This aquifer system usually displays semi-confined or confined characteristics with piezometric heads often significantly higher than the water-bearing fracture position. The aquifer forms in transmissive fractures in the consolidated and mostly impervious bedrock. The fractures may occur in any of the co-existing host rocks due to different tectonic, structural and depositional processes.

4.10.2 Groundwater Flow Evaluation

4.10.2.1 Depth to Water Level

Groundwater levels that were measured in the two hydrocensus surveys in 52 boreholes in the Greenside area together with the levels measured in the monitoring boreholes in the Greenside monitoring program will be considered in this section of this document.

The groundwater levels available from the hydrocensus and monitoring boreholes in and around the mining areas are presented in Figure 30. These water levels are essential as they were used in the generation of static groundwater level elevations with the use of the steady state numerical groundwater flow model calibration (Figure 31).

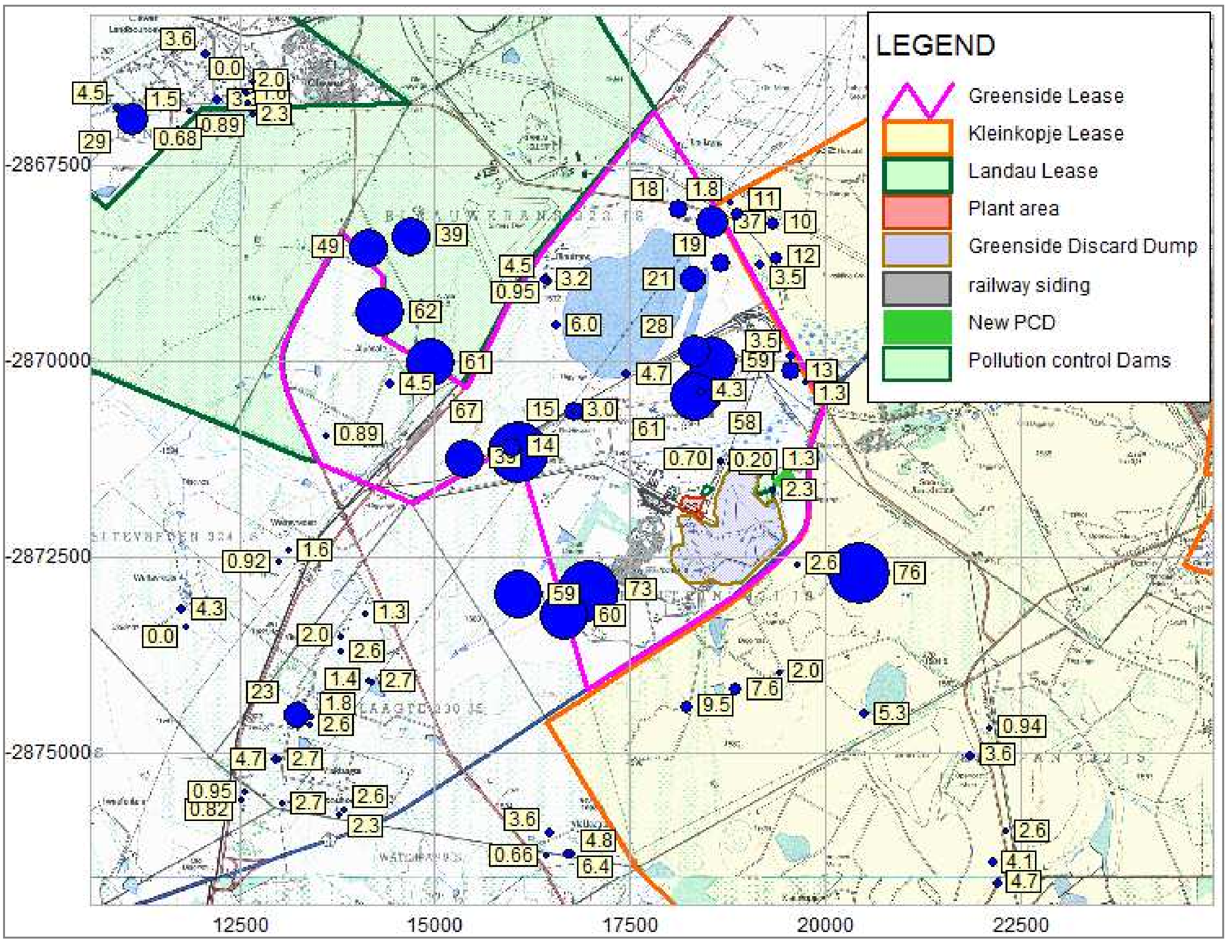


Figure 30: Thematic water level map in the Greenside mine lease area

Regional static groundwater levels around the Greenside mining area generally vary between 0 mbs (artesian boreholes) in the topographically lower lying areas to approximately 20 mbs for the higher lying topographies. The groundwater levels deeper than 20 mbs are measured in monitoring boreholes drilled into the underground mining areas to measure bulk volumes and fill rate of the mine voids.

Due to the generally low aquifer transmissivities the dewatering causes deep drawdown of the groundwater levels/piezometric heads and depression cones form that are deep, but very limited in lateral extent. It follows from the distribution that shallow water levels in some areas occur very close to or even right on top of underground workings.

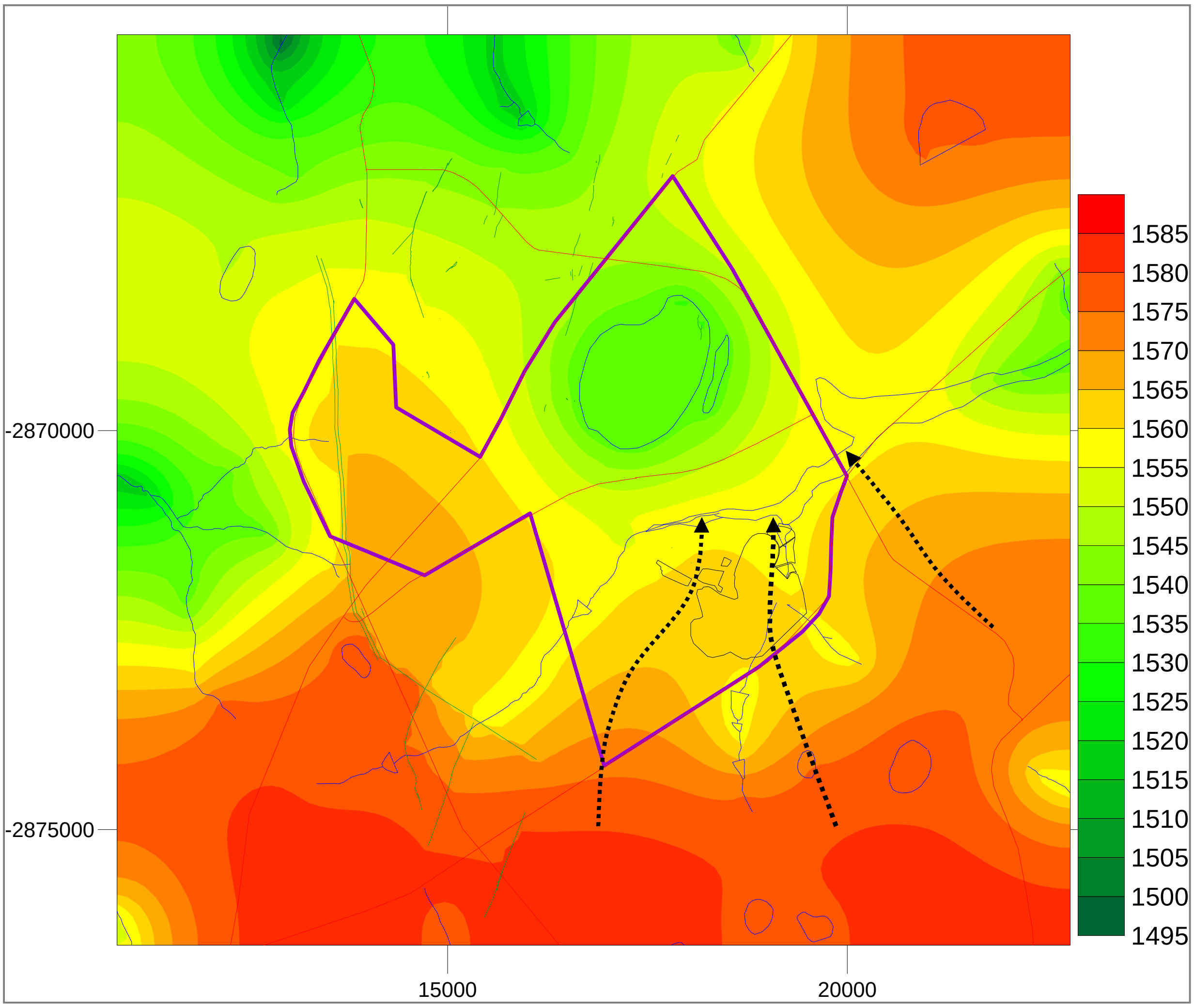


Figure 31: Steady state calibrated water level contours

The highest static water level elevations are approximately 1 585 mamsl and occur in the topographically higher region towards the south of the mining area **(**Figure 31**)**. The lowest static water level elevations where no impact from abstraction occurs are at approximately 1 495 mamsl in the valley bottoms towards the north of the mine lease area.

4.10.2.2 Groundwater Flow Directions and Gradients

Contours of the steady state (pre-operational) static water level or piezometric heads in and around the Greenside mining rights area are presented in Figure 31. Path lines or flow lines of groundwater particles are lines perpendicular to the contours, as indicated with arrows. Flow generally occurs faster where contours are closer together and gradients are thus steeper.

On the relatively steeper sloping hillocks where groundwater gradients are higher, groundwater seepage rates are correspondingly higher given similar hydraulic conductivity of the aquifer. Seepage rates on the other hand are much lower in the flat plateaus and valley bottoms.

The flow direction of the groundwater in the Greenside source areas are predominantly from south to north with a flow gradient of approximately 0.5%. The natural surface water flow direction in the Greenside area is from the south-west to the north-east.

4.10.2.3 Aquifer Transmissivity and Storativity

Aquifer transmissivity is defined as a measure of the amount of water that could be transmitted horizontally through a unit width of aquifer by the full-saturated thickness of the aquifer under a hydraulic gradient of 1. Transmissivity is the product of the aquifer thickness and the hydraulic conductivity of the aquifer, usually expressed as m^2/day (Length^2/Time). In other studies in areas surrounding the Greenside mining area and very recently a study conducted at Landau indicated that the transmissivity in the fracture zone can vary on average between approximately 1 and 1.7 m^2/day. The estimated transmissivity of the matrix is between 0.15 and 0.25 m^2/day.

Storativity (or the storage coefficient) is the volume of water that a permeable unit will absorb or expel from storage per unit surface area per unit change in piezometric head. Storativity (a dimensionless quantity) cannot be measured with a high degree of accuracy in slug tests or even in conventional pumping tests. It has been calculated by numerous different methods with the results published widely and a value of 0.002 to 0.01 is taken as representative for the Karoo Supergroup sediments.

No site specific information for the aquifer parameters in the Greenside mining area was available at the time of this study. It is recommended that pump tests be performed on monitoring boreholes that are proposed at the positions indicated in Chapter 10. The results from the pump tests can then be used to obtain aquifer parameter values for the site and re-calibrate the model in future.

4.10.2.4 Aquifer Recharge and Discharge Rates

Recharge in the Greenside area (unaffected by mining) is estimated at between 1 and 3 % of MAP. Where outcrop occurs, the effective recharge percentage can be slightly higher while in low-lying topographies where discharge generally occurs and thicker sediment deposition, the effective recharge will be lower. Based on this estimate, the average recharge to the Greenside surface rights area (predominantly covered by Karoo rocks) is approximately 900 m^3/d (329 500 m^3/y).

4.10.3 Groundwater Quality Evaluation

The groundwater quality data were collected from two sources, namely the analysis of groundwater samples taken from hydrocensus boreholes and from groundwater monitoring boreholes measured regularly in the Greenside mining area.

Groundwater quality data were evaluated with the aid of diagnostic chemical diagrams and by comparing the inorganic concentrations with the South African Drinking Water Guidelines for Domestic Use (Table 33).

Table 33: South African Drinking Water Standards (SANS:241-2005)

Chemical Parameter	Ideal	Recommended	Absolute Maximum
mg/l			
Calcium	0 - 150	150 - 300	300
Chloride	0 - 200	200 - 600	600
Chromium	0 - 0.1	0.1 - 0.5	0.5
Copper	0 - 1	1 - 2	2
EC	0 - 150	150 - 370	370
Fluoride	0 - 1	1 - 1.5	1.5
Iron	0 - 0.2	0.2 - 2	2
Lead	0 - 0.02	0.02 - 0.05	0.05
Magnesium	0 - 70	70 - 100	100
Manganese	0 - 0.1	0.1 - 1	1
Nitrate	0 - 10	10 - 20	20
pH	5 - 9.5	4 - 5; 9.5 - 10	< 4; >10
Potassium	0 - 50	50 - 100	100
Sodium	0 - 200	200 - 400	400
Sulphate	0 - 400	400 - 600	600
TDS	0 - 1000	1000 - 2400	2400

Because only one or two sets of monitoring data exists for the hydrocensus boreholes, time-series data, statistical analysis and trend analysis are not possible. The first step in the water quality interpretation was to classify the groundwater quality.

The classification was based on the following:

- The spatial distribution of the monitoring points, and
- The proximity of the monitoring points to certain known pollution sources that are expected to impact on the groundwater and/or surface water in the downstream flow direction area.

The four main factors usually influencing groundwater quality are:

- Annual recharge to the groundwater system,
- Type of bedrock where ion exchange may impact on the hydrogeochemistry,
- Flow dynamics within the aquifer(s), determining the water age and
- Source(s) of pollution with their associated leachates or contaminant streams.

Where no specific source of groundwater pollution is present upstream of the borehole, only the other three factors play a role.

One of the most appropriate ways to interpret the type of water at a sampling point is to assess the plot position of the water quality on different analytical diagrams like a Piper, Expanded Durov and Stiff diagrams. Of these three types, the Expanded Durov diagram probably gives the most holistic water quality signature.

Although never clear-cut like a fail-safe recipe, the general characteristics of the different fields of the diagram could be summarized as follows:

Field 1:

Fresh, very clean recently recharged groundwater with HCO_3 and CO_3 dominated ions.

Field 2:

Field 2 represents fresh, clean, relatively young groundwater that has started to undergo mineralization with especially Mg ion exchange.

Field 3:

This field indicates fresh, clean, relatively young groundwater that has undergone Na ion exchange (sometimes in Na - enriched granites or felsic rocks) or because of contamination effects from a source rich in Na.

Field 4:

Fresh, recently recharged groundwater with HCO_3 and CO_3 dominated ions that has been in contact with a source of SO_4 contamination or that has moved through SO_4 enriched bedrock.

Field 5:

Groundwater that is usually a mix of different types – either clean water from fields 1 and 2 that has undergone SO_4 and NaCl mixing / contamination or old stagnant NaCl dominated water that has mixed with clean water.

Field 6:

Groundwater from field 5 that has been in contact with a source rich in Na or old stagnant NaCl dominated water that resides in Na rich host rock/material.

Field 7:

Water rarely plots in this field that indicates NO_3 or Cl enrichment or dissolution.

Field 8:

Groundwater that is usually a mix of different types – either clean water from fields 1 and 2 that has undergone SO_4, but especially Cl mixing/contamination or old stagnant NaCl dominated water that has mixed with water richer in Mg.

Field 9:

Old or stagnant water that has reached the end of the geohydrological cycle (deserts, salty pans etc) or water that has moved a long time and / or distance through the aquifer or on surface and has undergone significant ion exchange because of the long distance or residence time in the aquifer.

The layout of the fields of the Expanded Durov diagram (EDD) is shown in Figure 32

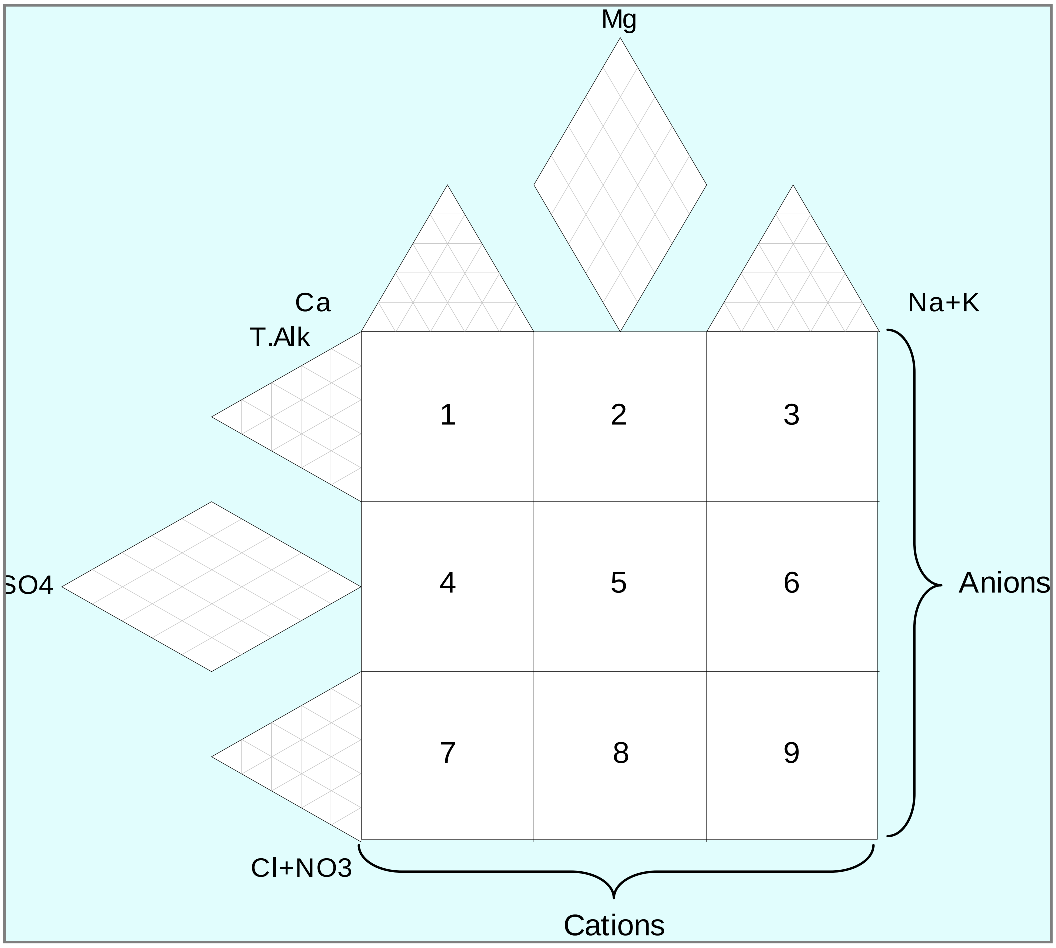


Figure 32: Layout of fields of the Expanded Durov diagram

Another way of presenting the signature or water type distribution in an area is by means of Stiff diagrams. These diagrams plot the equivalent concentrations of the major cations and anions on a horizontal scale on opposite sides of a vertical axis.

The plot point on each parameter is linked to the adjacent one resulting in a polygon around the cation and anion axes. The result is a small figure/diagram of which the geometry typifies the groundwater composition at the point. Groundwater with similar major ion ratios will show the same geometry. Ambient groundwater qualities in the same aquifer type and water polluted by the same source will for example display similar geometries.

4.10.3.1 Regional Groundwater Quality Evaluation

Regional groundwater quality information is available for privately used boreholes as well as mine monitoring boreholes from the surrounding mining areas (a total of 59 boreholes). These boreholes were sampled during the hydrocensus survey of the study area. For the regional groundwater quality discussion the groundwater qualities will be discussed firstly for the privately used boreholes and secondly for the mine monitoring boreholes.

4.10.3.1.1 Privately Used Boreholes

Five chemical parameters (pH, TDS, SO_4, Mg and Fe) were chosen from the full list of analytes as indicators of the specific type of contamination commonly occurring at coal mining operations. Although only the five parameters will be discussed, all inorganic parameters will be assessed and anomalies will be discussed. The positions of the privately used boreholes are indicated in Figure 33.

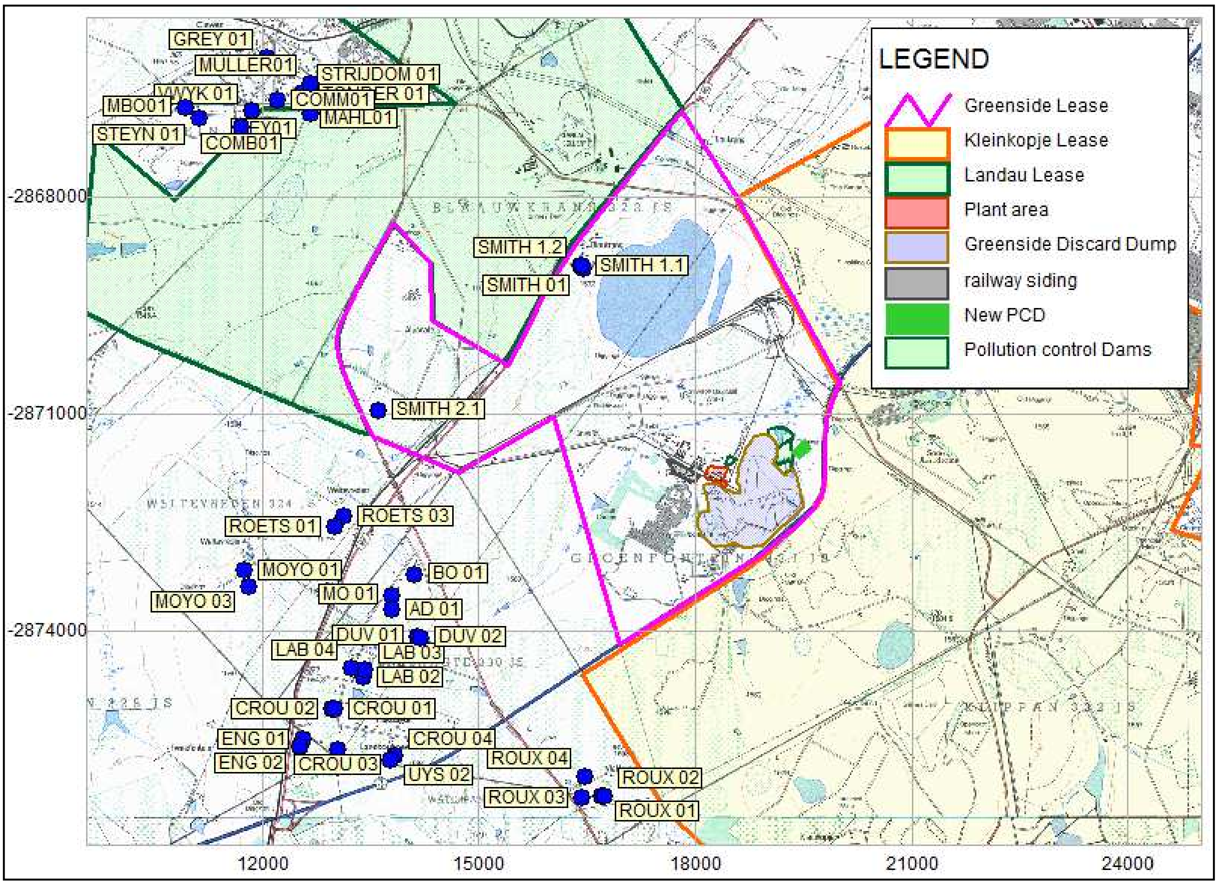


Figure 33: Positions of privately used boreholes sampled during the CSSS hydrocensus

The total dissolved solids (TDS) content of groundwater is a good indicator of the overall quality of groundwater, as it provides a measurement of the total amount/weight of salts that are in solution. TDS concentrations in all the privately used boreholes recorded during the hydrocensus are within ideal limits for drinking water. The TDS concentrations varied from below 60 mg/l to 830 mg/l.

Groundwater sulphate concentrations are mostly within ideal limits for drinking water in the privately used boreholes. The exception is in Smith 01 where the ideal limits for drinking water is exceeded at 563 mg/l. This borehole is situated within the Greenside lease area. The sulphate concentrations in the remainder of the boreholes vary from less than 1 to 312 mg/l. From the sulphate concentrations measured in the privately used boreholes it can be concluded, coal mining in general does not have an effect on the privately used groundwater. Smith01 could be impacted on to a small degree but are still within maximum permissible limits.

Groundwater pH conditions in all of the privately used boreholes are within the ideal limits boundary and varied from 5.3 to 8.1. The groundwater iron concentrations are also low in the privately used boreholes. All the concentrations are within ideal limits for drinking water.

Groundwater magnesium concentrations varied from less than 1 to 50 mg/l which is within the ideal limits for drinking water. The exception is Smith01 where the ideal limits for drinking water have been exceeded at 73 mg/l. As discussed previously, Smith01 could be impacted on by the coal mining to a small degree but are still within maximum permissible limits for drinking water.

Nitrate concentrations measured in hydrocensus boreholes LAB01 and LAB02 exceed the maximum permissible concentration. The reason for these elevated nitrate concentrations can only be determined through more in-depth investigation but it is assumed that it could result from accumulation of nitrate-based fertilizers or leachate from areas where farm animals are concentrated such as kraals, feedlots etc.

According to the Expanded Durov diagrams the groundwater qualities in the privately used boreholes are scattered over the diagram. Magnesium is generally the dominating cation, but sodium is also present at somewhat higher concentrations. Bi-carbonate alkalinity, sulphate and nitrate dominate the anion content but in low concentrations. The groundwater quality in the privately used boreholes is good and fit for human consumption.

From the Stiff diagrams, it is clear that the groundwater in Lab01 and Lab02 is dominated by nitrate. The domination of sulphate is also clear in Eng01 and Smith01.

The privately used groundwater is of good quality and fit for human consumption, The groundwater qualities indicate no/little impact from coal mining activities. The exception is Smith01 where elevated sulphate and magnesium concentrations were measured. It is recommended that the possible cause of the poor water quality is assessed. The groundwater types in the privately used boreholes varies and is proven by the different geometries of the Stiff diagrams.

4.10.3.1.2 Monitoring Boreholes at nearby Mining Operations

In this part of the document the qualities of the monitoring boreholes from neighbouring mining operations will be discussed. These boreholes are mostly situated on Kleinkopje mine and Landau. Some of these boreholes are situated downgradient of existing mining activities and impacts on the groundwater qualities are therefore almost inevitable. The positions of the monitoring boreholes are indicated in Figure 34.

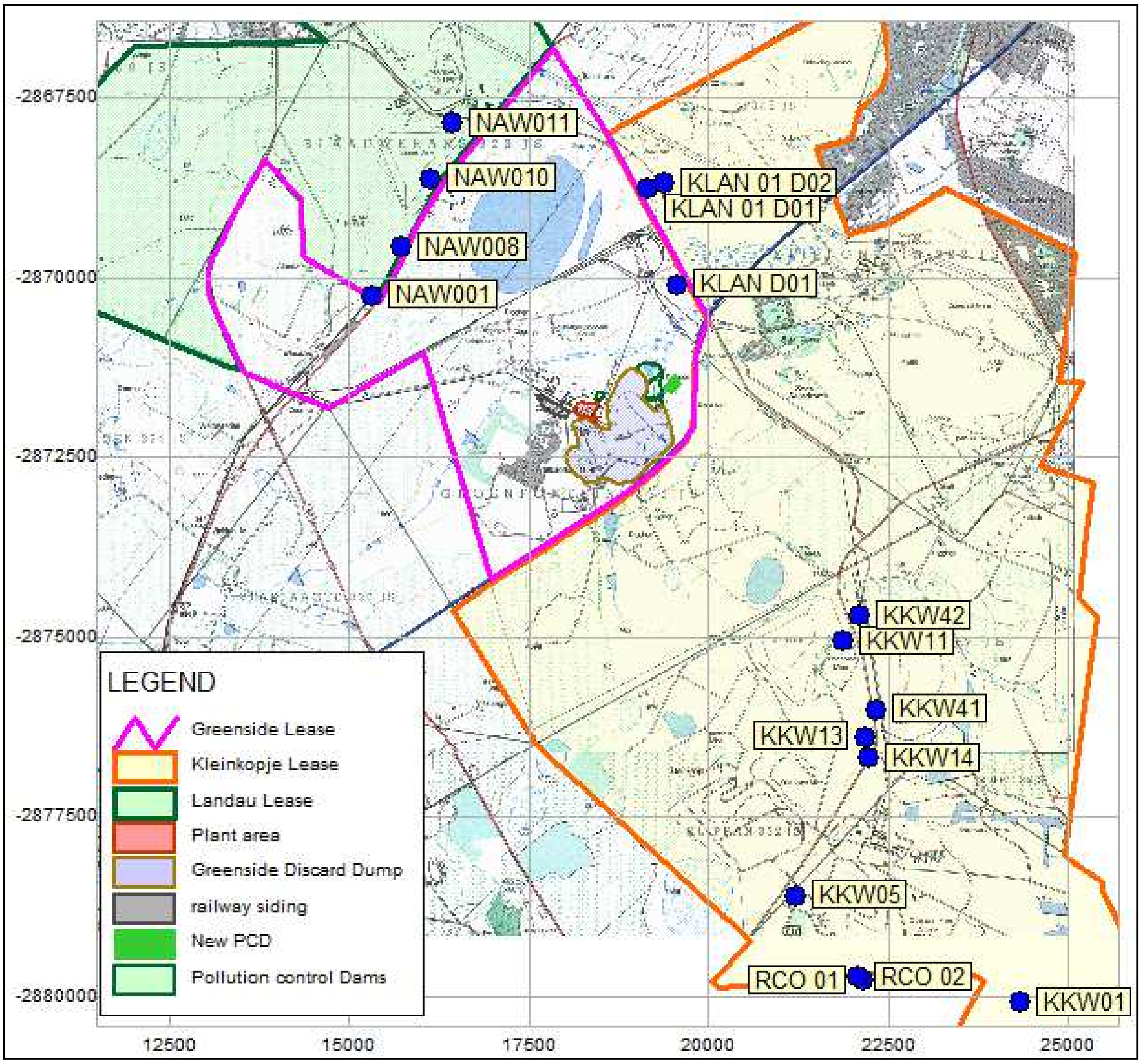


Figure 34: Positions of the neighbouring mine monitoring boreholes.

The TDS concentrations south-east of the Greenside lease area is clearly impacted on by the coal mining activities. In this region the TDS concentration in 3 boreholes (KKW01, KKW13 and KKW41) exceed the maximum permissible limits for drinking water and the ideal limits are exceeded in two boreholes (KKW11 and KKW14). In the Landau lease area, north of Greenside, TDS concentrations in two of the boreholes (NAV201 and NAV504) exceed the maximum permissible limits for drinking water. The TDS concentration varies from less than 60 mg/l to 4225 mg/l.

The sulphate concentration in two of the boreholes (NAV201 and NAV504) to the north of Greenside is high and exceed maximum permissible limits for drinking water. The sulphate concentration in the majority of the boreholes to the south-east of the Greenside lease area are extremely high, exceeding maximum permissible limits for drinking water. Since some of these boreholes are drilled into existing mine workings, the high sulphate concentration is to be expected as a direct result of the coal mining activities. Sulphate contamination in the coal mining environment is a result of the oxidation of sulphide bearing minerals (in particular pyrite), which is illustrated by means of the following reaction:

$$2FeS_2 + 7O_2 + 2H_2O \rightarrow 2Fe^{2+} + 4SO_4^{2-} + 4H^+$$

The above reaction requires both oxygen and water to take place, which is readily available in coal mining environments. The production of hydrogen ions will consequently lead to a decrease in the groundwater pH conditions. The pH in these boreholes are lower than ambient conditions and often below the maximum permissible limits for drinking water and it can therefore be concluded that the acid mine drainage is starting to occur in some areas.

The groundwater iron concentrations may also be affected by the oxidation of pyrite, as most metals become mobile in low groundwater pH conditions. Iron concentrations in 3 boreholes (KKW11, NAV201 and NAV504) exceed the maximum permissible limits while the ideal limits for drinking water are also exceeded in two boreholes (KLAN01D01 and NWG08). The iron concentration in the boreholes vary from below detection limit to a very high 702 mg/l.

The two most common processes by which groundwater are contaminated by magnesium include interstitial release and ion exchange release. Argillaceous sediments such as shale and mudstone are known to contain pore water with high saline content. Significant amounts of contaminants may therefore be released as these sediment structures disintegrate because of weathering or when exposed and crushed through the mining processes. Groundwater magnesium concentrations exceed the maximum permissible limits for drinking water in 7 of the mine boreholes, indicating clear impacts from mining activties.

According to the Expanded Durov diagrams and the Stiff diagrams, the groundwater in the boreholes is mostly dominated by magnesium on the cation side. Sulphate often dominates the anion side. It should be noted that nitrate concentrations were only available for the Kleinkopje monitoring boreholes and therefore the remainder of the boreholes are not presented in the EDD or Stiff diagrams.

The mine boreholes display groundwater qualities that are mostly poor and in certain areas are not suitable for human consumption. The mine groundwater qualities indicate definite impact from coal mining activities. The low pH conditions in certain boreholes support the evidence of the occurrence of acid-rock drainage reactions. The groundwater affected by coal mining activities is dominated by sulphate on the anion side and mostly magnesium on the cation side.

4.10.3.2 Site Specific Groundwater Quality Evaluation

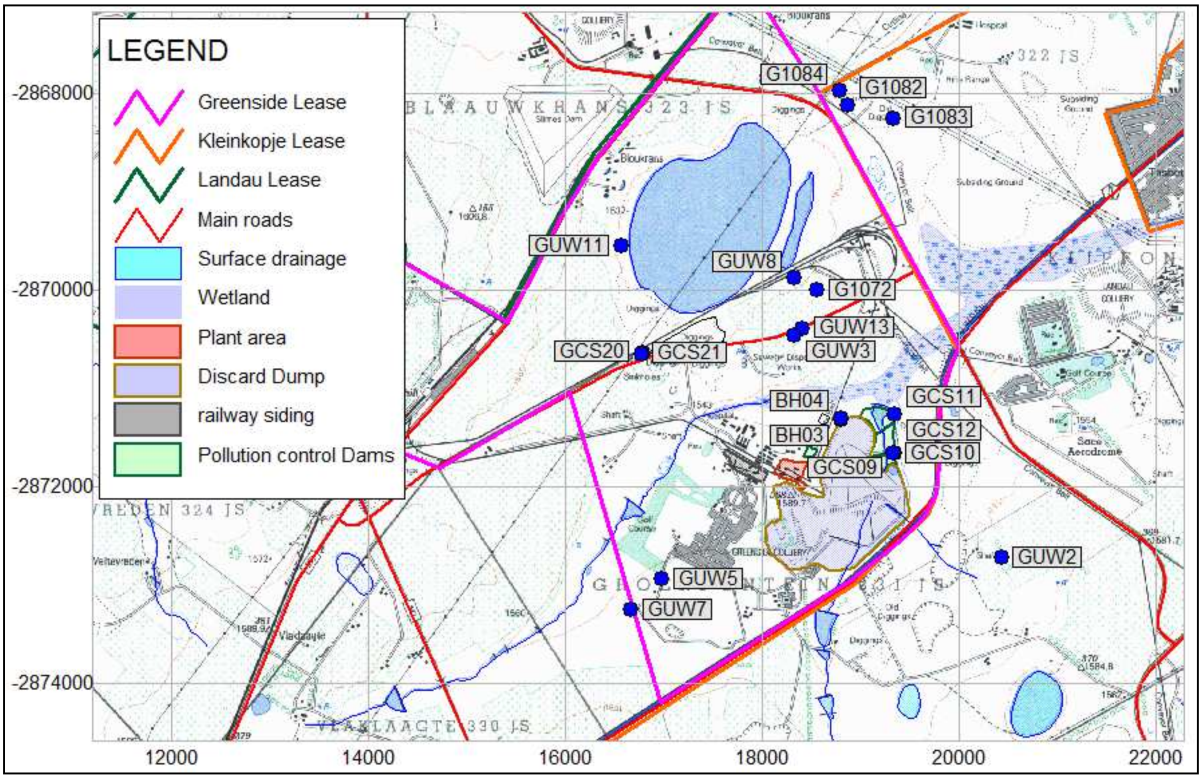


Figure 35: Positions of Greenside site specific monitoring boreholes monitored in the period since January 2011.

The water quality discussed in this section entails boreholes drilled for source monitoring on surface as well as into the mine workings (underground) and should thus be expected to be affected by the mining operation. The table below indicates which boreholes are source monitoring for surface infrastructure and which is drilled into the underground mine workings.

These are the boreholes that have been monitored in the period since January 2011. It should be noted that some of these boreholes have been monitored only once since January 2011. Therefore time-series trends will not be discussed in this part of the document. A comparison of the groundwater qualities to drinking water standards are presented in Table 34

The TDS concentrations in several boreholes exceed the ideal or maximum permissible limits for drinking water. Boreholes with high TDS concentrations include the down gradient boreholes from the discard dump and the pollution control dams and the boreholes drilled into the underground mine workings. From the monitoring results it is clear that the mining activities at Greenside have a negative impact in terms of quality on the groundwater.

The pH in the monitoring boreholes of Greenside indicates values that vary from neutral to more acidic. Once again, the pH in G1082 (drilled into the 1 seam workings) is below the maximum permissible limits for drinking water and G1072 (2 seam workings) is below ideal limits. These lower pH levels together with elevated sulphate concentrations indicate impacts on the groundwater from acid mine drainage reactions.

Table 34: Boreholes in the Greenside mining area monitored in the period since January 2011.

Underground workings boreholes		Surface source monitoring boreholes	
Borehole ID	**Description**	**Borehole ID**	**Description**
G1072	2 Seam Workings	BH03	Co-disposal facility
G1076	1 Seam Workings (Clydesdale pan)	BH04	Co-disposal facility
G1082	1 Seam (Highveld Hospital)	GCS09	Mixed perched & fractured (PCD1)
G1083	2 Seam (Highveld Hospital)	GCS10	Perched aquifer (PCD1)
G1084	2 Seam (Highveld Hospital)	GCS11	Mixed perched & fracture (PCD3)
GUW11	5 Seam Workings	GCS12	Perched aquifer (PCD3)
GUW13	5 Seam Workings	GCS20	Fractured aquifer (Railway line, Clydesdale pan)
GUW2	SE Water body (2 seam)	GCS21	Perched aquifer
GUW3	NE Water body (2 seam)		
GUW5	Water body 1 (2 seam)		
GUW7	BH in SW corner, south of Erickson dam		
GUW8			

A thematic representation of the sulphate concentrations in the Greenside monitoring boreholes is presented in Figure 36. Impacts from mining activities are very obvious with much of the boreholes displaying sulphate concentrations exceeding ideal or maximum permissible limits for drinking water. The co-disposal facility as well as the pollution control dams clearly has an impact on the groundwater quality in especially the shallow aquifer. Surface water samples taken in the stream downstream of the co-disposal facility and the pollution control dams also have a sulphate concentration exceeding the maximum permissible limits for drinking water. Therefore the impact from these surface mine facilities are also evident in the surface water, since sulphate concentrations upstream of the mine is within ideal limits for drinking water. The monitoring program in the Greenside area is not sufficient to completely cover the impacts from all the mining activities and the program needs to be expanded. Proposed positions for monitoring boreholes are presented in Chapter 10 later in the document.

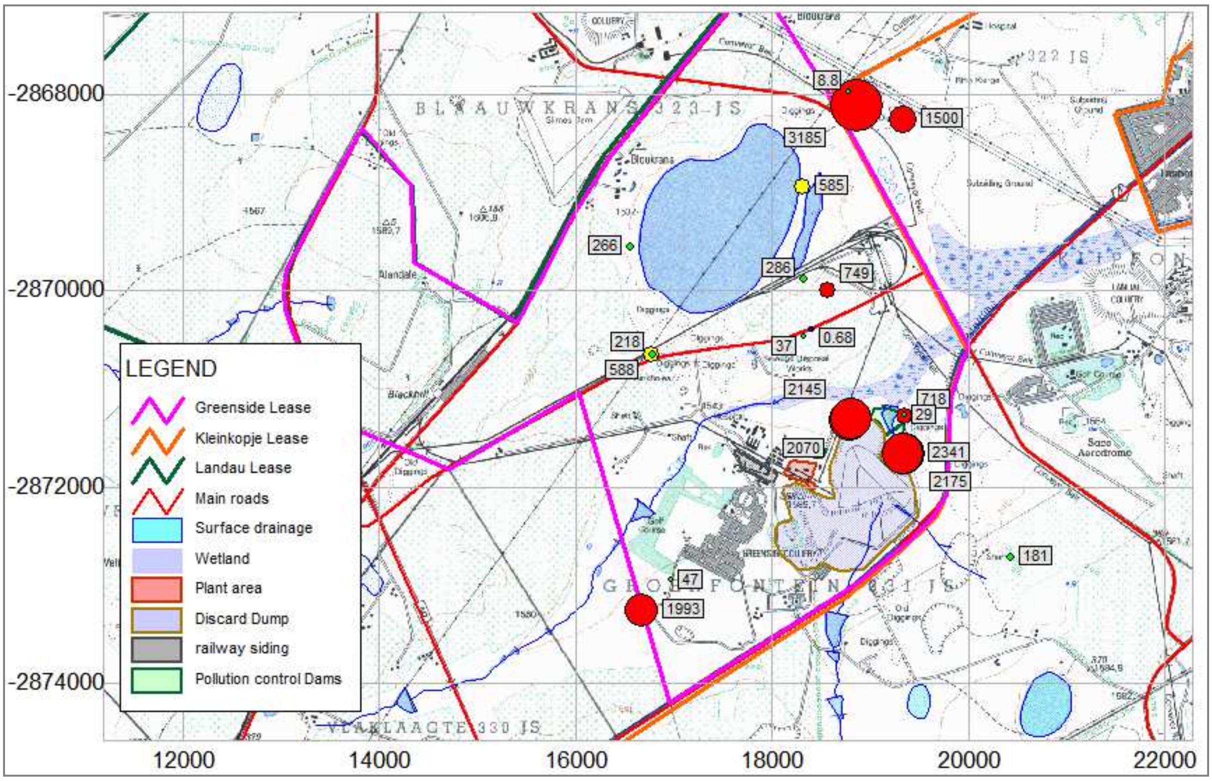


Figure 36: Thematic map indicating sulphate concentrations in Greenside monitoring boreholes.

The magnesium concentration in most of the monitoring boreholes indicates elevated values exceeding ideal or maximum permissible limits for drinking water. Calcium concentrations are also high and often exceed ideal and maximum permissible limits for drinking water.

The expanded Durov diagram clearly indicates that the majority of the groundwater is dominated by sulphate indicating definite impacts from the mining activities. Magnesium followed by calcium is the dominating cations. The domination of sulphate is also clearly displayed in the Stiff diagrams

Groundwater qualities in the Greenside monitoring boreholes vary from good to poor. Monitoring information display definite impacts from mining activities, especially downgradient of the co-disposal facility, the pollution control dams and in the boreholes drilled into the underground workings. . Elevated sulphate concentrations together with a decrease in pH indicate the presence of acid-rock drainage reactions. These concentrations are however to be expected in the mining area and the important factor is to ensure that water management is such that the affected water is not released into the receiving environment through discharge, decant or even plume movement. At the moment the surface water stream downgradient of the pollution sources indicate clear impacts from the mining activities. Groundwater qualities in the Greenside monitoring boreholes are dominated by sulphate content. Monitoring boreholes in the Greenside area are not sufficient to cover all potential sources and the monitoring program needs to be re-evaluated.

4.10.4 Geochemical Assessment of the existing Greenside Dump

Discard material and slimes from the existing Greenside dump have been sampled and analysed to aid in a geochemical assessment of the dump material. Leaching tests and acid-base accounting was performed and the results will be discussed in this section of the document.

4.10.4.1 Acid-base accounting

Acid-base accounting has been performed on 9 samples taken at the Greenside co-disposal facility. Four samples are coarse discard material from the outside ‘wall’ of the co-disposal dump and 5 samples are slimes samples taken from the middle of the dump. The results from the acid-base accounting tests are displayed in Table 35.

Table 35: Acid-base accounting results for the Greenside tailings dump.

Acid – Base Accounting	Greenside Discard				Greenside Slimes				
	SW - Side	SE - Side	N - Side	N - Outer	SW - Side	SE - Side	N - Side	NE - Side	NE - Side
Acid Potential (AP) (kg/t)	126.56	53.13	49.69	11.25	39.06	33.44	34.38	44.69	44.69
Neutralization Potential (NP)	37.88	7.54	-11.38	3.42	73.33	38.63	63.87	62.88	62.39
Nett Neutralization Potential (NNP)	-88.69	-45.59	-61.06	-7.83	34.26	5.19	29.49	18.19	17.7
Neutralising Potential Ratio (NPR) (NP : AP)	0.3	0.14	0.23	0.3	1.88	1.16	1.86	1.41	1.4
Rock Type	I	I	I	I	II	II	II	II	II

Notes:

<u>CLASSIFICATION ACCORDING TO NETT NEUTRALISING POTENTIAL (NNP)</u>

If NNP (NP – AP) < 0, the sample has the potential to generate acid
If NNP (NP – AP) > 0, the sample has the potential to neutralise acid produced

Any sample with NNP < 20 is potentially acid-generating, and any sample with NNP > -20 might not generate acid (Usher et al., 2003)

<u>ROCK CLASSIFICATION</u>

TYPE I	*Potentially Acid Forming*	*Total S(%) > 0.25% and NP:AP ratio 1:1 or less*
TYPE II	*Intermediate*	*Total S(%) > 0.25% and NP:AP ratio 1:3 or less*
TYPE III	*Non-Acid Forming*	*Total S(%) < 0.25% and NP:AP ratio 1:3 or greater*

The results indicate that all four coarse discard rock samples have a NNP < 0 which classifies the discard as a Type I rock. Type I has a NP:AP ratio of 1:1 or less, making it potentially acid forming.

The slimes samples on the other hand are all classified as a Type II rock where the NP:AP ratio is 1:3 or less. The slimes samples are thus classified as having an intermediate acid generating potential.

Thus, the ABA tests revealed that the discard from the Greenside discard dump are potentially acid generating and seepage from the discard can lead to contamination of the groundwater. Without sufficient buffering capacity in the groundwater and aquifer below the rock dump, leachate from the dump will in all probability turn acid some time in future. The sediments underlying the dump, especially the sandstone, has little base potential (buffering capacity). The ABA results combined with case examples at other collieries in the Emalahleni region lead to the conclusion that leachate through the dump will be of poor quality and will cause pollution of the underlying aquifer.

4.10.4.2 Leaching tests

Leaching tests were performed to assess the release of inorganic contaminants into the water from the Greenside co-disposal facility. The expected contents of leachate from the waste rock material as obtained from the leaching tests are presented in Table 36. The results of the tests have been compared to the drinking water standards presented in Table 33. Elevated concentrations based on the drinking water standards were indicated in the same colors as described in Table 33.

Table 36: Leaching test results for the Greenside discard dump.

Sample Id	Unit	Discard SW - Side	Discard SE - Side	Discard N - Side	Discard N - Outer	Slimes SW - Side	Slimes SE -Side	Slimes N -Side	Slimes NE -Side
Ca	**mg/l**	732	841	502	19	1252	1141	859	1627
Cl	**mg/l**	<5	<5	<5	<5	10	6	7	7
Cr	**mg/l**	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Cu	**mg/l**	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.044	<0.025
F	**mg/l**	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	0.2	0.2
Fe	**mg/l**	0.707	0.276	0.114	0.054	6.81	<0.025	15	5.62
K	**mg/l**	<1.0	1.4	<1.0	<1.0	2.0	<1.0	1.8	1.1
Mg	**mg/l**	2	34	<2	<2	64	28	72	36
Mn	**mg/l**	0.259	3.10	0.033	0.104	4.19	4.52	3.85	5.27
Na	**mg/l**	<2	<2	<2	<2	9	<2	7	3
Pb	**mg/l**	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
SO4	**mg/l**	1 546	220	1 341	48	245	124	205	95
N	**mg/l**	0.4	<0.2	0.3	0.7	<0.2	<0.2	<0.2	<0.2

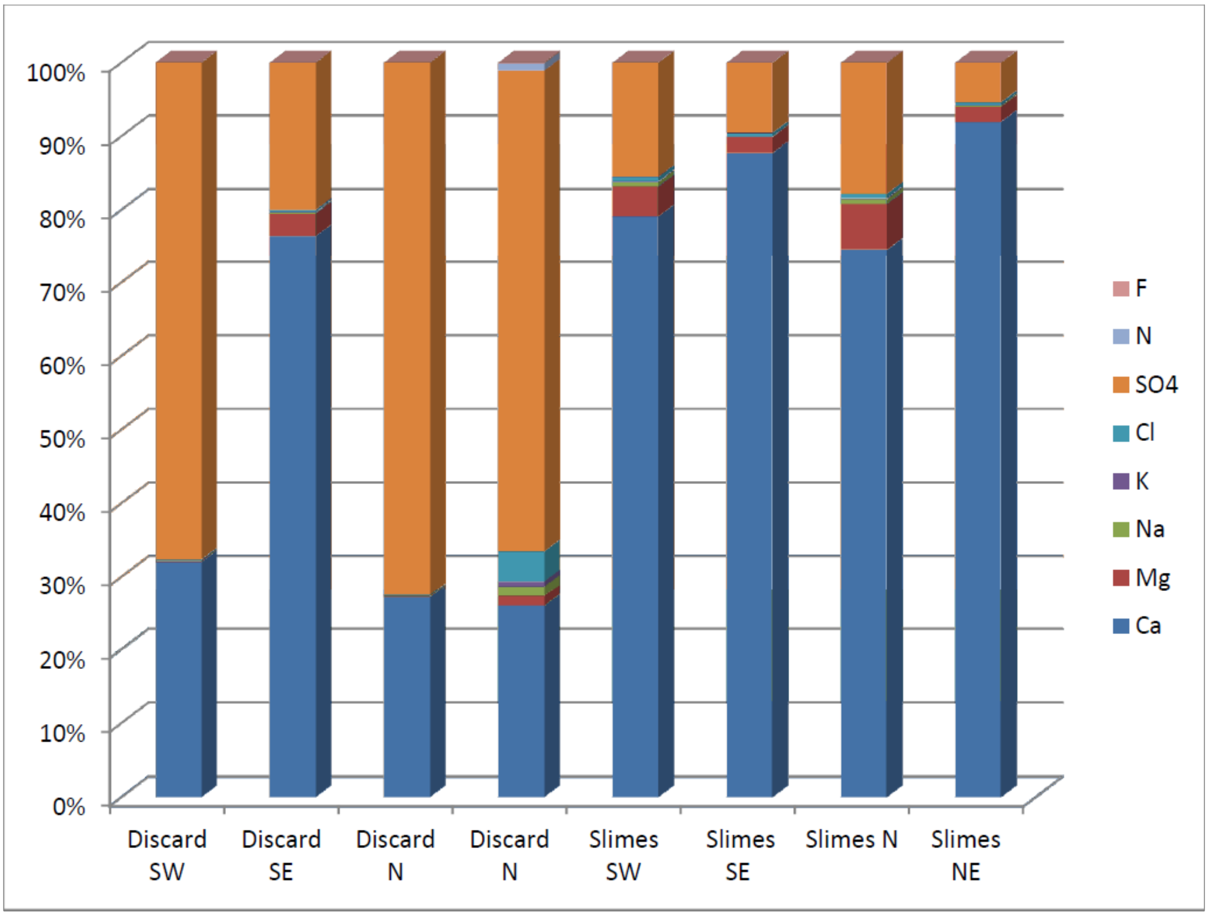


Figure 37 Graph showing relative macro element inorganic content of leachate

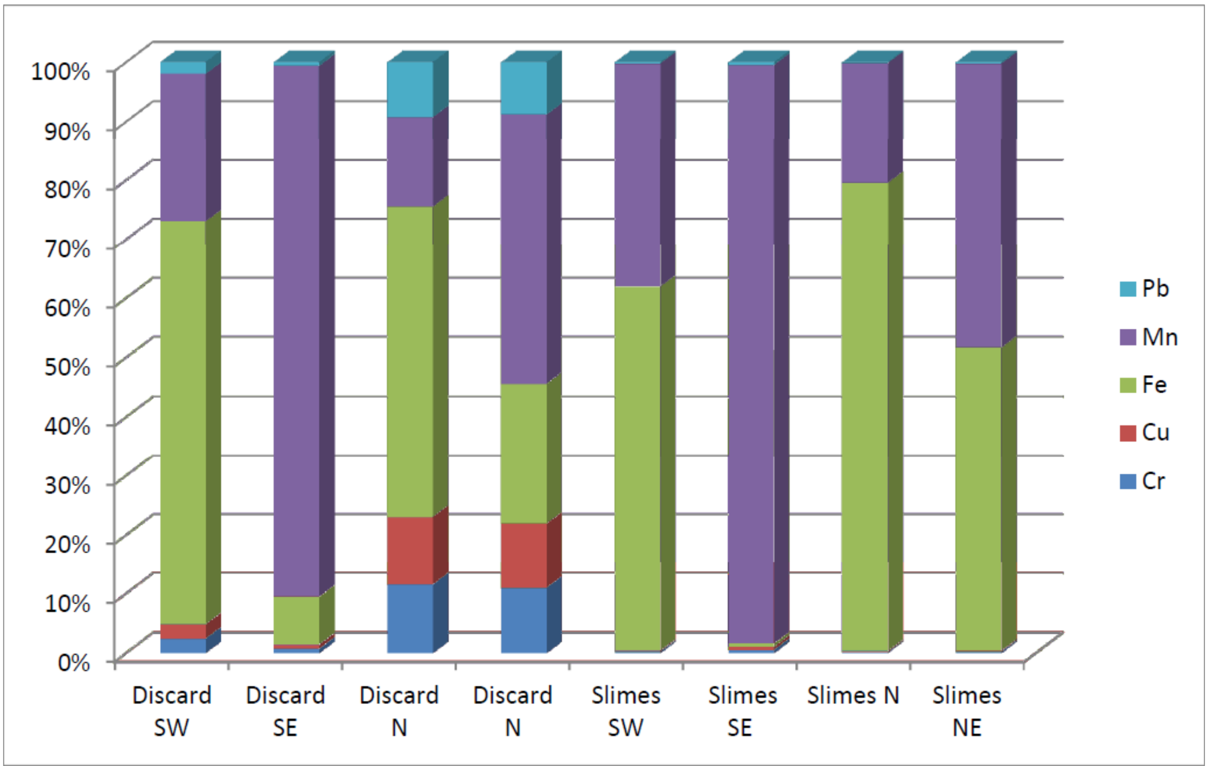


Figure 38: Graph showing relative metal content of leachate

It is clear from the leachate test results that the leachate leaving the dump will have elevated concentrations of calcium, iron, manganese and sulphate that will exceed drinking water concentrations. The macro element content of the leachate will be dominated by calcium and sulphate as is evident from the domination of these two parameters in the graph of Figure 37. The heavy metal content will be dominated by iron and manganese as indicated in Figure 38.

Calcium, iron, manganese, magnesium and sulphate concentrations of the majority of the samples exceed the ideal or maximum permissible limits for drinking water. The leachate from the dump will definitely have an adverse effect on the receiving groundwater environment.

The ABA tests indicated that the discard rock from the walls of the Greenside co-disposal have the potential to generate acid. The ABA tests further indicated that the slimes in the inner part of the co-disposal facility have an intermediate potential to generate acid. The leaching tests indicated that the leachate/seepage from the dump will have an adverse impact on the receiving groundwater quality.

4.11 AIR QUALITY

Greenside Colliery is primarily an underground bord and pillar mine, minimising surface dust fallout. However, the inherent air quality of the area is considered poor and is impacted on by the activities of adjacent collieries, industry, and vehicle use and veld fires. Furthermore, dust generation occurs from the discard dump on-site.

In addition, seven of the 14 coal-fired power stations operated by Eskom are located within a 50 km radius of Greenside Colliery (Eskom, 2002). Electricity generated through coal-fired power stations produces pollutants such as particulates, sulphur dioxide and nitrogen oxides, impacting negatively on the air quality of the area (Eskom, 2002).

4.12 NOISE

Although there are agricultural activities to the west of the prosed site the study area is characterised by the presence of major exiting noise sources. There are major coal mining activities at Kleinkopje in the south, Greenside Colliery in the north and Landau I the East. The N12 highway, which crosses the area immediately to the North of the proposed site, carries a large amount of traffic. This includes a very significant amount of heavy vehicles. Other busy roads crossing the area are the R547, the road connecting the R544 and the R547 past Kleinkopje, and the road leading from Kleinkopje, past Landau village to Clewer. Residential areas consist of villages associated with the mines of the area.

4.13 WETLANDS AND SENSITIVE LANDSCAPES

An ecological assessment of the wetland systems associated with the study area was conducted by Digby Wells Environmental in May 2013 entitled:" *An ecological assessment of the wetland areas associated the proposed new Discard Disposal Facility at Greenside Colliery: Anglo American Thermal Coa*l", .in order to identify, delineate, determine the current state and identify the functions associated with these wetland units and is described below.

4.13.1 Wetland delineation

The wetland areas were delineated in accordance with the (DWAF, 2005) guidelines, whereby features such as soil, vegetation and topography were considered. Some of the wetland soil features and characteristics used to assist with the delineation of wetland areas are presented in Figure 39. The delineated wetland areas are illustrated in Figure 40 below.

Figure 39: Some general wetland indicators that were used to complete the delineation. (A: *Phragmitis australis*: B: Valley Bottom position in the landscape; C: Obligate wetland vegetation; D: *Steobe vulgaris*: Facultative wetland vegetation; E: Radoxymorphic features in the soil; F: typical wetland grasses.)

4.13.2 Wetland unit identification

The wetland units associated with the proposed discard facility at Greenside Colliery were initially identified at desktop level and then ground truthing was conducted to confirm these findings. The wetlands in the study area are linked to both perched groundwater and surface water. A total of three different HGM types of natural wetland systems occur within the area assessed. The three HGM units identified for the project area include:

- Pan;
- Valley bottom without a channel; and
- Hillslope seepage wetlands.

Two types of seepage wetlands were identified within the project area. These include a hillslope seepage connected to a channel and an isolated hillslope seepage wetland. Figure 40 below indicates the identified HGM wetland units identified within the project area.

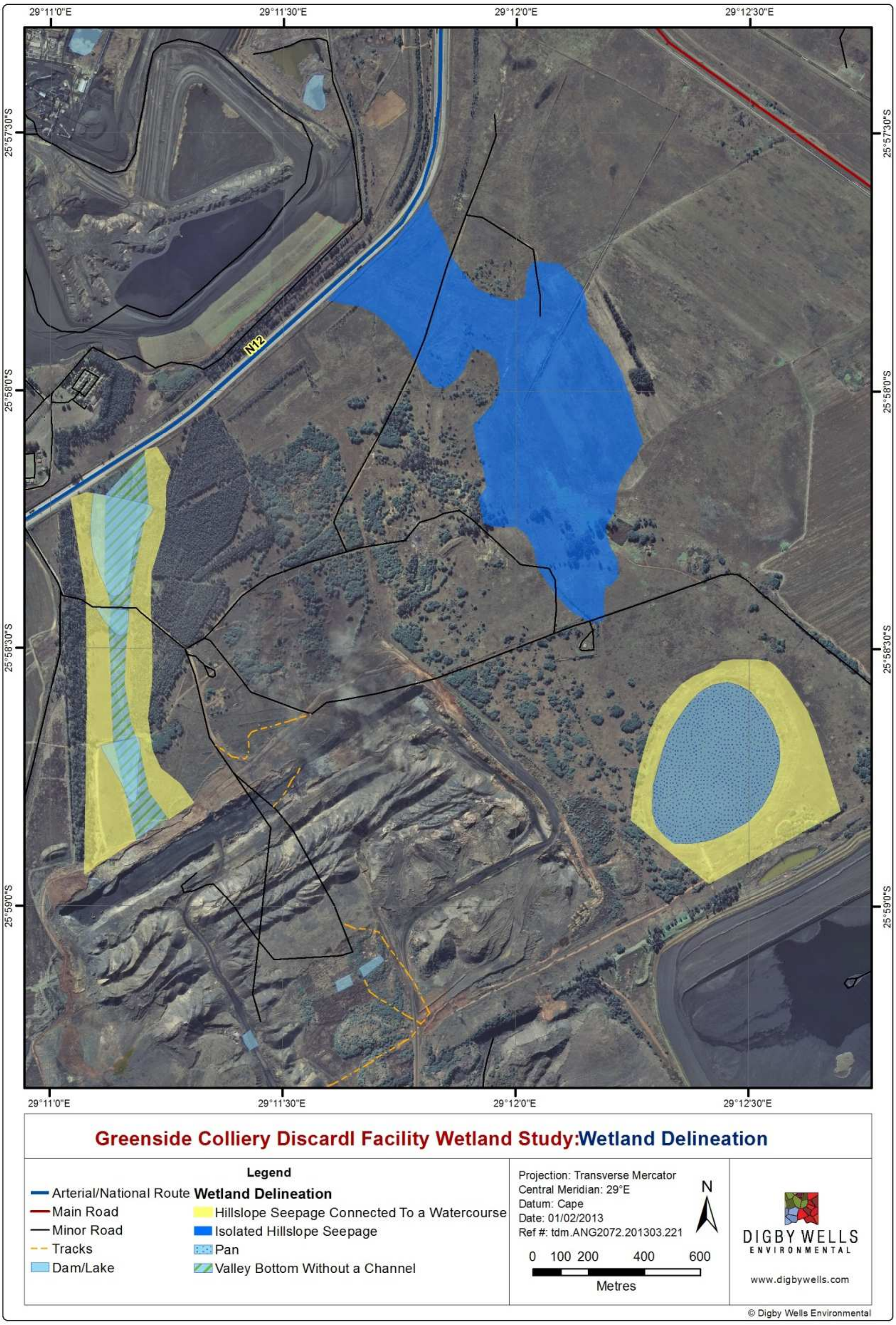


Figure 40: Illustrates the delineated areas within the project area

4.13.3 Wetland unit settings

A total of three HGM units were identified in close proximity to the proposed site, utilising both desktop and ground truthing for the identification of the units. The identification of various wetland units is often characterised by the position of the units in the landscape and the general topography of the survey area. A schematic diagram of how the identified wetland units for the project area are positioned in the landscape and the general topography of the study area is illustrated in Figure 41.

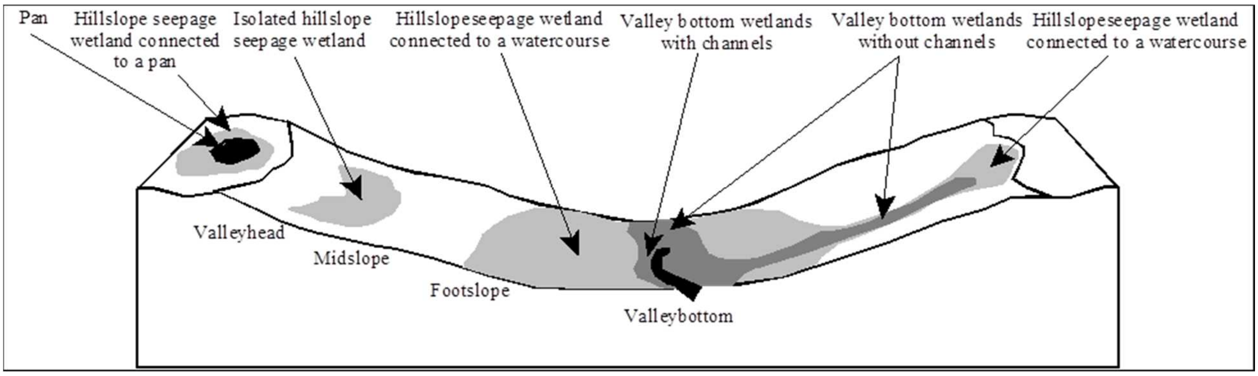


Figure 41: A schematic illustration of the HGM wetland types identified for the study area

4.13.4 Description of wetland types

The general descriptions of the identified wetland units within the area proposed for the development of a discard facility within the Greenside Colliery are provided in the subsequent sections.

4.13.4.1 Pans

Pans are inward draining environments that develop as a result of an interaction of a number of environmental factors. These factors include climate, availability of geologically susceptible surfaces (mainly calcrete), surface disturbance by the animals and salt weathering, lack of integrated drainage system and deflational processes including wind (Goudie and Thomas, 1985). Due to the lack of drainage in the area precipitation tends to form static pools that promote the formation of pans. When the pools dry out unconsolidated (unbound by vegetation) soil is left exposed to wind action, that scours the base of pans. The non-perennial pans are characterised by a circular or rounded shape resulting from the swirling winds and a low mound beyond their shorelines on the downwind side where soil lifted by wind action has been deposited over aeons. Water accumulates in the depression of the non-perennial pans owing to a generally impervious calcrete underlying layer which prevents the water draining away. The non-perennial pans become seasonal water holes following intensive thundershowers. Excessive grazing, trampling, digging, and burrowing by animals in the edges of the pans inhibit vegetation growth and expose the substrate to destructive wind actions. The removal of soil by wind actions deepens and helps to maintain the basin of the non-perennial pans (Allan, et. al., 1995). According to Kotze et al. (2007) pans are usually isolated from streams and because of their position in the landscape the opportunity for attenuating flows is limited, however, because of their inward draining nature they do capture runoff and as a result they reduce the volume of surface water that would otherwise reach the stream during storm flow conditions. According to

Goudie and Thomas (1985) and Marshall and Harmse (1992) pans are not considered locations for the trapping of sediment, as many pans originate from the removal of sediment by wind, thus creating what are referred to as deflation basins. Furthermore the catchments of the non-perennial pans are usually small due to the undulating nature of the landscape.

4.13.4.2 Valley bottom without a channel

The valley bottom wetlands without channels are located at the lowest position in the landscape where the water drained from the local slopes accumulates. Furthermore water expressed in the hillslope seepage wetlands may also drain towards the valley bottom wetlands. The valley bottom without a channel wetlands systems play important functions such as sediment trapping, flood attenuation and nutrient cycling. The valley bottom without channel wetlands on site receives extensive amounts of sediment and flow from the surrounding slopes. This allows an opportunity for contact between solute laden water and the wetland vegetation, thus providing an opportunity for flood and contaminant (nutrients, pesticides, herbicides) attenuation. Extensive areas of these wetlands remain saturated as stream channel input is spread diffusely across the valley bottom even at low flows (Kotze *et al*., 2007). These wetlands also tend to have a high organic content. Facultative wetland indicator plant species, comprising a mixture of grasses and sedges are evident as longitudinal bands within a relatively narrow zone along the valley bottoms. Facultative wetland plant species usually grow in wetlands (67-99% of occurrences) but occasionally are found in non-wetland areas. Lateral seep zones form part of the adjacent hillslope seepage wetlands, this is a characteristic for all the valley bottom wetlands. The primary drivers for these systems, owing to the shallow gradients along the valley bottoms are diffuse horizontal surface flow and interflow. There is generally a clear distinction in the transition in the vegetation structure between the mixed grass-sedge meadow zones that characterise these wetlands to the more intermittently wet grassland habitats associated with the adjacent hillslope seepage wetlands (Kotze *et al*., 2007).

4.13.4.3 Hillslope Seepage Wetlands

Hillslope seepage wetlands are usually associated with a perched groundwater table, where precipitation that occurs within the greater catchment is temporarily stored within the soil profile as a result of impervious strata within the soil profile. The impervious strata within the soil profile is normally made up of an unweathered parent material or swelling clays typically associated with granites, sandstones or shales. Hillslope seepage wetlands are expressed were the soil profile is shallow enough such that impervious layer and the water stored within the soil profile are expressed on the surface. The soils in the area must be waterlogged long enough such that the oxygen is depleted through a chemical process of reduction which results in the presence of radoximorphic features in the soil. Hillslope seepage wetlands are created and maintained by infiltration processes that occurs in the surrounding non wetland areas within the catchment. Two HGM types of hillslope wetlands occur in the study area:

- Hillslope seepage wetlands connected to watercourses; and
- Isolated hillslope seepage wetlands.

Hillslope seepage wetlands connected to watercourses are wetland systems which are directly linked on the surface to watercourses. This type of system typically contributes to flow in the watercourses, even if this contribution is only on a seasonal basis. Isolated hillslope seepage wetlands are isolated from other wetland systems and watercourses and in spite of this, this type of wetland system may be connected to other systems by subsurface flow (interflow). These systems are expressed as isolated seepage units in the landscape.

4.13.5 Delineated Wetlans Ecological Functional Assessments

The ecological functions performed by the identified HGM units were assessed in terms of functioning and the overall importance. Owing to the proximity of the HGM units to one another as well as the inter-dependence of the wetland resource users to the different HGM units within the proposed project area, the ecological functional assessment considered all identified HGM units jointly. The level of functioning supplied by the HGM units for various ecological services within the project area is presented in Table 37. The results from the “WET-EcoServices” tool are presented below in Figure 42: Radial plots of functions performed by wetland areas within the project area. Table 38: Lists of the percentage of each importance class of provided services presents the percentage of each importance class for the identified HGM units.

Table 37: A listing and scoring of ecological services offered by each of the HGM units identified for the project area

Ecological Services	Pan	Hillslope seepage wetlands	Valley bottom without a channel
Flood attenuation	2.7	2.2	2.6
Streamflow regulation	1.7	2.0	2.2
Sediment trapping	2.7	2.0	3.7
Phosphate trapping	3.1	2.4	3.2
Nitrate removal	2.8	3.3	2.8
Toxicant removal	3.0	2.8	3.0
Erosion control	1.9	1.9	2.9
Carbon storage	1.3	1.3	1.3
Maintenance of biodiversity	1.9	1.9	1.8
Water supply for human use	0.6	0.7	0.5
Natural resources	1.0	1.6	0.8
Cultivated foods	0.8	0.8	1.6
Cultural significance	0.8	0.5	0.0
Tourism and recreation	1.6	1.6	1.6
Education and research	1.0	0.5	0.3

Ecological Services	Pan	Hillslope seepage wetlands	Valley bottom without a channel
Note: The importance of EcoServices supplied by the wetland systems are scored according to the following: < 0.5 Low 0.5 – 1.5 Moderately Low 1.5 – 2.5 Intermediate 2.5 – 3.5 Moderately High >3.5 High			

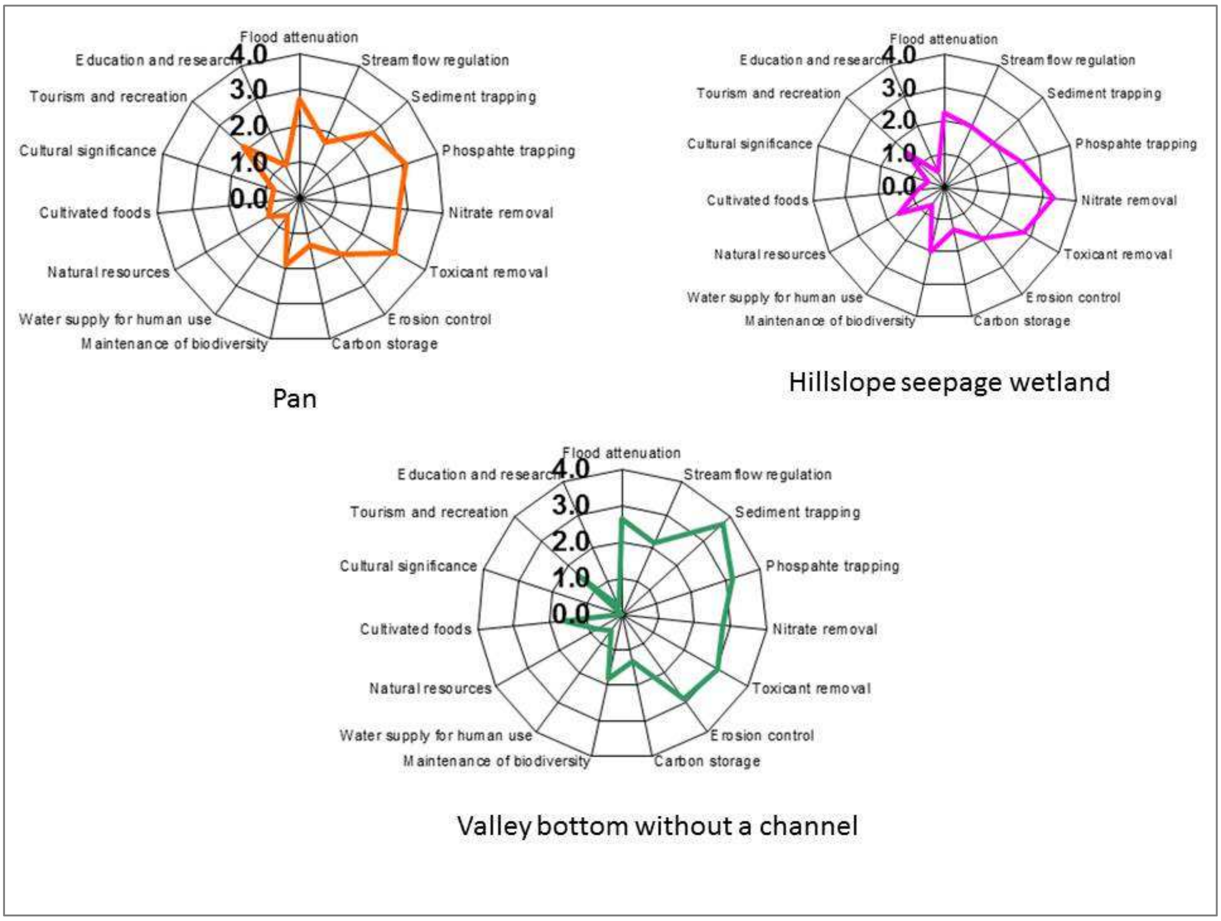


Figure 42: Radial plots of functions performed by wetland areas within the project area

Table 38: Lists of the percentage of each importance class of provided services

Ecological Services Importance	Pans	Hillslope Seepage wetlands	Valley Bottom without a channel
Low	0%	0%	13%
Moderately low	40%	33%	20%
Intermediate	27%	53%	20%
Moderately high	33%	14%	40%
High	0%	0%	7%

The services provided by the wetland areas within the project area primarily range from moderately low to moderately high, where only the valley bottom without a channel wetland was found to perform services of both low and high importance. The valley bottom without a channel wetland was therefore found to be performing the services of highest importance to local and downstream water users. The reduction in the importance of services provided by the pans and the hillslope seepage wetland units within the project area is as a result of the loss in the wetland integrity due to current and historical land-use activities. The current and historical land-uses have impacted on the capacity of the identified wetland areas to perform important ecological and hydrological functions.

4.13.5.1 Pans

The highest percentages of services that are provided by the pans within the mine lease area were found to be moderately low (40%). Moderately low services are associated with human benefits from the wetlands, however, most of the areas are fenced off or access controlled therefore the surrounding communities cannot access the wetland areas.

The moderately high services (33%) are associated with the hydrological services provided by the delineated pan wetland areas. These services include flood attenuation, phosphate trapping and sediment trapping. The services of intermediate importance include the maintenance of biodiversity, tourism and recreation (See Table 38: Lists of the percentage of each importance class of provided services).

4.13.5.2 Valley Bottom without a Channel

The highest percentages of services that are provided by the valley bottom with channel wetland areas within the project area were found to be of moderately high importance (40%). These are services such as flood attenuation, phosphate trapping, nitrate removal, toxicant removal and erosion control. The services of intermediate and moderately low importance (20%) were found to be associated with the supply of human services. The service of high importance associated with the valley bottom without a channel included the trapping of sediment originating from the side slopes and the old mine workings in the vicinity of the project area (See Table 38: Lists of the percentage of each importance class of provided services).

4.13.5.3 Hillslope Seepage Wetlands

Hillslope seepage wetlands within the project area are mostly planted with forestry plantations which have impacted on the ecological health of the unit. Furthermore a number alien invasive alien species have also established themselves within the hillslope seepage wetland areas within the project area. The reduction in the integrity of such wetland units within the project area has led to a loss of the capacity to perform functions. As a result the highest percentages of services that are provided by the hillslope seepage wetland areas within the project area were found to be of intermediate importance (53%). These services are mainly associated with the hydrological and water quality enhancement functions.

The services of moderately low importance (33%) are associated with the supply of services to the surrounding communities. These services include water supply for human use, cultural significance and cultivated foods. The services of moderately high importance (14%) that are performed by the hillslope seepage wetland within the project area include phosphate nitrate and toxicant removal (See Table 38: Lists of the percentage of each importance class of provided services).

4.13.6 The ecological health assessment

The general features of each wetland unit were assessed in terms of the impacts on the integrity HGM units. The proposed discard disposal facility within the Greenside Colliery is located within an area of intense coal mining, power generation and agricultural activity in close proximity to the town of Witbank. Coal mining operations in close proximity to the project area include both opencast and underground mining operations. Historical Coal mining in the area, especially opencast operations has resulted in alterations of wetland areas and therefore a loss of integrity and services provided by wetland areas. Some of the mining related impacts identified within the project area and surroundings include:

- Alteration of wetlands through opencast mining;
- Water contamination as a result of seepage from the existing licensed mining disposal facilities;
- Desiccation of wetland areas due to forest plantations; and
- Water contamination as a result of historical coal mining in the area.

Historical coal mining activities within the project area and surroundings has resulted in both direct and indirect impacts on the wetland areas. Coal mining is regarded as a principal cause for the alteration of wetland areas within the Olifants River catchment area. Some of the current impacts on the wetland areas that were identified during the site investigations include farm dams, canalisation of wetland areas, infestation by invasive species, opencast mining and contamination of surface water.

The abovementioned impacts have resulted in the deviation of the integrity of wetland areas within the project area from a reference state to the current state. The health assessment of the identified HGM unit made use of the indicators hydrology, geomorphology and vegetation. The PES of all the delineated wetland units is illustrated in Figure 43 below. The findings of the WET-Health assessment for the three indicators are presented in Table 39. An aggregate score for the integrity of all the identified wetland areas within the project area was calculated using the following formula:

((Hydrology score) x 3 + (geomorphology score) x 2 + (Vegetation score) x 2) ÷7

This formula provides a score ranging from 0 (pristine) to 10 (critically impacted in all respects). The rationale for this is that hydrology is considered to have the greatest contribution to health (Kleynhans and Louw, 2007).

Table 39: A summary of the WET-Health scores for the three indicator study components

HGM Unit	Module	Impact Score	Category	Change Symbol	Health Class
Pans	*Hydrology*	5.6	D	↓↓	D↓↓
	Geomorphology	1.9	B	↓	B↓
	Vegetation	4.5	D	↓↓	D↓↓
	Overall Score	**4.2**	**D**	↓↓	**D↓↓**
Hillslope Seepage wetlands	*Hydrology*	4.2	D	→	D→
	Geomorphology	3.1	C	→	C→
	Vegetation	8.6	F	→	F→
	Overall Score	**5.1**	**D**	→	**D→**
Valley bottom without a channel	*Hydrology*	**6.7**	**E**	→	**D→**
	Geomorphology	**7.2**	**E**	→	**D→**
	Vegetation	**4.2**	**D**	→	**D→**
	Overall Score	**6.1**	**E**	→	**E→**

Note: ↑↑ - Improve markedly
↑ - Improve slightly
→ - Remain stable
↓ - Deteriorate slightly
↓↓ - Deteriorate markedly

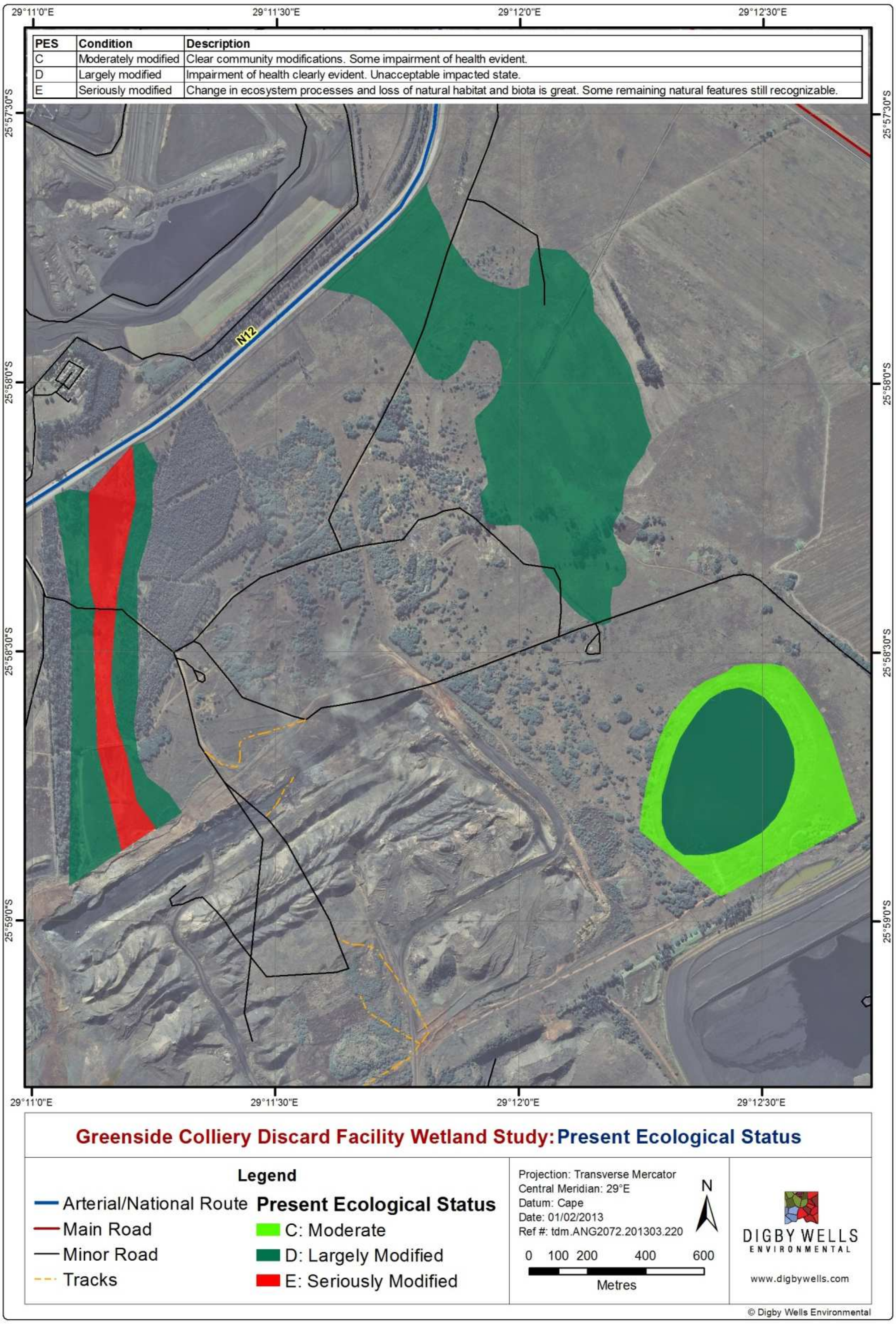


Figure 43: Illustrating the PES of the delineated wetland areas within the project area

4.13.6.1 Pan

It should be noted that a single pan (Berries Pan) within the project area receives contaminated seepage from one of the existing licensed discard disposal facility associated with the Greenside Colliery. Constant seepage of contaminated water into the pan will result in the decrease in the integrity of the pan. Although the discharge of mine water into the pan maybe authorised (WULA), however the impacts of contaminated water into the pan are considered to be negative and permanent.

The hydrology of the pan was found to be largely modified (Category D) where a large change in ecosystem processes and loss of natural habitat and biota and has occurred. The constant seepage of contaminated water into the pan may result in a seasonal pan changing into a permanent pan (See Table 39). The contaminated water will lead into losses in habitat suitability and therefore loses in the biodiversity support.

The geomorphology of the pan wetland was determined to be largely natural (Category B), where a slight change in geomorphic processes is discernible but the system remains largely intact (See Table 39).

The vegetation composition associated with the pans has been largely altered (Category D) as a result of the introduced alien species and the loss of natural vegetation due to the contaminated seepage into the pan system (seeTable 39).

The overall integrity of the pan was determined to be largely modified as a result of a moderate change in ecosystem processes (Figure 43 above), where the trajectory change is expected to deteriorate markedly.

4.13.6.2 Hillslope seepage wetlands

The integrity of hillslope seepage wetland areas within the project area has been impacted mainly by forestry plantations. These forestry plantations have substituted indigenous vegetation and reduced water availability due to a high water requirement. The hydrological impacts associated with the hillslope seepage wetlands located within the project area were considered to be largely modified (Category D) where a large change in ecosystem processes has occurred and the loss of natural habitat and biota has occurred (See Table 39). Some of the modifications that were identified include canalisation of the seepage wetlands and the forestry plantations within the wetlands.

The geomorphology of the hillslope seepage wetland was determined to be moderately modified (Category C), where a moderate change in geomorphic processes has taken place but the system remains predominantly intact (See Table 39). These effects may be attributed to canalisation of the hillslope seepage in order to facilitate drainage.

The modifications on the vegetation associated with the hillslope seepage wetlands have reached critical levels (Category F) where the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota (See Table 39).

The overall integrity of the hillslope seepage was determined to be largely modified as a result of a large change in ecosystem processes. The trajectory change for the hillslope seepage wetland is expected to deteriorate slightly (See Figure 43 above).

4.13.6.3 Valley Bottom without a channel

The integrity of the valley bottom with channel wetland areas within the project area has been impacted mainly by historical mining land-use activities. The hydrological impacts associated with the valley bottom wetland areas include farm dams, road crossings and receiving contaminated water from old stock piles and the pits. These hydrological impacts associated with the valley bottom without a channel were considered to be largely modified (Category D) where the changes in ecosystem processes and the loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable (See Table 39).

The geomorphology of the valley bottom wetlands was determined to be largely modified (Category D), where the changes in ecosystem processes and the loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable (See Table 39). These effects may be attributed to farm dams, erosion and canalisation.

The vegetation composition associated with the valley bottom wetlands has been largely modified (Category D) but some characteristic species remain, although the vegetation consists mainly of introduced, alien and/or ruderal species. These effects may be attributed the development of reed beds, kikuyu and, alien vegetation and bare areas as a result of surface contamination (See Table 39).

The overall integrity of the valley bottom wetlands was determined to be seriously modified where a large change in ecosystem processes and loss of natural habitat and biota and has occurred (See Figure 43 above).

4.13.7 Buffer Zones

The buffer zones are a requirement in order to facilitate the protection of the delineated non-perennial wetlands within the study area. The purpose of the establishment of buffer zones is to minimise the anthropogenic impacts associated with the proposed development on the receiving water resources. A buffer zone is defined as: *“the strips of undeveloped, typically vegetated land (composed in many cases of riparian habitat or terrestrial plant communities) which separate development or adjacent land uses from aquatic ecosystems (rivers and wetlands).”*

The delineated wetland areas, 32m, 100m and 500m buffer zones for the study area are indicated in Figure 44 below.

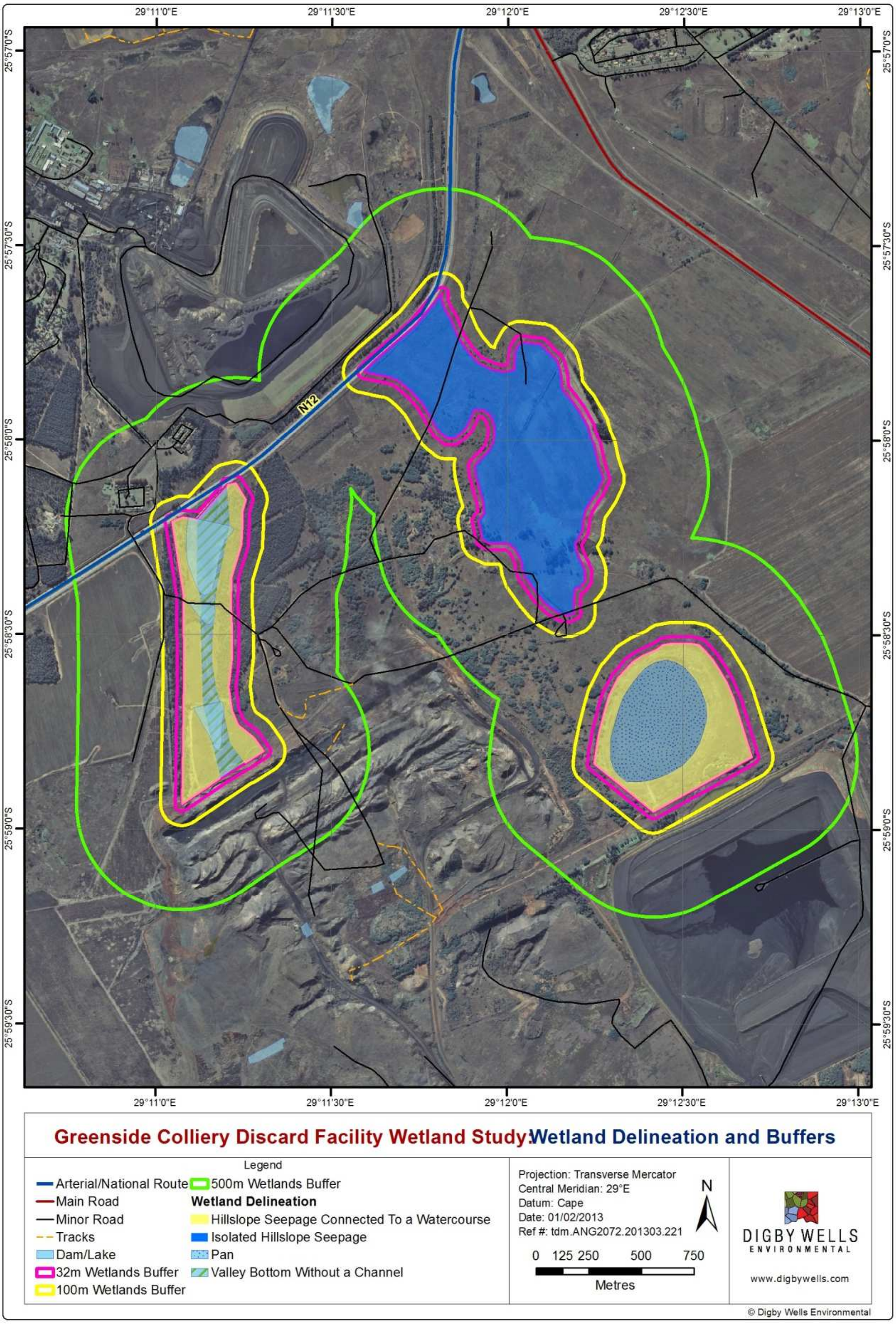


Figure 44: Delineated wetland areas, 32m, 100m and 500m buffer zones

4.14 VISUAL ASPECTS

The study area is characterised by mining activities from Kleinkopje Colliery. Greenside Colliery, Landau Colliery and industries in the area, such as Highveld Steel, further contribute to the background industrial visual environment. The existing Greenside Colliery discard dump, mine infrastructure, and Rapid Load-out Terminal as well as the Kleinkopje opencast operations, are particularly prominent visual features in the area, especially to commuters travelling along the N12 and N4 highways into eMalahleni.

4.15 SITES OF ARCHAEOLOGICAL AND CULTURAL IMPORTANCE

4.15.1 Heritage Resources

A brief overview of pre-historical and historical information can be obtained from the document entitled "*A Phase 1 Heritage Impact assessment (HIA) study for Anglo Operations Limted Greenside Colliery's new Discard Facility near eMahlahleni on the Eastern Highveld in the Mpumalanga Province*", dated November 2014, and performed by Dr. Julius Pistorius contextualises the Eastern Highveld and the study in particular (Attached as Appendix E7). This information is necessary to understand the meaning and significance of heritage resources which may exist in the study area.

The Phase I HIA study for the proposed study area revealed two graveyards located within the Greenside Colliery surface area, but outside of study area.

Table 40: Coordinates for graveyards near the study area

Graveyards	Coordinates
GY01.Graveyard with two visible graves of the Ntuli family near Eskom's power lines. Older than sixty years.	25º 58.734'S 29º 12.911'E
GY02. Located near a disturbed area where earlier mine infrastructure may have existed. Older than sixty years. Approximately 9 graves.	25º 57.426'S 29º 12.135'E

Both graves are fitted with cement headstones. Inscriptions on the headstones read as follow:

- 'Mss SAR Ntuli Ilangalo Kuealwa Lekufa 25-11-37 Jesus Christ Church.'
- 'Mr De Vidi Ntuli Ilangalo Zalwa 27-05-41 Jesus Christ Church.'

Graveyard (GY01) is located near Eskom's power lines south of the study. At least two graves of members of the Ntuli family are visible. It is possible that more graves may exist as they may be undecorated and also covered with vegetation. GY01 is older than sixty years.

Figure 45: GY01 is located near Eskom's power lines and hold the remains of two members of the Ntuli family.

Graveyard 02 (GY02) is demarcated with a fence and is located on the edge of former mining activities to the north-east of the Project Area. It holds at least nine visible graves of which the majority are those of children. More unmarked graves may exist.

Some of the graves are fitted with cement headstones with no inscriptions. One of the graves is fitted with a piece of iron plate with holes punched in the plate which spell out the following name:

- 'Seliena Mogidi Gemsbokspruit'

It is highly likely that all the graves in GY02 are older than sixty years.

Figure 46: GY02 is demarcated with a fence and holds at least nine partly decorated graves. Most of the graves belong to children.

The coordinates and levels of significance for the heritage resources which were recorded in the Project Area are as follow:

4.15.2 Paleontological Resources

A paleontological study is generally warranted where rock units of low to very high palaeontological sensitivity are concerned, levels of bedrock exposure within the study area are adequate; large scale projects with high potential heritage impact are planned; and where the distribution and nature of fossil remains in the proposed area is unknown.

A Palaeontological Impact Assessment (PIA) was conducted by Dr. Fourie entitled: *"Greenside Colliery New Discard Facility, eMalahleni Local Municipality, Mpumalanga Province, Farm: Portion 0, 2 and 3 Groenfontein 331JS, Palaeontological Impact Assessment: Phase 1 Field study"*, dated November 2014, and attached hereto in Appendix E8, to document resources in the studyarea and identify both the negative and positive impacts that the project brings to the receiving environment. The PIA therefore identifies palaeontological resources in the area to be developed and makes recommendations for protection or mitigation of these resources.

According to the above mention study formations present are part of the Karoo Supergroup. The Karoo Supergroup is renowned for its fossil wealth. The Vryheid Formation (Pe,Pv), Ecca Group is rich in plant fossils such as the Glossopteris flora represented by stumps, leaves, pollen and fructifications. This formation is early to mid-Permian in age and consists of sandstone, shaly sandstone, grit, conglomerate, coal and shale. Coal seams are present in the Vryheid Formation within the sandstone and shale layers. Fossils are mainly present in the grey shale which is interlayered between the coal seams.

Fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. Therefore, if there is the presence of Karoo Supergroup strata the palaeontological sensitivity is generally low to very high

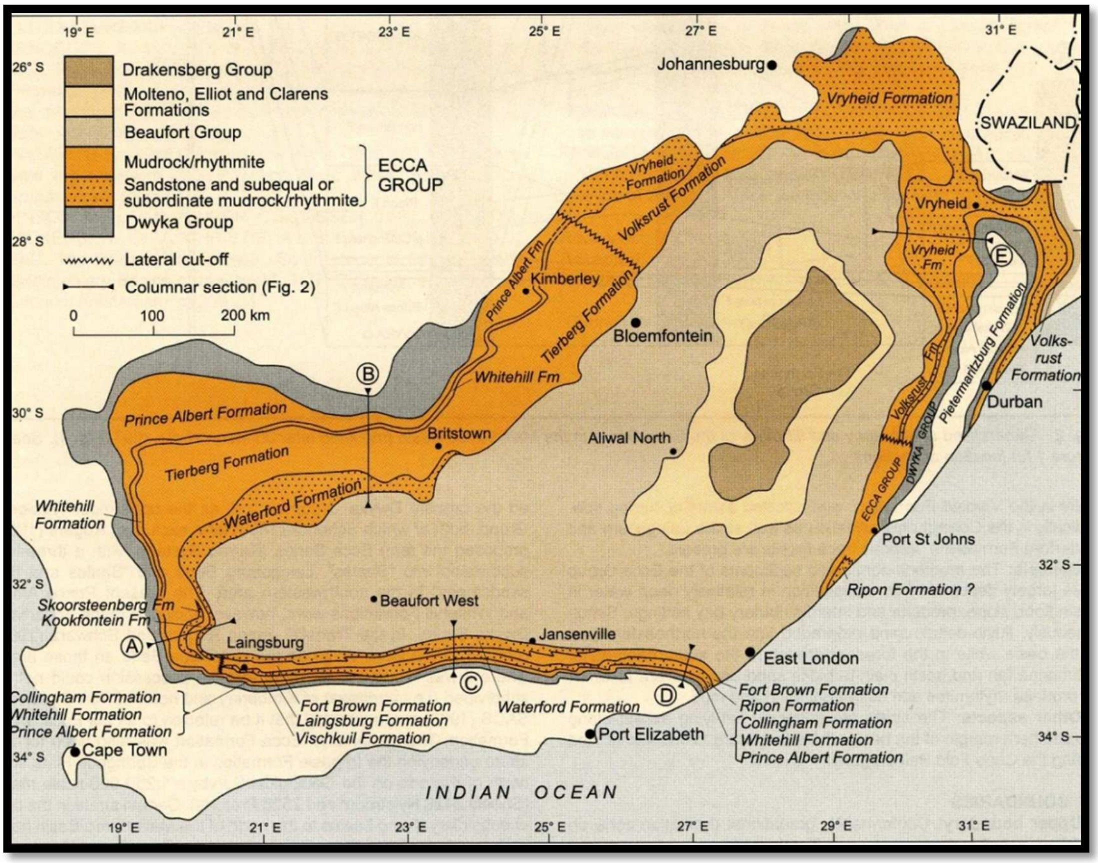


Figure 47: Map from Johnson (2009) to show extent of the Ecca Group, more specifically the Vryheid Formation.

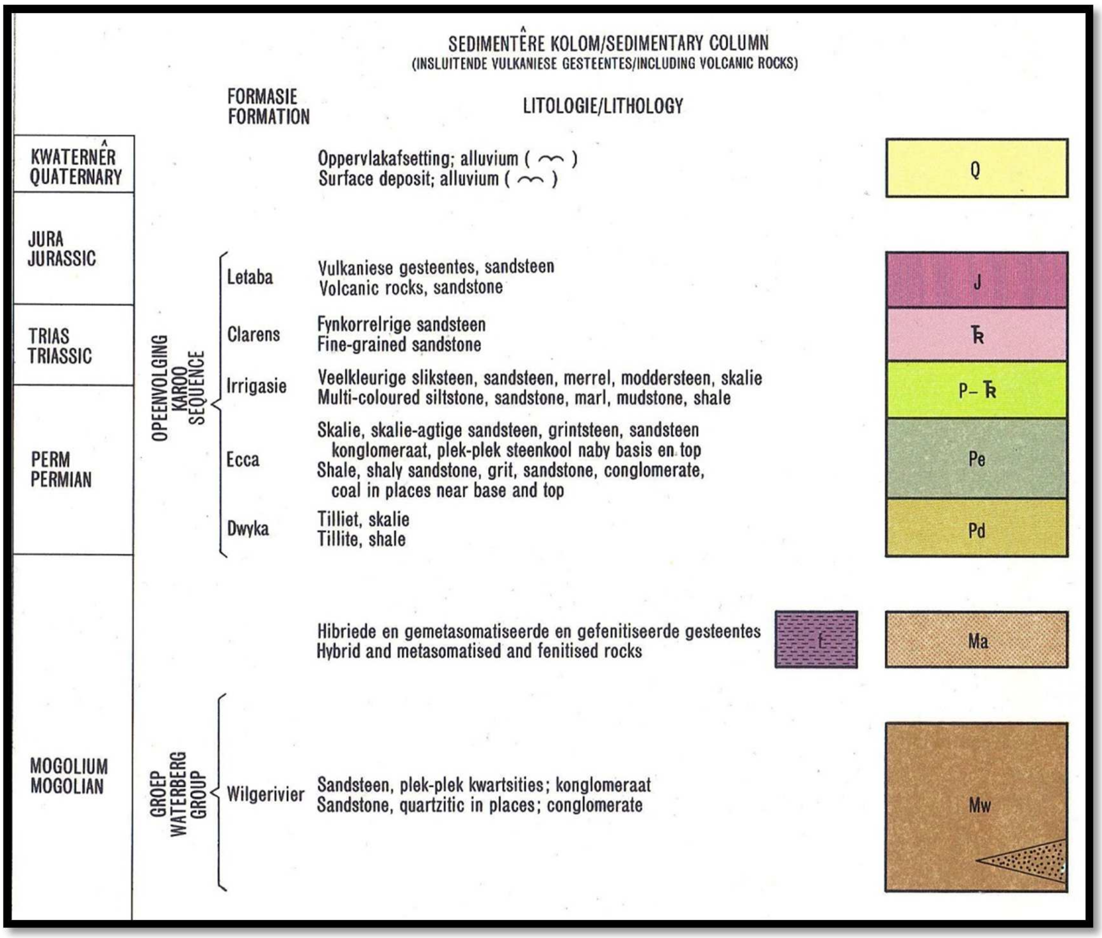


Figure 48: Lithostratigraphic column to show the Ecca Group within the Karoo Supergroup.

The Ecca Group may contain fossils of diverse non-marine trace, *Glossopteris* flora, mesosaurid reptiles, palaeoniscid fish, marine invertebrates, insects, and crustaceans (Johnson 2009). *Glossopteris* trees rapidly colonised the large deltas along the northern margin of the Karoo Sea. Dead vegetation accumulated faster than it could decay, and thick accumulations of peat formed, which were ultimately converted to coal. It is only in the northern part of the Karoo Basin that the glossopterids and cordaitales, ferns, clubmosses and horsetails thrived (McCarthy and Rubidge 2005).

The Glossopteris flora is thought to have been the major contributor to the coal beds of the Ecca. These are found in Karoo-age rocks across Africa, South America, Antarctica, Australia and India. This was one of the early clues to the theory of a former unified Gondwana landmass (Norman and Whitfield 2006).

Fossils likely to be found in the study area are mostly plants such as '*Glossopteris* flora' of the Vryheid Formation refer to Figure 49 below. The aquatic reptile *Mesosaurus* and fossil fish may also occur with marine invertebrates, arthropods and insects. Trace fossils can also be present (Johnson 2009).

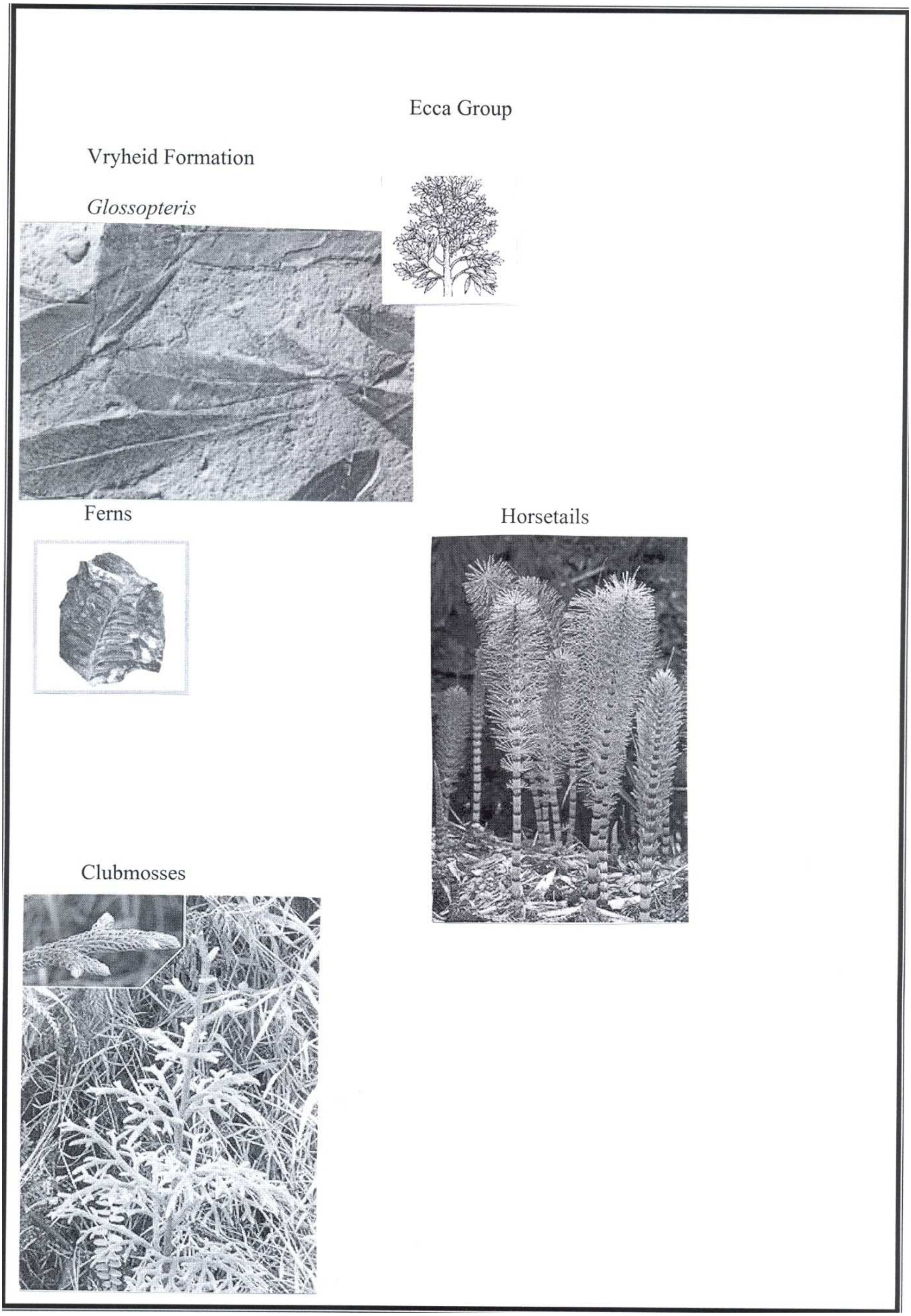


Figure 49: Fossils likely to be found in the Vrydheid formation

4.16 REGIONAL SOCIO-ECONOMIC ASPECTS

The following information is based information from studies for other processes at Greenside Colliery, which referenced ELM's Integrated Development Plan (IDP) for 2011-2012, the Community Survey 2007 Municipal Data on Household Services, and Statistics South Africa 2001 Census.

4.16.1 Population

As mentioned previously, Greenside Colliery is located within the Emahlalhelni Local Municipality (ELM). The ELM had the largest population size of 435,217 persons in 2007. The municipality is also the most populated in the district with a population density of 162.54 persons per square meter.

The age and sex structure of the ELM shows an atypical pattern for a developing province such as Mpumalanga. In 2001, an equal size of the population occurred in the age groups between 0 to 4 years and 20 to 24 years, indicating a population stabilizing over time with stable levels of fertility. A typically aging population was determined for the ELM in 2001. In comparison, the pattern shown in 2007 has distortions in the middle ages with an unusually larger population of males compared to females between the ages of 20 and 34; this may be an indication of high economic activity within the ELM.

An annual growth rate of 7.6% (the highest in the district) was observed for the 6 year period between 2001 and 2007. By extrapolating the growth rate over-time, the projected population of the local municipality is expected to be 635,324 persons by 2012, and reach 927,438 in 2017. In 2007, the population of the ELM was mostly Black (85.8%) of the population. The remaining 14.2% of the population comprised White (12.7%), Coloured (1.2%) and Indian (0.3%).

4.16.2 Educational attainment

Educational attainment, i.e. the provision of educational services to a population, in the ELM is higher compared to most municipalities in Mpumalanga province. In addition, improvement in educational levels was observed to occur between 2001 and 2007. About 14% of males and 15% of females over 20 years had no schooling in 2001. This was reduced to 8% for both males and females by 2007, which indicate favourable improvements in educational attainment over a period of 6 years. There was also a reduction in the percentage of persons with primary educational attainment in favour of higher educational levels. What is unexpected is the reduction in the percentage with Grade 12 between 2001 and 2007 for both males and females. This decline is not offset by more persons attaining qualifications higher than Matric, since the percentage with higher education hardly changed.

4.16.3 Employment

Employment opportunities are favourable in the ELM, roughly 61% for males and 38% for females, were employed in 2007. Figure 50 further indicates that there has been a reduction in the percentage unemployed in the district between 2001 and 2007 for both males and females. The decline is similar for males and females, although employment remains higher for males than for females.

About a third of females were unemployed in 2001 compared to 20% of males in economically active ages. By 2007, this was reduced to 18% for males and 27% for females. Also evident is that the improvements in employment are much more prominent for males rather than females by 2007. In general, the municipality has better employment opportunities in the district.

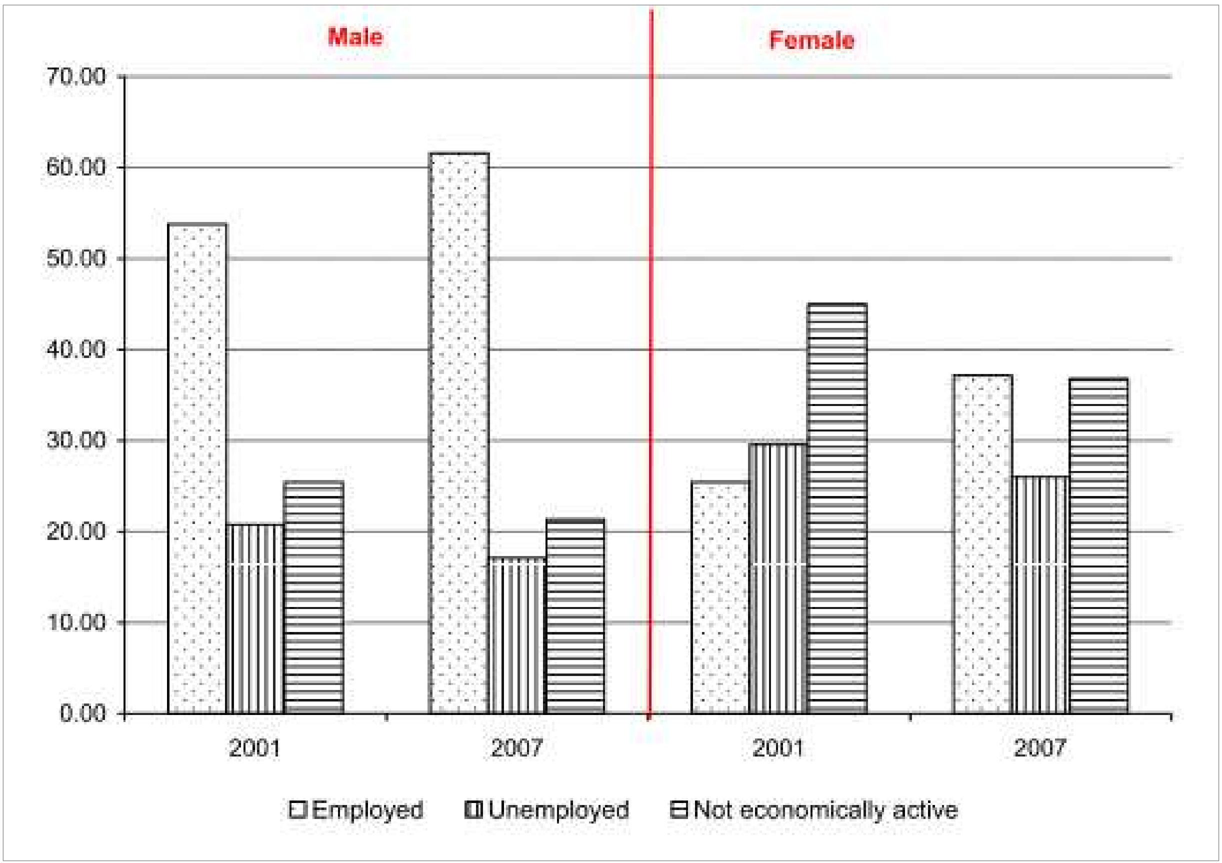


Figure 50: Employment status for persons between 15 and 65 years old (after ELM IDP, 2011)

4.16.3 Disability

Disability can be used as a measure to evaluate the health of a population. A decline in the percentage of disabled persons was observed in the district between 2001 and 2007. When looking at the percentage distribution of the disabled population by type of disability, one observes that, in 2001, almost half of the disabled persons in the municipality either had sight, hearing or physical limitation (see Table 41). By 2007, the most prevalent form of disability was physical and emotional limitations, where over half of disabled persons experienced one of these limitations. This is an important disaggregation to note for knowledge of what types of resources are needed by disabled persons within the district.

Table 41: Prevalence of disabled by type of disability

Disability	2001	2007
Percentage disabled	5.4	4.3
Sight	27.2	12.0
Hearing	17.6	8.8
Communication	3.1	3.9
Physical	17.2	37.9
Intellectual	8.3	10.6

Emotional	11.7	16.6
Multiple disability	14.9	10.2

4.16.4 Social grants

One of the services that the South African government provides to the population is in the form of income grants. These grants are designed to alleviate poverty among vulnerable persons for which the grant is intended for. Each grant has its own eligibility criteria that can be accessed from the Department of Social Development. The number of persons receiving social grants is indicated in Table 42.

Table 42: Number of recipients of social grants in 2007

Grant type	Number receiving grant
Old age pension	12,189
Disability grant	9,284
Child support grant	54,602
Care dependency grant	1,636
Foster care grant	272
Grant in aid	250
Social relief	641
Multiple grants	981

The grant with the largest recipients is the child support grant (54,602 children). This partly reflects the need for this grant in improving child well-being, but also the larger numbers of recipients for this grant is merely a function of the size of the population aged below 15. The second grant with the most recipients is the old age pension. The district has a sizable number of persons above the age 65, which reflects the number eligible for the old age pension. The data from census 2001 and CS 2007 is limited in the information obtained that can allow for evaluating the accessibility of these grants for those in need and eligible.

4.16.5 Access to water

The majority of households have access to safe water either through pipes to within the dwelling, or access it from a point outside the dwelling. There were some improvements in provision of piped water inside the dwelling between 2001 and 2007 (from 42% to 46%). Evidence suggests that the provision of basic services had focused its attention towards lowering the number accessing piped water from outside a dwelling. Not much change is observed from the other types of water sources, except for eliminating households that had unspecified water sources in 2001.

4.16.6 Access to sanitation

In 2001, over two thirds (75%) of households in the municipality either had a flushed toilet or pit latrine without ventilation. There is clear evidence of a local government campaign to replace pit latrines without ventilations with those that are ventilated to promote safer sanitation facilities. By 2007, almost no households were using pit latrine without vent. Although the number of households with no toilet facility has declined between 2001 and 2007, the decline is small.

4.16.7 Access to electricity

Electricity was the leading source of energy for all uses; however, it declined somewhat between 2001 and 2007 in the ELM. In 2007, electricity use for heating and cooking was observed in 47% and 60% of households, respectively. Electricity use among households was not uniform, meaning even households with electricity do not choose to use it for all their energy needs. The other sources of cooking and heating energy are paraffin and coal, the use of which increased in 2007, while the use of electricity declined between 2001 and 2007 from 69% to 60%. The use of candles and paraffin for lighting surprisingly increased between 2001 and 2007, an unusual trend in all the Mpumalanga municipalities.

4.16.8 Dwelling type

The type of dwelling where a household resides is directly linked to well-being of household members. There is evidence that suggests that children under age 5 who reside in dwellings that have poor floor, wall and roof materials have higher prevalence of negative developmental outcomes. They have higher mortality during childhood, higher morbidity and lower school attendance. This is also because dwellings with poor building structures are often poor, have no access to other basic services, such as safe water and sanitation. The types of dwelling that prevailed in the municipality in 2007 were formal dwellings, such as houses. There was actually a decline in formal dwelling between the 6 year period, and an increase in informal dwellings.

5. PUBLIC PARTICIPATION PROCESS

Section 24 of the Constitution of the Republic of South Africa of 1996 guarantees everyone the right to an environment that is not harmful to their health and well-being and to have the environment protected for the benefit of present and future generations. In order to give effect to this right, the NEMA, 1998, as amended, came into effect in January 1999.

In terms of Section 24 (4) of the NEMA, 1998, procedures for the investigation, assessment and communication of the potential consequences or impacts of activities on the environment must, *inter alia*, ensure, with respect to every application:

- Coordination and cooperation between organs of state in the consideration of assessments where an activity falls under the jurisdiction of more than one organ of state.
- That the findings and recommendations flowing from an investigation, the general objective of integrated management laid down in NEMA, 1998 and the principles of environmental management set out in Section 2 of NEMA, 1998 are taken into account in any decision made by the organ state in relation to any proposed policy, programme, process, plan or projects, consequences or impacts.
- Public information and participation procedures which provide all integrated and affected parties, including all organs of state in all spheres of government that may have jurisdiction over any aspect of the activity, with a reasonable opportunity to participate in those information and participation procedures.

One of the general objectives of integrated environmental management laid down in Section 23(2) (d) of NEMA, 1998 is to: “ensure adequate and appropriate opportunity for public participation in decisions that may affect the environment.”

The National Environmental Management Principles as stipulated in NEMA, 1998 say;

- “Environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably.
- The participation of all interested and affected parties in environmental governance must be promoted, and all people must have an opportunity to develop the understanding, skills and capacity necessary to achieve equitable and effective participation, and participation by vulnerable and disadvantage persons must be ensured”.

The EIA Regulations of 2010 require that public participation must be done after submission of an application for a Scoping and Environmental Impact Assessment Report (S&EIR).

The public participation process for this project has been conducted in terms of the procedures and provisions of the public participation process in terms of the NEMA, 1998 and Chapter 6 of the EIA Regulations of 2010, as well as other relevant legislation such as the PAJA, 2000 and the PAIA, 2000.

5.1 METHOD OF NOTIFICATION

5.1.1 Press advertising

The proposed project was advertised in English and Afrikaans in a local newspaper, Witbank News, on 23 November 2012. The Witbank News was found to be the most appropriate newspaper in terms of its accessibility and language to the I&APs. A copy of the advertisement and proof of the placement thereof is attached in Appendix D1.

5.1.2 On-site advertising

Notice was also given to Interested and Affected Parties (I&APs) by notice boards. Notice boards were placed at three different, noticeable and conspicuous places (the entrance gate to the mine and two other locations surrounding the Greenside Colliery) on 22 November 2012. A copy of the site notice and photographs of the site notices are attached in Appendix D2.

5.1.3 Background Information Document

The Background Information Document (BID) developed for the proposed project provides background information pertaining to the project and is intended to inform I&APs of the proposed project. The BID also includes a registration form which I&APs, stakeholders and organs of state are encouraged to complete in order to register as an I&AP for the proposed project.

The BID was made available to all landowners within and surrounding the mine boundary area of the proposed project, as well as to all organs of state that may have jurisdiction over any aspect of the activity on 22 November 2012. The BID will also be made available to any other person who becomes involved in the on-going Public Participation Process.

Copies of the BID and proof of distribution of the BID to the adjacent landowners and organs of state have been attached as Appendix D3.

5.2 LIST OF I&APS AND STAKEHOLDERS IDENTIFIED

All landowners within and surrounding the mine boundary area of the proposed project are considered to be registered I&APs.

Table 43 below, indicates the list landowners and adjacent landowners identified and notified (by means of e-mail, telephone, fax and/or post) of the proposed project. Copies of the notifications to the I&APs have been included in Appendix D4.

Table 43: List of I&APs notified

Farm Name	Owners Details
Blaauwkrans 323 JS Portion 1	Transnet Ltd.
Weltevreden 324 JS Portion RE	Truter Boerdery Trust
Vlaklaagte 330 JS Portion 16, 17	Uitspan Uitbreidings

Farm Name	Owners Details
Vlaklaagte 330 JS Portion 7, 14	Rudolf Martinus Botha
Vlaklaagte 330 JS Portion 9	Madeleine Louw
Vlaklaagte 330 JS Portion 10	Morne Stander
Vlaklaagte 330 JS Portion 12	Stephanus Johannes Petrus Duvenhage
Vlaklaagte 330 JS Portion 13	Adistra 96 CC
Vlaklaagte 330 JS Portion 15	Marie Liebenberg
Blaauwkrans 323 JS Portion 4, 17	Transnet Ltd.
Weltevreden 324 JS Portion 3, 4	National Department of Land Affairs
Vlaklaagte 330 JS Portion 0, 1, 3, 4	Uitspan Uitbreidings Pty Ltd.
Vlaklaagte 330 JS Portion 2	Jacobus Theodorus du Preez
Vlaklaagte 330 JS Portion 5, 6	Republic of South Africa
Vlaklaagte 330 JS Portion 8	Barend Johannes Venter
Vlaklaagte 330 JS Portion 11	Ludwig Paul van Schalkwyk
Waterpan 8 IS Portion 0	Duiker Mining Pty Ltd.
Tweefontein 13 IS Portion	Duiker Mining Pty Ltd.
Other adjacent landowners and lessees	Andrew Serelane
	Kleinkopje Colliery
	Landau Colliery
	Johan Oelofse
	Mr. Engelbrecht
	Mr. Bezuidenhout
	Mr. Jan Lauschagne
	Mr. PH Venter
	Neels Smith
	Paula Duvenhage
	Pierre Liebenberg
	Stefanus Johannes van Jaarsveld
	Truter Boerdery Trust
	Blackhill Primary School
	Mr. Babu Jiyane
	Mr. Fanie van Jaarsveld
	Mr. RM Botha
	Mr. Tielman Roux
	Sophia van Schalkwyk

5.3 LIST OF ORGANS OF STATE IDENTIFIED

All organs of state which may have jurisdiction in respect of the proposed project is considered to be registered I&APs.

Table 44 below indicates the list of organs of state notified of the proposed project. Copies of the notifications to the organs of state have been included in Appendix D4.

Table 44: List of organs of state notified

Company Name
Department of Water Affairs
Mpumalanga Department of Economic Development, Environment and Tourism.
Department of Public Works
Department of Agriculture

Company Name
Department of Minerals Resources.
Green Trust
Wildlife Society.
Mpumalanga Tourism and Part Agency
Mpumalanga Working for Wetlands (SANBI)
eMalahleni Local Municipality
Mpumalanga Parks Board
Nkangala District Municipality
Olifants Catchment Environmental Protection Group
South African Heritage Resource Agency
Transnet
Spoornet
Witbank Framers Association
Witbank Tourism Board
South African National Roads Agency Limited

5.4 I&AP REGISTER

All organs of state and landowners within and surrounding the mine boundary area of the proposed project is considered registered I&APs.

Table 45 below indicates the list of all registered I&APs of the project.

Table 45: List of all registered I&APs

No.	Name	Interest
1.	Transnet Ltd.	I&AP
2.	Truter Boerdery Trust	I&AP
3.	Uitspan Uitbreidings	I&AP
4.	Rudolf Martinus Botha	I&AP
5.	Madeleine Louw	I&AP
6.	Morne Stander	I&AP
7.	Stephanus Johannes Petrus Duvenhage	I&AP
8.	Adistra 96 CC	I&AP
9.	Marie Liebenberg	I&AP
10.	National Department of Land Affairs	I&AP
11.	Jacobus Theodorus du Preez	I&AP
12.	Republic of South Africa	I&AP
13.	Barend Johannes Venter	I&AP
14.	Ludwig Paul van Schalkwyk	I&AP
15.	Duiker Mining Pty Ltd.	I&AP

No.	Name	Interest
16.	Andrew Serelane	I&AP
17.	Kleinkopje Colliery	I&AP
18.	Landau Colliery	I&AP
19.	Johan Oelofse	I&AP
20.	Mr. Engelbrecht	I&AP
21.	Mr. Bezuidenhout	I&AP
22.	Mr. Jan Lauschagne	I&AP
23.	Mr. PH Venter	I&AP
24.	Neels Smith	I&AP
25.	Paula Duvenhage	I&AP
26.	Pierre Liebenberg	I&AP
27.	Stefanus Johannes van Jaarsveld	I&AP
28.	Truter Boerdery Trust	I&AP
29.	Blackhill Primary School	I&AP
30.	Mr. Babu Jiyane	I&AP
31.	Mr. Fanie van Jaarsveld	I&AP
32.	Mr. RM Botha	I&AP
33.	Mr. Tielman Roux	I&AP
34.	Sophia van Schalkwyk	I&AP
35.	Department of Water Affairs	Organ of State
36.	Department of Economic Development, Environment and Tourism.	Organ of State
37.	Department of Public Works	Organ of State
38.	Department of Agriculture	Organ of State
39.	Department of Minerals Resources.	Organ of State
40.	Green Trust	Organ of State
41.	Wildlife Society.	Organ of State
42.	Mpumalanga Tourism and Part Agency	Organ of State
43.	Mpumalanga Working for Wetlands (SANBI)	Organ of State
44.	eMalahleni Local Municipality	Organ of State
45.	Mpumalanga Parks Board	Organ of State
46.	Nkangala District Municipality	Organ of State
47.	Olifants Catchment Environmental Protection Group	Organ of State
48.	South African Heritage Resource Agency	Organ of State
49.	Transnet	Organ of State
50.	Spoornet	Organ of State
51.	Witbank Framers Association	Organ of State
52.	Witbank Tourism Board	Organ of State
53.	South African National Roads Agency Limited	Organ of State

5.5 COMMENTS AND RESPONSES REPORT

All issues, comments and questions received from the I&APs up to date have been summarised in Table 46. Copies of the comments received have been included in Appendix D5.

Table 46: Issues received to date, and responses to these issues

Name	Company	Date	Contact Person	Method of comment	Issue raised	Response
Mr. Andrew Silabela	Enqome Yethu Primary Co-operative (Pty) Ltd	9th January 2013	Mr. Andrew Silabela	Fax	We as community of Mgewane are surrounded by Kleinkopje, Shared Services, Greenside, Highveld Hospital and Navigation Plant. We have been affected with coal dust, blasting, noise from conveyor belt, sinking holes and cracks.	Thank you for your letter. We have registered you as an interested and affected party.
Mr. Pierre Marias (e-mail was intended for Mr. Jan Labuschagne and Mr. Pierre Marias responded)	Private Landowner	22 November 2012	Mr. Pierre Marias	E-mail	Ms Fellowes, This email address does not belong to your intended recipient. Please delete from all records. "All construction will take place within the 100m buffer of the wetland"? For how many years will the coal mining industry and the government be allowed to rape our soil and scarce water sources before it is all gone?? - Make sure that Shangoni starts paying you in foreign currency, because your children will not inherit the land they were born to.	Dear Pierre, Thank you for your response. I will update the database. For the sake of the database and to prevent future miss communications on which farm do you reside?

Amos Bantu Mkhonto	Papamo General Services cc	27 November 2012	Amos Bantu Mkhonto	Fax	We at Papamo Services cc wish to be included in the interested and affected parties register and to comment on this application.	Thank you for your letter. We have registered you as an interested and affected party.
Jenna Lavin	South African Heritage Resources Agency	30 November 2013	Jenna Lavin	Letter	Thank you for submitting the Draft Scoping Report for the proposed construction of a new Greenside Colliery discard dump and associated infrastructure to be located on portions 0, 2, & 3 of the farm Groenfontein 331 JS, Emalahleni Local Municipality, Mpumalanga Province. In terms of Section 38(8) of the National Heritage Resources Act (Act 25 of 1999), any proposed development that requires an application in terms of NEMA or the MPRDA must have an assessment of impacts to heritage resources completed as part of the application process. The relevant heritage authority must determine whether the assessment done in terms of impacts to heritage resources satisfies our requirements and must provide comments or recommendations to the decision-making authority. According to the submitted documentation, the existing Greenside Colliery requires a new discard dump as the existing discard dump is not able to	The Heritage and Paleontological study was conducted in accordance to SAHRA's request and attached hereto in Appendix E7 and E8. These documents will also be submitted to SAHRA together with the draft EIR for review.

					accomodate discards for the full life of the mine. The existing Greenside Colliery has been in operation since 1998 and as such, the area proposed for development has been previously impacted my mining activities. However insufficient information has been provided for SAHRA to assess the impact of the proposed development on heritage resources. As such, SAHRA requires that a Heritage Impact Assessment be conducted. This heritage impact assessment must assesses the impact of the proposed prospecting on all heritage resources including, but not limited to, archaeological heritage, palaeontological heritage, rock art, any significant structures and intangible heritage. This assessment must not only assess impacts in terms of the development footprint, but must also assess broader, indirect impacts to heritage that may result from the proposed development. No assessment of impacts to palaeontological heritage is required. The quickest process to follow for the archaeological component would be to contract a specialist (see	

					www.asapa.org.za) to provide a Phase 1 Archaeological Impact Assessment Report. The Phase 1 Impact Assessment Report will identify the archaeological sites to be impacted and assess their significance. It should also make recommendations (as indicated in section 38 of the NHRA) about the process to be followed. For example, there may need to be a mitigation phase (Phase 2) where the specialist will collect or excavate material and date the site. At the end of the process the heritage authority may give permission for destruction of the sites. A Palaeontological Field assessment study must be undertaken to assess whether or not the development will impact upon significant palaeontological resources. If necessary a Phase 2 rescue operation might be required (see www.palaeontologicalsociety.co.za). Any other heritage resources that may be impacted such as built structures, sites of cultural significance associated with oral histories, burial grounds and graves, graves of victims of conflict, and cultural landscapes or viewscapes must also be assessed.	

					This assessment must satisfy SAHRA's minimum requirements for impact assessments and must comply with the requirements in Section 38(3) of the NHRA and as such, this assessment must provide recommendations regarding the mitigation of any identified direct and indirect impacts to heritage resources. SAHRA looks forward to receiving this assessment before commenting further on this proposed development. Should you have any further queries, please contact the designated official using the case number quoted above in the case header	
Mr Trevor Blazer	Department of Water Affairs	29 January 2013	Mr Trevor Blazer		Herewith a response to the receipt of the Scoping Report on 20 November 2013. .. In terms of the National Water Act (Act No. 36 of 1998) the Sub-Directorate Environment and Recreation's responsibilities are towards ensuring compliance with regards to integrated environmental management (IEM) as it relates to water resource management and specifically with section 21 (c) [impeding and diverting the flow of water in a water course] and - section 21 (i) [altering the bed, banks and characteristics of a water course] water uses.	The Water Use Licence will be applied for in terms of section 21 (c) and (i) water uses and will be submitted to the Regional DWS. The distance of the wetlands from the discard facility and related infrastructure is specified in the WULA.

					This unit's roles are mainly focused in the development, regulation, control and management 'of policy and protocol; performance and compliance monitoring, evaluation and auditing; and providing training and capacity building to the DWAF Regional Offices for the afore-mentioned sub-directorate's responsibilities. Consequently the review and comment/recommendations on environmental reports is a Regional Office competency. In order to avoid unnecessary setbacks in your environmental authorization processes please ensure that all environmental reports for review are submitted to the relevant Regional Office (Bronkhcrstspruit Regional Office), contact details provided below. Based on the information at hand (refer to item 3.9.2.2 on page 60, item 3.9.5 on pages 67 to 68, the Overall layout plan 3.1), it is clear that this activity will take place within the extent of a water course (the area within the 1:100 year flood line or delineated riparian habitat, whichever is the greatest, and/or within a 500m radius from the boundary of a wetland). There are pans present in the vicinity of the proposed discard dump and therefore a Water Use Licence must be	

					applied for in terms of section 21 (c) and (i) water uses. Refer to the overall layout of access roads plan 3.4. The exact distance of the discard dump from the effected wetlands is not specified, and must be specified. DWA Sub-Directorate: Environment and Recreation (E&R) trust that you find the above in order, and that it will assist you in finalising this WULA.	
Ms B Mnguni	Department: of Water Affairs	8 January 2014	Ms B Mnguni	Fax	1. Page 33, the applicant has identified the Department of Water Affairs as the relevant government department that might be affected by the proposed development. The Applicant shall conduct a preliminary legal assessment to identify all the water use activities associated with the proposed project that will require authorisation by the DWA and shall note that in terms of section 22(1) of the National Water Act, 1998 (Act No. 36 of 1998). 2. The applicant must note that no activities should occur within a 100 m or within 1:100 year floodline (whichever one is greater). 3. Storm water management: Stormwater management plan must be implemented to prevent pollution on run—off. A plan	1. A preliminary legal assessment to identify all the water use activities associated with the proposed project that will require authorisation by the DWA has been conducted as part of the WULA. 2. The designs of the discard dump and related infrastructure has been modified to accommodate for all infrastructure to be outside of the 100m and 1:100 floodline, except for the existing bridge crossing over

					depicting the management of stormwater, stormwater drainage lines and the discharge thereof, must be approved by the responsible local authority. 4. The applicant is advised to conduct a pre—application meeting with the department prior' submission of the integrated Water Use license application (IWULA) to ensure all sufficient information is submitted. 5. The applicant is further advised to not commence with any water uses activities before prior obtaining a Water Use License. 6. The applicant must report any pollution incident originating from this proposed project to the Regional Head: Mpumalanga of the Department of Water Affairs within 24 hours. 7. Please Note: The Mine Manager/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	the Greenside spruit. 3. A stormwater management plan has been completed and attached hereto in Appendix E11. Greenside Colliery will ensure that the stormwater designs are approved by the local authority. 4. A pre-application meeting was held with the DWS in May 2014. 5. Noted. 6. Noted. 7. Noted.

					Notice No.704 and published in Government Gazette No. 20119 of June 1999. Please contact the Department on the contact details listed above should have further queries.	

5.6 SCOPING PHASE PUBLIC MEETING

A public meeting was held on the 23rd of January 2013. Stakeholders were notified of this meeting via the newspaper advertisements, on-site notices and telephonically (refer to Part 5.1), as well as in the BID. The minutes of the public meeting, a copy of the presentation and the attendance register are attached as Appendix D6.

5.7 ACCESS AND OPPORTUNITY TO COMMENT ON ALL WRITTEN SUBMISSIONS

The draft Scoping Report was made available to the public for review for a period of sixty (60) days, from 18 November 2013 – 05 February 2014. Hard copies of the mentioned draft document have been made available at the Greenside Colliery for the I&APs to view and a copy of the draft document has been submitted to DARDLEA, DMR and DWA for review. A register and comment sheet accompanies the hard copies at the public viewing station. An electronic copy of the draft Scoping Report was also posted on the Shangoni Management Service's website (www.shangoni.co.za) for public comment for the same period of sixty days.

All the registered I&APs were notified of the availability of the draft Scoping Report for public review by 18 November 2013. The I&APs were also informed to complete the register subsequent to reviewing the draft Scoping Report and also to submit any comments to Shangoni Management Services by no later than 05 February 2013.

The final Scoping Report was submitted to the public and the DARDLEA, DWS and DMR on 18 August 2014.

The draft EIA and EMP is available to the public for review for a period of forty (40) days, from 30 March 2015 until 15 May 2015. Hard copies of the mentioned draft document were made available at the Greenside Colliery. A register and comment sheet accompanied the hard copies at the public viewing stations. An electronic copy of the draft EIA and EMP was also posted on the Shangoni Management Service's website (www.shangoni.co.za) for public comment for the same period of forty days.

All the registered I&APs were notified of the availability of the draft EIR and EMP for public review. The I&APs were also informed to complete the register subsequent to reviewing the draft EIA and EMP and also to submit any comments to Shangoni Management Services by no later than 15 May 2015.

The final EIA and EMP will be made available to the public for review. Hard copies of the mentioned document will be made available at the Greenside Colliery. An electronic copy of the final EIA and EMP will be posted on the Shangoni Management Service's website (www.shangoni.co.za).

All the registered I&APs will be notified of the availability of the final EIA and EMP for public review. The I&APs will be informed to submit any comments to the DARDLEA and copy such comments to Shangoni Management Service.

5.8 CONSULTATION WITH THE RELEVANT AUTHORITIES

5.8.1 Application Form in Terms of the NEMA, 1998

The applicable Environmental Authorisation Application Form under NEMA, 1998 was submitted to the then Mpumalanga Department of Economic Development, Environment and Tourism (MDEDET) on the 30th of October 2012. A reference number (17/2/3N-205) was issued by the then MDEDET on the 9th of November 2012. The letter of acknowledgement indicating the above mentioned reference number is attached as Appendix B1.

5.8.2 Authorities meetings

Meetings were held on 29 November 2012 and 14 May 2013 at the then DWA in Pretoria to inform the DWS of the proposed project and to gain their input into the process to be followed for the compilation of the IWULA for the proposed project. The minutes of the meetings and attendance registers are attached hereto as Appendix B2.

An authorities meetings was also be held with the DMR on 07 May 2013 to gain input on the way forward with regards to the EMP Addendum under the MPRDA, 2002 and to gain input on the project. The minutes of the meeting and attendance register are attached hereto as Appendix B3.

5.8.3 Further consultation with relevant Authorities

Once the EMP, IWULA and EIA for the proposed project has been finalised for submission authorities meetings will be held with DARDLEA, DMR and DWS respectively. The purpose of this authorities meeting will be to present the findings of the various environmental processes to the authorities to assist them in the decision making process.

6. DESCRIPTION OF ALTERNATIVES

The following definition of "alternatives" is given in the EIA Regulations 2010, under the NEMA, 1998: "*alternatives, in relation to the proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to-*

a) the property on which or location where it is proposed to undertake the activity;

b) the type of activity to be undertaken;

c) the design or layout of the activity;

d) the technology to be used in the activity;

e) the operational aspects of the activity; and

f) *the option of not implementing the activity*".

As required in term of the requirements of Regulation 31 (g) (of Regulation 543) of the EIA Regulations, 2010, under the NEMA, 1998 a description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity is given here. Also included here is a description and comparative assessment of all alternatives identified during the environmental impact assessment process as required in terms of Regulation 31(i).

6.1 IDENTIFIED POTENTIAL ALTERNATIVES

A number of potential alternatives have been identified for the project:

a) The property on which or location where it is proposed to undertake the activity;
   - Alternatives in terms of location of the discard facility.

b) The type of activity to be undertaken;
   - Alternatives in terms of land use development.

c) The design or layout of the activity;
   - Alternatives in terms of road infrastructure.
   - Alternatives in terms of layout of the discard facility.
   - Alternatives in terms of the pollution control dam location.

d) The option of not implementing the activity.

6.2 METHODOLOGY APPLIED IN ASSESSING ALTERNATIVES

6.2.1 Categories for Site Selection

Four categories have been selected for review of each selected option, which include Environmental, Technical/Engineering, Economical and Social. Criteria as used for the various categories are reflected in Table 47.

6.2.2 Criteria

Under the 4 selected categories, a number of criteria have been identified for assessment, as contained within Table 47.

Table 47: Site Selection Criteria

CRITERIA	CATEGORY			
	ENVIRONMENTAL /LEGAL	TECHNICAL /ENGINEERING	ECONOMICAL	SOCIAL
AIR QUALITY	X			
AQUATIC AND SURFACE WATER	X			
CULTURAL HERITAGE	X			
FAUNA	X			
FLORA	X			
GEOHYDROLOGY	X			
GEOLOGY	X			
NOISE	X			
SOIL	X			
TRAFFIC	X			
VIBRATION AND AIR BLAST	X			
VISUAL	X			
OTHER LEGAL REQUIREMENTS (E.G. WATER USE ACTIVITIES, EIA REQUIREMENTS ETC.)	X			
SENSE OF PLACE				X
SOCIAL LICENSE TO OPERATE				X
SOCIO-ECONOMIC				X
HAZARDS TO COMMUNITY, THEFT, HEALTH RISKS, ETC.				X
EASE OF INTEGRATION WITH PLANNED INFRASTRUCTURE		X		
SITE ACCESS		X		
CONSTRAINTS TO SITE LAYOUT		X		
CONSTRUCTION DURATION		X		
CONSTRUCTION RISKS		X		
OPERATIONAL RISKS		X		
CAPITAL COST (INCLUDING SITE ESTABLISHMENT/PREPARATION)			X	
OPERATING COST			X	
SITE REHABILITATION			X	

6.2.3 Assigning score

Under each of the four categories, by assessing the identified criteria, a score is assigned to each of the identified options (Between 1 and 3, with 3 being most favourable). The final score obtained for each of the option support decision on the most suitable for the proposed development.

6.2.4 Category Weighting

The following table contains the weighting as assigned to each category. The higher the weighting, the more important the category.

Table 48: Category Weighting

CATEGORY	LOCATION OF DISCARD FACILITY[36]	LAND USE DEVELOPMENT	ROAD INFRASTRUCTURE	DESIGN OF DISCARD DUMP	PCD LOCATION
ENVIRONMENTAL/LEGAL	0.05	0.25	0.30	0.30	0.50
SOCIAL	0.05	0.25	0.30	0.15	0.50
TECHNICAL/ENGINEERING	0.80	0.25	0.25	0.25	0.25
ECONOMICAL	0.10	0.25	0.15	0.30	0.15

6.2.5 Criteria Weighting

The following table contains the weighting as assigned to each criteria. The higher the weighting, the more significant the criteria.

Table 49: Criteria Weighting[37]

MAJOR CRITERIA	LOCATION OF DISCARD FACILITY	LAND USE DEVELOPMENT	ROAD INFRASTRUCTURE	DESIGN OF DISCARD DUMP	PCD LOCATION
AIR QUALITY	4	2	2	3	2
AQUATIC AND SURFACE WATER	4	4	3	4	4
CULTURAL HERITAGE	2	3	3	4	3
FAUNA	2	4	3	5	3
FLORA	3	4	4	5	4
GEOHYDROLOGY	3	3	2	2	2
GEOLOGY	1	1	1	1	1
NOISE	1	2	2	1	2
SOIL	3	3	2	2	2
TRAFFIC	2	2	5	2	5
VIBRATION AND AIR BLAST	1	1	2	2	2
VISUAL	4	4	4	4	4
OTHER LEGAL REQUIREMENTS (E.G. WATER USE ACTIVITIES, EIA REQUIREMENTS ETC.)	4	3	1	3	1

[36] Weighting favours technical and economical categories, due to the high technical and economical constraints when considering the location of the discard dump.

[37] Assigning a criteria weighting should not be viewed as the overall importance or significance placed on such criteria, but how strongly such criteria may influence a specific alternative assessment in context to other criteria.

SENSE OF PLACE	2	4	4	4	4
SOCIAL LICENSE TO OPERATE	2	3	3	2	3
SOCIO-ECONOMIC	3	4	2	3	2
HAZARDS TO COMMUNITY, THEFT, HEALTH RISKS	2	3	5	4	5
EASE OF INTEGRATION WITH PLANNED INFRASTRUCTURE	3	4	2	3	2
SITE ACCESS	2	3	2	2	2
CONSTRAINTS TO SITE LAYOUT	4	3	3	3	3
CONSTRUCTION DURATION	2	2	2	2	2
CONSTRUCTION RISKS	3	2	3	3	3
OPERATIONAL RISKS	3	3	3	3	3
CAPITAL COST (INCLUDING SITE ESTABLISHMENT/ PREPARATION)	4	4	3	3	3
OPERATING COST	4	4	4	4	4
SITE REHABILITATION	3	4	2	3	2

6.2.6 Calculating Score

6.2.6.1 Initial score

An initial score is assigned to each of the options, for each of the criteria identified. As this is a comparative analysis, a score of 1, 2 and 3 is assigned, where 1 is least favourable, and 3 being most favourable. In event where all options have similar favourability, a score of 3 is assigned to all sites. Where only two alternatives are assed a score of either 1 (least favourable) or 2 (most favourable) is assigned.

6.2.6.2 Assigning weighting

The weighting value of the assessed criteria is multiplied with the initial score allocated to each option for every criteria assessed, which is added to obtain a final score to be reflected under the four categories. Final values to be reflected as percentage of maximum score.

6.2.6.3 Final score

The final score for each of the options is obtained by multiplying the % score for each category by the assigned weighting and adding the respective scores (as obtained for each category) to reach a final value for each option. The higher the % value, the more favourable the option.

6.3 DESCRIPTION, ADVANTAGES, DISADVANTAGES AND COMPARATIVE ASSESSMENT OF ALL ALTERNATIVES CONSIDERED DURING THE EIA PHASE

6.3.1 Alternatives in terms of the location of the discard facility

Initially, four potential sites were identified for the placement of the proposed discards facility. These four sites are indicated in Figure 51. Table 50 below indicates the alternative sites identified, as well as the advantages and disadvantages associated with each.

Table 50: Alternative Sites for the discard facility

Site	Vlaklaagte	RLT	Main Village	Groenfontein
Location	West of the plant	North east of the plant	South west of the plant	South of the plant
Advantages	The largest volume of discard can be placed here, as there is a large space available.	Close to existing plant. Surface rights belong to AOL	Close to existing plant. Surface rights belong to AOL	Close to existing plant. Surface rights belong to AOL
Disadvantages	Furthest from existing plant. Some Surface and Mineral rights do not belong to AOL.	The discard facility will have to consist of two separate dumps. Discard conveyance will cross Nauuwpoortspruit and public road. Insufficient volume of space available for LOM. Restricted height of dump as 2 and 4 seams are mined out.	Insufficient volume for LOM. Will require village to be demolished and redeployment of mine personnel. Restricted height as 2 and 4 seam mined out.	Insufficient volume for worst case LOM scenario. Will require Kleinkopje to change their rehabilitation strategy for the 3A North Pit. Mine plan needs to accommodate 4 seam pillar safety.

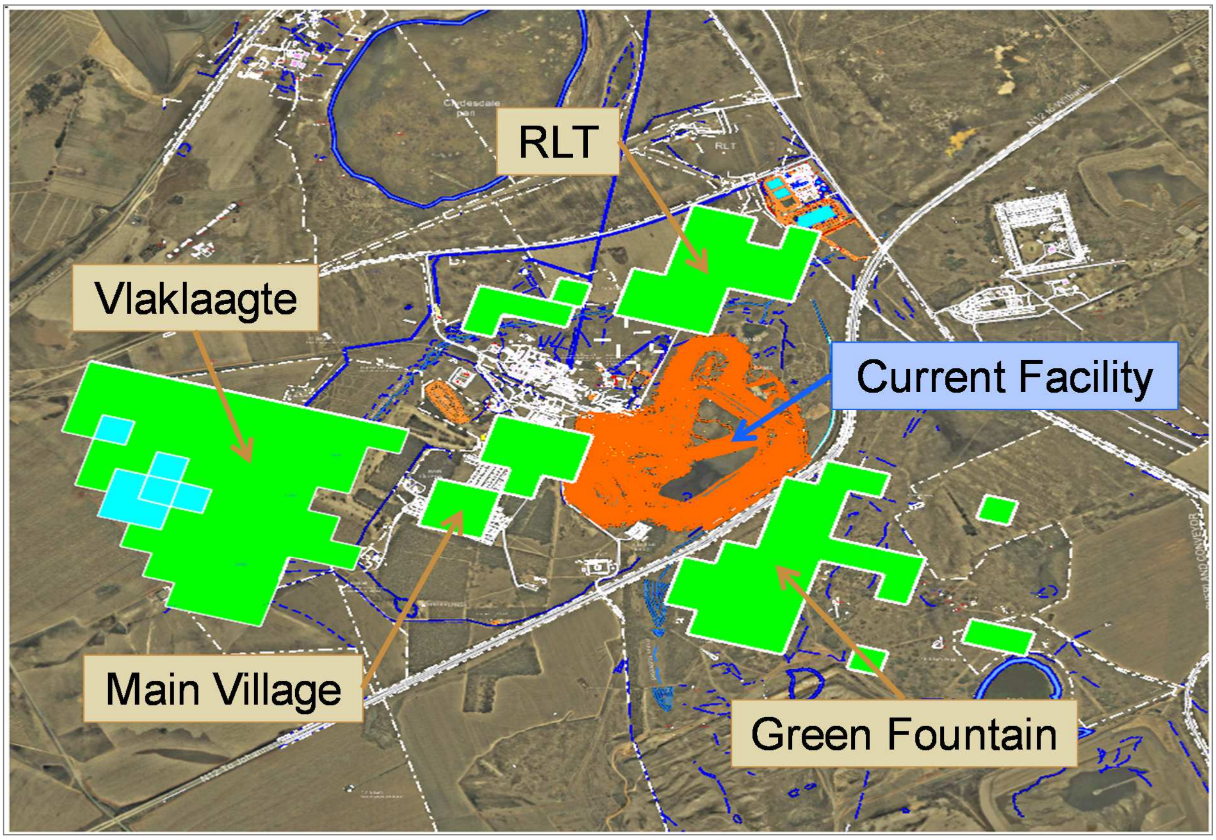


Figure 51: Proposed Alternative Sites

The comparative assessment of the various options have been assessed in terms of four categories which include Environmental, Technical/Engineering, Economical and Social and the outcome of the assessment is reflected in Table 51.

Table 51: Comparative review – Alternatives in terms of discard dump sites

	Vlaklaagte	RLT	Main Village	Groenfontein
Environmental	37.14%	83.81%	90.48%	43.81%
Social	40.74%	66.67%	74.07%	40.74%
Technical	62.96%	53.70%	57.41%	62.96%
Economic	45.45%	75.76%	54.55%	57.58%
Final Score	58.81%	58.06%	59.61%	60.36%

Based on the comparative assessment in terms of the Environmental, Technical/Engineering, Economical and Social categories, the Groenfontein Site has received the highest comparative Score. Technically and economically this site will be the most suitable for the project.

Currently the preferred option based on the findings of the above mentioned comparisons is Option 4: Groenfontein. This option has therefore been described in Part 3 of this document for approval.

6.3.2 Land use or development alternatives[38]

The following land use alternatives have been identified and were investigated as part of the Scoping process, and are briefly compared in Table 52 below:

- Utilisation of the surface area for the new discard facility.
- Utilise the surface area for grazing of livestock.
- Utilise the surface area for crop production.
- None of the above (No-go option) (refer also to Section 6.3.6).

Table 52: Assessment of land use alternatives

Environmental component	Discard Facility	Grazing	Crop production	No-go
Geology	No impact.	No impact.	No impact.	Some geological strata may be permanently altered by future underground mining activities to be done by Greenside Colliery.
Topography	Topography will be permanently altered by the new discard Facility.	No impact.	Topography will be levelled.	Topography has already been altered by previous mining and burrow pits.
Soil	Soil structure and functioning will be permanently altered.	Soils will be eroded.	Soils will be chemically and physically modified.	Soils have already been altered by previous mining and minor erosion exists in cultivated areas.
Land use	Land use will change from derelict land to mining and related activities.	Land use will be altered to agriculture.	Land use will be altered to agriculture.	Land use remains derelict.
Land capability	Land capability will be permanently altered.	Land capability may be lowered if overgrazing occurs.	Land capability may be impacted on if poor farming	Land capability has already been impacted on by previous mining

[38] For the land use alternatives, a qualitative assessment was applied and not the quantitative comparative model (as such a model is applicable to different activity alternatives and not project alternatives.)

Environmental component	Discard Facility	Grazing	Crop production	No-go
			techniques are employed.	and related activities.
Flora	Natural vegetation will be destroyed in the land use area.	Natural vegetation will be impacted on if overgrazing occurs.	Natural vegetation will be destroyed in all crop areas.	Natural vegetation has already been disturbed by mining and related activities and alien infestation.
Fauna	Fauna will be impacted on as habitats are destroyed.	No impact.	Fauna will be impacted on as habitats are destroyed.	Fauna has already been impacted on as habitats have been destroyed by past mining activities.
Surface water	Surface water quantity and quality may be compromised.	No impact.	Surface and groundwater may be used for irrigation.	Surface water has already been polluted by previous mining, and will continue to be polluted until such time as mining areas are rehabilitated.
Groundwater	Groundwater quantity and quality may be impacted upon.	No impact.	Groundwater may be used for irrigation.	Groundwater has already been polluted by previous underground and opencast mining activities, and will continue to be polluted until such time as the mining areas Closed and rehabilitated.

Environmental component	Discard Facility	Grazing	Crop production	No-go
Air quality	Dust will be generated.	Dust will be generated if overgrazing occurs.	Dust will be generated after the harvest season.	Dust from the surrounding mining activities will continue to be generated.
Noise	Noise will be slightly increased.	No impact.	Noise will be generated during planting and harvesting seasons.	Noise will continue to be generated by the surrounding mining and related activities, as well as the N12.
Visual	The visual environment will be altered by changes in topography.	No impact.	The planting of crops will alter the visual environment.	No impact.
Sensitive landscapes	Sensitive landscapes will be altered.	Sensitive landscapes will be altered or destroyed if overgrazing occurs.	Sensitive landscapes will be altered or destroyed.	No further impact.
Sites of archaeological and cultural interest	No impact.	No impact.	No impact.	No further impact.
Socio-economic	Loss of jobs will be avoided.	No impact.	Some jobs may be created.	No further impact.
Interested and affected parties	Surrounding landowners may be further impacted upon as a result of impacts listed above.	No impact.	No impact.	No further impact.
Cumulative impacts	Large mining complexes already exist in the vicinity of the Greenside Colliery. Impacts of mining (as described above) may be slightly increased.	Destruction of the natural environment will be compounded if overgrazing takes place.	Destruction of the natural environment will be compounded if over-fertilisation occurs or poor farming	Large mining complexes already exist in the vicinity of the Greenside Colliery. Impacts of mining (as described above)

Environmental component	Discard Facility	Grazing	Crop production	No-go
			techniques are employed.	will be compounded.

The grazing option will be the most viable environmental option. However, the discard facility might not be as environmentally favoured, but it will significantly contribute to the socio-economic environment and allow continuation of mining operations, compared to that of the grazing and crop production options. The discard facility is the preferred land use option and has been further discussed in Part 3 of the document.

6.3.3 Alternatives in terms of road infrastructure

The following alternatives were identified with regard to the type of access routes to and from the new discard facility and associated infrastructure (refer to Table 53):

- Tar road.
- Gravel road.

Table 53: Alternative access to site

Option	Advantage	Disadvantage
Tar road	Sturdier and longer lasting	More costly to construct
	Less dust is created	
Gravel road	Cheaper to construct	Requires maintenance more regularly
		More dust is generated

The comparative assessment of the various options have been assessed in terms of four categories which include Environmental, Technical/Engineering, Economical and Social and the outcome of the assessment is reflected in Table 54.

Table 54: Comparative review – Alternatives in terms of road infrastructure

	Tar Road	Gravel road
Environmental	85.29%	70.59%
Social	57.14%	92.86%
Technical	66.67%	83.33%
Economic	50.00%	100.00%
Final Score	66.90%	84.87%

From the comparative assessment it is evident that the gravel road will be the most feasible option. Since tarred roads are expected to be more resilient, it is intended to construct tarred roads in order to gain access to the proposed site. This will also aid in minimising the cumulative impacts of dust within and around the site. However the haul roads to be used by the haul trucks will remain gravel road.

6.3.4 Alternatives in terms of layout of the discard facility

The following alternatives were identified with regard to the layout of the discard facility and associated infrastructure (refer to Table 55):

- Discard facility within the 100 m wetland buffer.
- Discard facility outside of the 100 m wetland buffer.

Table 55: Alternative in terms of layout of discard facility

Option	Advantage	Disadvantage
Discard facility within the 100 m wetland buffer.	More space available for placement of the discard facility.	Loss of functionality of wetland.
	Original discard facility design in terms of rock stability.	Risk of not obtaining environmental authorisation as the sensitive wetland area will be lost.
		High rehabilitation cost in terms of wetland rehabilitation.
Discard facility outside of the 100 m wetland buffer.	The impact on the wetland area will be reduced, therefore maintaining the functionality of the wetland.	Less space for placement of the discard facility, which will have an impact on the production of the mine.
	Compliance to relevant legislation.	Discard facility design to change according to wetland areas and still accommodate for rock stability.
	Lower rehabilitation cost in terms of wetland rehabilitation.	All related dirty and clean water management measures as well as roads required to be re-designed.

The comparative assessment of the various options have been assessed in terms of four categories which include Environmental, Technical/Engineering, Economical and Social and the outcome of the assessment is reflected in Table 56.

Table 56: Comparative review – Alternatives in terms of layout of discard facility

	Within 100m wetland buffer	Outside 100m wetland buffer
Environmental	57.89%	92.11%
Social	61.54%	88.46%
Technical	87.50%	50.00%
Economic	50.00%	100.00%
Final Score	63.47%	83.40%

It is evident that the constructing the discard facility outside the 100 meter wetland buffer will be the most viable option environmentally, socially and economically. From the comparative assessment constructing the discard facility within the 100m wetland buffer may accommodate for more land space, but the risks of constructing a discard facility within a wetland area outweighs the benefits.

Constructing the discard facility outside of the 100 meter wetland buffer is the most feasible option for this project and the discard dump facility has been designed to accommodate for this, making it the preferred option.

6.3.5 Alternatives in terms of the location of the dams

- Pollution control dam within the 100m wetland buffer.
- Pollution control dam outside of the 100m wetland buffer on an undisturbed area.
- Pollution control dam outside of the 100m wetland buffer in an old borrow pit.

Table 57: Alternative in terms of location of the dams

Option	Advantage	Disadvantage
Pollution control dam within the 100m wetland buffer.	More space available for placement of the discard facility.	Loss of functionality of wetland.
		Risk of spillage into the wetland area.
	Original design in terms of Pollution Control Dam remains.	Risk of not obtaining environmental authorisation as the sensitive wetland area will be lost.
		High rehabilitation cost in terms of wetland rehabilitation.
Pollution control dam outside of the 100m wetland buffer on an undisturbed area.	The impact on the wetland area will be reduced, therefore maintaining the functionality of the wetland.	Less space for placement of the discard facility, which will have an impact on the production of the mine.
	Lower rehabilitation cost in terms of wetland rehabilitation.	
	Compliance to relevant legislation.	Loss of natural vegetation.
	Risk of spillage into the sensitive wetland area is reduced.	
Pollution control dam outside of the 100m wetland buffer in an old borrow pit (preferred option).	The impact on the wetland area will be reduced, therefore maintaining the functionality of the wetland.	Less space for placement of the discard facility, which will have an impact on the production of the mine.
	No additional loss of natural vegetation.	
	Rehabilitation of old borrow pit.	
	Compliance to relevant legislation.	
	Risk of spillage into the sensitive wetland area is reduced.	

The comparative assessment of the various options have been assessed in terms of four categories which include Environmental, Technical/Engineering, Economical and Social and the outcome of the assessment is reflected in Table 58.

Table 58: Comparative review – Alternatives in terms of location of pollution control dam

	Within 100m wetland buffer	Outside 100m wetland buffer, undisturbed area	Outside 100m wetland buffer, old borrow pit
Environmental	42.86%	60.95%	69.52%
Social	38.10%	61.90%	71.43%
Technical	48.89%	51.11%	51.11%
Economic	33.33%	66.67%	66.67%
Final Score	57.70%	84.21%	93.25%

Constructing the pollution control dam outside the 100 meter wetland buffer within an old borrow pit will be the most viable option environmentally, socially, technically and economically. From the comparative assessment constructing the pollution control dam within the 100 m wetland buffer accommodates for more land space but the risks of constructing the pollution control dam within the wetland area outweighs the benefits. By constructing the pollution control dam outside the 100 m wetland buffer but still within undisturbed land will significantly contribute to environmental loss.

Constructing the pollution control dam outside of the 100 meter wetland buffer within a disturbed area (borrow pit) is the most feasible option for this project environmentally, socially, technically and economically, making it the most feasible option.

6.3.6 Consequences of not proceeding with the proposed project (no project alternative)

The ‘No Project’ alternative has been investigated in terms of the above-mentioned alternatives.

The ‘No Project’ alternative is not considered due to the anticipated benefits of the proposed new discard facility. Expected indirect benefits of the proposed project include:

- Continued employment of staff.
- Potential for the creation of additional jobs.
- Continued upliftment of the surrounding communities.
- Rehabilitation of environmental issues within the wetland areas.
- Continued supply of coal to the local, national, and international markets, and therefore contribution to local, provincial and national economy.

Should the ‘No Project’ option be implemented, jobs of workers that are currently employed at the Greenside Colliery may be compromised. In addition, the Greenside Colliery will not be able to continue to supply coal to the existing markets at the current rate of demand. Positive impacts of the proposed project would also be lost if the no-project option is carried out.

The ‘No Project’ option is not considered to be the preferred project alternative.

7. ENVIRONMENTAL IMPACT ASSESSMENT, MITIGATION MEASURES AND ACTION PLAN

7.1 AIMS OF ENVIRONMENTAL IMPACT ASSESSMENT

Potential environmental impacts associated with the proposed Greenside Colliery new Discard Facility have been identified.

The Environmental Impact Assessment (EIA) phase aims to adequately investigate and address all potentially significant environmental issues in order to provide the DARDLEA with sufficient information to make an informed decision regarding the proposed project.

This part of the document thus focuses on the identification of the major potential impacts the activities, processes and actions may have on the surrounding environment. It indicates the major impacts that these activities may have on the environmental components associated with the site, as required in terms of R.543 of the EIA Regulations, 2010.

The EIA aims to achieve the following:

- To provide a detailed assessment of the biophysical environments affected by the proposed project;
- To assess impacts on the study area in terms of environmental criteria; and
- To identify and recommend appropriate mitigation measures for potentially significant environmental impacts.

All specialist studies conducted for the proposed project have been incorporated into this consolidated report to allow for easy assessment of the potential aspects with associated impacts.

7.2 ENVIRONMENTAL IMPACT ASSESSMENT PROCEDURE

The environmental risk of any aspect is determined by a combination of parameters associated with the impact. Each parameter connects the physical characteristics of an impact to a quantifiable value to rate the environmental risk.

Impact assessments should be conducted based on a methodology that includes the following:

- Clear processes for impact identification, predication and evaluation;
- Specification of the impact identification techniques;
- Criteria to evaluate the significance of impacts;
- Design of mitigation measures to lessen impacts;
- Definition of the different types of impacts (indirect, direct or cumulative); and
- Specification of uncertainties.

After all impacts have been identified, the nature and scale of each impact can be predicted. The impact prediction will take into account physical, biological, socio-economic and cultural information and will then estimate the likely parameters and characteristics of the impacts. The impact prediction will aim to provide a basis from which the significance of each impact can be determined and appropriate mitigation measures can be developed.

The risk assessment methodology is based on defining and understanding the three basic components of the risk, i.e. the source of the risk, the pathway and the target that experiences the risk (receptor). Refer to Figure 52 below for a model representing the above principle (as contained in the DWA's Best Practice Guideline: G4 – Impact Prediction.

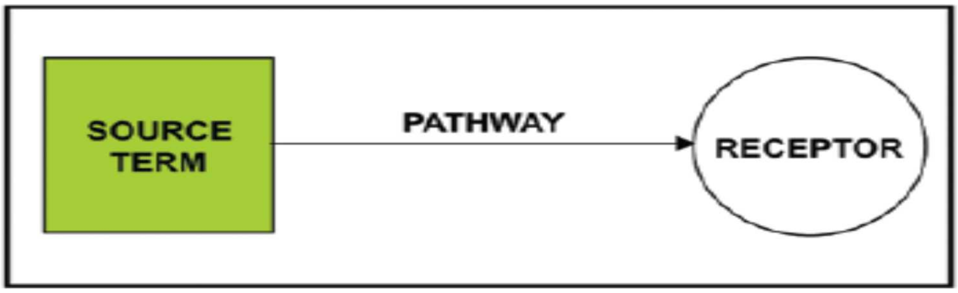


Figure 52: Impact prediction model

Table 59 and Table 60 below indicate the methodology to be used in order to assess the Probability and Magnitude of the impact, respectively, and Table 61 provides the Risk Matrix that will be used to plot the Probability against the Magnitude in order to determine the Severity of the impact.

Table 59: Determination of Probability of impact

FREQUENCY OF ASPECT / UNWANTED EVENT	SCORE	AVAILABILITY OF PATHWAY FROM THE SOURCE TO THE RECEPTOR	SCORE	AVAILABILITY OF RECEPTOR	SCORE
Never known to have happened, but may happen	1	A pathway to allow for the impact to occur is never available	1	The receptor is never available	1
Known to happen in industry	2	A pathway to allow for the impact to occur is almost never available	2	The receptor is almost never available	2
< once a year	3	A pathway to allow for the impact to occur is sometimes available	3	The receptor is sometimes available	3
Once per year to up to once per month	4	A pathway to allow for the impact to occur is almost always available	4	The receptor is almost always available	4
Once a month - Continuous	5	A pathway to allow for the impact to occur is always available	5	The receptor is always available	5

Step 1: Determine the PROBABILITY of the impact by calculating the average between the Frequency of the Aspect, the Availability of a pathway to the receptor and the availability of the receptor.

Table 60: Determination of Magnitude of impact

SOURCE								RECEPTOR			
Duration of impact	Score	Extent	Score	Volume / Quantity / Intensity	Score	Toxicity / Destruction Effect	Score	Reversibility	Score	Sensitivity of environmental component	Score
Lasting days to a month	1	Effect limited to the site. (metres);	1	Very small quantities / volumes / intensity (e.g. < 50L or < 1Ha)	1	Non-toxic (e.g. water) / Very low potential to create damage or destruction to the environment	1	Bio-physical and/or social functions and/or processes will remain unaltered.	1	Current environmental component(s) are largely disturbed from the natural state. Receptor of low significance / sensitivity	1
Lasting 1 month to 1 year	2	Effect limited to the activity and its immediate surroundings. (tens of metres)	2	Small quantities / volumes / intensity (e.g. 50L to 210L or 1Ha to 5Ha)	2	Slightly toxic / Harmful (e.g. diluted brine) / Low potential to create damage or destruction to the environment	2	Bio-physical and/or social functions and/or processes might be negligibly altered or enhanced / Still reversible	2	Current environmental component(s) are moderately disturbed from the natural state. No environmentally sensitive components.	2

SOURCE								RECEPTOR			
Duration of impact	Score	Extent	Score	Volume / Quantity / Intensity	Score	Toxicity / Destruction Effect	Score	Reversibility	Score	Sensitivity of environmental component	Score
Lasting 1 – 5 years	3	Impacts on extended area beyond site boundary (hundreds of metres)	3	Moderate quantities / volumes / intensity (e.g. > 210 L < 5000L or 5 – 8Ha)	3	Moderately toxic (e.g. slimes) Potential to create damage or destruction to the environment	3	Bio-physical and/or social functions and/or processes might be notably altered or enhanced / Partially reversible	3	Current environmental component(s) are a mix of disturbed and undisturbed areas. Area with some environmental sensitivity (scarce / valuable environment etc.).	3
Lasting 5 years to Life of Organisation	4	Impact on local scale / adjacent sites (km's)	4	Very large quantities / volumes / intensity (e.g. 5000 L – 10 000L or	4	Toxic (e.g. diesel & Sodium Hydroxide)	4	Bio-physical and/or social functions and/or processes might be considerably altered or enhanced / potentially irreversible	4	Current environmental component(s) are in a natural state. Environmentally sensitive environment /	4

SOURCE								RECEPTOR			
Duration of impact	Score	Extent	Score	Volume / Quantity / Intensity	Score	Toxicity / Destruction Effect	Score	Reversibility	Score	Sensitivity of environmental component	Score
				8Ha–12Ha)						receptor (endangered species / habitats etc.).	
Beyond life of Organisation / Permanent impacts	5	Extends widely (nationally or globally)	5	Very large quantities / volumes / intensity (e.g. > 10 000 L or > 12Ha)	5	Highly toxic (e.g. arsenic or TCE)	5	Bio-physical and/or social functions and/or processes might be severely/substantially altered or enhanced / Irreversible	5	Current environmental component(s) are in a pristine natural state. Highly Sensitive area (endangered species, protected habitats etc.)	5

Step 2: Determine the MAGNITUDE of the impact by calculating the average of the factors above.

Table 61: Determination of Severity of impact

ENVIRONMENTAL IMPACT RATING / PRIORITY					
	MAGNITUDE				
PROBABILITY	1 Minor	2 Low	3 Medium	4 High	5 Major
5 Almost Certain	Low	Medium	High	High	High
4 Likely	Low	Medium	High	High	High
3 Possible	Low	Medium	Medium	High	High
2 Unlikely	Low	Low	Medium	Medium	High
1 Rare	Low	Low	Low	Medium	Medium

Step 3: Determine the SEVERITY of the impact by plotting the averages that were obtained above for Probability and Magnitude in the table below

7.3 DESCRIPTION OF ENVIRONMENTAL IMPACTS

The aim of this section of this Environmental Impact Assessment Report (EIR) is to provide information regarding the potential environmental impacts associated with the proposed activities. In compiling the impact assessment tables, technical input was obtained from the various specialists, with copies of these reports attached to the EIR.

7.3.1 Topography

7.3.1.1 Temporary change in Topography

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
ENVIRONMENTAL COMPONENT: Topography										
ACTIVITY: • Construction and operation of the infrastructure related to the new discard facility including: an Overland Conveyor System from the plant to the new discard dump, Discard Silo., Haul roads, Dirty and Clean Water Separation Systems, The Workshop Complex, The Office Complex, including Water and Sewage system for the workshop and offices, Diesel storage tanks, Power Lines and Pollution Control Dam.										
PROJECT PHASE APPLICABILITY: Construction X; Operation X; Closure										
Impact description: The North area of the proposed site is characterised by gentle undulating platue which varies between 1600 mamsl in the south and 1540mamsl in the north. The lowest point is at 1540 mamsl where the extreme north of pit 3A of Kleinkopje approaches the Greensidespruit. The southern edge of the proposed site runs roughly along a minor watershed. The proposed site thus has no streams running onto the site. The Greensidespruit does however begin on the site and bisects the site, flowing from the south to the north. Temporary stockpiling of topsoil, construction and operation of the Overland Conveyor System, Discard Silo., Haul roads, Dirty and Clean Water Separation Systems, The Workshop Complex, The Office Complex, including Water and Sewage system for the workshop and offices, Diesel storage tanks, Power Lines, and Pollution Control Damwill cause a temporary minor change in topography until the closure of the mine when the infrastructure will be demolished. Extent of impact: Local Duration of impact: Until the decommissioning phase. Degree to which impact will cause irreplaceable loss: Impact will not result in the irreplaceable loss as the topography of the affected areas can be rehabilitated back to their natural state during the decommissioning phase.	5	2	M	Topography to be disturbed to be kept at a minimum.	Degree to which impact can be reversed: Reversible Mitigation The disturbance area for the construction of the overland Conveyor System, Discard Silo., Haul roads, Dirty and Clean Water Separation Systems, The Workshop Complex, The Office Complex, including Water and Sewage system for the workshop and offices, Diesel storage tanks, Power Lines, and Pollution Control Dam will be kept at a minimum and in the designated areas as indicated on the design for the proposed project attached hereto as Plan 3a in Appendix A. Topsoil and subsoil will be stripped from the proposed footprint areas before construction starts. All topsoil stockpiles should also be protected by berms to prevent erosion of stockpiled material and to divert surface water runoff around the material. Topsoil stockpiles should not have steep slopes that encourage the possibility of erosion Ensure topsoil stockpiles do not exceed a height of 1.5 metres. Topsoil removed from the construction areas must be stockpiled in the designated areas as indicated in Plan 3a of Appendix A where the stockpiles are positioned to be located downslope of	Planning and Construction Phase	Greenside Colliery Environmental Manager	5	2	M

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
					the dirty water areas away from seepage zones, flood lines, water courses and other ecological sensitive areas. Should these stockpiles become a source of windblown dust, they must be covered by plastic sheeting or vegetated with indigenous vegetation. All alien invasive flora should be removed from the stockpiles.					

7.3.1.2 Permanent change in Topography

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
ENVIRONMENTAL COMPONENT: Topography (also soil and surface water)										
ACTIVITY: • Development of the proposed new Discard facility.										
PROJECT PHASE APPLICABILITY: Construction X; Operation X; Closure X										
Impact description: The North area of the proposed site is characterised by gentle undulating platue which varies between 1600 mamsl in the south and 1540mamsl in the north. The lowest point is at 1540 mamsl where the extreme north of pit 3A of Kleinkopje approaches the Greensidespruit. The proposed new discard dump will reach a maximum height of 55 metres. The facility will be developed from the lowest point adjacent to the N12 highway and progressively developed towards the south	5	3	H	Preserve and prevent the sterilisation of natural resources (loss of soil and surface water).	Degree to which impact can be reversed: Potentially reversible if dump is reworked Mitigation: The disturbance area for the Discard Facility will be kept at a minimum and in the designated area as indicated on the design for the proposed project attached hereto as Plan 3b in Appendix A. The Discard dump will be progressively rehabilitated with 500 mm of compacted sub soil and 300 mm of un-compacted top soil and vegetated. The facility will be developed from the lowest point adjacent to the N12 highway and progressively developed	All Phases	Greenside Colliery Environmental Manager	5	3	H

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
As the development of the discard facility progress this will cause a permanent change in the topography. This change in topography will continue until post closure. It is expected that storm water will attenuate on top of the discard dump and toe seepage should also occur due to rainfall infiltration. Extent of impact: Local Duration of impact: Permanent Degree to which impact will cause irreplaceable loss: A potential permanent change to the topography will occur, that may through possible future reworking of the dump be reversed. No irreplaceable loss of resource will occur associated with topography.					towards the south. This will keep the dirty water run-off length to a minimum and allow clean water to be diverted clear of the developing footprint Topsoil and subsoil will be stripped from the proposed footprint are. Topsoil and subsoil will be stripped from the proposed footprint areas before construction starts. All topsoil stockpiles should also be protected by berms to prevent erosion of stockpiled material and to divert surface water runoff around the material. Topsoil stockpiles should not have steep slopes that encourage the possibility of erosion Ensure topsoil stockpiles do not exceed a height of 1.5 metres. Topsoil removed from the construction areas must be stockpiled in the designated areas as indicated in Plan 3a of Appendix A where the stockpiles are positioned to be located downslope of the dirty water areas away from seepage zones, flood lines, water courses and other ecological sensitive areas. Should these stockpiles become a source of windblown dust, they must be covered by plastic sheeting or vegetated with indigenous vegetation. All alien invasive flora should be removed from the stockpiles. A grass mix should be selected for rehabilitation of the discard dump. The selected grass mix should consist of a mix of quick covering grassed pioneer species mat-forming grasses (e.g. *Gynodon dactylon, Chloris gayana*) and tufted grasses (e.g. *Eragrostis curvula*) to ensure prompt and adequate coverage of the exposed soil whilst also achieving long-term stability. Alternatively, the current seed mix may be used as per Greenside					

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
					Colliery's Original Environmental Management Programme Report. The chemical and physical properties of top soil to be used for the purposes of rehabilitation must not be changed by introducing foreign material, gravel, rock, rubble or mine residue to such soil."					

7.3.2 Soil, land use and land capability

7.3.2.1 Erosion and loss of topsoil

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
ENVIRONMENTAL COMPONENT: Soil										
ACTIVITY: Construction and operation of the new discard facility and infrastructure related to the new discard facility including: an Overland Conveyor System from the plant to the new discard dump, Discard Silo., Haul roads, Dirty and Clean Water Separation Systems, The Workshop Complex, The Office Complex, including Water and Sewage system for the workshop and offices, Diesel storage tanks, Power Lines, Pollution Control Dam.										
PROJECT PHASE APPLICABILITY	Construction: X Operation: X Closure: X									
Impact description: The soils presented on the site are typical of the Highveld catena with deep red apedal strctureless soils (Hutton, Bainsvlei) present on the upper slope with an average dept of 1000mm, yellow and brown soils (Clovelly, Griffen, Glencor, Avalon) of shallower depth (approximately 750mm), on the mid and lower slopes. Soils towards the base slope become beached sandier and grey (Dresden, Mispah) with an average dept of 500mm.	4	3	H	To conserve topsoil and prevent erosion	Degree to which impact can be reversed: Reversible Mitigation-Erosion: Erosion prevention measures (e.g. grass, cement or rock) should be in place at all concentration points. These areas include roads, trenches, berms and other infrastructure that may increase surface runoff.	Planning/ Construction and Operational phases	Greenside Colliery Environmental Manager	2	2	L

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
The footprint of the proposed discard facility will be approximately 115 ha with a maximum height of 55 m and will be developed progressively from the lowest point adjacent to the N 12 highway towards the south. Topsoil and subsoil will be progressively stripped from the proposed footprint area and development of the discard dump will take place on a compact base. Topsoil and subsoil will also be stripped from the footprint areas where the infrastructure is being constructed. Stripping and stockpiling of soils during the construction phase could have a permanent negative impact on the quality of soils if not stripped according to a well-structured and executed soil stripping and stockpiling plan. Topsoil availability may be very limited due to the unrehabilitated void of the 3A north open-pit. Impacts associated with such a loss, will also impact on the final rehabilitation during closure phase. It is expected that storm water will attenuate on top of the discard dump and toe seepage should also occur due to rainfall infiltration. The discard facility will cause significant disturbance to soil, including potential erosion if drainage and storm water are not managed and controlled.					Erosion of access roads should be addressed by implementing energy dissipaters to drain surface runoff away from the roads if necessary. All berms should be inspected regularly for cracks that reduces the integrity of the structures. Vegetation growth should be encouraged on the berms to limit erosion. Regular inspections will be undertaken and if signs of erosion are identified, mechanical inputs will be required. Mitigation-Topsoil preservation Undertake a detail survey for the identification of topsoil and the depth thereof. The person responsible for the identification should be competent and have the relevant experience. Identified topsoil and the depth thereof should be clearly indicated as contours of topsoil depth on a surface layout plan and clearly marked by the survey department in the field. Based on the construction activities required, mine planning should include the removal and storage areas in the planning program and layout plans. The volumes of the different topsoil heaps must be calculated and added to the surface layout plan. This is done to ensure that when rehabilitation is required the volume required and the volume available can be compared (topsoil balance). The topsoil should be stripped to a maximum depth as measured during the initial survey, and after stripping verified for effectiveness of stripping.					

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
					Topsoil and subsoil will be stripped from the proposed footprint areas before construction starts and at the discard dump area progressively as the dump progress. All topsoil stockpiles should also be protected by berms to prevent erosion of stockpiled material and to divert surface water runoff around the material. Topsoil stockpiles should not have steep slopes that encourage the possibility of erosion Ensure stockpiles do not exceed a height of 1.5 metres. Topsoil removed from the construction areas must be stockpiled in the designated areas as indicated in Plan 3a of Appendix A where the stockpiles are positioned to be located downslope of the dirty water areas away from seepage zones, flood lines, water courses and other ecological sensitive areas. Should these stockpiles become a source of windblown dust, they must be covered by plastic sheeting or vegetated with indigenous vegetation. All alien invasive flora should be removed from the stockpiles. The discard should be capped with topsoil and the soil ripped to prevent compaction and then seeded with native grass species. This will also have the added effect of reducing erosion on the sides of the facing.					

7.3.2.2 Chemical alteration of soils

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
ENVIRONMENTAL COMPONENT: Soil (surface water and groundwater)										
ACTIVITY: Construction and operation of the new discard facility and infrastructure related to the new discard facility including: an Overland Conveyor System from the plant to the new discard dump, Discard Silo., Haul roads, Dirty and Clean Water Separation Systems, The Workshop Complex, The Office Complex, including Water and Sewage system for the workshop and offices, Diesel storage tanks, Power Lines, Pollution Control Dam.										
PROJECT PHASE APPLICABILITY: Construction X; Operation X; Closure X										
Impact description: Soil structure loss will occur as a result of a number of operational activities. Key impacts that may arise that can result in a loss of soil structure include: Storm water runoff, dirty water trenches, overflow from affected water storage facilities and seepage of discard dump that could impact on the soil structure of the immediate surrounding areas permanent, but will be localised to the specific structures. At vehicle maintenance areas, soil contamination by hydrocarbon contaminating waste water. Seepage of hydrocarbons into groundwater may further take place through the pathway of the contaminated soil, and may extend beyond area of impact. Lubricant, fuel and chemical spillages arising from chemical storage and handling, bulk fuel storage and vehicle refueling activities. Seepage into groundwater may further take place through the pathway of the contaminated soil, and may extend beyond area of impact. Loss of soil structure at the discard dump during the operational phase that will be permanent but localized to the area. Extent of impact: Impact may extend beyond the life of mine. Duration of impact: Extending beyond incident if no mitigation measures applied.	4	3	H	To conserve soil and land capability	Degree to which impact can be reversed: Impact is reversible but at cost (e.g. sourcing of soil, and undertaking of soil rehabilitation) Mitigation To ensure that the area to be disturbed by construction activities is to be kept to a minimum, only large enough to carry out the necessary activities as indicated on the design for the proposed project attached hereto as Plan 3a in Appendix A. Affected runoff from the plant areas and the discard dump will be collected and contained in the affected water management system, with further diversion of the clean water. Conceptual water management strategies are contained within the stormwater management plan and civil engineering designs of the approved by a registered professional civil engineer (Appendix A). The 3A north pollution control dam must be designed according to the design plans (Appendix A). The dam should be lined with a plastic lining of 2mm in thickness and the pump station to be installed should regularly maintained and water should be pumped from the pollution control dam to the return water dam located across the N12 highway for process purposes. to prevent overflow and to be used during emergency conditions Implement a planned maintenance programme covering the affected water management circuit. This maintenance	Construction and Operation Phases	Greenside Colliery Environmental Manger	3	1	L

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
Degree to which impact will cause irreplaceable loss: Impact may result in irreplaceable loss if no mitigation measures are implemented.					programme to assess aspects of siltation, capacity and containment integrity. Subsoil drainage is to be incorporated under the liner of the 3A North pollution control dam to detect potential leakages and spillages. This will act as a barrier for groundwater that may permeate the water table. The mines existing emergency response plan should be updated to include activities associated with the new discard dump. Equipment and Vehicle Storage Area: Areas of open ground that are to be utilised (i.e. equipment and vehicle storage) should be hard standing. Furthermore, a clean and dirty water separation system must be constructed to ensure that no contamination of clean water systems occurs. Should a spillage or leakage of a hydrocarbon, chemical or hazardous substance occur, the spill/leakage must be cleaned up as per EP 14 Oil, Fuel and Chemical Spill Cleanup and EP 09 Environmental Incidents, Non-conformance and Complaints. Ensure that areas containing chemical and hazardous substances are contained (e.g. in a bund) to ensure no contamination of surrounding water resources or soil is contaminated. The bunded area must be able to contain 110% of the total volume of materials stored at any given time. Also follow the procedure EP18 on Handling and Storage of hazardous materials Small quantities (50 litres or less) of chemical and hazardous substances (oil, lubricant, etc.) shall be stored in appropriate containers within a secure storage area. The base of the storage					

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
					area should be impervious and designed to ensure that the contained substances do not infiltrate into the soil. Regular inspections of the integrity of all bund areas will be undertaken. MSDS for on-site chemicals, hydrocarbons and hazardous substances must be readily available. A MSDS should include information pertaining to environmental impacts and measures to minimise and mitigate against any potential environmental impact which may result from a spill. Used fuels, oil, hydraulic fluids, paints, solvents, and grease should be stored in drums or other suitable containers and stored on a hardstanding and impermeable surface. These should be labelled, sealed and removed from the site to an appropriate disposal site or recycling facility. Under no circumstances will these substances be disposed of on-site or into the surrounding environment. No mixing or storing of concrete is permitted on areas where topsoil will be stockpiled. A designated area should be demarcated to prepare concrete in order to minimise soil contamination. The area should contain any potential runoff. Soils that may be contaminated during the construction and operational phases are to be removed to prevent the contamination of the soils, surrounding surface water or underlying groundwater. Contaminated soil must be removed from site as hazardous waste. All construction materials used may be temporarily stored on-site, but bags and containers should be sealed during storage.					

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
					All leakages, spillages and incidents must be cleaned-up and reported as per EP 14 Oil, Fuel and Chemical Spill Cleanup and EP 09 Environmental Incidents, Non-conformance and Complaints. No vehicles or equipment may be repaired or washed on-sites other than the designated washbay area and maintenance workshop at the Workshop Complex. Temporary drip trays must be placed underneath vehicles or equipment that are leaking hydrocarbons until such a time that they are repaired. The liberation of dust into the surrounding environment must be effectively controlled by the use of water spraying and/or other dust-allaying agents. The speed of vehicles must be strictly controlled to a maximum speed of 40km/h to avoid dangerous conditions, excessive dust or excessive deterioration of the roads. Monitor effectiveness of mitigation measures: Implement the surface water (monthly), groundwater (quarterly) and bio-monitoring programme (biannually) as within the receiving surface water environment (Greensidespruit). Dust monitoring should be conducted in accordance to the Dust monitoring Procedure EP22. Undertake annual GN 704 compliance audits, to verify the effectiveness of clean/affected water separation. Any shortcomings, with further consideration to the surface water monitoring results, should be addressed as a matter of urgency. Regular site inspections to be undertaken to assess if spillages or soil pollution incidents have occurred. Such incidents shall be					

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
					reported (use of the incident reporting procedure), and immediately corrected.					

7.3.2.3 Waste management

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
ENVIRONMENTAL COMPONENT: Soil (but also potential impact to surface water and groundwater)										
ACTIVITY: Generation of hazardous and general waste (non-mineral waste material)										
PROJECT PHASE APPLICABILITY: Construction X; Operation X; Closure										
Impact description: The incorrect handling and disposal of general waste, scrap metal and industrial waste (e.g. waste tyres) will have a long-term impact on the local area. Impact will not only effect soil but could also impact on the habitat of fauna and impact of fauna, surface water and groundwater. In addition, the visual character of the area will be impacted on. The incorrect handling and disposal of hazardous waste can also have a permanent negative impact on the local area. soil, water sources and fauna habitats can be adversely affected and human health can be impacted on. Extent of impact: Impact may extend beyond the mine. Duration of impact: Extending beyond the life of mine if no mitigation measures applied.	4	3	H	To conserve soil and land capability	Degree to which impact can be reversed: Impact is easily reversible. Mitigation The project site should be kept in an orderly state at all times. Littering is prohibited. Suitably covered receptacles must be available at all times and conveniently placed for the disposal of waste. These receptacles will be removed to the central salvage yard before being removed from site and disposed of by a permitted contractor at a licensed site. While being stored on-site, the receptacles should be placed within designated areas on an impermeable surface and must be correctly labelled and/or adequately colour coded.	Commence during Construction phase	Greenside Colliery Environmental Manager	3	1	L

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
Degree to which impact will cause irreplaceable loss: Impact may result in irreplaceable loss if no mitigation measures are implemented.					Hazardous and general waste will be separated at source, with separate waste bins provided in accordance to the waste management procedure EP 12 Waste Management. Under no circumstances is waste to be burnt or buried on-site. Records of hazardous waste being taken off-site must be kept as evidence. All leakages, spillages and incidents must be cleaned-up and reported as per EP 14 Oil, Fuel and Chemical Spill Cleanup and EP 09 Environmental Incidents, Non-conformance and Complaints. All general and hazardous waste material will be disposed of at registered waste sites (appropriate to the type of waste as disposed of). Certificates of safe and legal disposal shall be kept on file at the mine. Documentation (waste manifest) will be maintained detailing the quantity, nature and fate of any regulated waste. Management and disposal of waste will be in accordance with relevant legislative requirements, including the use of licensed contractors.					

7.3.2.4 Land use and capability

<table>
<tr><th rowspan="2">Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss</th><th colspan="3">Risk rating (before mitigation)</th><th rowspan="2">Environmental objective</th><th rowspan="2">Degree to which impact can be reversed and the supporting mitigatory action plan</th><th rowspan="2">Timeframe</th><th rowspan="2">Responsibility</th><th colspan="3">Risk rating (after mitigation)</th></tr>
<tr><th>Probability</th><th>Magnitude</th><th>Severity</th><th>Probability</th><th>Magnitude</th><th>Severity</th></tr>
<tr><td colspan="11">ENVIRONMENTAL COMPONENT: Land use and capability</td></tr>
<tr><td colspan="11">ACTIVITY: Construction and operation of the new discard facility and infrastructure related to the new discard facility including: an Overland Conveyor System from the plant to the new discard dump, Discard Silo., Haul roads, Dirty and Clean Water Separation Systems, The Workshop Complex, The Office Complex, including Water and Sewage system for the workshop and offices, Diesel storage tanks, Power Lines, Pollution Control Dam.</td></tr>
<tr><td colspan="11">PROJECT PHASE APPLICABILITY: Construction X; Operation X; Closure X</td></tr>
<tr><td>Impact description: The pre-mining land capability of the surface area of Greenside Colliery was pre-dominantly that of agriculture and grazing. 61% of the surface area was capable of arable production (the growing of crops) with a further 25% of the surface area having grazing potential. The remaining 14% was classified as that of wilderness and wetland areas (WMB, 2002).

The pre-mining land use of the site was predominantly that of agriculture with 13% of the land being occupied with wetlands, dams and pans. The arable areas to the east and west of the proposed site are actively cropped, with dry land maize constituting the principle crop. Open grassland areas (both natural veld and rehabilitated areas) are grazed at a low intensity. The south central portion of the site is derelict on account of past, unrehabilitated, opencast activity. A large portion of the area within the eastern portion of the site is currently under a mixed wattle / grassland community. To the south, the density of wattle is such that the grazing value of the land is currently lost. About 72% of the proposed site has arable potential. Much of the arable land within the site will be lost due to the proposed new discard facility project.

As noted in the original EMPR, evidence of minor soil erosion in the cultivated areas exists. The central and eastern portion of the site is however heavily infested with black wattle. A large portion of the site has been impacted on by past opencast mining.

Extent of impact: Site

Duration of impact: Permanent</td><td>5</td><td>2</td><td>M</td><td>To prevent or minimise the impact on land use and land capability</td><td>Degree to which impact can be reversed: Through effective rehabilitation, land use can be reverted back to agriculture, although there will be loss in high agricultural potential.

Mitigation
Use of topsoil for rehabilitation, that contains the seeds of alien vegetation, will not be permitted unless a program to germinate indigenous seed and eradicate alien seedlings is implemented.

All compacted areas should be ripped to a minimum depth of 300 mm to allow organic contaminants to breakdown and promote vegetation establishment. Should soil analysis depict, fertilizer is to be placed on the area as per Greenside Colliery's Original Environmental Management Programme Report.

A grass mix should be selected for rehabilitation of disturbed open areas. The selected grass mix should consist of a mix of quick covering grassed pioneer species mat-forming grasses (e.g. Gynodon dactylon, Chloris gayana) and tufted grasses (e.g. Eragrostis curvula) to ensure prompt and adequate coverage of the exposed soil whilst also achieving long-term stability. Alternatively, the current seed mix may be used as per Greenside Colliery's Original Environmental Management Programme Report.</td><td>All project phases</td><td>Greenside Colliery Environmental Manager</td><td>5</td><td>1</td><td>L</td></tr>
</table>

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
Degree to which impact will cause irreplaceable loss: Will loose high agricultural potential that through rehabilitation can in future be utilised for agricultural land use.					It is imperative that alien invasive species are continually controlled in all rehabilitated areas. Greenside Colliery must compile and implement a procedure for ongoing monitoring to assess the progress of rehabilitation. A closure plan will be developed allowing for annual refining of objectives and commitments based on progress made with rehabilitation and mining activites. Financial provision will be calculated annually to determine the premature closure cost required to fund the closure of the mining operation at any stage of the mining operation. Rehabilitation and closure planning must ensure the protection and rehabilitation of soil and land use resources within the mine area.					

7.3.3 Vegetation

7.3.3.1 Site Clearing: removal of topsoil and vegetation.

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
ENVIRONMENTAL COMPONENT: Flora										
ACTIVITY: Construction and operation of the new discard facility and infrastructure related to the new discard facility including: an Overland Conveyor System from the plant to the new discard dump, Discard Silo., Haul roads, Dirty and Clean Water Separation Systems, The Workshop Complex, The Office Complex, including Water and Sewage system for the workshop and offices, Diesel storage tanks, Power Lines, Pollution Control Dam.										

PROJECT PHASE APPLICABILITY			
	Construction	X	
	Operation	X	
	Closure		

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
Impact description: The Flora report for the proposed project indicates that the mine lies within the grassland biome, as within that area the Eastern Highveld Grassland vegetation type. This variation occurs on flattish sandy country in which the dominant species include *Tristachya leucothrix, Eragrostis racemosa, Heteropogon contortus, Trachypogon spicatus, Digitaria tricholaenoides, Themeda triandra* and others. The vegetation type is considered to be ***Endangered*** nationally with none conserved and 43% altered, primarily by cultivation. Any remaining areas of natural grassland within this vegetation type should therefore be considered to have a high conservation value. The major land-use activities in the study area include agriculture and mining. Both activities have transformed large parts of the surface rights area of the mine leaving small patches of natural vegetation located primarily along the drainage lines. The area comprises largely of grassland which is typical of the area, as well as seasonal wetlands and 'wet' vegetation surrounding the dams. Areas which have previously been developed have poor vegetation which can be described as secondary plant community. A proportion of the land is currently under crop cultivation. Furthermore there exists an alien vegetation community (*Eucalyptus* stand). Vegetation communities which were delineated for the Greenside Project area are as follows; • Remnant Natural Grassland Community; • Secondary Grassland Community; • Wetland Community; • Dam Vegetation Community; • Transformed Areas; which comprise of Agricultural fields (predominantly maize), Alien Vegetation (plantations of Eucalyptus etc.), and Development (Mining infrastructure and residential buildings); and • These communities are described in greater detail in the following sections.	5	2	M	To prevent the destruction/loss of plant species	Degree to which impact can be reversed: Reversable Mitigation: With mitigation measures it may be possible to reduce the impacts on the flora of the project area. This can be done by re-vegetating the mineral discard facility by placing topsoil, ripping and seeding the rehabilitated dump in order to encourage the growth of grasses. These grasses would then provide habitat for the displaced animals thus mitigating against the initial habitat loss and will also prevent soil losses by wind and/or stormwater erosion. Minimise the footprint as far as possible to mitigate impacts associated with the clearance of existing vegetation; Keep clean and dirty water systems separate and ensure that dirty water is not discharged into the environment to avoid impact occurring to flora and fauna species; and Keep infrastructure out of wetland vegetation (impacts assessed in the Wetland Specialist Report, compiled by Digby Wells, 2013) areas to minimise impact to flora and fauna as these areas are important habitat types. A grass mix should be selected for rehabilitation of disturbed open areas. The selected grass mix should consist of a mix of quick covering grassed pioneer species mat-forming grasses (e.g. *Gynodon dactylon, Chloris gayana*) and tufted grasses (e.g. *Eragrostis curvula*) to ensure prompt and adequate coverage of the exposed soil whilst also achieving long-term stability. Alternatively, the current seed mix may be used as per Greenside Colliery's Original Environmental Management Programme Report.	Operational and Closure Phase	Greenside Colliery Environmental Manager	5	1	L

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
No threatened species were encountered during the field survey of the study area. According to the Flora study the discard facility is proposed to be constructed on an area that is already heavily modified. The land offers low biodiversity value and it is therefore not anticipated that the development of the discard facility will impact severely on the current surrounding environment if it is properly rehabilitated. Extent of impact: Impact may extend beyond the life of mine. Duration of impact: Extending beyond the life of mine if no mitigation measures applied. Degree to which impact will cause irreplaceable loss: Impact may result in irreplaceable loss if no mitigation measures are implemented.										

7.3.3.2 Enchroament of alien invasives

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
ENVIRONMENTAL COMPONENT: Flora										
ACTIVITY: Construction and operation of the new discard facility and infrastructure related to the new discard facility including: an Overland Conveyor System from the plant to the new discard dump, Discard Silo., Haul roads, Dirty and Clean Water Separation Systems, The Workshop Complex, The Office Complex, including Water and Sewage system for the workshop and offices, Diesel storage tanks, Power Lines, Pollution Control Dam.										
PROJECT PHASE APPLICABILITY: Construction X; Operation X; Closure X										
Impact description: According to the flora study; given the current density of alien trees largely wattles it is likely that the population will continue to expand if no management action is taken place	3	3	M	To prevent the destruction/loss of plant species	Degree to which impact can be reversed: If no mitigation is implemented, the impact may be irreversible. Mitigation:		Greenside Colliery	2	2	L

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
Invasive plants may establish due to surface area disturbance and also through future rehabilitation activities (e.g. seeding practices). This may lead to: • Displacement of indigenous vegetation; • Change in plant species composition; • Change in vegetation composition and structure; • Competition for sunlight and 'living space' will increase between indigenous and alien species; • Loss of habitat and a change in biodiversity. • Change in flammability of existing vegetation structure – pending the introduction of the alien species; Extent of impact: The impact could spread beyond area of disturbance. Duration of impact: Permanent Degree to which impact will cause irreplaceable loss: Not applicable, but if no mitigation is implemented, this may result in irreplaceable loss.					Control of alien plant species is essential to restore the natural biodiversity of the landscape. Alien trees utilise excessive amounts of water and often out compete local plants due to their lack of parasites. Removal of alien plants can lead to a net gain in biodiversity as the natural grassland is rehabilitated. Implement an alien invasive control procedure for the area	Construction phase until post-closure.	Environmental Manager			

7.3.4 Animal Life

7.3.4.1 Habitat transformation due to surface clearance

Environmental impact, extent, duration, significance and degree to which impact has caused irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
ENVIRONMENTAL COMPONENT: Fauna										
ACTIVITY: Removal of natural vegetation with incurred increased edge-effects and potential loss of ecosystem function										

PROJECT PHASE APPLICABILITY	Construction	X
	Operation	
	Closure	

Environmental impact, extent, duration, significance and degree to which impact has caused irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
Impact description: The environment at Greenside Colliery is largely disturbed. Large parts of the project area have been modified and disturbed as a result of mining and agriculture. Few small patches of natural vegetation in the form of what can be termed primary grassland and secondary grassland have not been transformed, or are in a state of rehabilitation. These lie fragmented throughout the area. These patches support higher levels of biodiversity and provide suitable habitat which contrasts their largely modified, inhospitable surrounds. Other natural areas which are not considered modified are wetlands, which lie along the drainage lines which provide varied habitat for a number of species and the Dam areas, which are similarly host to a number of species surrounding the open water. The following habitat types were identified within the project area; • Natural Grassland Habitat; • Natural Secondary Grassland Habitat • Wetland Habitat; • Dam Habitat; and • Transformed habitat (Including Residential and mining development). Various natural and introduced species were identified within these habitats during the field survey undertaken by De Castro and Brits (De Castro Brits, 2006), Two mammal species, 75 bird species, two reptile and one frog species were recorded at Greenside Colliery and has also been confirmed from additional reconnaissance surveys conducted in 2013. These low species numbers reflect the habitat modification and disturbance which has occurred within the Greenside project area. According to the fauna study the current land-uses has impacted on faunal habitat, resulting in loss and degradation of habitat. The study area is already heavily modified. The land offers low biodiversity value and it is therefore not anticipated that the development of the mineral discard facility	3	3	M	To prevent the transformation and loss of habitat.	Degree to which impact can be reversed: If no mitigation is implemented, the impact will continue. Mitigation: With mitigation measures it may be possible to reduce the impacts on the fauna of the project area. This can be done by re-vegetating the mineral discard facility by placing topsoil, ripping and seeding the rehabilitated areas in order to encourage the growth of grasses. These grasses would then provide habitat for the displaced animals thus mitigating against the initial habitat loss and will also prevent soil losses by wind and/or stormwater erosion. Removal of alien plants can lead to a net gain in biodiversity as the natural grassland is rehabilitated. The following mitigations measures are proposed: • Minimise the footprint as far as possible to mitigate impacts associated with the clearance of existing vegetation; • Implement an alien invasive control procedure for that area; • Keep clean and dirty water systems separate and ensure that dirty water is not discharged into the environment to avoid impact occurring to flora and fauna species; and • Keep infrastructure out of wetland vegetation (impacts assessed in the Wetland Specialist Report, compiled by Digby Wells, 2013) areas to minimise impact to flora and fauna as these areas are important habitat types.	Construction phase until post-Closure	Greenside Colliery Environmental Manager	2	2	L

Environmental impact, extent, duration, significance and degree to which impact has caused irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
will impact severely on the current surrounding environment if it is properly rehabilitated. Extent of impact: Effect limited to the activity and its immediate surroundings. Duration of impact: Long-term and will last more than 5 years if not mitigated Degree to which impact has caused irreplaceable loss: If no mitigation is implemented, this may cause loss of habitat.										

7.3.5 Surface water

7.3.5.1 Receiving surface environment (impacts resulting from erosion, affected water runoff and loss of catchment)

<table>
<tr><th rowspan="2">Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss</th><th colspan="3">Risk rating (before mitigation)</th><th rowspan="2">Environmental objective</th><th rowspan="2">Degree to which impact can be reversed and the supporting mitigatory action plan</th><th rowspan="2">Timeframe</th><th rowspan="2">Responsibility</th><th colspan="3">Risk rating (after mitigation)</th></tr>
<tr><th>Probability</th><th>Magnitude</th><th>Severity</th><th>Probability</th><th>Magnitude</th><th>Severity</th></tr>
<tr><td colspan="11">ENVIRONMENTAL COMPONENT: Aquatic and surface water</td></tr>
<tr><td colspan="11">ACTIVITY: Construction and operation of the new discard facility and infrastructure related to the new discard facility including: an Overland Conveyor System from the plant to the new discard dump, Discard Silo., Haul roads, Dirty and Clean Water Separation Systems, The Workshop Complex, The Office Complex, including Water and Sewage system for the workshop and offices, Diesel storage tanks, Power Lines, Pollution Control Dam</td></tr>
<tr><td colspan="11">PROJECT PHASE APPLICABILITY: Construction X; Operation X; Closure X</td></tr>
<tr><td>Impact description:
In general, the mine boundary area is located in the headwaters of the Naauwpoortspruit, the origin about 2 km west of the mine boundary area. The Naauwpoortspruit flows into the eMalahleni Dam 15 km east of the mine boundary area. A tributary of the Naauwpoortspruit, the Greensidespruit, originates in the mine boundary area. Greenside Colliery is situated within the, primary catchment B (Olifants River Catchment area), secondary catchment B1 and B2, quaternary catchments B11F, B20G and B11G.

The Upper Olifants River Catchment is located on the eastern Mpumalanga Highveld and drains a total catchment area of 3 446 km² to the eMalahleni dam. The catchment is characterised by diverse land use including urban development, agriculture, power generation and coal mining. The catchment mainly drains along the river valleys of the Olifants River and Steenkoolspruit. Several tributaries including the Trichardtspruit, Vaalbankspruit, Rietspruit, Saaiwaterspruit, Boesmanskransspruit and the Naauwpoortspruit drain into these two major drainage valleys. Greenside Colliery falls within Management Unit 6 of the Olifants Water Management Area

The southern edge of the proposed site runs roughly along a minor watershed. The proposed site thus has no streams running onto the site. The Greensidespruit does however begin on the site and bisects the site, flowing from the south to the north. The Greensidespruit begins at a stream that feeds a small wetland area and the three constructed dams before passing under the N12 and into a steam diversion on the existing operations at Greenside Colliery. The Greensidespruit flows into the</td><td>4</td><td>4</td><td>H</td><td>To conserve the surface water resource and prevent impact on downstream water users</td><td>Degree to which impact can be reversed: Effective mitigation can reverse impact.

Mitigation:
Loss in catchment yield:
• To ensure that the area to be disturbed by construction activities is to be kept to a minimum, only large enough to carry out the necessary activities as indicated on the design for the proposed project attached hereto as Plan 3a in Appendix A which was designed for the proposed Discard facility to be located outside of the 1 in 100 year floodline.
• It is imperative that any construction of any infrastructure (e.g. Roads) within the Greensidespruit ensure appropriate conveyance of the flows.
• Ensure designated pathways are allocated for vehicle movement to minimise compacted surfaces.
• No abstraction of water from surface water resources such as the stream or pan will take place; this will reduce the overall impact on the surface water yield.
• Implement water conservation measures to reduce volumes of water usage.

Surface water quality:</td><td>Planning phase up until Closure.</td><td>Greenside Colliery Environmental Manager</td><td>4</td><td>3</td><td>H</td></tr>
</table>

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
Naauwpoortspruit within approximately four kilometres. The Naauwpoortspruit in return flows into the upper section of the Witbank Dam. Loss in Catchment yield: The catchment of the Greensidespruit can be characterised as being agricultural land, straight row crops with some tree plantations along the Greensidespruit. The total catchment area is approximately 5.1 km^2, however due to: • a major portion that has already been disturbed due to mining activities, and • discounting the area of the 3AN Discard facility, the total catchment area of the Greensidespruit will be approximately 3.2 km^2. Impacting in a loss in catchment yield. Currently the surface water stream downgradient of the existing pollution sources indicate clear impacts from the mining activities. Surface water quality There may be a decrease in surface water quality when any surface water comes into contact with dust, eroded soil, carbonaceous materials or other pollutants. The sediment load within surface water runoff may increase if not prevented or mitigated, or the chemistry of surface water may be altered. Water quality will be impacted to a greater degree within the dirty water management area. Should any spillages of carbonaceous materials, chemicals or other pollutants occur, the surface water quality in the vicinity of and downstream of the spillage may be compromised, if not prevented or mitigated. Surface water flow Surface water flow paths will be altered during the construction phase due to construction of infrastructure and stockpiling of soils. Surface water flow paths will be further altered by subsidence should it occur. Extent of impact: Impact onto Greensidespruit and locally.					• Monitor water and only release water if the quality is sufficiently good (as per licence conditions and catchment requirements). • Ensure that all the relevant permissions are obtained for the release of water into the catchment. • Maintain sewage system to ensure that it operates optimally. • The dirty water management area should be kept as small as possible. • Affected runoff from the plant areas and the discard dump will be collected and contained in the affected water management system, with further diversion of the clean water. Conceptual water management strategies are contained within the stormwater management plan and civil engineering designs of the approved by a registered professional civil engineer (Appendix A). • The 3A north pollution control dam must be designed according to the design plans (Appendix A). The dam should be lined with a plastic lining of 2mm in thickness and the pump station to be installed should regularly maintained and water should be pumped from the pollution control dam to the return water dam located across the N12 highway for process purposes. to prevent overflow and to be used during emergency conditions • Implement a planned maintenance programme covering the affected water management circuit. This maintenance programme to assess aspects of siltation, capacity and containment integrity. • Suppress dust on cleared land. • Prevent erosion of loose particles by vegetating cleared land / stockpiles as soon as possible.					

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
Duration of impact: Commencing during construction phase that could be beyond life of mine if mitigation measures are not implemented. Degree to which impact will cause irreplaceable loss: If not adequately mitigated, could result in irreplaceable loss.					• Ensure that the gradient of soil stockpiles is 1:3 or less (shallower) to allow for the establishment of vegetation on all stockpiles, and prevention of erosion. • No dirty water should be allowed to leave the dirty water management area (except during an exceptional flood event, as per the GN.704, 1999 capacity requirements and only under Licence conditions). • Only clean or suitably treated water should be released or allowed to flow into the environment (depending on the catchment objectives and Licence conditions). • Limit vehicle movement to designated roads wherever possible to prevent dust generation. • Ensure that contaminated runoff will be contained in the pollution control dams. • Monitor water levels in the pollution control dams to ensure that it comply with GN704, 1999. • Monitor the dam walls of the pollution control dams for the nature of vegetation cover. Remove shrubs and trees from the dam wall. Ensure that the dam wall has grass cover to minimise erosion, but also that the grass cover does not damage liner. • Berms and trenches must be monitored regularly to ensure they are not blocked. • Pumps should be regularly checked to ensure that they are functioning optimally. • Pipelines should be regularly monitored for leaks, and leaks patched so as to prevent spillage of water. • Ensure that the conveyor belt is covered for its full length to minimise dust generation. • Ensure that haul trucks are covered with tarpaulins to minimise dust generation. • Spillages should be cleaned up immediately.					

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
					• Spillages should be neutralised if necessary (i.e. if too basic or too acidic). • Once the spillage has been cleaned up the areas where it might came in contact with soils should be tested and fertilised, if necessary. • Natural vegetation should be established on areas where the soils have been exposed during the cleanup. • Monitor conveyor route in order to identify spillages. • The conveyor belt should be covered so as to limit the chances of spillage. Surface water flow • Ensure that the gradient of soil stockpiles is 1:3 or less (shallower) so as to allow for the establishment of vegetation on all stockpiles. Ensure stockpiles do not exceed a height of 1.5 metres • Ensure that subsided areas are free draining. • Fertilise and vegetate damaged subsided areas to restore its pre-mining status if required. • To ensure that the area to be disturbed by construction activities is to be kept to a minimum, only large enough to carry out the necessary activities as indicated on the design for the proposed project attached hereto as Plan 3a in Appendix A which was designed for the proposed Discard facility to be locatate outside of the 1 in 100 year floodline. • No discharge of pollutants such as contaminated water, cement, fuels or oils will be allowed into any water resource. Monitoring and maintenance: • Regular site inspections to be undertaken to assess if spillages or water pollution incidents have occurred. Such					

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
					incidents shall be reported (use of the incident reporting procedure), and immediately corrected. • Should a spillage or leakage of a hydrocarbon, chemical or hazardous substance occur, the spill/leakage must be cleaned up as per EP 14 Oil, Fuel and Chemical Spill Cleanup and EP 09 Environmental Incidents, Non-conformance and Complaints. • Ensure that areas containing chemical and hazardous substances are contained (e.g. in a bund) to ensure no contamination of surrounding water resources or soil is contaminated. The bunded area must be able to contain 110% of the total volume of materials stored at any given time. Also follow the procedure EP18 on Handling and Storage of hazardous materials • Implement the surface water (monthly), groundwater (quarterly) and bio-monitoring programme (biannually) as within the receiving surface water environment (Greensidespruit). • Dust monitoring should be conducted in accordance to the Dust monitoring Procedure EP22. • Undertake annual GN 704 compliance audits, to verify the effectiveness of clean/affected water separation. Any shortcomings, with further consideration to the surface water monitoring results, should be addressed as a matter of urgency. • Regular site inspections to be undertaken to assess if spillages or soil pollution incidents have occurred. Such incidents shall be reported (use of the incident reporting procedure), and immediately corrected. • The pump station to be installed at the pollution control dam should regularly maintained and water should be pumped from the pollution control dam to the return water dam					

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
					located across the N12 highway for process purposes. to prevent overflow and to be used during emergency conditions. • The mines existing emergency response plan should be upgraded to include activities associated with the new discard dump. • Adhere to the stormwater management plan and civil engineering designs of the approved by a registered professional civil engineer (Appendix A).					

7.3.6. Groundwater

7.3.6.1 Preparation of the surface/base of the new discard dump, stripping of vegetation and compaction of surface below the new discard dump.

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
ENVIRONMENTAL COMPONENT: Geohydrology										
ACTIVITY: Land clearance during construction phase of the discard dump and related infrastructure, that includes vegetation clearance and topsoil & subsoil stripping and stockpiling.										
PROJECT PHASE APPLICABILITY	Construction: X Operation: X Closure:									
Impact description: Little impact (if any) would be expected during this phase in terms of groundwater levels or quality, although recharge may be modestly reduced. Duration of impact: Construction phase extending to post rehabilitation phase.	2	2	L	To minimise the extent of disturbance of the aquifer. To limit degeneration of groundwater quality.	Degree to which impact can be reversed: Not applicable since activity will not result in measurable groundwater impact Mitigation: • Compacted soils should be ripped once available for rehabilitation so as to allow infiltration in the future. • Restrict vehicle movement to designated pathways.	Planning and Construction Phase	Greenside Colliery Environmental Manger	2	2	L

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
Degree to which impact may cause irreplaceable loss: Not applicable, due to low significance					• Erosion control as discussed in section 7.3.2 and 7.3.5. • Waste management as discussed in section 7.3.2.3. • Maintain sewage system to ensure that it operates optimally. • To ensure that the area to be disturbed by construction, activities is to be kept to a minimum, only large enough to carry out the necessary activities. • Affected runoff from the plant areas and the discard dump will be collected and contained in the affected water management system, with further diversion of the clean water. • The dirty water management area should be kept as small as possible and managed in accordance to the conceptual water management strategies contained within the stormwater management plan and the civil engineering designs (Plan 3i, j, k in Appendix A). • The 3A north pollution control dam must be designed according to the design plans (Appendix A). The dam should be lined with a plastic lining of 2mm in thickness • The pump station to be installed should regularly maintained and water should be pumped from the pollution control dam to the return water dam located across the N12 highway for process purposes. to prevent overflow and to be used during emergency conditions.					

7.3.6.2 Utilisation of the new discard facility and related infrastructure.

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
ENVIRONMENTAL COMPONENT: Geohydrology										
ACTIVITY: Operation of the new discard facility and infrastructure related to the new discard facility including: an Overland Conveyor System from the plant to the new discard dump, Discard Silo., Haul roads, Dirty and Clean Water Separation Systems, The Workshop Complex, The Office Complex, including Water and Sewage system for the workshop and offices, Diesel storage tanks, Power Lines, Pollution Control Dam										
PROJECT PHASE APPLICABILITY: Construction X; Operation X; Closure X										
Impact description: The ABA tests indicated that the discard from the Greenside discard dump have the potential to generate acid and the slimes have an intermediate potential to generate acid. It can therefore be expected that the new discard dump material will have similar characteristics. The leaching tests indicated that the leachate/seepage from the dump will have an adverse impact on the receiving groundwater quality. The proposed discard facility is a facility designed for dry coarse discards. As such, a limited contribution of leachate formation to the underlying aquifer can be expected. The proposed positioning the 3A North discard dump partially within the footprint of former opencast areas (Kleinkopje, Block 3A North) is both appropriate and potentially beneficial for the following reasons (Groundwater Complete, 2013) • It overlies a brownfield coal mining operation with already impacted groundwater. • The open cast void base level is located above the water table thus avoiding direct hydraulic connectivity between the backfill and groundwater in the deeper underground mine workings at Greenside. • The disposal of discard in the open void will form part of the void rehabilitation. • Discard seepage reaching the mine workings will be intercepted and treated at the Emalahleni Water Treatment works.	4	4	H	To minimise the extent of disturbance of the aquifer. To limit degeneration of groundwater quality.	Degree to which impact can be reversed: If not mitigated the impact may be irreversible. Mitigation: A range of scenarios involving alternative measures for seepage flux control during the operation of the 3A North discard dump. These options have included simulation of the effects of a basal liner, plus a range of covers of variable efficiency. The conclusion drawn from this exercise is that basal liner emplacement, while forming the only viable measure for infiltration control during active operations, is likely to result in adverse geotechnical stability conditions, in conjunction with underground mining. It is therefore considered preferable to defer infiltration/seepage control to closure, at which time a low permeability engineered cover should be installed. In the absence of a basal liner, an alternative approach to impact mitigation during operations may viably involve gradient reversal via the construction of a pumping well curtain down-gradient of the dump. This would effectively isolate the contaminant plume associated with operational phase seepage to the immediate vicinity of the dump footprint. The main mitigation measures required includes: • Maintain clean and dirty water separation (refer to section 7.3.5).	Planning phase up until Closure.	Greenside Colliery Environmental Manager	4	3	H

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
Both physical and chemical perturbation of the local aquifer system is possible, as leachate from the facility will affect the water levels and quality of the aquifer. Due to the higher permeability of the discard compared with the in situ aquifer matrix, effective recharge below the discard facility will generally increase. This will result in mounding of the aquifer water level below the facility. Mounding will in turn cause a local increase in the groundwater gradient and an increased rate of migration of the contaminant plume formed by the seepage flux (and includes inflow to surface water streams and underground workings during operation). Duration of impact: During the life of mine extending to closure. Degree to which impact will cause irreplaceable loss: If not adequately mitigated, could result in irreplaceable loss.					• Prevent spills or accidental releases (refer to section 7.3.2 and 7.3.5). • Drilling of up and down-gradient shallow and deep monitoring boreholes as indicated in the monitoring programme in section 10.1. • Aquifer tests on these monitoring boreholes to aid in determining aquifer parameter values and model updates. • Selection of up and down-gradient surface water locations, as stipulated in the surface water monitoring programme in section 10.1. • Quarterly monitoring of the existing and proposed monitoring boreholes, • Model update with site specific parameters determined from the aquifer tests. • Although the geochemistry could be expected to be very similar than the existing dump it is recommended that samples be taken from the new dump for similar tests and confirmation of geochemistry for optimal management planning of the new dump operation. • The water levels at these borehole localities should be measured on at least a quarterly basis for inclusion into the groundwater database with the objective of groundwater model calibration at a later stage. • The groundwater qualities should be analyzed on a quarterly basis for inorganic content. • The parameters recommended for analysis are listed in Table 5.2. This monitoring schedule should be re-assessed by a qualified person every year or two. • Emplace a 1 m thick cover with a permeability of 4 x 10-9 m/s on the 3A North facility, following the completion or incrementally during active operation.					

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
					• Mining beneath the 3A North facility should be undertaken with caution, given the clear potential of an increased seepage flux beneath the facility. This effect could be mitigated by the implementation of a basal liner, however the long term integrity of a clay liner will be questionable with underground mining. • Continued hydraulic and geochemical characterization is required on the combined discard material and backfill to be placed on the 3A North facility, to validate model findings and to refine mitigation measures during operation of the dump. This should include moisture retention analysis at different compaction levels, and kinetic tests with comprehensive leachate analysis. • Continually refine the numerical models as new geochemical and groundwater quality and level data becomes available. • Continued collection of site-specific daily climatic information (to include minimum and maximum temperature, relative humidity, wind speed, precipitation duration and rate).					

7.3.6.3 Rehabilitation of proposed discard dump

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
ENVIRONMENTAL COMPONENT: Geohydrology										
ACTIVITY: Rehabilitation of the discard facility										

PROJECT PHASE APPLICABILITY	Construction	
	Operation	X
	Closure	X

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
Impact description: Possibly the most significant aspect of the results of groundwater impact simulations described in the previous sections relates to the predicted continuation of deterioration of groundwater quality in the vicinity of the 3A North discard dump for at least a century (the model run time limit) following closure in the absence of effective rehabilitation of the dump surface at closure. This long-term impact has, however, been shown to be effectively neutralized in the event that a suitably engineered cover is installed. Rehabilitation of the discard dump should have a positive effect on the groundwater regime since it entails the reduction of contaminated seepage, however it will continue to have an effect on the groundwater regime as a result of potential acid mine drainage reactions and local concentration of contaminants. Any seepage from the facility will flow to the rehabilitated opencast pit (Block 3A North) that is currently affected by acid rock drainage reactions and associated water quality deterioration, as well as into the historic and planned underground mine workings. It can be concluded that the proposed 3A North facility is partially an existing mined out pit, where the aquifer is already destroyed and the groundwater already influenced and with the appropriate management procedures (proposed cover design), no significant additional impacts are foreseen. Duration of impact: Operational phase extending to post closure phase. Degree to which impact will cause irreplaceable loss: No irreplaceable loss as impacts will be reversed through natural dilution reactions.	4	4	H	To minimise the extent of disturbance of the aquifer. To limit degeneration of groundwater quality.	Degree to which impact can be reversed: Recharge will largely return to ambient conditions after rehabilitation. Dilution with fresh recharge will return groundwater quality back to ambient conditions after rehabilitation Mitigation: • Rehabilitation of proposed 3A North discard dump, whit a designed cover (1 m thick cover - hydraulic conductance = 4 x e-9 m/s). • Discard seepage will be intercepted and treated at the Emalahleni Water Treatment works. Rehabilitation of the dump should therefore include the emplacement of a cover with a recommended K of the order of 4 x 10-9 m/s. If possible, partial cover emplacement could be undertaken progressively during operations in areas of dump which are not required for further waste placement. Further hydraulic and geochemical characterization is required on the combined discard material and backfill to be placed on the 3A North facility. This should include moisture retention analysis at different compaction levels, and kinetic tests with comprehensive leachate analysis The results from the groundwater investigation should be verified through monitoring during the operational and closure phases of the 3A North discard dump and suitable measures implemented, should the results not confirm the initial conclusion regarding closure/decommissioning related impacts. It is anticipated that the groundwater levels and quality will improve away from the discard dump area as the dilution effect of the entire aquifer increases further away from this footprint, with the implementation of the recommended cover at closure.	Operational phase to Post Closure Phase	Greenside Colliery and the Environmental Manager	3	2	M

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation) Probability	Magnitude	Severity	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation) Probability	Magnitude	Severity
					Numerical models can be used as tools to update and assess measures, as new information and understanding becomes available.					

7.3.7 Air Quality

7.3.7.1 Site establishment

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation) Probability	Magnitude	Severity	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation) Probability	Magnitude	Severity
ENVIRONMENTAL COMPONENT: Air quality										
ACTIVITY: Construction of the new discard facility and infrastructure related to the new discard facility including: an Overland Conveyor System from the plant to the new discard dump, Discard Silo., Haul roads, Dirty and Clean Water Separation Systems, The Workshop Complex, The Office Complex, including Water and Sewage system for the workshop and offices, Diesel storage tanks, Power Lines, Pollution Control Dam										
PROJECT PHASE APPLICABILITY: Construction X; Operation; Closure										
Impact description: Direct, negative impacts: Dust fallout impacts relate to nuisance impacts, i.e. reduced visibility and layers of dust deposited on the surrounding environment. PM2.5 and PM10 impacts can in general be of concern due to their direct health impact potentials. Such fine particles are able to be deposited in, and damaging to, the lower airways and gas-exchanging portions of the lung. Extent of impact: Site-specific. Identified impacts are likely to be confined to the site. Duration of impact: Short-term (0-7) years	5	3	H	Activities remain compliant with air quality legislation. To further eliminate/minimise the risks of nuisance impacts and direct health impact potential.	Degree to which impact can be reversed: As soon as the dust generating activities ceased the air quality impact on the surrounding population and environment will have improved and the impacts would be easily reversible. Proposed mitigation: The following mitigation measures will be implemented: • Phasing of earthmoving activities to reduce source size. • Dust suppression in dirty areas in accordance to the dust suppression procedure EP22. • Early vegetation and stabilization of topsoil stockpile and reduction of the frequency of disturbance.	Construction Phase and Operational Phase	Greenside Colliery Environmental Manger	5	2	M

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
Degree to which impact will cause irreplaceable loss: None					• Early paving or treatment with chemical surfactant of mine-owned permanent roads. • Speed control will be enforced on all roads. • Complaints register must be make available for the recording of complaints relating to dust –“EP 09: Environmental Incidents, Non-conformance and Complaints” • Dust fall out monitoring plan must be developed and effectively implemented. Consideration should be given to ambient monitoring (PM10 and PM2.5). • Greenhouse gas emissions must be managed through effective maintenance of all diesel driven vehicles					

7.3.7.2 Mine operation

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
ENVIRONMENTAL COMPONENT: Air quality										
ACTIVITY: Construction of the new discard facility and infrastructure related to the new discard facility including: an Overland Conveyor System from the plant to the new discard dump, Discard Silo., Haul roads, Dirty and Clean Water Separation Systems, The Workshop Complex, The Office Complex, including Water and Sewage system for the workshop and offices, Diesel storage tanks, Power Lines, Pollution Control Dam										
PROJECT PHASE APPLICABILITY	Construction									
	Operation	X								
	Closure									
Impact description: Direct, negative impacts: Dust fallout impacts relate to nuisance impacts, i.e. reduced visibility and layers of dust deposited on the surrounding environment. PM2.5 and PM10 impacts can in general be of concern due to their direct health impact potentials. Such fine particles are able to be deposited in, and damaging to, the lower airways and gas-exchanging portions of the lung.	5	4	H	Activities remain compliant with air quality legislation. To further eliminate/minimise the risks of nuisance	Degree to which impact can be reversed: As soon as the dust generating activities ceased the air quality impact on the surrounding population and environment will have improved and the impacts due to dust fallout and PM2.5 would be easily reversible. Impacts due to PM10 are potentially reversible			5	3	H

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
Greenside Colliery is primarily an underground bord and pillar mine, minimising surface dust fallout. However, the inherent air quality of the area is considered poor and is impacted on by the activities of adjacent collieries, industry, and vehicle use and veld fires. Furthermore, dust generation occurs from the discard existing discard dump on-site. Under the assumption of background conditions remaining the same as for the construction phase (low PM concentrations) the operational phase would result in mainly incremental impacts as the progressive development of the discard dump will add to the impacts on the air quality of the area. Extent of impact: Site-specific (PM2.5 and dust fallout). Local (PM10) – impacts on extended area beyond site boundary (hundreds of metres). Duration of impact: Long-term: Life of Mine. Degree to which impact will cause irreplaceable loss: None				impacts and direct health impact potential.	– this is primarily due to health impacts that may result from the mining activities. Mitigation: Air quality management measures will be implemented to ensure the lowest possible impacts on the surrounding environment. The following mitigation measures will be implemented: Should areas of the discard facility surface dry out, resulting in the generation of dust, a water bowser will be utilised for dust suppression. Dust suppression in dirty areas in accordance to the dust suppression procedure EP22. Early vegetation and stabilization of topsoil stockpile and reduction of the frequency of disturbance. Early paving or treatment with chemical surfactant of mine-owned permanent roads. Speed control will be enforced on all roads. Complaints register must be make available for the recording of complaints relating to dust –“EP 09: Environmental Incidents, Non-conformance and Complaints” Implementation of the dust fall out monitoring plan. Consideration should be given to ambient monitoring (PM10 and PM2.5). Greenhouse gas emissions must be managed through preventing of sponcom of dump through effective deposition/compaction and	Operational Phase	Greenside Colliery Environmental Manger			

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
					rehabilitation, and effective maintenance of all diesel driven vehicles Continually assess the efficiency of dust mitigation measures.					

7.3.7.3 Site rehabilitation

Environmental impact, extent, duration, significance and degree to which impact will caused irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
ENVIRONMENTAL COMPONENT: Air quality										
ACTIVITY: Re-shaping of the discard dump, removal of all infrastructure, replacement of topsoil and re-vegetation. This further includes demolition activities (which may involve blasting) and dust generation from vehicle movement along unpaved roads.										
PROJECT PHASE APPLICABILITY: Construction [ ]; Operation [ ]; Closure [X]										
Impact description: Direct, negative impacts: Dust fallout impacts relate to nuisance impacts, i.e. reduced visibility and layers of dust deposited on the surrounding environment. PM2.5 and PM10 impacts can in general be of concern due to their direct health impact potentials. Such fine particles are able to be deposited in, and damaging to, the lower airways and gas-exchanging portions of the lung. Impacts due to this phase are short-term in nature and are not likely to have cumulative effects. Extent of impact: Site-specific. Identified impacts are likely to be confined to the site. Duration of impact: Short-term (0-7) years.	5	3	H	Activities remain compliant with air quality legislation. To further eliminate/ minimise the risks of nuisance impacts and direct health impact potential.	Degree to which impact can be reversed: As soon as the dust generating activities ceased the air quality impact on the surrounding population and environment will have improved. The impacts would be easily reversible, provided that stockpiles and disturbed mining areas (which may potentially give rise to wind erosion) are permanently vegetated. Mitigation: The following mitigation measures will be implemented: • Phasing of earthmoving activities to reduce source size. • Dust suppression in dirty areas in accordance to the dust suppression procedure EP22. • Early vegetation and stabilization of topsoil stockpile and reduction of the frequency of disturbance.	Decommissioning and Closure Phase	Greenside Colliery Environmental Manger	5	2	M

Environmental impact, extent, duration, significance and degree to which impact will caused irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
Degree to which impact will cause irreplaceable loss: None					• Early paving or treatment with chemical surfactant of mine-owned permanent roads. • Speed control will be enforced on all roads. • Complaints register must be make available for the recording of complaints relating to dust –"EP 09: Environmental Incidents, Non-conformance and Complaints" • Dust fall out monitoring plan must be developed and effectively implemented. Consideration should be given to ambient monitoring (PM10 and PM2.5). • Greenhouse gas emissions must be managed through effective rehabilitation of the discard dump, to prevent the risk of sponcom.					

7.3.8 Noise

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
ENVIRONMENTAL COMPONENT: Noise										
ACTIVITY: Construction and Operation of the new discard facility and infrastructure related to the new discard facility including: an Overland Conveyor System from the plant to the new discard dump, Discard Silo., Haul roads, Dirty and Clean Water Separation Systems, The Workshop Complex, The Office Complex, including Water and Sewage system for the workshop and offices, Diesel storage tanks, Power Lines, Pollution Control Dam										
PROJECT PHASE APPLICABILITY	Construction: X Operation: X Closure: X									
Impact description: Although there are agricultural activities to the west of the prosed site the study area is characterised by the presence of major exiting noise sources. There are major coal mining activities at Kleinkopje in the south, Greenside Colliery in the north and Landau I the East. The N12 highway, which crosses the area immediately to the North of the proposed site, carries a large amount of traffic. This includes a very significant amount of heavy vehicles. Other	5	2	M	To prevent noise nuisance to surrounding environment	Mitigation: Ensure all equipment and vehicles are serviced regularly to prevent excessive noise. Vehicles and equipment generating excessive noise should be fitted with appropriate noise abatement measures.	Commence at Construction phase		5	2	M

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
busy roads crossing the area are the R547, the road connecting the R544 and the R547 past Kleinkopje, and the road leading from Kleinkopje, past Landau village to Clewer. Residential areas consist of villages associated with the mines of the area. Noise levels were expected have significant contributions from the N12 Highway and the other coal mines in the area, and in light of the above, the proposed project is not expected to worsen the noise levels of the study area. Therefore with the general high level of mechanisation in the area, relatively high existing ambient noise may be expected. The current ambient noise levels are characterised by the presence of mining and road traffic related noises. Noise levels at the proposed discard facility are expected to be the same as that of the rest of the Greenside Colliery.					Construction workers must be provided with the appropriate personal protection equipment in areas required as per the Mine Health and Safety Act (No. 29 of 1996) (MHSA). Records of the PPE supplied must be maintained for record keeping purposes. A complaints register must be made available the site security office and should any complaints be received, these must be logged in the complaints register and reported to the responsible person on-site. All complaints must be closed out within 14 days. Training and induction requirements must be undertaken as outlined in section 12.3. Environmental incidents register (to be updated in Greenside Colliery's EMS), with records of close-out on incidents received. Undertake environmental noise monitoring and keep records of montoring reports. Personal protective equipment register to be kept Induction training and register to be kept	Construction Phase until Closure Phase	Greenside Colliery Environmental Manager			

7.3.9. Wetlands and Sensitive landscapes

7.3.9.1 Loss of wetland catchment areas

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
ENVIRONMENTAL COMPONENT: Protected areas and conservation planning										
ACTIVITY: Construction and operation of the new discard facility and infrastructure related to the new discard facility including: an Overland Conveyor System from the plant to the new discard dump, Discard Silo., Haul roads, Dirty and Clean Water Separation Systems, The Workshop Complex, The Office Complex, including Water and Sewage system for the workshop and offices, Diesel storage tanks, Power Lines, Pollution Control Dam										
PROJECT PHASE APPLICABILITY: Construction X; Operation X; Closure X										
Description of impact" During the construction phase the entire footprint of the proposed discard facility will be cleared and lined. This will prevent infiltration processes to take place and therefore cut-off interflow and surface flow feed into the wetlands. This will lead into desiccation of the wetland areas within the project area. During operational phase, the project area will be covered in discard which will increase storm water volumes into the wetland areas. The change in flow patterns will results in a changes in the manner in which water enters the wetland area from low intensity to high intensity flows. This will result erosion and a change in the valley bottom wetland from a valley bottom without a channel to a valley bottom with a channel. Extent of impact: Local Duration of impact: Beyond closure, depending on effectiveness of rehabilitation. Degree to which impact will cause irreplaceable loss: Irreplacebale loss of the wetlands may occure should the catchment area not be preserved by implementing the mitigations	5	5	H	To protect wetland and sensitive areas. Upgrading the wetland from a Class D to Class C.	Degree to which impact can be reversed: Reversible, should mitigations be implemented. Mitigation Construction and major earthworks should be undertaken during the dry season to ensure minimum water driven erosion impacts; The footprint of the cleared area should be limited to the required extent only; and Following the end of the construction process all the disturbed soils should be re-stabilised by planting appropriate grasses. Based on the proposed mine plan (Plan 3a in Appendix A), the proposed discard facility was designed not to impact on the wetland areas within the project area. The dump will be placed outside the 100m buffer of the wetlands. Although the footprint of the proposed discard facility does not directly impact on the on the wetland areas within the project area, however indirect impacts such as desiccation of wetlands and contamination with seepage from the discard facility are foreseen. Based on these foreseeable impacts, the following recommendations were made: A dirty water trench to intercept contaminated seepage is constructed around the proposed discard facility. The dirty water	Construction Phase until Closure	Greenside Colliery Environmental Manager	2	2	L

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
					trench should be directed towards the dirty water containment structures such as a pollution control dam; Pollution from the existing surface and underground sources entering the pans within the project area should be avoided or minimised at all costs. Cut-off trenches and pollution control dams should be installed in order to ensure that dirty water is managed and controlled; Rehabilitation and closure of the existing pit located south of the proposed discard facility; Rehabilitation of the discard facility should take place during the operational phase. This will limit the amount of dirty water runoff from entering the outside environment; An alien invasive species eradication programme should be initiated in order to eradicate the alien invasive outside of the wetland areas; and An alien invasive eradication programme and rehabilitation of wetland areas within the project area should be undertaken in conjunction with Working for Wetlands.					

7.3.9.2 Sedimentation of wetland areas

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
ENVIRONMENTAL COMPONENT: Protected areas and conservation planning										
ACTIVITY: Construction and operation of the new discard facility and infrastructure related to the new discard facility including: an Overland Conveyor System from the plant to the new discard dump, Discard Silo., Haul roads, Dirty and Clean Water Separation Systems, The Workshop Complex, The Office Complex, including Water and Sewage system for the workshop and offices, Diesel storage tanks, Power Lines, Pollution Control Dam										

PROJECT PHASE APPLICABILITY		
	Construction	X
	Operation	X
	Closure	X

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
Description of impact: Construction Phase: During the construction process the entire footprint of the proposed project area will be cleared of vegetation and the topsoil will be stripped off and stock pilled. The removal of vegetation (transformed grassland) and the disturbance of the soil profile will expose the soils to erosion by wind (dust) and water (from surface run-off). Eroded soil is likely to enter downstream wetland areas, increasing sedimentation within these wetlands and leading to changes in vegetation composition and aquatic fauna. Erosion is likely to be highest during the summer months when high intensity storm events are likely to result in significant surface runoff. Operational Phase: The steep side slopes of the discard facility will be prone to erosion, increasing sediment loads in adjacent wetlands. Extent of impact: Local Duration of impact: Beyond closure, depending on effectiveness of rehabilitation. Degree to which impact will cause irreplaceable loss: Irreplacebale loss of the wetlands may occure should the mitigation to reduce sediment runoff not be implemented.	5	5	H	To protect wetland and sensitive areas. Upgrading the wetland from a Class D to Class C.	Degree to which impact can be reversed: Reversible should mitigation be implemented. Mitigation Erosion of the footprint should be minimised at all costs by limiting the extent of the foot print to only the required extent; Construction and major earthworks should be undertaken during the dry season to ensure minimum water driven erosion impacts; Dust suppression should be ensured by watering the disturbed areas; Following the end of the construction process all the disturbed soils and stockpiles should be stabilised by planting appropriate grasses; and Some of the eroded sediments from the side slopes are likely to be captured by the dirty water management system which is already available on site. Refer to the mitigations in section 7.3.9.1.	Construction phase until closure	Greenside Colliery Environmental Manager	3	3	M

7.3.9.3 Deterioration of wetland water quality

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
ENVIRONMENTAL COMPONENT: Deterioration of wetland water quality										

<table>
<tr><th rowspan="2">Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss</th><th colspan="3">Risk rating (before mitigation)</th><th rowspan="2">Environmental objective</th><th rowspan="2">Degree to which impact can be reversed and the supporting mitigatory action plan</th><th rowspan="2">Timeframe</th><th rowspan="2">Responsibility</th><th colspan="3">Risk rating (after mitigation)</th></tr>
<tr><th>Probability</th><th>Magnitude</th><th>Severity</th><th>Probability</th><th>Magnitude</th><th>Severity</th></tr>
<tr><td colspan="11">ACTIVITY: Construction and operation of the new discard facility and infrastructure related to the new discard facility including: an Overland Conveyor System from the plant to the new discard dump, Discard Silo., Haul roads, Dirty and Clean Water Separation Systems, The Workshop Complex, The Office Complex, including Water and Sewage system for the workshop and offices, Diesel storage tanks, Power Lines, Pollution Control Dam</td></tr>
<tr><td colspan="11">PROJECT PHASE APPLICABILITY
Construction: X
Operation: X
Closure: X</td></tr>
<tr><td>Impact description:
Construction Phase: Water quality deterioration will result as a consequence of increased sediment loads within the valley bottom without a channel wetland area. Furthermore pollutants derived from spillage, leakage and incorrect disposal of hazardous substances on site. Incorrect waste management and disposal is also likely to contribute further to water quality deterioration.
Operational Phase: Seepage or leakage of polluted water out of the new discard facility and into the hillslope seepage wetlands will result in the deterioration of water quality within the wetlands. Decreasing water quality within the wetlands is likely to have negative effects on biodiversity supported by the delineated wetland areas. Furthermore, this will render the water less fit for use of the downstream water end users. Downstream water end users at a local scale include farmers using the water for livestock watering and irrigation, while further downstream the polluted water would enter the already polluted Olifants River.

Extent of impact: National – Protection of critical biodiversity of national and

Duration of impact: Beyond closure, depending on effectiveness of rehabilitation.

Degree to which impact will cause irreplaceable loss: Irreplacebale loss of the wetlands may occure should the mitigation to reduce impact on wetland water quality not be implemented.</td><td>5</td><td>5</td><td>H</td><td>To protect wetland and sensitive areas.
Upgrading the wetland from a Class D to Class C.</td><td>Degree to which impact can be reversed: Reversible

Mitigation
Use of potentially polluting hazardous substances on site should be strictly controlled;
Hazardous material such as oil, diesel, petrol, hydraulic oils etc, should only be allowed in clearly demarcated areas, under the supervision of suitably trained personnel;
Sufficient quantities of spill response equipment and products (e.g. Drizit) should always be available on site;
A detailed waste management plan must also be put in place that clearly defines the different categories of waste and how each must be handled and disposed;
In order to limit seepage and leakage out of the discard disposal facility, it is recommended that a dirty water trench is constructed and directs contaminated water towards the dirty water management areas; and
Hydrological calculations should be undertaken to determine if the existing dams capacity is sufficient.
Refer to the mitigations in section 7.3.9.1</td><td>Construction phase until closure</td><td>Greenside Colliery Environmental Manager</td><td>3</td><td>3</td><td>M</td></tr>
</table>

7.3.10 Visual

7.3.10.1 Visual on sensitive receptors

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
ENVIRONMENTAL COMPONENT: Visual on sensitive receptors										
ACTIVITY: Construction and operation of the new discard facility and infrastructure related to the new discard facility including: an Overland Conveyor System from the plant to the new discard dump, Discard Silo., Haul roads, Dirty and Clean Water Separation Systems, The Workshop Complex, The Office Complex, including Water and Sewage system for the workshop and offices, Diesel storage tanks, Power Lines, Pollution Control Dam										
PROJECT PHASE APPLICABILITY	Construction: X Operation: X Closure: X									
Impact description: The proposed new discard facility will lie adjacent to the N12 which is a major route for tourists and holiday makers travelling between Johannesburg and the eastern Mpumalanga. Other coal mines in the vicinity surround Greenside Colliery and therefore, the background visual effects is dominated by mining activities. The proposed new discard facility may lead to the mining activities becoming more visually prominent due to the height of the discard dump, most of the receptors will have a clear line of sight of the proposed new discard dump and ADT headlights becoming a nuisance for motorists on the N12 Therefore, notwithstanding the existing mining character of the area, measures will be taken to screen the new discard facility from both the N12 and Kleinkopje – Clewer Road. Extent of impact: Regional Duration of impact: Permanent Degree to which impact will cause irreplaceable loss: A potential permanent change to the topography and associated visual impacts will occur, that may through possible future reworking of the dump be reversed. No irreplaceable loss of resource will occur.	5	3	M	To preserve the sense of place of the area	Degree to which impact can be reversed: Impact can be reversed through possible future reworking of dump, and mitigated through effective rehabilitation. Mitigation As a result of the nature and location of the proposed activity, very little mitigation measures could be implemented. Most of these measures are aimed at the activities and infrastructure to be established on the lower lying portions of the project site. the following mitigation measures are proposed: • Keep disturbed areas to a minimum. • No clearing of land to take place outside the demarcated footprint. • Only indigenous plant species to be introduced and planted. All areas must be vegetated with a suitable ground cover immediately after or construction activities to prevent erosion and mud slides. • Buildings and similar structures must be in keeping with the principles of critical regionalism, namely sense of place, sense of history, sense of nature, sense of craft and sense of limits. • Maintain the site during operation of the mine. Inoperative equipment and poor housekeeping, in general, creates a poor image of the activity in the eyes of the public.	Construction until Closure Phase	Greenside Colliery Environmental Manger	5	3	M

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
					• Implement a rehabilitation plan as previously discussed. • To reduce the visual impact of the facility and prevent ADT headlights becoming a nuisance for motorists on the N12, a suitable indigenous tree screen will be planted.					

7.3.11 Sites of Archaeological and cultural importance

7.3.11.1 Cultural Heritage

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
ENVIRONMENTAL COMPONENT: Cultural Heritage										
ACTIVITY: Construction and Operation of the new discard facility and infrastructure related to the new discard facility including: an Overland Conveyor System from the plant to the new discard dump, Discard Silo., Haul roads, Dirty and Clean Water Separation Systems, The Workshop Complex, The Office Complex, including Water and Sewage system for the workshop and offices, Diesel storage tanks, Power Lines, Pollution Control Dam										
PROJECT PHASE APPLICABILITY: Construction X; Operation X; Closure X										
Impact description: The Phase I HIA study for the proposed Project Area revealed the following types and ranges of heritage resources as outlined in Section 38 of the National Heritage Resources Act (No 25 of 1999), namely: • Two graveyards. The two graveyards occur outside the Project Area and will not be affected by the proposed new Discard Facility. All graveyards and graves can be considered to be of high significance and are protected by various laws Legislation with regard to graves includes Section 36 of the National Heritage Resources Act (Act No 25 of 1999) whenever graves are	2	2	L	To preserve the cultural heritage of the area.	Degree to which impact can be reversed: Reversible should heritage resources of significance be destroyed this may lead to an Irreversible impact. Mitigation: No mitigation measures are needed as the graveyards will not be affected by the proposed Discard Facility Project. Managing the graveyards G01 and G02 must be demarcated with a fence and fitted with a gate in order to allow for family or friends to visit the deceased.	Construction until Closure Phase	Greenside Colliery Environmental Manger	2	2	L

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
older than sixty years. It seems as if both graveyards are older than sixty years. Other legislation with regard to graves includes those which apply when graves are exhumed and relocated, namely the Ordinance on Exhumations (No 12 of 1980) and the Human Tissues Act (No 65 of 1983 as amended). Extent of impact: Restricted to the site Duration of impact: Permanent Degree to which impact will cause irreplaceable loss: Low degree of irreplaceable loss					This will also lessen the risk that the graveyards may be affected by any developmental activities. <u>General (disclaimer)</u> It is possible that this Phase I HIA study may have missed heritage resources in the Project Area as heritage sites may occur in thick clumps of vegetation while others may lie below the surface of the earth and may only be exposed once development commences. If any heritage resources of significance are exposed during AOL's proposed new Discard Facility the South African Heritage Resources Authority (SAHRA) should be notified immediately, all development activities must be stopped and an archaeologist accredited with the Association for Southern African Professional Archaeologist (ASAPA) should be notified in order to determine appropriate mitigation measures for the discovered finds. This may include obtaining the necessary authorisation (permits) from SAHRA to conduct the mitigation measures.					

7.3.11.2 Palaeontology

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
ENVIRONMENTAL COMPONENT: Palaeontology										
ACTIVITY: Construction and Operation of the new discard facility and infrastructure related to the new discard facility including: an Overland Conveyor System from the plant to the new discard dump, Discard Silo., Haul roads, Dirty and Clean Water Separation Systems, The Workshop Complex, The Office Complex, including Water and Sewage system for the workshop and offices, Diesel storage tanks, Power Lines, Pollution Control Dam										
Construction	X									

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)			Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)		
	Probability	Magnitude	Severity					Probability	Magnitude	Severity
PROJECT PHASE APPLICABILITY: Operation X; Closure X										
Impact description: The Phase 1 Palaeontological Impact Assessment indicated that formations present are part of the Karoo Supergroup. The Karoo Supergroup is renowned for its fossil wealth. The Vryheid Formation (Pe,Pv), Ecca Group is rich in plant fossils such as the *Glossopteris* flora represented by stumps, leaves, pollen and fructifications. This formation is early to mid-Permian in age and consists of sandstone, shaly sandstone, grit, conglomerate, coal and shale. Coal seams are present in the Vryheid Formation within the sandstone and shale layers. Fossils are mainly present in the grey shale which is interlayered between the coal seams. Fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. Therefore, if there is the presence of Karoo Supergroup strata the palaeontological sensitivity is generally very high. The impact of the development on fossil heritage is very high and therefore a field survey or further mitigation or conservation measures are necessary for this development (according to SAHRA protocol). A Phase 2 Palaeontological Impact Assessment and or mitigation are recommended. The overburden and inter-burden must be surveyed for fossiliferous outcrops. Special care must be taken during the digging of foundations, trenches, channels and footings. Extent of impact: Restricted to the site Duration of impact: Permanent Degree to which impact will cause irreplaceable loss: Irreplaceable loss if mitigation measures are not followed.	5	5	H	Prevent impact on fossil heritage	Degree to which impact can be reversed: I Reversible, should paleontological resources of significance be exposed this may lead to an Irreversible impact. Mitigation: A Phase 2 Palaeontological Impact Assessment should be conducted prior to digging, excavating, drilling or blasting. If any palaeontological material is exposed during digging, excavating, drilling or blasting SAHRA must be notified. All construction activities must be stopped and a palaeontologist should be called in to determine proper mitigation measures.	Construction until Closure Phase	Greenside Colliery Environmental Manger	2	2	L

7.3.12 Socio-Economic

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)
ENVIRONMENTAL COMPONENT: Socio-Economic						
ACTIVITY: Greenside Colliery New Discard Facility Project						
PROJECT PHASE APPLICABILITY: Construction X; Operation X; Closure X						
Impact description: The annual household income for Mpumalanga remains fairly low, with most households earning less than R18 000 per annum. Adult literacy has improved in the past two decades, but still remains below the national average and many scholars do not complete their matriculation exams. Approximately 33% of the provinces population is unemployed. The new discard dump project benefits the workers on the mine directly. Indirectly the loss of employment is avoided, which does not affect the economic value of the community in general. The society in general will not be affected as the risk of an emergency was avoided. The products from the mining operations at Greenside Colliery are sold to the South African and international markets. SACE employs more than 900 people at Greenside Colliery. The existing education programme implemented at the mine comprises of the following elements: • New schools. • Adult education. • Vegetable garden. • Life skills inclusive of sewing, cooking, health, environmental awareness and entrepreneurial skills. • Community schools. The safe continuation of the mining and related activities at the Greenside Colliery continues employment of staff at the Greenside Colliery as well as the continued supply of coal to the local market. As a result of the multiplier effect, the continued	Positive	A desirable future state for human societies in which living conditions and resource-use meet human needs without undermining the sustainability of natural systems and the environment, so that future generations may also have their needs met.	Mitigation: Greenside Colliery currently provides jobs for 914 people and funds and participates in community projects. The positive impacts of Greenside Colliery on the regional socio-economic conditions during the Operational Phase are discussed in Part 4 All positive impacts of the mine on the socio-economy that will have taken place during the Operational Phase will continue during the Decommissioning Phase until they cease, mainly due to the reduction or cessation of jobs and the cessation of demand for goods and services.	Construction until Closure Phase	Greenside Colliery Environmental Manger	Positive

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Risk rating (before mitigation)	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Risk rating (after mitigation)
operation of the existing Greenside Colliery will benefit the local, regional and national economy. Should Greenside Colliery not construct the new Discard Dump they may be forced to cease operation. Should this have occurred, jobs of personnel currently employed will be lost and the local, regional and national economic benefits of the continuation of the mining and related activities would have been lost. Mine closure will raise unemployment levels in the region, and would increase significantly as more mines close down.						

7.4 DESCRIPTION OF CUMULATIVE IMPACTS

Cumulative impacts refer to the situation where an activity may in itself not have a significant impact, but may become significant when added to the existing and potential impacts from similar or different activities in the area. The following potential cumulative impacts have been identified:

Table 62: Cumulative impacts

Cumulative Impacts			
Nr.	**Environmental component**	**General description of regional conditions and existing cumulative impacts**	**Contribution of Greenside Colliery (including the discard facility) to cumulative impacts**
1	Geology	The Witbank Coal Field, located mostly within the Mpumalanga Highveld region between Bethal and Springs in Gauteng, generally contains five seams of coal most of which is good quality and high calorific value. As such, coal is extracted from numerous mines located near eMalahleni, in the eMalahleni Local Council's area of jurisdiction. Due to the existing surrounding coal mining operations (Xstrata South Africa (Pty) Ltd., Anglo Operations Ltd., etc.) in the surrounding area, the geological strata in the region will be permanently altered.	The contribution of the mine to this cumulative impact will increase progressively as mining advances.
2	Geology and Socio-economic conditions	The extraction of coal from the Witbank Coal Field has occurred over a period spanning more than a century, and modern day opencast mining techniques enable coal extraction to be maximised. This has led to the systematic depletion of the coal reserves in the region, increasing significantly in the last several decades due to improvements in mining technology. Since coal is a fossil fuel it is a non-renewable resource, and as the remaining coal reserves decrease, the value of the coal will increase because of supply and demand principles. This will lead to an increase in income generation and positive contributions to the regional socio-economic conditions during the Operational Phase of the mine, but will ultimately result in the complete exhaustion of the coal reserves, leaving no coal for future generations.	Coal reserves currently being mined at the Greenside Colliery will be exhausted by 2035.

3	Topography, Land use and Visual aspects	The Greenside Colliery is located in a region where opencast coal mining is common place. The large number of opencast coal mines in the region, together with the historical nature of the mining in the Witbank region (over 100 years of mining history) will most likely have desensitised local residents and frequent travellers through the area. On the contrary, the visibility of the mining areas from the surrounding areas could be of interest to passers-by, especially since coal mining is an important part of Mpumalanga's history, and visits to coal mines are even cited as being of interest to tourists.	Visual impacts of the discard facility would result from the removal of vegetation and the, stockpiling of soil and spoils, changes in topography and the general sense of place associated with the pre-mining landscape. In addition, much of the surface infrastructure at Greenside Colliery has resulted in topographical elevations within the surface land use area, thereby altering the visual 'sense of place' from that associated with the pre-mining agricultural land use.
4			*In situ* rehabilitation of discard disposal facilities and the continued utilisation of some water management infrastructure mean that the resultant permanent change in topography will also result in permanent changes to the visual aspects of the study area.
5	Topography, Land use and Visual aspects		Rehabilitation of discard facility and footprint areas remaining once infrastructure has been removed to agricultural land capability and grazing land use will contribute to the restoration of the pre-mining 'sense of place' associated with the agricultural areas in the Mpumalanga Highveld region.

6	Topography	Large sections of the Emalahleni Municipal area affected by shallow undermining, which has had a significant impact on the environment, resulting in sinkhole formation, subsidence and seepage of water from underground workings (ELM IDP, 2009-2010), amongst others.	Restoration and improvement of the topography at Greenside Colliery will have consequent impacts on surface water, visual aspects, and safety of future land users, amongst others.
8	Soil, land capability and Socio-economic conditions	Agriculture is one of the largest economic sectors in Mpumalanga, producing 15% of total output in South Africa (South Africa Yearbook, 2001/02). The number of opencast mines in Mpumalanga, particularly large operations, has led to a significant loss of high agricultural potential soils that would otherwise continue to be capable of supporting crop cultivation. Loss of high potential agricultural land due to opencast mining activities in the area will reduce the food production capability of the region.	The contribution of the mine to this cumulative impact will increase progressively as mining advances.
9	Soil, land capability, biodiversity and sensitive landscapes	In addition, large areas of the surface have been affected by agriculture and opencast mining, which has led to loss of soil structure and function, and ultimately to loss of biodiversity due to the transformation and fragmentation of natural habitats and ecosystems.	

	Wetlands	The project area is located within the Upper Olifants River Water Management Area quaternary catchments B11G. The quaternary catchment (B11G) is drained by the Greensidespruit. In general, the water resources within the quaternary catchment area Upper Olifants River catchment are regarded seriously modified (PES: E) largely due to the coal mining and agricultural activities in the catchment area. The cumulative impacts associated with mining in the region have already impacted on the water quality as a result of water pumped from the mines to dewater the underground workings.	The deterioration of water quality within the region is regarded as one of the major cumulative impacts, however, owing to the nature of the proposed discard facility project as well as the current impacts in the area the cumulative impact of the project is considered to be minor.
10	Land use and Socio-economic conditions	Mining is an important sector in Mpumalanga providing jobs and contributing to over one fifth of Mpumalanga's Gross Geographic Product (Mpumalanga SoE, 2003).	The temporary change in land use to mining will result in a much higher income per hectare of land over the short-term in comparison with agriculture.
11	Biodiversity - Alien species	Invading alien plants are the single biggest threat to plant and animal biodiversity through the effects of predation, alteration of habitat or disruption of ecosystem process and services. Invading alien plants have become established in over 10 million hectares of land in South Africa. If left uncontrolled, the problem will double within 15 years. Invading alien plants waste 7% of our water resources, reduce farming productivity, intensity flooding and fires, cause erosion, degrade river systems, increase rate of siltation of dams and estuaries, reduce water quality and can cause extinction of indigenous plants and animals (Mpumalanga SoE, 2003).	Alien and invasive species tend to establish in disturbed surface areas at Greenside Colliery, which will be abundant during opencast mining. Unless appropriately managed, it is likely that alien and invasive species will encroach into natural vegetation areas, and especially into areas that are newly disturbed or rehabilitated.

12	Biodiversity - Threatened species	Numerous species in Mpumalanga face the risk of extinction due to factors such as habitat loss, environmental degradation and fragmentation of landscapes (Mpumalanga SoE, 2003).	Grass owls (*Tyto capensis*), with a Red Data status of 'Vulnerable', occur within the mine boundary area. The impacts of mining, in terms of noise, ground vibrations, surface water and groundwater impacts will severely affect the habitat of the Grass owls, and may lead to the loss of life of the owls. Furthermore, the increase in human presence on site will contribute to the migration of this species but the lack of suitable habitat in the surrounding areas may further contribute to loss of animal life.
13	Surface water	The bulk (65%) of water resources available in Mpumalanga comes from surface water resources, water transfers into the province provide 19% of total water availability, groundwater contributes 6% of available water and return flows from mining, industrial, irrigation and urban sectors contribute 10%. Water use in South Africa is dominated by irrigation and Mpumalanga province is no exception with 46% of its water being used for irrigation. The second largest requirement for water is for water transfers to neighbouring catchments and Water Management Areas(WMAs) which accounts for 16% of water use in the province, while water use in the urban sector is slightly less (8%) and requirements for the industrial, forestry and mining sectors each account for 9% of the provinces water use (Mpumalanga SoE, 2003).	The containment of contaminated water in pollution control facilities at Greenside Colliery will lead to a decrease in the MAR available to the affected catchments. This applies to both the Operational and Post Closure Phases for containment and decants management respectively.

14		Water quality indicators have shown a general decrease in water quality over time. Median levels of surface water nutrients have increased and indicate a potential for enrichment. The consequences of these elevated levels are: *A greater potential for algal blooms; *An impact on riverine ecosystems; and *Impairment of human health. High (and increasing) total dissolved solids (TDS) levels in the Olifants Water Management Area (WMA) have the potential for decreasing the aesthetic value of the water. Exceedance of the guideline levels for certain metals in the Olifants WMA may be attributed to the numerous industrial and mining activities taking place in that area. At the WMA scale, high exceedance above water quality guideline levels exist for pH levels in the province.	If contaminated surface water (including decanting acid mine water) is discharged, or allowed to flow to the receiving environment, the water quality in the receiving environment would further deteriorate. Downstream users and aquatic habitats would be negatively affected by such discharge, and the wetlands in downstream receiving areas would also be negatively impacted.
15	Groundwater	Groundwater contributes 6% of available water in Mpumalanga (Mpumalanga SoE, 2003).	The extent and quality of pollution plumes emanating from mining areas will affect the overall groundwater quality in the area. This could impact on the water users in the area.
16		Groundwater is used for irrigation and domestic consumption in the surrounding agricultural region. Groundwater levels are drawn down at all operational mines in the region, leading to an overall impact on groundwater levels but have also lead to a complicated flow of groundwater between mines.	Development of draw down cones during the Operational Phase will occur due to the dewatering of mining operations. This will affect the regional groundwater level during the Operational Phase, but once dewatering ceased, groundwater levels are expected to recover.
17	Air quality	Air quality is an issue of concern in Mpumalanga, as it is in many other parts of South Africa. A wide variety of air pollution exist in Mpumalanga, ranging from veld fires to industrial processes, agriculture, mining activities, power generation,	Dust generated by drilling and blasting activities as well as the transport of coal along gravel roads will cause an increase in the fugitive dust in the area.

18		paper and pulp processing, vehicle use and domestic use of fossil fuels (Mpumalanga Province, 2002).	Emission of carbon dioxide in exhaust fumes and smoke is generally of little consequence in isolation, but contributes to the regional air quality problems in Mpumalanga, and also to the larger, global issue of climate change.
19	Noise	Noise generated by mining activities is related to blasting and use of equipment and vehicles. However, noise is directional, and dissipates with distance. The spatial distribution of mines and related operations in the region reduces noise impacts inherently. However, when the noise is generated near residential areas, the location of the I&APs within the noise transmission paths together with the actual generation of noise cumulatively increases the significance of the impact.	Noise impacts on nearby residential locations.
20	Socio-Economic	The annual household income for Mpumalanga remains fairly low, with most households earning less than R18 000 per annum. Adult literacy has improved in the past two decades, but still remains below the national average and many scholars do not complete their matriculation exams. Approximately 33% of the provinces population is unemployed.	Greenside Colliery currently provides jobs for 914 people and funds and participates in community projects. The positive impacts of Greenside Colliery on the regional socio-economic conditions during the Operational Phase are discussed in Part 4.
21		Mine closure will raise unemployment levels in the region, and would increase significantly as more mines close down.	All positive impacts of the mine on the socio-economy that will have taken place during the Operational Phase will wane during the Decommissioning Phase until they cease, mainly due to the reduction or cessation of jobs and the cessation of demand for goods and services.

22			Rehabilitation of the surface to support 90% of the pre-mining land capability means that future land use of the site will be sustainable over the long-term. Use of the land for agricultural purposes such as crop cultivation or grazing will enable the contribution of future land users to the local and regional socio-economy through food production and agricultural job creation.
23	I&APs	The use of provincial roads by heavy duty vehicles for the haulage of coal from the mines in the region leads to the deterioration of the public roads and increased safety hazards for all road users, particularly in poor visibility conditions which occur frequently on the Mpumalanga Highveld due to the weather (mist).	Heavy goods vehicles are used to transport coal from the Greenside Colliery to the domestic market. Coal is mainly transported by rail and conveyor, and so Greenside Colliery does not contribute significantly to the increased road hazards in the region.
24		I&APs are generally affected indirectly by direct impacts of mining and related activities on environmental aspects. The location of I&APs in relation to the mining and related activities strongly influences the severity of the impacts.	Impacts on air quality, noise, vibrations, surface water, groundwater and visual impacts will cumulatively impact on I&APs

7.5 ENVIRONMENTAL IMPACT STATEMENT

In accordance with the EIA Regulations GN R543 31 (2) (n), an environmental impact statement which contains— (i) a summary of the key findings of the environmental impact assessment; and (ii) a comparative assessment of the positive and negative implications of the proposed activity and identified alternatives;

7.5.1 Summary of key findings

7.5.1.1 Significant environmental impacts (negative)

The table below provides a summary of significant environmental impacts that after mitigation, will remain of high significance.

Table 63: Summary of significant environmental impacts (negative), after mitigation.

TOPOGRAPHY	
Permanent change in topography: The proposed new discard dump will reach a maximum height of 55 metres. The facility will be developed from the lowest point adjacent to the N12 highway and progressively	H

developed towards the south As the development of the discard facility progress this will cause a permanent change in the topography. This change in topography will continue until post closure.	
SURFACE WATER	
Receiving Surface Environment: Impacts on surface water quality due to erosion, affected water runoff and loss of catchment. If not mitigated the impact may be irreversible.	H
GROUNDWATER	
Utilisation of the discard dump A range of scenarios involving alternative measures for seepage flux control during the operation of the 3A North discard dump. These options have included simulation of the effects of a basal liner, plus a range of covers of variable efficiency. The conclusion drawn from this exercise is that basal liner emplacement, while forming the only viable measure for infiltration control during active operations, is likely to result in adverse geotechnical stability conditions, in conjunction with underground mining. It is therefore considered preferable to defer infiltration/seepage control to closure, at which time a low permeability engineered cover should be installed. In the absence of a basal liner, an alternative approach to impact mitigation during operations may viably involve gradient reversal via the construction of a pumping well curtain down-gradient of the dump. This would effectively isolate the contaminant plume associated with operational phase seepage to the immediate vicinity of the dump footprint.	H
AIR QUALITY	
Mine Operation Greenside Colliery is primarily an underground bord and pillar mine, minimising surface dust fallout. However, the inherent air quality of the area is considered poor and is impacted on by the activities of adjacent collieries, industry, and vehicle use and veld fires. Furthermore, dust generation occurs from the discard existing discard dump on-site. Under the assumption of background conditions remaining the same as for the construction phase (low PM concentrations) the operational phase would result in mainly incremental impacts as the progressive development of the discard dump will add to the impacts on the air quality of the area.	H

7.5.1.2 Positive environmental impacts

The project will result in a number of positive impacts that relate primarily to economic growth and job creation as reflected in the table below.

Table 64: Summary of environmental impacts (positive), after mitigation.

SOCIO-ECONOMIC	
The products from the mining operations at Greenside Colliery are sold to the South African and international markets. SACE employs more than 900 people at Greenside Colliery. The existing education programme implemented at the mine comprises of the following elements: • New schools. • Adult education. • Vegetable garden. • Life skills inclusive of sewing, cooking, health, environmental awareness and entrepreneurial skills. • Community schools. The safe continuation of the mining and related activities at the Greenside Colliery continues employment of staff at the Greenside Colliery as well as the continued supply of coal to the local market. As a result of the multiplier effect, the continued operation of the existing Greenside Colliery will benefit the local, regional and national economy. Should Greenside Colliery not construct the new Discard Dump they may be forced to cease operation. Should this have occurred, jobs of personnel currently employed will be lost and the local, regional and national economic benefits of the continuation of the mining and related activities would have been lost. Mine closure will raise unemployment levels in the region, and would increase significantly as more mines close down.	Positive

7.5.2 Comparative assessment of positive and negative implications of the proposed activity and alternatives

Section 6 contains a detailed investigation and comparative assessment of the alternative options for the new Discard Facility Project activities, including the positive and negative implications of the proposed activity and identified alternatives.

7.5.2.1 Alternatives in terms of the location of the discard facility

Based on the comparative assessment in terms of the Environmental, Technical/Engineering, Economical and Social categories, the Groenfontein Site has received the highest comparative Score. Technically and economically this site will be the most suitable for the project.

Currently the preferred option based on the findings of the above mentioned comparisons is Option 4: Groenfontein. This option has therefore been described in Part 3 of this document for approval.

7.5.2.2 Land use or development alternatives

The following land use alternatives have been identified and were investigated, which include

- Utilisation of the surface area for the new discard facility.
- Utilise the surface area for grazing of livestock.
- Utilise the surface area for crop production.

Major impacts associated with each land use alternative have been summarised for comparative purposes. Each proposed land use alternative will impact on the natural environment at the proposed site.

The grazing option will be the most viable environmental option. However, the discard facility might not be as environmentally favoured, but it will significantly contribute to the socio-economic environment and allow continuation of mining operations, compared to that of the grazing and crop production options. The discard facility is the preferred land use option and has been further discussed in Part 3 of the document.

7.5.2.3 Alternatives in terms of road infrastructure

The following alternatives were identified with regard to the type of access routes to and from the new discard facility and associated infrastructure:

- Tar road.
- Gravel road.

From the comparative assessment it is evident that the gravel road will be the most feasible option.
Since tarred roads are expected to be more resilient, it is intended to construct tarred roads in order to gain access to the proposed site. This will also aid in minimising the cumulative impacts of dust within and around the site. However the haul roads to be used by the haul trucks will remain gravel road.

7.5.2.4 Alternatives in terms of layout of the discard facility

The following alternatives were identified with regard to the layout of the discard facility and associated infrastructure (refer to Table 55):

- Discard facility within the 100 m wetland buffer.
- Discard facility outside of the 100 m wetland buffer.

It is evident that the constructing the discard facility outside the 100 meter wetland buffer will be the most viable option environmentally, socially and economically. From the comparative assessment constructing the discard facility within the 100m wetland buffer may accommodate for more land space, but the risks of constructing a discard facility within a wetland area outweighs the benefits...

Constructing the discard facility outside of the 100 meter wetland buffer is the most feasible option for this project and the discard dump facility has been designed to accommodate for this, making it the preferred option.

7.5.2.5 Alternatives in terms of the location of the dams

- Pollution control dam within the 100m wetland buffer.
- Pollution control dam outside of the 100m wetland buffer on an undisturbed area.
- Pollution control dam outside of the 100m wetland buffer in an old borrow pit.

Constructing the pollution control dam outside the 100 meter wetland buffer within an old borrow pit will be the most viable option environmentally, socially, technically and economically. From the comparative assessment constructing the pollution control dam within the 100 m wetland buffer accommodates for more land space but the risks of constructing the pollution control dam within the wetland area outweighs the benefits. By constructing the pollution control dam outside the 100 m wetland buffer but still within undisturbed land will significantly contribute to environmental loss.

Constructing the pollution control dam outside of the 100 meter wetland buffer within a disturbed area (borrow pit) is the most feasible option for this project environmentally, socially, technically and economically, making it the most feasible option.

7.5.2.6 Consequences of not proceeding with the proposed project (no project alternative)

The ‘No Project’ alternative has been investigated in terms of the above-mentioned alternatives.

The ‘No Project’ alternative is not considered due to the anticipated benefits of the proposed new discard facility. Expected indirect benefits of the proposed project include:

- Continued employment of staff.
- Potential for the creation of additional jobs.
- Continued upliftment of the surrounding communities.
- Rehabilitation of environmental issues within the wetland areas.
- Continued supply of coal to the local, national, and international markets, and therefore contribution to local, provincial and national economy.

Should the ‘No Project’ option be implemented, jobs of workers that are currently employed at the Greenside Colliery may be compromised. In addition, the Greenside Colliery will not be able to continue to supply coal to the existing markets at the current rate of demand. Positive impacts of the proposed project would also be lost if the no-project option is carried out.

The ‘No Project’ option is not considered to be the preferred project alternative.

8. ENVIRONMENTAL MANAGEMENT PROGRAMME

8.1 TOPOGRAPHY

8.1.1 Temporary change in Topography

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Impact description: The North area of the proposed site is characterised by gentle undulating platue which varies between 1600 mamsl in the south and 1540mamsl in the north. The lowest point is at 1540 mamsl where the extreme north of pit 3A of Kleinkopje approaches the Greensidespruit. The southern edge of the proposed site runs roughly along a minor watershed. The proposed site thus has no streams running onto the site. The Greensidespruit does however begin on the site and bisects the site, flowing from the south to the north. Temporary stockpiling of topsoil, construction and operation of the Overland Conveyor System, Discard Silo., Haul roads, Dirty and Clean Water Separation Systems, The Workshop Complex, The Office Complex, including Water and Sewage system for the workshop and offices, Diesel storage tanks, Power Lines, and Pollution Control Damwill cause a temporary minor change in topography until the closure of the mine when the infrastructure will be demolished. Extent of impact: Local Duration of impact: Until the decommissioning phase. Degree to which impact will cause irreplaceable loss: Impact will not result in the irreplaceable loss as the topography of the affected areas can be rehabilitated back to their natural state during the decommissioning phase.	Topography to be disturbed to be kept at a minimum.	Degree to which impact can be reversed: Reversible Mitigation The disturbance area for the construction of the overland Conveyor System, Discard Silo., Haul roads, Dirty and Clean Water Separation Systems, The Workshop Complex, The Office Complex, including Water and Sewage system for the workshop and offices, Diesel storage tanks, Power Lines, and Pollution Control Dam will be kept at a minimum and in the designated areas as indicated on the design for the proposed project attached hereto as Plan 3a in Appendix A. Topsoil and subsoil will be stripped from the proposed footprint areas before construction starts. All topsoil stockpiles should also be protected by berms to prevent erosion of stockpiled material and to divert surface water runoff around the material. Topsoil stockpiles should not have steep slopes that encourage the possibility of erosion Ensure topsoil stockpiles do not exceed a height of 1.5 metres. Topsoil removed from the construction areas must be stockpiled in the designated areas as indicated in Plan 3a of Appendix A where the stockpiles are positioned to be located downslope of the dirty water areas away from seepage zones, flood lines, water courses and other ecological sensitive areas. Should these stockpiles become a source of windblown dust, they must be covered by plastic sheeting or vegetated with indigenous vegetation. All alien invasive flora should be removed from the stockpiles.	Planning and Construction Phase	Greenside Colliery Environmental Manager	Regular site inspections by ECO

8.1.2 Permanent change in Topography

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Impact description: The North area of the proposed site is characterised by gentle undulating platue which varies between 1600 mamsl in the south and 1540mamsl in the north. The lowest point is at 1540 mamsl where the extreme north of pit 3A of Kleinkopje approaches the Greensidespruit. The proposed new discard dump will reach a maximum height of 55 metres. The facility will be developed from the lowest point adjacent to the N12 highway and progressively developed towards the south As the development of the discard facility progress this will cause a permanent change in the topography. This change in topography will continue until post closure. It is expected that storm water will attenuate on top of the discard dump and toe seepage should also occur due to rainfall infiltration. Extent of impact: Local Duration of impact: Permanent Degree to which impact will cause irreplaceable loss: A potential permanent change to the topography will occur, that may through possible future reworking of the dump be reversed. No irreplaceable loss of resource will occur associated with topography.	Preserve and prevent the sterilisation of natural resources (loss of soil and surface water).	Degree to which impact can be reversed: Potentially reversible if dump is reworked. Mitigation: The disturbance area for the Discard Facility will be kept at a minimum and in the designated area as indicated on the design for the proposed project attached hereto as Plan 3b in Appendix A. The Discard dump will be progressively rehabilitated with 500 mm of compacted sub soil and 300 mm of un-compacted top soil and vegetated. The facility will be developed from the lowest point adjacent to the N12 highway and progressively developed towards the south. This will keep the dirty water run-off length to a minimum and allow clean water to be diverted clear of the developing footprint Topsoil and subsoil will be stripped from the proposed footprint are. Topsoil and subsoil will be stripped from the proposed footprint areas before construction starts. All topsoil stockpiles should also be protected by berms to prevent erosion of stockpiled material and to divert surface water runoff around the material. Topsoil stockpiles should not have steep slopes that encourage the possibility of erosion Ensure topsoil stockpiles do not exceed a height of 1.5 metres. Topsoil removed from the construction areas must be stockpiled in the designated areas as indicated in Plan 3a of Appendix A where the stockpiles are positioned to be located downslope of the dirty water areas away from seepage zones, flood lines, water courses and other ecological sensitive areas. Should these stockpiles become a source of windblown dust, they must be covered by plastic sheeting or vegetated with indigenous vegetation.	All Phases	Greenside Colliery Environmental Manager	Regular site inspections by ECO ECO to verify that rehabilitation plan developed, covering all specific requirements and risks as identified within the EIR. Records of ECO audit, internal audits and rehabilitation monitoring records to be kept on site, with evidence of corrective measures undertaken.

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
		All alien invasive flora should be removed from the stockpiles. A grass mix should be selected for rehabilitation of the discard dump. The selected grass mix should consist of a mix of quick covering grassed pioneer species mat-forming grasses (e.g. *Gynodon dactylon, Chloris gayana*) and tufted grasses (e.g. *Eragrostis curvula*) to ensure prompt and adequate coverage of the exposed soil whilst also achieving long-term stability. Alternatively, the current seed mix may be used as per Greenside Colliery's Original Environmental Management Programme Report. The chemical and physical properties of top soil to be used for the purposes of rehabilitation must not be changed by introducing foreign material, gravel, rock, rubble or mine residue to such soil."			

8.2 SOIL, LAND USE AND LAND CAPABILITY

8.2.1 Erosion and loss of topsoil

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Impact description: The soils presented on the site are typical of the Highveld catena with deep red apedal strctureless soils (Hutton, Bainsvlei) present on the upper slope with an average dept of 1000mm, yellow and brown soils (Clovelly, Griffen, Glencor, Avalon) of shallower depth (approximately 750mm), on the mid and lower slopes. Soils towards the base slope become beached sandier and grey (Dresden, Mispah) with an average dept of 500mm. The footprint of the proposed discard facility will be approximately 115 ha with a maximum height of 55 m and will be developed progressively from the lowest point	To conserve topsoil and prevent erosion	Degree to which impact can be reversed: Reversible Mitigation-Erosion: Erosion prevention measures (e.g. grass, cement or rock) should be in place at all concentration points. These areas include roads, trenches, berms and other infrastructure that may increase surface runoff.	Planning/ Construction and Operational phases	Greenside Colliery Environmental Manager	Audits to be undertaken by Environmental Department, with more regular internal audits when required (e.g. after

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
adjacent to the N 12 highway towards the south. Topsoil and subsoil will be progressively stripped from the proposed footprint area and development of the discard dump will take place on a compact base. Topsoil and subsoil will also be stripped from the footprint areas where the infrastructure is being constructed. Stripping and stockpiling of soils during the construction phase could have a permanent negative impact on the quality of soils if not stripped according to a well-structured and executed soil stripping and stockpiling plan. Topsoil availability may be very limited due to the unrehabilitated void of the 3A north open-pit. Impacts associated with such a loss, will also impact on the final rehabilitation during closure phase. It is expected that storm water will attenuate on top of the discard dump and toe seepage should also occur due to rainfall infiltration. The discard facility will cause significant disturbance to soil, including potential erosion if drainage and storm water are not managed and controlled.		Erosion of access roads should be addressed by implementing energy dissipaters to drain surface runoff away from the roads if necessary. All berms should be inspected regularly for cracks that reduces the integrity of the structures. Vegetation growth should be encouraged on the berms to limit erosion. Regular inspections will be undertaken and if signs of erosion are identified, mechanical inputs will be required. Mitigation-Topsoil preservation Undertake a detail survey for the identification of topsoil and the depth thereof. The person responsible for the identification should be competent and have the relevant experience. Identified topsoil and the depth thereof should be clearly indicated as contours of topsoil depth on a surface layout plan and clearly marked by the survey department in the field. Based on the construction activities required, mine planning should include the removal and storage areas in the planning program and layout plans. The volumes of the different topsoil heaps must be calculated and added to the surface layout plan. This is done to ensure that when rehabilitation is required the volume required and the volume available can be compared (topsoil balance). The topsoil should be stripped to a maximum depth as measured during the initial survey, and after stripping verified for effectiveness of stripping. Topsoil and subsoil will be stripped from the proposed footprint areas before construction starts and at the discard dump area progressively as the dump progress. All topsoil stockpiles should			heavy rainfall events Audit reports to be kept on site, with evidence of corrective measures taken to be kept.) Topsoil survey records

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
		also be protected by berms to prevent erosion of stockpiled material and to divert surface water runoff around the material. Topsoil stockpiles should not have steep slopes that encourage the possibility of erosion Ensure stockpiles do not exceed a height of 1.5 metres. Topsoil removed from the construction areas must be stockpiled in the designated areas as indicated in Plan 3a of Appendix A where the stockpiles are positioned to be located downslope of the dirty water areas away from seepage zones, flood lines, water courses and other ecological sensitive areas. Should these stockpiles become a source of windblown dust, they must be covered by plastic sheeting or vegetated with indigenous vegetation. All alien invasive flora should be removed from the stockpiles. The discard should be capped with topsoil and the soil ripped to prevent compaction and then seeded with native grass species. This will also have the added effect of reducing erosion on the sides of the faci			

8.2.2 Chemical alteration of soils

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Impact description: Soil structure loss will occur as a result of a number of operational activities. Key impacts that may arise that can result in a loss of soil structure include:	To conserve soil and land capability	Degree to which impact can be reversed: Impact is reversible but at cost (e.g. sourcing of soil, and undertaking of soil rehabilitation) Mitigation	Construction and Operation Phases	Greenside Colliery Environmental Manger	ECO to verify that these requirements are implemented.

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Storm water runoff, dirty water trenches, overflow from affected water storage facilities and seepage of discard dump that could impact on the soil structure of the immediate surrounding areas permanent, but will be localised to the specific structures. At vehicle maintenance areas, soil contamination by hydrocarbon contaminating waste water. Seepage of hydrocarbons into groundwater may further take place through the pathway of the contaminated soil, and may extend beyond area of impact. Lubricant, fuel and chemical spillages arising from chemical storage and handling, bulk fuel storage and vehicle refueling activities. Seepage into groundwater may further take place through the pathway of the contaminated soil, and may extend beyond area of impact. Loss of soil structure at the discard dump during the operational phase that will be permanent but localized to the area. Extent of impact: Impact may extend beyond the life of mine. Duration of impact: Extending beyond incident if no mitigation measures applied. Degree to which impact will cause irreplaceable loss: Impact may result in irreplaceable loss if no mitigation measures are implemented.		To ensure that the area to be disturbed by construction activities is to be kept to a minimum, only large enough to carry out the necessary activities as indicated on the design for the proposed project attached hereto as Plan 3a in Appendix A. Affected runoff from the plant areas and the discard dump will be collected and contained in the affected water management system, with further diversion of the clean water. Conceptual water management strategies are contained within the stormwater management plan and civil engineering designs of the approved by a registered professional civil engineer (Appendix A). The 3A north pollution control dam must be designed according to the design plans (Appendix A). The dam should be lined with a plastic lining of 2mm in thickness and the pump station to be installed should regularly maintained and water should be pumped from the pollution control dam to the return water dam located across the N12 highway for process purposes. to prevent overflow and to be used during emergency conditions Implement a planned maintenance programme covering the affected water management circuit. This maintenance programme to assess aspects of siltation, capacity and containment integrity. Subsoil drainage is to be incorporated under the liner of the 3A North pollution control dam to detect potential leakages and spillages. This will act as a barrier for groundwater that may permeate the water table. The mines existing emergency response plan should be updated to include activities associated with the new discard dump. Equipment and Vehicle Storage Area: Areas of open ground that are to be utilised (i.e. equipment and vehicle storage) should be hard standing. Furthermore, a clean			Internal audits by Environmental Department Emergency Response Procedure Surface water quality monitoring (monthly), groundwater monitoring (quarterly) and bio-monitoring reports (bi-annual submission to the relevant competent authority) GN704 Compliance Audit report

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
		and dirty water separation system must be constructed to ensure that no contamination of clean water systems occurs. Should a spillage or leakage of a hydrocarbon, chemical or hazardous substance occur, the spill/leakage must be cleaned up as per EP 14 Oil, Fuel and Chemical Spill Cleanup and EP 09 Environmental Incidents, Non-conformance and Complaints. Ensure that areas containing chemical and hazardous substances are contained (e.g. in a bund) to ensure no contamination of surrounding water resources or soil is contaminated. The bunded area must be able to contain 110% of the total volume of materials stored at any given time. Also follow the procedure EP18 on Handling and Storage of hazardous materials Small quantities (50 litres or less) of chemical and hazardous substances (oil, lubricant, etc.) shall be stored in appropriate containers within a secure storage area. The base of the storage area should be impervious and designed to ensure that the contained substances do not infiltrate into the soil. Regular inspections of the integrity of all bund areas will be undertaken. MSDS for on-site chemicals, hydrocarbons and hazardous substances must be readily available. A MSDS should include information pertaining to environmental impacts and measures to minimise and mitigate against any potential environmental impact which may result from a spill. Used fuels, oil, hydraulic fluids, paints, solvents, and grease should be stored in drums or other suitable containers and stored on a hardstanding and impermeable surface. These should be labelled, sealed and removed from the site to an appropriate disposal site or recycling facility. Under no circumstances will			

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
		these substances be disposed of on-site or into the surrounding environment. No mixing or storing of concrete is permitted on areas where topsoil will be stockpiled. A designated area should be demarcated to prepare concrete in order to minimise soil contamination. The area should contain any potential runoff. Soils that may be contaminated during the construction and operational phases are to be removed to prevent the contamination of the soils, surrounding surface water or underlying groundwater. Contaminated soil must be removed from site as hazardous waste. All construction materials used may be temporarily stored on-site, but bags and containers should be sealed during storage. All leakages, spillages and incidents must be cleaned-up and reported as per EP 14 Oil, Fuel and Chemical Spill Cleanup and EP 09 Environmental Incidents, Non-conformance and Complaints. No vehicles or equipment may be repaired or washed on-sites other than the designated washbay area and maintenance workshop at the Workshop Complex. Temporary drip trays must be placed underneath vehicles or equipment that are leaking hydrocarbons until such a time that they are repaired. The liberation of dust into the surrounding environment must be effectively controlled by the use of water spraying and/or other dust-allaying agents. The speed of vehicles must be strictly controlled to a maximum speed of 40km/h to avoid dangerous conditions, excessive dust or excessive deterioration of the roads. Monitor effectiveness of mitigation measures:			

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
		Implement the surface water (monthly), groundwater (quarterly) and bio-monitoring programme (biannually) as within the receiving surface water environment (Greensidespruit). Dust monitoring should be conducted in accordance to the Dust monitoring Procedure EP22. Undertake annual GN 704 compliance audits, to verify the effectiveness of clean/affected water separation. Any shortcomings, with further consideration to the surface water monitoring results, should be addressed as a matter of urgency. Regular site inspections to be undertaken to assess if spillages or soil pollution incidents have occurred. Such incidents shall be reported (use of the incident reporting procedure), and immediately corrected.			

8.2.3 Waste management

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Impact description: The incorrect handling and disposal of general waste, scrap metal and industrial waste (e.g. waste tyres) will have a long-term impact on the local area. Impact will not only effect soil but could also impact on the habitat of fauna and impact of fauna, surface water and groundwater. In addition, the visual character of the area will be impacted on. The incorrect handling and disposal of hazardous waste can also have a permanent negative impact on the local area. Soil, water sources and fauna habitats can be adversely affected and human health can be impacted on. Extent of impact: Impact may extend beyond the mine. Duration of impact: Extending beyond the life of mine if no mitigation measures applied.	To conserve soil and land capability	Degree to which impact can be reversed: Impact is easily reversible. Mitigation The project site should be kept in an orderly state at all times. Littering is prohibited. Suitably covered receptacles must be available at all times and conveniently placed for the disposal of waste. These receptacles will be removed to the central salvage yard before being removed from site and disposed of by a permitted contractor at a licensed site. While being stored on-site, the receptacles should be placed within designated areas on an impermeable surface and must be correctly labelled and/or adequately colour coded.	Commence during Construction phase	Greenside Colliery Environmental Manager	ECO to verify compliance during 6 monthly audits, and further internal audits on more regular basis (by Greenside Colliery) to confirm compliance.

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Degree to which impact will cause irreplaceable loss: Impact may result in irreplaceable loss if no mitigation measures are implemented.		Hazardous and general waste will be separated at source, with separate waste bins provided in accordance to the waste management procedure EP 12 Waste Management. Under no circumstances is waste to be burnt or buried on-site. Records of hazardous waste being taken off-site must be kept as evidence. All leakages, spillages and incidents must be cleaned-up and reported as per EP 14 Oil, Fuel and Chemical Spill Cleanup and EP 09 Environmental Incidents, Non-conformance and Complaints. All general and hazardous waste material will be disposed of at registered waste sites (appropriate to the type of waste as disposed of). Certificates of safe and legal disposal shall be kept on file at the mine. Documentation (waste manifest) will be maintained detailing the quantity, nature and fate of any regulated waste. Management and disposal of waste will be in accordance with relevant legislative requirements, including the use of licensed contractors.			Records of all audit reports and corrective actions taken to be kept at site. Register depicting monthly volumes and types of waste as generated and disposed

8.2.4 Land use and capability

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Impact description: The pre-mining land capability of the surface area of Greenside Colliery was pre-dominantly that of agriculture and grazing. 61% of the surface area was capable of arable production (the growing of crops) with a further 25% of the surface area having grazing potential. The remaining 14% was classified as that of wilderness and wetland areas (WMB, 2002). The pre-mining land use of the site was predominantly that of agriculture with 13% of the land being occupied with wetlands, dams and pans. The arable areas to the east and west of the proposed site are actively cropped, with dry land maize constituting the principle crop. Open grassland areas (both natural veld and rehabilitated areas) are grazed at a low intensity. The south central portion of the site is derelict on account of past, unrehabilitated, opencast activity. A large portion of the area within the eastern portion of the site is currently under a mixed wattle / grassland community. To the south, the density of wattle is such that the grazing value of the land is currently lost. About 72% of the proposed site has arable potential. Much of the arable land within the site will be lost due to the proposed new discard facility project. As noted in the original EMPR, evidence of minor soil erosion in the cultivated areas exists. The central and eastern portion of the site is however heavily infested with black wattle. A large portion of the site has been impacted on by past opencast mining. Extent of impact: Site Duration of impact: Permanent Degree to which impact will cause irreplaceable loss: Will lose high agricultural potential that through rehabilitation can in future be utilised for agricultural land use.	To prevent or minimise the impact on land use and land capability	Degree to which impact can be reversed: Through effective rehabilitation, land use can be reverted back to agriculture, although there will be loss in high agricultural potential. Mitigation Use of topsoil for rehabilitation, that contains the seeds of alien vegetation, will not be permitted unless a program to germinate indigenous seed and eradicate alien seedlings is implemented. All compacted areas should be ripped to a minimum depth of 300 mm to allow organic contaminants to breakdown and promote vegetation establishment. Should soil analysis depict, fertilizer is to be placed on the area as per Greenside Colliery's Original Environmental Management Programme Report. A grass mix should be selected for rehabilitation of disturbed open areas. The selected grass mix should consist of a mix of quick covering grassed pioneer species mat-forming grasses (e.g. Gynodon dactylon, Chloris gayana) and tufted grasses (e.g. Eragrostis curvula) to ensure prompt and adequate coverage of the exposed soil whilst also achieving long-term stability. Alternatively, the current seed mix may be used as per Greenside Colliery's Original Environmental Management Programme Report. It is imperative that alien invasive species are continually controlled in all rehabilitated areas. Greenside Colliery must compile and implement a procedure for ongoing monitoring to assess the progress of rehabilitation. A closure plan will be developed allowing for annual refining of objectives and commitments based on progress made with rehabilitation and mining activites.	All project phases	Greenside Colliery Environmental Manager	ECO to verify that rehabilitation plan developed, covering all specific requirements and risks as identified within the EIR. Records of ECO audit, internal audits and rehabilitation monitoring records to be kept on site, with evidence of corrective measures undertaken. Annual submission of quantum to relevant competent authority.

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
		Financial provision will be calculated annually to determine the premature closure cost required to fund the closure of the mining operation at any stage of the mining operation. Rehabilitation and closure planning must ensure the protection and rehabilitation of soil and land use resources within the mine area.			

8.3 VEGETATION

8.3.1 Site Clearing: removal of topsoil and vegetation.

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Impact description: The Flora report for the proposed project indicates that the mine lies within the grassland biome, as within that area the Eastern Highveld Grassland vegetation type. This variation occurs on flattish sandy country in which the dominant species include *Tristachya leucothrix, Eragrostis racemosa, Heteropogon contortus, Trachypogon spicatus, Digitaria tricholaenoides, Themeda triandra* and others. The vegetation type is considered to be ***Endangered*** nationally with none conserved and 43% altered, primarily by cultivation. Any remaining areas of natural grassland within this vegetation type should therefore be considered to have a high conservation value. The major land-use activities in the study area include agriculture and mining. Both activities have transformed large parts of the surface rights area of the mine leaving small patches of natural vegetation located primarily along the drainage lines. The area comprises largely of grassland which is typical of the area, as well as seasonal wetlands and 'wet' vegetation surrounding the dams. Areas which have previously been developed have poor vegetation which can be described as	To prevent the destruction/loss of plant species	Degree to which impact can be reversed: Reversable Mitigation: With mitigation measures it may be possible to reduce the impacts on the flora of the project area. This can be done by re-vegetating the mineral discard facility by placing topsoil, ripping and seeding the rehabilitated dump in order to encourage the growth of grasses. These grasses would then provide habitat for the displaced animals thus mitigating against the initial habitat loss and will also prevent soil losses by wind and/or stormwater erosion. Minimise the footprint as far as possible to mitigate impacts associated with the clearance of existing vegetation; Keep clean and dirty water systems separate and ensure that dirty water is not discharged into the environment to avoid impact occurring to flora and fauna species; and	Operational and Closure Phase	Greenside Colliery Environmental Manager	Rehabilitation monitoring to be undertaken by suitably qualified rehabilitation specialist (in consultation with ecologist). Monitoring frequencies as per the rehabilitation plan. Records of ECO audit,

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
secondary plant community. A proportion of the land is currently under crop cultivation. Furthermore there exists an alien vegetation community (*Eucalyptus* stand). Vegetation communities which were delineated for the Greenside Project area are as follows; • Remnant Natural Grassland Community; • Secondary Grassland Community; • Wetland Community; • Dam Vegetation Community; • Transformed Areas; which comprise of Agricultural fields (predominantly maize), Alien Vegetation (plantations of Eucalyptus etc.), and Development (Mining infrastructure and residential buildings); and • These communities are described in greater detail in the following sections. No threatened species were encountered during the field survey of the study area. According to the Flora study the discard facility is proposed to be constructed on an area that is already heavily modified. The land offers low biodiversity value and it is therefore not anticipated that the development of the discard facility will impact severely on the current surrounding environment if it is properly rehabilitated. Extent of impact: Impact may extend beyond the life of mine. Duration of impact: Extending beyond the life of mine if no mitigation measures applied. Degree to which impact will cause irreplaceable loss: Impact may result in irreplaceable loss if no mitigation measures are implemented.		Keep infrastructure out of wetland vegetation (impacts assessed in the Wetland Specialist Report, compiled by Digby Wells, 2013) areas to minimise impact to flora and fauna as these areas are important habitat types. A grass mix should be selected for rehabilitation of disturbed open areas. The selected grass mix should consist of a mix of quick covering grassed pioneer species mat-forming grasses (e.g. *Gynodon dactylon, Chloris gayana*) and tufted grasses (e.g. *Eragrostis curvula*) to ensure prompt and adequate coverage of the exposed soil whilst also achieving long-term stability. Alternatively, the current seed mix may be used as per Greenside Colliery's Original Environmental Management Programme Report.			internal audits and rehabilitation monitoring records to be kept on site, with evidence of corrective measures undertaken.

8.3.2 Enchroament of alien invasives

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Impact description: According to the flora study; given the current density of alien trees largely wattles it is likely that the population will continue to expand if no management action is taken place Invasive plants may establish due to surface area disturbance and also through future rehabilitation activities (e.g. seeding practices). This may lead to: • Displacement of indigenous vegetation; • Change in plant species composition; • Change in vegetation composition and structure; • Competition for sunlight and 'living space' will increase between indigenous and alien species; • Loss of habitat and a change in biodiversity. • Change in flammability of existing vegetation structure – pending the introduction of the alien species; Extent of impact: The impact could spread beyond area of disturbance. Duration of impact: Permanent Degree to which impact will cause irreplaceable loss: Not applicable, but if no mitigation is implemented, this may result in irreplaceable loss.	To prevent the destruction/loss of plant species	Degree to which impact can be reversed: If no mitigation is implemented, the impact may be irreversible. Mitigation: Control of alien plant species is essential to restore the natural biodiversity of the landscape. Alien trees utilise excessive amounts of water and often out compete local plants due to their lack of parasites. Removal of alien plants can lead to a net gain in biodiversity as the natural grassland is rehabilitated. Implement an alien invasive control procedure for the area	Construction phase until post-closure.	Greenside Colliery Environmental Manager	ECO to verify that alien and eradication programme has developed and verify effective implementation (e.g. records of identification and eradication)

8.4 ANIMAL LIFE

8.4.1 Habitat transformation due to surface clearance

Environmental impact, extent, duration, significance and degree to which impact has caused irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Impact description: The environment at Greenside Colliery is largely disturbed. Large parts of the project area have been modified and disturbed as a result of mining and agriculture. Few	To prevent the transformation and loss of habitat.	Degree to which impact can be reversed: If no mitigation is implemented, the impact will continue.			Rehabilitation monitoring to be undertaken

Environmental impact, extent, duration, significance and degree to which impact has caused irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
small patches of natural vegetation in the form of what can be termed primary grassland and secondary grassland have not been transformed, or are in a state of rehabilitation. These lie fragmented throughout the area. These patches support higher levels of biodiversity and provide suitable habitat which contrasts their largely modified, inhospitable surrounds. Other natural areas which are not considered modified are wetlands, which lie along the drainage lines which provide varied habitat for a number of species and the Dam areas, which are similarly host to a number of species surrounding the open water. The following habitat types were identified within the project area; • Natural Grassland Habitat; • Natural Secondary Grassland Habitat • Wetland Habitat; • Dam Habitat; and • Transformed habitat (Including Residential and mining development). Various natural and introduced species were identified within these habitats during the field survey undertaken by De Castro and Brits (De Castro Brits, 2006), Two mammal species, 75 bird species, two reptile and one frog species were recorded at Greenside Colliery and has also been confirmed from additional reconnaissance surveys conducted in 2013. These low species numbers reflect the habitat modification and disturbance which has occurred within the Greenside project area. According to the fauna study the current land-uses has impacted on faunal habitat, resulting in loss and degradation of habitat. The study area is already heavily modified. The land offers low biodiversity value and it is therefore not anticipated that the development of the mineral discard facility will impact severely on the current surrounding environment if it is properly rehabilitated. Extent of impact: Effect limited to the activity and its immediate surroundings. Duration of impact: Long-term and will last more than 5 years if not mitigated		Mitigation: With mitigation measures it may be possible to reduce the impacts on the fauna of the project area. This can be done by re-vegetating the mineral discard facility by placing topsoil, ripping and seeding the rehabilitated areas in order to encourage the growth of grasses. These grasses would then provide habitat for the displaced animals thus mitigating against the initial habitat loss and will also prevent soil losses by wind and/or stormwater erosion. Removal of alien plants can lead to a net gain in biodiversity as the natural grassland is rehabilitated. The following mitigations measures are proposed: • Minimise the footprint as far as possible to mitigate impacts associated with the clearance of existing vegetation; • Implement an alien invasive control procedure for that area; • Keep clean and dirty water systems separate and ensure that dirty water is not discharged into the environment to avoid impact occurring to flora and fauna species; and • Keep infrastructure out of wetland vegetation (impacts assessed in the Wetland Specialist Report, compiled by Digby Wells, 2013) areas to minimise impact to flora and fauna as these areas are important habitat types.	Construction phase until post-Closure	Greenside Colliery Environmental Manager	by suitably qualified rehabilitation specialist (in consultation with ecologist). Monitoring frequencies as per the rehabilitation plan. Records of ECO audit, internal audits and rehabilitation monitoring records to be kept on site, with evidence of corrective measures undertaken.

Environmental impact, extent, duration, significance and degree to which impact has caused irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Degree to which impact has caused irreplaceable loss: If no mitigation is implemented, this may cause loss of habitat.					

8.5 SURFACE WATER

8.5.1 Receiving surface environment (impacts resulting from erosion, affected water runoff and loss of catchment)

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Impact description: In general, the mine boundary area is located in the headwaters of the Naauwpoortspruit, the origin about 2 km west of the mine boundary area. The Naauwpoortspruit flows into the eMalahleni Dam 15 km east of the mine boundary area. A tributary of the Naauwpoortspruit, the Greensidespruit, originates in the mine boundary area. Greenside Colliery is situated within the, primary catchment B (Olifants River Catchment area), secondary catchment B1 and B2, quaternary catchments B11F, B20G and B11G. The Upper Olifants River Catchment is located on the eastern Mpumalanga Highveld and drains a total catchment area of 3 446 km² to the eMalahleni dam. The catchment is characterised by diverse land use including urban development, agriculture, power generation and coal mining. The catchment mainly drains along the river valleys of the Olifants River and Steenkoolspruit. Several tributaries including the Trichardtspruit, Vaalbankspruit, Rietspruit, Saaiwaterspruit, Boesmanskransspruit and the Naauwpoortspruit drain into these two major drainage valleys. Greenside Colliery falls within Management Unit 6 of the Olifants Water Management Area The southern edge of the proposed site runs roughly along a minor watershed. The proposed site thus has no streams running onto the site. The Greensidespruit does however begin on the site and bisects the site, flowing from the south to the north. The Greensidespruit begins at a stream that feeds a small wetland area and the three constructed dams before passing under the N12 and into a steam diversion on the existing operations at Greenside Colliery. The Greensidespruit flows into the Naauwpoortspruit within approximately four kilometres. The Naauwpoortspruit in return flows into the upper section of the Witbank Dam. Loss in Catchment yield: The catchment of the Greensidespruit can be characterised as being agricultural land, straight row crops with some tree plantations along the Greensidespruit. The total catchment area is approximately 5.1 km², however due to: • a major portion that has already been disturbed due to mining activities, and	To conserve the surface water resource and prevent impact on downstream water users	Degree to which impact can be reversed: Effective mitigation can reverse impact. Mitigation: Loss in catchment yield: • To ensure that the area to be disturbed by construction activities is to be kept to a minimum, only large enough to carry out the necessary activities as indicated on the design for the proposed project attached hereto as Plan 3a in Appendix A which was designed for the proposed Discard facility to be located outside of the 1 in 100 year floodline. • It is imperative that any construction of any infrastructure (e.g. Roads) within the Greensidespruit ensure appropriate conveyance of the flows. • Ensure designated pathways are allocated for vehicle movement to minimise compacted surfaces. • No abstraction of water from surface water resources such as the stream or pan will take place; this will reduce the overall impact on the surface water yield. • Implement water conservation measures to reduce volumes of water usage. Surface water quality: • Monitor water and only release water if the quality is sufficiently good (as per licence conditions and catchment requirements). • Ensure that all the relevant permissions are obtained for the release of water into the catchment. • Maintain sewage system to ensure that it operates optimally. • The dirty water management area should be kept as small as possible.	Planning phase up until Closure.	Greenside Colliery Environmental Manager	Environmental Department to undertake regular audits to assess compliance to housekeeping requirements including vehicle maintenance, waste management, chemical management etc. Annual update to rehabilitation plan and financial provision. Submission of updated quantum to DMR. . ECO to verify that these requirements

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
• discounting the area of the 3AN Discard facility, the total catchment area of the Greensidespruit will be approximately 3.2 km^2. Impacting in a loss in catchment yield. Currently the surface water stream downgradient of the existing pollution sources indicate clear impacts from the mining activities. Surface water quality There may be a decrease in surface water quality when any surface water comes into contact with dust, eroded soil, carbonaceous materials or other pollutants. The sediment load within surface water runoff may increase if not prevented or mitigated, or the chemistry of surface water may be altered. Water quality will be impacted to a greater degree within the dirty water management area. Should any spillages of carbonaceous materials, chemicals or other pollutants occur, the surface water quality in the vicinity of and downstream of the spillage may be compromised, if not prevented or mitigated. Surface water flow Surface water flow paths will be altered during the construction phase due to construction of infrastructure and stockpiling of soils. Surface water flow paths will be further altered by subsidence should it occur. Extent of impact: Impact onto Greensidespruit and locally. Duration of impact: Commencing during construction phase that could be beyond life of mine if mitigation measures are not implemented. Degree to which impact will cause irreplaceable loss: If not adequately mitigated, could result in irreplaceable loss.		• Affected runoff from the plant areas and the discard dump will be collected and contained in the affected water management system, with further diversion of the clean water. Conceptual water management strategies are contained within the stormwater management plan and civil engineering designs of the approved by a registered professional civil engineer (Appendix A). • The 3A north pollution control dam must be designed according to the design plans (Appendix A). The dam should be lined with a plastic lining of 2mm in thickness and the pump station to be installed should regularly maintained and water should be pumped from the pollution control dam to the return water dam located across the N12 highway for process purposes. to prevent overflow and to be used during emergency conditions • Implement a planned maintenance programme covering the affected water management circuit. This maintenance programme to assess aspects of siltation, capacity and containment integrity. • Suppress dust on cleared land. • Prevent erosion of loose particles by vegetating cleared land / stockpiles as soon as possible. • Ensure that the gradient of soil stockpiles is 1:3 or less (shallower) to allow for the establishment of vegetation on all stockpiles, and prevention of erosion. • No dirty water should be allowed to leave the dirty water management area (except during an exceptional flood event, as per the GN.704, 1999 capacity requirements and only under Licence conditions). • Only clean or suitably treated water should be released or allowed to flow into the environment (depending on the catchment objectives and Licence conditions). • Limit vehicle movement to designated roads wherever possible to prevent dust generation.			are implemented. Internal audits by Environmental Department Emergency Response Procedure Surface water quality monitoring (monthly), groundwater monitoring (quarterly) and bio-monitoring reports (bi-annual submission to the relevant competent authority) GN704 Compliance Audit report Rehabilitation monitoring to be undertaken by suitably qualified

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
		• Ensure that contaminated runoff will be contained in the pollution control dams. • Monitor water levels in the pollution control dams to ensure that it comply with GN704, 1999. • Monitor the dam walls of the pollution control dams for the nature of vegetation cover. Remove shrubs and trees from the dam wall. Ensure that the dam wall has grass cover to minimise erosion, but also that the grass cover does not damage liner. • Berms and trenches must be monitored regularly to ensure they are not blocked. • Pumps should be regularly checked to ensure that they are functioning optimally. • Pipelines should be regularly monitored for leaks, and leaks patched so as to prevent spillage of water. • Ensure that the conveyor belt is covered for its full length to minimise dust generation. • Ensure that haul trucks are covered with tarpaulins to minimise dust generation. • Spillages should be cleaned up immediately. • Spillages should be neutralised if necessary (i.e. if too basic or too acidic). • Once the spillage has been cleaned up the areas where it might came in contact with soils should be tested and fertilised, if necessary. • Natural vegetation should be established on areas where the soils have been exposed during the cleanup. • Monitor conveyor route in order to identify spillages. • The conveyor belt should be covered so as to limit the chances of spillage. Surface water flow • Ensure that the gradient of soil stockpiles is 1:3 or less (shallower) so as to allow for the establishment of vegetation			rehabilitation specialist (in consultation with ecologist). Monitoring frequencies as per the rehabilitation plan. Records of ECO audit, internal audits and rehabilitation monitoring records to be kept on site, with evidence of corrective measures undertaken.

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
		on all stockpiles. Ensure stockpiles do not exceed a height of 1.5 metres • Ensure that subsided areas are free draining. • Fertilise and vegetate damaged subsided areas to restore its pre-mining status if required. • To ensure that the area to be disturbed by construction activities is to be kept to a minimum, only large enough to carry out the necessary activities as indicated on the design for the proposed project attached hereto as Plan 3a in Appendix A which was designed for the proposed Discard facility to be locatate outside of the 1 in 100 year floodline. • No discharge of pollutants such as contaminated water, cement, fuels or oils will be allowed into any water resource. Monitoring and maintenance: • Regular site inspections to be undertaken to assess if spillages or water pollution incidents have occurred. Such incidents shall be reported (use of the incident reporting procedure), and immediately corrected. • Should a spillage or leakage of a hydrocarbon, chemical or hazardous substance occur, the spill/leakage must be cleaned up as per EP 14 Oil, Fuel and Chemical Spill Cleanup and EP 09 Environmental Incidents, Non-conformance and Complaints. • Ensure that areas containing chemical and hazardous substances are contained (e.g. in a bund) to ensure no contamination of surrounding water resources or soil is contaminated. The bunded area must be able to contain 110% of the total volume of materials stored at any given time. Also follow the procedure EP18 on Handling and Storage of hazardous materials • Implement the surface water (monthly), groundwater (quarterly) and bio-monitoring programme (biannually) as within the receiving surface water environment (Greensidespruit).			

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
		• Dust monitoring should be conducted in accordance to the Dust monitoring Procedure EP22. • Undertake annual GN 704 compliance audits, to verify the effectiveness of clean/affected water separation. Any shortcomings, with further consideration to the surface water monitoring results, should be addressed as a matter of urgency. • Regular site inspections to be undertaken to assess if spillages or soil pollution incidents have occurred. Such incidents shall be reported (use of the incident reporting procedure), and immediately corrected. • The pump station to be installed at the pollution control dam should regularly maintained and water should be pumped from the pollution control dam to the return water dam located across the N12 highway for process purposes. to prevent overflow and to be used during emergency conditions. • The mines existing emergency response plan should be upgraded to include activities associated with the new discard dump. • Adhere to the stormwater management plan and civil engineering designs of the approved by a registered professional civil engineer (Appendix A).			

8.6. GROUNDWATER

8.6.1 Preparation of the surface/base of the new discard dump, stripping of vegetation and compaction of surface below the new discard dump.

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Impact description: Little impact (if any) would be expected during this phase in terms of groundwater levels or quality, although recharge may be modestly reduced. Duration of impact: Construction phase extending to post rehabilitation phase. Degree to which impact may cause irreplaceable loss: Not applicable, due to low significance	To minimise the extent of disturbance of the aquifer. To limit degeneration of groundwater quality.	Degree to which impact can be reversed: Not applicable since activity will not result in measurable groundwater impact Mitigation: • Compacted soils should be ripped once available for rehabilitation so as to allow infiltration in the future. • Restrict vehicle movement to designated pathways. • Erosion control as discussed in section 8.2 and 8.5. • Waste management as discussed in section 8.2.3. • Maintain sewage system to ensure that it operates optimally. • To ensure that the area to be disturbed by construction, activities is to be kept to a minimum, only large enough to carry out the necessary activities. • Affected runoff from the plant areas and the discard dump will be collected and contained in the affected water management system, with further diversion of the clean water. • The dirty water management area should be kept as small as possible and managed in accordance to the conceptual water management strategies contained within the stormwater management plan and the civil engineering designs (Plan 3i, j, k in Appendix A).. • The 3A north pollution control dam must be designed according to the design plans (Appendix A). The dam should be lined with a plastic lining of 2mm in thickness • The pump station to be installed should regularly maintained and water should be pumped from the pollution control dam to the return water dam located across the N12 highway for process purposes. to prevent overflow and to be used during emergency conditions.	Planning and Construction Phase	Greenside Colliery Environmental Manger	ECO to verify that these requirements are implemented. Internal audits by Environmental Department Emergency Response Procedure Surface water quality monitoring (monthly), groundwater monitoring (quarterly) and bio-monitoring reports (bi-annual submission to the relevant competent authority) GN704 Compliance Audit report

8.6.2 Utilisation of the new discard facility and related infrastructure.

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Impact description: The ABA tests indicated that the discard from the Greenside discard dump have the potential to generate acid and the slimes have an intermediate potential to generate acid. It can therefore be expected that the new discard dump material will have similar characteristics. The leaching tests indicated that the leachate/seepage from the dump will have an adverse impact on the receiving groundwater quality. The proposed discard facility is a facility designed for dry coarse discards. As such, a limited contribution of leachate formation to the underlying aquifer can be expected. The proposed positioning the 3A North discard dump partially within the footprint of former opencast areas (Kleinkopje, Block 3A North) is both appropriate and potentially beneficial for the following reasons (Groundwater Complete, 2013) • It overlies a brownfield coal mining operation with already impacted groundwater. • The open cast void base level is located above the water table thus avoiding direct hydraulic connectivity between the backfill and groundwater in the deeper underground mine workings at Greenside. • The disposal of discard in the open void will form part of the void rehabilitation. • Discard seepage reaching the mine workings will be intercepted and treated at the Emalahleni Water Treatment works. Both physical and chemical perturbation of the local aquifer system is possible, as leachate from the facility will affect the water levels and quality of the aquifer. Due to the higher permeability of the discard compared with the in situ aquifer matrix, effective recharge below the discard facility will generally increase. This will result in mounding of the aquifer water level below the facility. Mounding will in turn cause a local increase in the groundwater gradient and an increased rate of migration of the contaminant plume formed by the seepage flux	To minimise the extent of disturbance of the aquifer. To limit degeneration of groundwater quality.	Degree to which impact can be reversed: If not mitigated the impact may be irreversible. Mitigation: A range of scenarios involving alternative measures for seepage flux control during the operation of the 3A North discard dump. These options have included simulation of the effects of a basal liner, plus a range of covers of variable efficiency. The conclusion drawn from this exercise is that basal liner emplacement, while forming the only viable measure for infiltration control during active operations, is likely to result in adverse geotechnical stability conditions, in conjunction with underground mining. It is therefore considered preferable to defer infiltration/seepage control to closure, at which time a low permeability engineered cover should be installed. In the absence of a basal liner, an alternative approach to impact mitigation during operations may viably involve gradient reversal via the construction of a pumping well curtain down-gradient of the dump. This would effectively isolate the contaminant plume associated with operational phase seepage to the immediate vicinity of the dump footprint. The main mitigation measures required includes: • Maintain clean and dirty water separation (refer to section 8.5). • Prevent spills or accidental releases (refer to section 8.2 and 8.5). • Drilling of up and down-gradient shallow and deep monitoring boreholes as indicated in the monitoring programme in section 10.1. • Aquifer tests on these monitoring boreholes to aid in determining aquifer parameter values and model updates.	Planning phase up until Closure.	Greenside Colliery Environmental Manager	ECO to verify that these requirements are implemented. Internal audits by Environmental Department Emergency Response Procedure Surface water quality monitoring (monthly), groundwater monitoring (quarterly) and bio-monitoring reports (bi-annual submission to the relevant competent authority) GN704 Compliance Audit report

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
(and includes inflow to surface water streams and underground workings during operation). Duration of impact: During the life of mine extending to closure. Degree to which impact will cause irreplaceable loss: If not adequately mitigated, could result in irreplaceable loss.		• Selection of up and down-gradient surface water locations, as stipulated in the surface water monitoring programme in section 10.1. • Quarterly monitoring of the existing and proposed monitoring boreholes, • Model update with site specific parameters determined from the aquifer tests. • Although the geochemistry could be expected to be very similar than the existing dump it is recommended that samples be taken from the new dump for similar tests and confirmation of geochemistry for optimal management planning of the new dump operation. • The water levels at these borehole localities should be measured on at least a quarterly basis for inclusion into the groundwater database with the objective of groundwater model calibration at a later stage. • The groundwater qualities should be analyzed on a quarterly basis for inorganic content. • The parameters recommended for analysis are listed in Table 5.2. This monitoring schedule should be re-assessed by a qualified person every year or two. • Emplace a 1 m thick cover with a permeability of 4 x 10-9 m/s on the 3A North facility, following the completion or incrementally during active operation. • Mining beneath the 3A North facility should be undertaken with caution, given the clear potential of an increased seepage flux beneath the facility. This effect could be mitigated by the implementation of a basal liner, however the long term integrity of a clay liner will be questionable with underground mining. • Continued hydraulic and geochemical characterization is required on the combined discard material and backfill to be placed on the 3A North facility, to validate model findings and to refine mitigation measures during operation of the dump. This should include moisture retention analysis at different			Rehabilitation monitoring to be undertaken by suitably qualified rehabilitation specialist (in consultation with ecologist). Monitoring frequencies as per the rehabilitation plan. Records of ECO audit, internal audits and rehabilitation monitoring records to be kept on site, with evidence of corrective measures undertaken.

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
		compaction levels, and kinetic tests with comprehensive leachate analysis. • Continually refine the numerical models as new geochemical and groundwater quality and level data becomes available. • Continued collection of site-specific daily climatic information (to include minimum and maximum temperature, relative humidity, wind speed, precipitation duration and rate).			

8.6.3 Rehabilitation of proposed discard dump

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Impact description: Possibly the most significant aspect of the results of groundwater impact simulations described in the previous sections relates to the predicted continuation of deterioration of groundwater quality in the vicinity of the 3A North discard dump for at least a century (the model run time limit) following closure in the absence of effective rehabilitation of the dump surface at closure. This long-term impact has, however, been shown to be effectively neutralized in the event that a suitably engineered cover is installed. Rehabilitation of the discard dump should have a positive effect on the groundwater regime since it entails the reduction of contaminated seepage, however it will continue to have an effect on the groundwater regime as a result of potential acid mine drainage reactions and local concentration of contaminants. Any seepage from the facility will flow to the rehabilitated opencast pit (Block 3A North) that is currently affected by acid rock drainage reactions and associated water quality deterioration, as well as into the historic and planned underground mine workings. It can be concluded that the proposed 3A North facility is partially an existing mined out pit, where the aquifer is already destroyed and the groundwater already influenced and with the appropriate management procedures (proposed cover design), no significant additional impacts are foreseen.	To minimise the extent of disturbance of the aquifer. To limit degeneration of groundwater quality.	Degree to which impact can be reversed: Recharge will largely return to ambient conditions after rehabilitation. Dilution with fresh recharge will return groundwater quality back to ambient conditions after rehabilitation Mitigation: • Rehabilitation of proposed 3A North discard dump, whit a designed cover (1 m thick cover - hydraulic conductance = 4 x e-9 m/s). • Discard seepage will be intercepted and treated at the Emalahleni Water Treatment works. Rehabilitation of the dump should therefore include the emplacement of a cover with a recommended K of the order of 4 x 10-9 m/s. If possible, partial cover emplacement could be undertaken progressively during operations in areas of dump which are not required for further waste placement. Further hydraulic and geochemical characterization is required on the combined discard material and backfill to be placed on the 3A North facility. This should include moisture retention analysis at	Operational phase to Post Closure Phase	Greenside Colliery and the Environmental Manager	ECO to verify implementatio n Surface water quality monitoring (monthly), groundwater monitoring (quarterly) and bio-monitoring reports (bi-annual submission to the relevant competent authority)

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Duration of impact: Operational phase extending to post closure phase. Degree to which impact will cause irreplaceable loss: No irreplaceable loss as impacts will be reversed through natural dilution reactions.		different compaction levels, and kinetic tests with comprehensive leachate analysis The results from the groundwater investigation should be verified through monitoring during the operational and closure phases of the 3A North discard dump and suitable measures implemented, should the results not confirm the initial conclusion regarding closure/decommissioning related impacts. It is anticipated that the groundwater levels and quality will improve away from the discard dump area as the dilution effect of the entire aquifer increases further away from this footprint, with the implementation of the recommended cover at closure. Numerical models can be used as tools to update and assess measures, as new information and understanding becomes available.			Rehabilitation monitoring to be undertaken by suitably qualified rehabilitation specialist (in consultation with ecologist). Monitoring frequencies as per the rehabilitation plan. Records of ECO audit, internal audits and rehabilitation monitoring records to be kept on site, with evidence of corrective measures undertaken.

8.7 AIR QUALITY

8.7.1 Site establishment

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Impact description: Direct, negative impacts: Dust fallout impacts relate to nuisance impacts, i.e. reduced visibility and layers of dust deposited on the surrounding environment. PM2.5 and PM10 impacts can in general be of concern due to their direct health impact potentials. Such fine particles are able to be deposited in, and damaging to, the lower airways and gas-exchanging portions of the lung. Extent of impact: Site-specific. Identified impacts are likely to be confined to the site. Duration of impact: Short-term (0-7) years Degree to which impact will cause irreplaceable loss: None	Activities remain compliant with air quality legislation. To further eliminate/minimise the risks of nuisance impacts and direct health impact potential.	Degree to which impact can be reversed: As soon as the dust generating activities ceased the air quality impact on the surrounding population and environment will have improved and the impacts would be easily reversible. Proposed mitigation: The following mitigation measures will be implemented: • Phasing of earthmoving activities to reduce source size. • Dust suppression in dirty areas in accordance to the dust suppression procedure EP22. • Early vegetation and stabilization of topsoil stockpile and reduction of the frequency of disturbance. • Early paving or treatment with chemical surfactant of mine-owned permanent roads. • Speed control will be enforced on all roads. • Complaints register must be make available for the recording of complaints relating to dust –“EP 09: Environmental Incidents, Non-conformance and Complaints” • Dust fall out monitoring plan must be developed and effectively implemented. Consideration should be given to ambient monitoring (PM10 and PM2.5). • Greenhouse gas emissions must be managed through effective maintenance of all diesel driven vehicles	Construction Phase and Operational Phase	Greenside Colliery Environmental Manger	Bi-annual dust monitoring reports to be submitted to the relevant competent authorities until closure is applied for. Regular site inspections by Environmental Department Bi-annual dust monitoring reports to be submitted to the relevant competent authorities

8.7.2 Mine operation

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Impact description: Direct, negative impacts: Dust fallout impacts relate to nuisance impacts, i.e. reduced visibility and layers of dust deposited on the surrounding environment. PM2.5 and PM10 impacts can in general be of concern due to their direct health impact potentials. Such fine particles are able to be deposited in, and damaging to, the lower airways and gas-exchanging portions of the lung. Greenside Colliery is primarily an underground bord and pillar mine, minimising surface dust fallout. However, the inherent air quality of the area is considered poor and is impacted on by the activities of adjacent collieries, industry, and vehicle use and veld fires. Furthermore, dust generation occurs from the discard existing discard dump on-site. Under the assumption of background conditions remaining the same as for the construction phase (low PM concentrations) the operational phase would result in mainly incremental impacts as the progressive development of the discard dump will add to the impacts on the air quality of the area. Extent of impact: Site-specific (PM2.5 and dust fallout). Local (PM10) – impacts on extended area beyond site boundary (hundreds of metres). Duration of impact: Long-term: Life of Mine. Degree to which impact will cause irreplaceable loss: None	Activities remain compliant with air quality legislation. To further eliminate/minimise the risks of nuisance impacts and direct health impact potential.	Degree to which impact can be reversed: As soon as the dust generating activities ceased the air quality impact on the surrounding population and environment will have improved and the impacts due to dust fallout and PM2.5 would be easily reversible. Impacts due to PM10 are potentially reversible – this is primarily due to health impacts that may result from the mining activities. Mitigation: Air quality management measures will be implemented to ensure the lowest possible impacts on the surrounding environment. The following mitigation measures will be implemented: Should areas of the discard facility surface dry out, resulting in the generation of dust, a water bowser will be utilised for dust suppression. Dust suppression in dirty areas in accordance to the dust suppression procedure EP22. Early vegetation and stabilization of topsoil stockpile and reduction of the frequency of disturbance. Early paving or treatment with chemical surfactant of mine-owned permanent roads. Speed control will be enforced on all roads. Complaints register must be make available for the recording of complaints relating to dust –“EP 09: Environmental Incidents, Non-conformance and Complaints” Implementation of the dust fall out monitoring plan. Consideration should be given to ambient monitoring (PM10 and PM2.5).	Operational Phase	Greenside Colliery Environmental Manger	Bi-annual dust monitoring reports to be submitted to the relevant competent authorities until closure is applied for. Regular site inspections by Environmental Department Bi-annual dust monitoring reports to be submitted to the relevant competent authorities

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
		Greenhouse gas emissions must be managed through preventing of sponcom of dump through effective deposition/compaction and rehabilitation, and effective maintenance of all diesel driven vehicles Continually assess the efficiency of dust mitigation measures.			

8.7.3 Site rehabilitation

Environmental impact, extent, duration, significance and degree to which impact will caused irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Impact description: Direct, negative impacts: Dust fallout impacts relate to nuisance impacts, i.e. reduced visibility and layers of dust deposited on the surrounding environment. PM2.5 and PM10 impacts can in general be of concern due to their direct health impact potentials. Such fine particles are able to be deposited in, and damaging to, the lower airways and gas-exchanging portions of the lung. Impacts due to this phase are short-term in nature and are not likely to have cumulative effects. Extent of impact: Site-specific. Identified impacts are likely to be confined to the site. Duration of impact: Short-term (0-7) years. Degree to which impact will cause irreplaceable loss: None	Activities remain compliant with air quality legislation. To further eliminate/ minimise the risks of nuisance impacts and direct health impact potential.	Degree to which impact can be reversed: As soon as the dust generating activities ceased the air quality impact on the surrounding population and environment will have improved. The impacts would be easily reversible, provided that stockpiles and disturbed mining areas (which may potentially give rise to wind erosion) are permanently vegetated. Mitigation: The following mitigation measures will be implemented: • Phasing of earthmoving activities to reduce source size. • Dust suppression in dirty areas in accordance to the dust suppression procedure EP22. • Early vegetation and stabilization of topsoil stockpile and reduction of the frequency of disturbance. • Early paving or treatment with chemical surfactant of mine-owned permanent roads. • Speed control will be enforced on all roads. • Complaints register must be make available for the recording of complaints relating to dust –"EP 09: Environmental Incidents, Non-conformance and Complaints" • Dust fall out monitoring plan must be developed and effectively implemented. Consideration should be given to ambient monitoring (PM10 and PM2.5).	Decommissioning and Closure Phase	Greenside Colliery Environmental Manger	Bi-annual dust monitoring reports to be submitted to the relevant competent authorities until closure is applied for. Regular site inspections by Environmental Department Bi-annual dust monitoring reports to be submitted to the relevant competent authorities

Environmental impact, extent, duration, significance and degree to which impact will caused irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
		• Greenhouse gas emissions must be managed through effective rehabilitation of the discard dump, to prevent the risk of sponcom.			

8.8 NOISE

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Impact description: Although there are agricultural activities to the west of the prosed site the study area is characterised by the presence of major exiting noise sources. There are major coal mining activities at Kleinkopje in the south, Greenside Colliery in the north and Landau I the East. The N12 highway, which crosses the area immediately to the North of the proposed site, carries a large amount of traffic. This includes a very significant amount of heavy vehicles. Other busy roads crossing the area are the R547, the road connecting the R544 and the R547 past Kleinkopje, and the road leading from Kleinkopje, past Landau village to Clewer. Residential areas consist of villages associated with the mines of the area. Noise levels were expected have significant contributions from the N12 Highway and the other coal mines in the area, and in light of the above, the proposed project is not expected to worsen the noise levels of the study area. Therefore with the general high level of mechanisation in the area, relatively high existing ambient noise may be expected. The current ambient noise levels are characterised by the presence of mining and road traffic related noises. Noise levels at the proposed discard facility are expected to be the same as that of the rest of the Greenside Colliery.	To prevent noise nuisance to surrounding environment	Mitigation: Ensure all equipment and vehicles are serviced regularly to prevent excessive noise. Vehicles and equipment generating excessive noise should be fitted with appropriate noise abatement measures. Construction workers must be provided with the appropriate personal protection equipment in areas required as per the Mine Health and Safety Act (No. 29 of 1996) (MHSA). Records of the PPE supplied must be maintained for record keeping purposes. A complaints register must be made available the site security office and should any complaints be received, these must be logged in the complaints register and reported to the responsible person on-site. All complaints must be closed out within 14 days. Training and induction requirements must be undertaken as outlined in section 12.3. Environmental incidents register (to be updated in Greenside Colliery's EMS), with records of close-out on incidents received. Undertake environmental noise monitoring and keep records of montoring reports.	Commence at Construction phase Construction Phase until Closure Phase	Greenside Colliery Environmental Manager	ECO to verify: Vehicle maintenance programmes Hearing conservation programmes Environmental noise monitoring programme Complaints handing system

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
		Personal protective equipment register to be kept Induction training and register to be kept			

8.9. WETLANDS AND SENSITIVE LANDSCAPES

8.9.1 Loss of wetland catchment areas

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Description of impact" During the construction phase the entire footprint of the proposed discard facility will be cleared and lined. This will prevent infiltration processes to take place and therefore cut-off interflow and surface flow feed into the wetlands. This will lead into desiccation of the wetland areas within the project area. During operational phase, the project area will be covered in discard which will increase storm water volumes into the wetland areas. The change in flow patterns will results in a changes in the manner in which water enters the wetland area from low intensity to high intensity flows. This will result erosion and a change in the valley bottom wetland from a valley bottom without a channel to a valley bottom with a channel. Extent of impact: Local Duration of impact: Beyond closure, depending on effectiveness of rehabilitation. Degree to which impact will cause irreplaceable loss: Irreplacebale loss of the wetlands may occure should the catchment area not be preserved by implementing the mitigations	To protect wetland and sensitive areas. Upgrading the wetland from a Class D to Class C.	Degree to which impact can be reversed: Reversible, should mitigations be implemented. Mitigation Construction and major earthworks should be undertaken during the dry season to ensure minimum water driven erosion impacts; The footprint of the cleared area should be limited to the required extent only; and Following the end of the construction process all the disturbed soils should be re-stabilised by planting appropriate grasses. Based on the proposed mine plan (Plan 3a in Appendix A), the proposed discard facility was designed not to impact on the wetland areas within the project area. The dump will be placed outside the 100m buffer of the wetlands. Although the footprint of the proposed discard facility does not directly impact on the on the wetland areas within the project area, however indirect impacts such as desiccation of wetlands and contamination with seepage from the discard facility are foreseen. Based on these foreseeable impacts, the following recommendations were made: A dirty water trench to intercept contaminated seepage is constructed around the proposed discard facility. The dirty water	Construction Phase until Closure	Greenside Colliery Environmental Manager	Rehabilitation monitoring to be undertaken by suitably qualified rehabilitation specialist (in consultation with ecologist). Monitoring frequencies as per the rehabilitation plan. Regular site inspections by ECO (after installation of culverts) and after wet season.

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
		trench should be directed towards the dirty water containment structures such as a pollution control dam; Pollution from the existing surface and underground sources entering the pans within the project area should be avoided or minimised at all costs. Cut-off trenches and pollution control dams should be installed in order to ensure that dirty water is managed and controlled; Rehabilitation and closure of the existing pit located south of the proposed discard facility; Rehabilitation of the discard facility should take place during the operational phase. This will limit the amount of dirty water runoff from entering the outside environment; An alien invasive species eradication programme should be initiated in order to eradicate the alien invasive outside of the wetland areas; and An alien invasive eradication programme and rehabilitation of wetland areas within the project area should be undertaken in conjunction with Working for Wetlands.			Internal audits by Greenside Colliery (6 monthly) Records of ECO audit, internal audits and rehabilitation monitoring records to be kept on site, with evidence of corrective measures undertaken. Surface water quality monitoring (monthly), groundwater monitoring (quarterly) and bio-monitoring reports (bi-annual submission to the relevant competent authority)

8.9.2 Sedimentation of wetland areas

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Description of impact: Construction Phase: During the construction process the entire footprint of the proposed project area will be cleared of vegetation and the topsoil will be stripped off and stock pilled. The removal of vegetation (transformed grassland) and the disturbance of the soil profile will expose the soils to erosion by wind (dust) and water (from surface run-off). Eroded soil is likely to enter downstream wetland areas, increasing sedimentation within these wetlands and leading to changes in vegetation composition and aquatic fauna. Erosion is likely to be highest during the summer months when high intensity storm events are likely to result in significant surface runoff. Operational Phase: The steep side slopes of the discard facility will be prone to erosion, increasing sediment loads in adjacent wetlands. Extent of impact: Local Duration of impact: Beyond closure, depending on effectiveness of rehabilitation. Degree to which impact will cause irreplaceable loss: Irreplacebale loss of the wetlands may occure should the mitigation to reduce sediment runoff not be implemented.	To protect wetland and sensitive areas. Upgrading the wetland from a Class D to Class C.	Degree to which impact can be reversed: Reversible should mitigation be implemented. Mitigation Erosion of the footprint should be minimised at all costs by limiting the extent of the foot print to only the required extent; Construction and major earthworks should be undertaken during the dry season to ensure minimum water driven erosion impacts; Dust suppression should be ensured by watering the disturbed areas; Following the end of the construction process all the disturbed soils and stockpiles should be stabilised by planting appropriate grasses; and Some of the eroded sediments from the side slopes are likely to be captured by the dirty water management system which is already available on site. Refer to the mitigations in section 8.9.1.	Construction phase until closure	Greenside Colliery Environmental Manager	Rehabilitation monitoring to be undertaken by suitably qualified rehabilitation specialist (in consultation with ecologist). Monitoring frequencies as per the rehabilitation plan. Regular site inspections by ECO (after installation of culverts) and after wet season. Internal audits by Greenside Colliery (6 monthly) Records of ECO audit, internal audits and rehabilitation monitoring records to be

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
					kept on site, with evidence of corrective measures undertaken. Surface water quality monitoring (monthly), groundwater monitoring (quarterly) and bio-monitoring reports (bi-annual submission to the relevant competent authority)

8.9.3 Deterioration of wetland water quality

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Impact description: Construction Phase: Water quality deterioration will result as a consequence of increased sediment loads within the valley bottom without a channel wetland area. Furthermore pollutants derived from spillage, leakage and incorrect disposal of hazardous substances on site. Incorrect waste management and disposal is also likely to contribute further to water quality deterioration. Operational Phase: Seepage or leakage of polluted water out of the new discard facility and into the hillslope seepage wetlands will result in the deterioration of	To protect wetland and sensitive areas. Upgrading the wetland from a Class D to Class C.	Degree to which impact can be reversed: Reversible Mitigation Use of potentially polluting hazardous substances on site should be strictly controlled; Hazardous material such as oil, diesel, petrol, hydraulic oils etc, should only be allowed in clearly demarcated areas, under the supervision of suitably trained personnel;	Construction phase until closure	Greenside Colliery Environmental Manager	Rehabilitation monitoring to be undertaken by suitably qualified rehabilitation specialist (in consultation

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
water quality within the wetlands. Decreasing water quality within the wetlands is likely to have negative effects on biodiversity supported by the delineated wetland areas. Furthermore, this will render the water less fit for use of the downstream water end users. Downstream water end users at a local scale include farmers using the water for livestock watering and irrigation, while further downstream the polluted water would enter the already polluted Olifants River. Extent of impact: National – Protection of critical biodiversity of national and Duration of impact: Beyond closure, depending on effectiveness of rehabilitation. Degree to which impact will cause irreplaceable loss: Irreplacebale loss of the wetlands may occure should the mitigation to reduce impact on wetland water quality not be implemented.		Sufficient quantities of spill response equipment and products (e.g. Drizit) should always be available on site; A detailed waste management plan must also be put in place that clearly defines the different categories of waste and how each must be handled and disposed; In order to limit seepage and leakage out of the discard disposal facility, it is recommended that a dirty water trench is constructed and directs contaminated water towards the dirty water management areas; and Hydrological calculations should be undertaken to determine if the existing dams capacity is sufficient. Refer to the mitigations in section 8.9.1			with ecologist). Monitoring frequencies as per the rehabilitation plan. Regular site inspections by ECO (after installation of culverts) and after wet season. Internal audits by Greenside Colliery (6 monthly) Records of ECO audit, internal audits and rehabilitation monitoring records to be kept on site, with evidence of corrective measures undertaken. Surface water quality monitoring

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
					(monthly), groundwater monitoring (quarterly) and bio-monitoring reports (bi-annual submission to the relevant competent authority)

8.10 VISUAL

8.10.1 Visual on sensitive receptors

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Impact description: The proposed new discard facility will lie adjacent to the N12 which is a major route for tourists and holiday makers travelling between Johannesburg and the eastern Mpumalanga. Other coal mines in the vicinity surround Greenside Colliery and therefore, the background visual effects is dominated by mining activities. The proposed new discard facility may lead to the mining activities becoming more visually prominent due to the height of the discard dump, most of the receptors will have a clear line of sight of the proposed new discard dump and ADT headlights becoming a nuisance for motorists on the N12 Therefore, notwithstanding the existing mining character of the area, measures will be taken to screen the new discard facility from both the N12 and Kleinkopje – Clewer Road. Extent of impact: Regional	To preserve the sense of place of the area	Degree to which impact can be reversed: Impact can be reversed through possible future reworking of dump, and mitigated through effective rehabilitation. Mitigation As a result of the nature and location of the proposed activity, very little mitigation measures could be implemented. Most of these measures are aimed at the activities and infrastructure to be established on the lower lying portions of the project site. the following mitigation measures are proposed: • Keep disturbed areas to a minimum. • No clearing of land to take place outside the demarcated footprint. • Only indigenous plant species to be introduced and planted. All areas must be vegetated with a suitable ground cover	Construction until Closure Phase	Greenside Colliery Environmental Manger	ECO to verify requirements at planning/implementation stage

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Duration of impact: Permanent Degree to which impact will cause irreplaceable loss: A potential permanent change to the topography and associated visual impacts will occur, that may through possible future reworking of the dump be reversed. No irreplaceable loss of resource will occur.		immediately after or construction activities to prevent erosion and mud slides. • Buildings and similar structures must be in keeping with the principles of critical regionalism, namely sense of place, sense of history, sense of nature, sense of craft and sense of limits. • Maintain the site during operation of the mine. Inoperative equipment and poor housekeeping, in general, creates a poor image of the activity in the eyes of the public. • Implement a rehabilitation plan as previously discussed. • To reduce the visual impact of the facility and prevent ADT headlights becoming a nuisance for motorists on the N12, a suitable indigenous tree screen will be planted.			

8.11 SITES OF ARCHAEOLOGICAL AND CULTURAL IMPORTANCE

8.11.1 Cultural Heritage

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Impact description: The Phase I HIA study for the proposed Project Area revealed the following types and ranges of heritage resources as outlined in Section 38 of the National Heritage Resources Act (No 25 of 1999), namely: • Two graveyards. The two graveyards occur outside the Project Area and will not be affected by the proposed new Discard Facility. All graveyards and graves can be considered to be of high significance and are protected by various laws Legislation with regard to graves includes Section 36 of the National Heritage Resources Act (Act No 25 of 1999) whenever graves are older than sixty years. It seems as if both graveyards are older than sixty years.	To preserve the cultural heritage of the area.	Degree to which impact can be reversed: Reversible. should heritage resources of significance be destroyed this may lead to an Irreversible impact. Mitigation: No mitigation measures are needed as the graveyards will not be affected by the proposed Discard Facility Project. Managing the graveyards G01 and G02 must be demarcated with a fence and fitted with a gate in order to allow for family or friends to visit the deceased. This will also lessen the risk that the graveyards may be affected by any developmental activities.	Construction until Closure Phase	Greenside Colliery Environmental Manger	ECO to assess progress and use as identified (and that such complies with heritage requirements) ECO to verify that requirements are included

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Degree to which impact can be reversed and the supporting mitigatory action plan	Timeframe	Responsibility	Monitoring and compliance reporting
Other legislation with regard to graves includes those which apply when graves are exhumed and relocated, namely the Ordinance on Exhumations (No 12 of 1980) and the Human Tissues Act (No 65 of 1983 as amended). Extent of impact: Restricted to the site Duration of impact: Permanent Degree to which impact will cause irreplaceable loss: Low degree of irreplaceable loss		General (disclaimer) It is possible that this Phase I HIA study may have missed heritage resources in the Project Area as heritage sites may occur in thick clumps of vegetation while others may lie below the surface of the earth and may only be exposed once development commences. If any heritage resources of significance are exposed during AOL's proposed new Discard Facility the South African Heritage Resources Authority (SAHRA) should be notified immediately, all development activities must be stopped and an archaeologist accredited with the Association for Southern African Professional Archaeologist (ASAPA) should be notified in order to determine appropriate mitigation measures for the discovered finds. This may include obtaining the necessary authorisation (permits) from SAHRA to conduct the mitigation measures.			within site education programme

8.11.2 Palaeontology

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Management/Mitigation Measure	Time frame	Responsibility	Monitoring and compliance reporting
Impact description: The Phase 1 Palaeontological Impact Assessment indicated that formations present are part of the Karoo Supergroup. The Karoo Supergroup is renowned for its fossil wealth. The Vryheid Formation (Pe,Pv), Ecca Group is rich in plant fossils such as the *Glossopteris* flora represented by stumps, leaves, pollen and fructifications. This formation is early to mid-Permian in age and consists of sandstone, shaly sandstone, grit, conglomerate, coal and shale. Coal seams are present in the Vryheid Formation within the sandstone and shale layers. Fossils are mainly present in the grey shale which is interlayered between the coal seams.	Prevent impact on fossil heritage	Degree to which impact can be reversed: I Reversible, should paleontological resources of significance be exposed this may lead to an Irreversible impact. Mitigation: A Phase 2 Palaeontological Impact Assessment should be conducted prior to digging, excavating, drilling or blasting.	Construction until Closure Phase	Greenside Colliery Environmental Manger	During site inspections, the ECO and Environmental Department to be aware of possibility of important fossils.

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Management/Mitigation Measure	Time frame	Responsibility	Monitoring and compliance reporting
Fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. Therefore, if there is the presence of Karoo Supergroup strata the palaeontological sensitivity is generally very high. The impact of the development on fossil heritage is very high and therefore a field survey or further mitigation or conservation measures are necessary for this development (according to SAHRA protocol). A Phase 2 Palaeontological Impact Assessment and or mitigation are recommended. The overburden and inter-burden must be surveyed for fossiliferous outcrops. Special care must be taken during the digging of foundations, trenches, channels and footings. Extent of impact: Restricted to the site Duration of impact: Permanent Degree to which impact will cause irreplaceable loss: Irreplaceable loss if mitigation measures are not followed.		If any palaeontological material is exposed during digging, excavating, drilling or blasting SAHRA must be notified. All construction activities must be stopped and a palaeontologist should be called in to determine proper mitigation measures.			ECO to verify that requirements are included within site education programme

8.12 SOCIO-ECONOMIC

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Management/Mitigation Measure	Time frame	Responsibility	Monitoring and compliance reporting
Impact description: The annual household income for Mpumalanga remains fairly low, with most households earning less than R18 000 per annum. Adult literacy has improved in the past two decades, but still remains below the national average and many scholars do not complete their matriculation exams. Approximately 33% of the provinces population is unemployed. The new discard dump project benefits the workers on the mine directly. Indirectly the loss of employment is avoided, which does not affect the economic value of the community in general. The society in general will not be affected as the risk of an emergency was avoided.	A desirable future state for human societies in which living conditions and resource-use meet human needs without undermining the sustainability of natural systems and the environment, so that future generations may	Mitigation: Greenside Colliery currently provides jobs for 914 people and funds and participates in community projects. The positive impacts of Greenside Colliery on the regional socio-economic conditions during the Operational Phase are discussed in Part 4 All positive impacts of the mine on the socio-economy that will have taken place during the Operational Phase will continue during the Decommissioning Phase until they cease, mainly due to the reduction or cessation of jobs and the cessation of demand for goods and services.	Construction until Closure Phase	Greenside Colliery Environmental Manger	Skills development programme Recruitment policy Procurement policy

Environmental impact, extent, duration, significance and degree to which impact will cause irreplaceable loss	Environmental objective	Management/Mitigation Measure	Time frame	Responsibility	Monitoring and compliance reporting
The products from the mining operations at Greenside Colliery are sold to the South African and international markets. SACE employs more than 900 people at Greenside Colliery. The existing education programme implemented at the mine comprises of the following elements: • New schools. • Adult education. • Vegetable garden. • Life skills inclusive of sewing, cooking, health, environmental awareness and entrepreneurial skills. • Community schools. The safe continuation of the mining and related activities at the Greenside Colliery continues employment of staff at the Greenside Colliery as well as the continued supply of coal to the local market. As a result of the multiplier effect, the continued operation of the existing Greenside Colliery will benefit the local, regional and national economy. Should Greenside Colliery not construct the new Discard Dump they may be forced to cease operation. Should this have occurred, jobs of personnel currently employed will be lost and the local, regional and national economic benefits of the continuation of the mining and related activities would have been lost. Mine closure will raise unemployment levels in the region, and would increase significantly as more mines close down.	also have their needs met.				Audit of SLP implementation and compliance. ECO to verify conditions during construction audit Minutes from meetings held for various forums (e.g. of Community Liaison Forum) Complaints register and records of follow-up

9. EMERGENCY AND REMEDIATION PROCEDURE

The purpose of this part of the EIA and EMP is to anticipate the occurrence of environmental crises, which may occur due to unforeseen circumstances. Since these events cannot be accurately predicted or prevented, a procedure has been prepared that must be followed should such an incident occur, which will assist in the mitigation, remediation and conservation of the environment and contribute to the safety of workers and I&APs.

At the Greenside Colliery, emergency incidents are dealt with in accordance to the "*Emergency Preparedness and Response Procedure*, *EP08*" (refer to **Error! Reference source not found.** below) and the "*Emergency Response Chart*" (refer to **Error! Reference source not found.**), that describes how emergencies are to be handled, including environmental spillages and other major environmental incidents. Emergencies of an environmental nature are also reported as an environmental incident in accordance to the "*Environmental Incidents, Non-conformances and Complaints Procedure, EP-09*" (refer to Figure 55), where after the appropriate corrective and preventative actions are planned.

Figure 53: Emergency Preparedness and Response Procedure

AngloAmerican

THERMAL COAL

Date:	Revision:	Procedure no:	Page:			GREENSIDE COLLIERY
August 2011	*8*	*EnvProc/08 (EP08)*	1	of	9	
Next Review date:	Procedure Name:					DEPARTMENT
August 2014	*EMERGENCY PREPAREDNESS AND RESPONSE*					*Environmental*

1. TITLE

EMERGENCY PREPAREDNESS AND RESPONSE

2. PURPOSE

The environmental emergency preparedness and response procedure explain how to identify potential environmental emergency situations, how corrective/follow-up actions are implemented and describes the periodic testing of emergency response procedures.

Emergency activities identified

The Greenside Emergency Manual contains a detailed description of how emergencies should be managed. The purpose of the manual is to provide guidance to all employees and contractors as to their responsibilities in the event of an emergency.

The manual applies to any environmental emergency arising on the mine property, whether within the area of control of the company or whilst under transport to or from the mine. This procedure describes the correct actions necessary to manage the following environmental emergency situations:

- Surface Fire
- Bulk Petroleum and Chemical Spillage; and
- Dump / Slurry Dam Failure.

3. SCOPE

This procedure applies to all areas and activities on the mine.

4. DEFINITIONS

SACE – South African Coal Estates

SD – Sustainable development

ORIGINATOR	HEAD OF DEPARTMENT	GENERAL MANAGER

Real Mining. Real People. Real Difference

07/02/2015 Valid only on day of printing — Page 1 of 9

AngloAmerican

THERMAL COAL

Date:	Revision:	Procedure no:	Page:			GREENSIDE COLLIERY
August 2011	*8*	*EnvProc/08 (EP08)*	2	of	9	
Next Review date:	**Procedure Name:**					**DEPARTMENT**
August 2014	*EMERGENCY PREPAREDNESS AND RESPONSE*					***Environmental***

AA plc – Anglo American plc

EMS – Environmental Management System

EP – Environmental Procedure

HOD's – Head of Departments

PTO's – Planned Task Observations

Emergency

An environmental emergency is an unplanned event, which has the potential to result in a significant adverse environmental impact and/or could result in legal liability to Greenside Colliery in terms of environmental legislation commitments. Emergencies and crises are broadly defined as follows:

- Fatal accidents;
- Major Environmental incidents:
  - Hazardous spills
  - Dump / dam failure
  - Gas Leaks, etc.
- Material events (including legal proceedings) likely to lead to adverse national publicity.

A description of external communication which would be relevant in some emergency situations is dealt with as described in EP06 – Environmental communication and reporting procedure.

Anglo American uses the hierarchical incident classification to determine whether or not an environmental incident should be regarded as an environmental emergency. This begins with level 1 and 2 incidents that are not considered to be emergency level incidents. Level 3 items are however of such a critical nature that they would be considered emergencies. For the full definitions of the AA plc SD Database Definitions of level 1 & 2 incidents please refer to the AA plc SD Database. Below is the full definition for Level 3 Incidents that would constitute an emergency.

Definitions of level 1 & 2 incidents please refer to the AA plc SD Database. Below is the full definition for Level 3 Incidents that would constitute an emergency.

ORIGINATOR	HEAD OF DEPARTMENT	GENERAL MANAGER

Real Mining. Real People. Real Difference

AngloAmerican THERMAL COAL

Date:	Revision:	Procedure no:	Page:			GREENSIDE COLLIERY
August 2011	8	EnvProc/08 (EP08)	3	of	9	
Next Review date:	Procedure Name:					DEPARTMENT
August 2014	EMERGENCY PREPAREDNESS AND RESPONSE					Environmental

Level 3 incident – Regional/Severe incident

A significant impact on the physical or biological environment (air, land, water or habitats) with extensive or long-term impairment of ecosystem function or surface/ground water resource; and/or an impact to unique or protected species or habitats; and/or an inconvenience/disturbance/disruption/ annoyance (including odour, dust, noise, traffic problem, loss of water supply) of long duration or with long-term effect on the community; and/or a release of material (gas, liquid, solid) or energy which causes chronic illness, permanent disabling injury, fatality or extensive property damage to the public; and/or irreparable damage to highly valued structures or sacred locations; and/or instances where prosecution has led to conviction and fines totalling more than US$ 100 000 per event.

5. RESPONSIBILITIES

The Person/s Resonsible are indicated in section six in the right hand column

6. PROCEDURE / PROCESS

No.	Activity	Responsibility
	6.1 Emergency	
6.1.1	**Method of emergency activity identification** Emergencies identified by the mining operation come from a number of sources. Some of these were not identified from a risk assessment but rather from the definition for level 3 incidents above. Other emergency situations were subject to risk analysis. Those dealing with loss of property were not done as part of the ISO14001 EMS but as part of the mine Health and Safety process to reduce risks to employees and property. Environmental emergency activities are also identified from the EMS	

ORIGINATOR	HEAD OF DEPARTMENT	GENERAL MANAGER

Real Mining. Real People. Real Difference

AngloAmerican THERMAL COAL

Date:	Revision:	Procedure no:	Page:			GREENSIDE COLLIERY
August 2011	8	EnvProc/08 (EP08)	4	of	9	
Next Review date:	Procedure Name:					DEPARTMENT
August 2014	EMERGENCY PREPAREDNESS AND RESPONSE					Environmental

No.	Activity	Responsibility
	risk assessment (EP02 - Aspects identification and Management).	
6.1.2	**Emergency Drills** Emergency drills will be conducted at specified intervals throughout the year according to the drill schedule EnvForm005. Information on drills will be recorded on the drill report (EnvForm006) and assessed by the EMS Management Representative within a month after the drill has been executed. Alterations and modifications to the Emergency Response Procedure will also be done after the response drill evaluation. Changes to training, risk assessments and any other procedures will be made after drills if required. This task will be done by the Environmental Co-ordinator in co-ordination with the EMS Representative to which the drill applies. Assistance from the EMS Management Representative or any other specialist will be given if required. Testing of the Emergency Preparedness Plan shall consist of: • Checking that adequate emergency equipment is in place and in working order; • Checking that site staff know how to respond in the event of an emergency; and • Checking that site staff knows who to contact in the event of an emergency.	Environmental Coordinator
6.1.3	**Emergency training** Employees are trained on the emergency manual during induction. Regular drills are held to ensure the efficient handling of an emergency situation should one occur.	
6.2	**Potential Emergency Situations & Specific Emergency Response Plans**	
6.2.1	**Bulk fuel and oil tanks** The discoverer will notify the Control Room who will alert the required personnel.	
6.2.2	**Veld fire**	

ORIGINATOR	HEAD OF DEPARTMENT	GENERAL MANAGER

Real Mining. Real People. Real Difference

07/02/2015 Valid only on day of printing Page 4 of 9

AngloAmerican THERMAL COAL

Date:	Revision:	Procedure no:	Page:			GREENSIDE COLLIERY
August 2011	*8*	*EnvProc/08 (EP08)*	5	of	9	
Next Review date:	**Procedure Name:**					**DEPARTMENT**
August 2014	*EMERGENCY PREPAREDNESS AND RESPONSE*					***Environmental***

No.	Activity	Responsibility
	• The discoverer will not attempt to extinguish the fire. S/he will immediately report to the Control Room and shall notify persons within the path of the fire. • Establish photographic record of events, if possible; • Fire teams to attend to fire.	
6.2.3	**Pollution and / or Chemical Spillage** • The Official in control of the area where the incident occurs is responsible to take charge of and to co-ordinate the emergency response plan. • On detection/observation/alarm or receiving first information of the occurrence of such an emergency the responsible official will take the following immediate action, depending on the severity of the reported incident: • React to the site and assess the impact of the emergency; • Obtain the Material Safety Data Sheet for the Hazardous Material or Chemical; • Decide on a plan of action to prevent further loss and or damage to the environment in accordance with the Material Safety Data Sheet; • Inform his HOD and in conjunction with him, determine the nature of the spillage: • Establish photographic record of events, if possible; • Activate the Fire Team and/or other emergency services; • Inform the Environmental Coordinator; • Inform the Safety Superintendent; • Put above plan in place using any resources available; • Arrange for a record of occurrence to be loaded into the electronic database.	
6.2.4	**Discard disposal & Pollution Control Dam 3** Greenside dispose off the discard from the plant at the Discard Facility as per Greenside Discard Management code of practice. Anglo Technical Services perform regular audits on the discard disposal facility to ensure correct and safe disposal of the discard as per the COP for the life of mine. Pollution control dam3 (PCD3) located downstream of the discard dump was constructed to collect seepage from the discard dump as	

ORIGINATOR	HEAD OF DEPARTMENT	GENERAL MANAGER

Real Mining. Real People. Real Difference

07/02/2015 Valid only on day of printing **Page 5 of 9**

AngloAmerican THERMAL COAL

Date:	Revision:	Procedure no:	Page:			GREENSIDE COLLIERY
August 2011	8	EnvProc/08 (EP08)	6	of	9	
Next Review date:	Procedure Name:					DEPARTMENT
August 2014	EMERGENCY PREPAREDNESS AND RESPONSE					Environmental

No.	Activity	Responsibility
	well as 1 in 20 year flood. The risk associated with the PCD3 is that should it overflow it will contaminate the Naauwpoortspruit which is downstream from the facility. The following measures have been put in place to ensure that the PCD does not overflow: • PCD3 is fitted with level indicator which is displayed in the Plant control room that is manned 24 hours. If the water level reaches 85% the pumps are stared. Operation philosophy is such that the dam level should not be allowed to reach 85%, thus the pump is started on a regular basis to keep the level below 80%. • There are two pumps installed to pump the water back to the Plant. • Boreholes (to monitor both the shallow and deep aquifers) have been installed downstream of the dam. These boreholes are sampled every six months.	
6.2.5	**Dump failure / Dam overflow** Should the dam overflow or dump failure occur for any reason, the following will apply: • The discoverer shall immediately report to the Control Room. • The Senior Mining Official must ensure that all people are evacuated from the affected area if necessary; • Establish photographic record of events, if possible; • The Engineering Manager will notify Anglo Technical Division and/or an independent civil engineering company to come onto the site immediately to assess the cause of failure and repair needs. The Environmental Coordinator will notify immediate downstream users and take stream water samples. • The Mine Manager will notify the Department of Water Affairs & Environmental in terms of the National Water Act 36 of 1998 S20. • Any directives given in writing by the Department of Water and Environmental, or the CMA must be complied with within the timeframe specified.	

ORIGINATOR	HEAD OF DEPARTMENT	GENERAL MANAGER

Real Mining. Real People. Real Difference

07/02/2015 Valid only on day of printing — Page 6 of 9

AngloAmerican THERMAL COAL

Date:	Revision:	Procedure no:	Page:			GREENSIDE COLLIERY
August 2011	*8*	*EnvProc/08 (EP08)*	7	of	9	
Next Review date:	**Procedure Name:**					**DEPARTMENT**
August 2014	*EMERGENCY PREPAREDNESS AND RESPONSE*					***Environmental***

No.	Activity	Responsibility
	6.3 Records Required for this Procedure	
6.3.1	**Report Required** / **Frequency** / **Responsibility** Drill schedule (EnvForm005) / Annually / Env. Co-ordinator Drill report (EnvForm006) / As drills are held / Env. Co-ordinator	Note
	6.4 Revision Criteria	
6.4.1	This document shall be reviewed as follows: • At least every **THREE** years; • When there is a change of method and/or technology that may affect the accuracy of the document; • When there has been a significant event to which this document was relevant; • As a result of relevant audit findings.	Note
	6.5 Appendices	
6.5.1	There are no appendices attached to this procedure.	Note

7. REFERENCES

ISO14001: 2004

EP06 – Environmental communication and reporting procedure.

EP02 - Aspects identification and Management

Drill schedule (EnvForm005)

Drill report (EnvForm006) Records

7.5 Procedure History

Revision	Changes	Date
Version 1	Section 1 Add: This procedure supersede the Greenside Emergency Procedure for environmental related emergencies	July 2004

ORIGINATOR	HEAD OF DEPARTMENT	GENERAL MANAGER

Real Mining. Real People. Real Difference

07/02/2015 Valid only on day of printing **Page 7 of 9**

AngloAmerican THERMAL COAL

Date:	Revision:	Procedure no:	Page:			GREENSIDE COLLIERY
August 2011	*8*	*EnvProc/08 (EP08)*	8	of	9	
Next Review date:	**Procedure Name:**					**DEPARTMENT**
August 2014	*EMERGENCY PREPAREDNESS AND RESPONSE*					***Environmental***

Revision	Changes	Date
Version 1	Section 1 Add: Basic emergency activities identified	July 2004
Version 1	Section 2 Explain Level 1 and 2 incidents, but delete these definitions	July 2004
Version 1	Section 2.2 Add method of emergency activity identification	July 2004
Version 1	Section 2.3 Numerous changes	July 2004
Version 1	Section 2.6 Add last 3 paragraphs	July 2004
Version 1	Appendix 1 Add Kleinkopje & Landau Collieries contact numbers	July 2004
Version 2	Include drill report and drill schedules as records	October 2005
Version 2	Section 2.6 Deleted description of emergency drills	October 2005
Version 2	Changed environmental officer to environmental co-ordinator	October 2005
Version 3	Deleted description of emergency procedures to follow	July 2006
Version 3	Included quarterly fire alarm and fire drill test record	July 2006
Version 4	No changes made	May 2007
Version 5	Included description of Greenside Emergency response plan	July 2008
Version 5	Include reference to communication procedure – EP06	July 2008
Version 5	Included risk assessments, training and other procedures will be amended as necessary after drills	July 2008
Version 6	Section 2.5 – Added section on Potential Emergency Situations & Specific Emergency Response Plans	Sept 2009

ORIGINATOR	HEAD OF DEPARTMENT	GENERAL MANAGER

Real Mining. Real People. Real Difference

07/02/2015 Valid only on day of printing **Page 8 of 9**

AngloAmerican THERMAL COAL

Date:	Revision:	Procedure no:	Page:			GREENSIDE COLLIERY
August 2011	8	EnvProc/08 (EP08)	9	of	9	
Next Review date:	Procedure Name:					DEPARTMENT
August 2014	EMERGENCY PREPAREDNESS AND RESPONSE					Environmental

Revision	Changes	Date
Version7	Section 2.5.4 Changed DWAR to Department of Water and Environmental	June 2010
Revision 8	Updated procedure with new format. Section 6.4. Changed revision interval to 3 yearly.	August 2011

ORIGINATOR	HEAD OF DEPARTMENT	GENERAL MANAGER
Real Mining. Real People. Real Difference		
07/02/2015 Valid only on day of printing		Page 9 of 9

Figure 54: Emergency and Response Chart

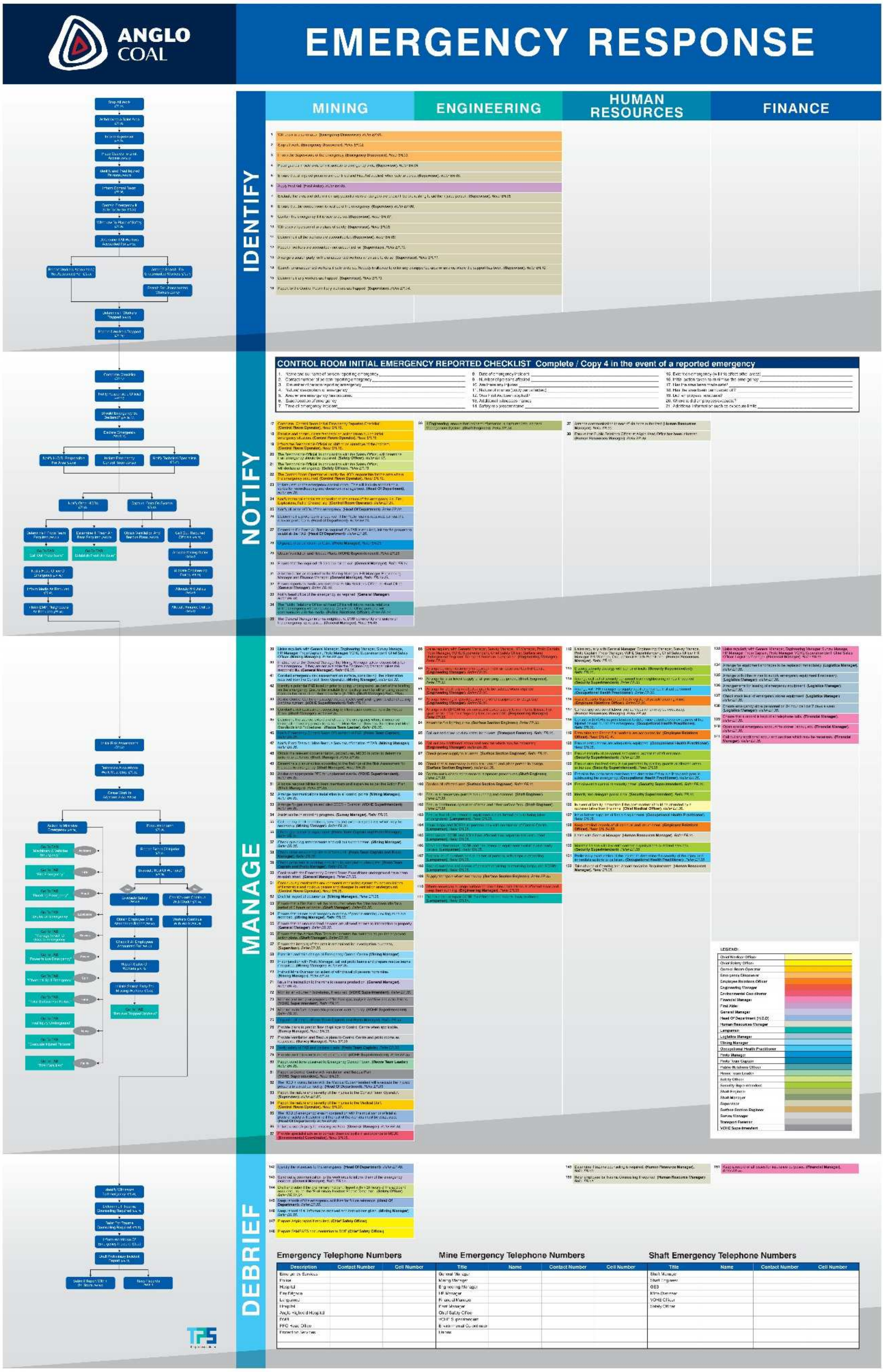


Figure 55: Environmental Incidents, Non-conformances and Complaints Procedure

AngloAmerican THERMAL COAL

Date:	Revision:	Procedure no:	Page:			GREENSIDE COLLIERY
August 2012	12	AATC-GS-EMS-MP-09	1	of	13	Anglo Operations Ltd
Next Review date:	Procedure Name:					DEPARTMENT
August 2015	Environmental Incidents, Non-Conformances and Complaints					Environmental

1. TITLE

ENVIRONMENTAL INCIDENTS, NON-CONFORMANCES AND COMPLAINTS

2. PURPOSE

The Environmental Incidents, Non-conformances and Complaints Procedure describe the procedural requirements for the reporting of an environmental incident, non-conformance or complaint at Greenside Colliery. The objectives set for this procedure are to:

- Describe and encourage the immediate and correct reporting of all environmental incidents, non-conformances and complaints, including full details of the event, measures taken to reduce the impact, and preventative measures implemented to prevent a re-occurrence;
- Clarify the differences between an incident, a non-conformance and a complaint;

3. SCOPE

This procedure applies to all areas and activities on the mine.

4. DEFINITIONS

Abbreviation / Term	Description
COMPLAINTS	An issue that results in an environmental complaint from local residents, government bodies, neighbouring farmers, or any other interested and affected parties
EMS	Environmental Management System
EMSD	Environmental Management System Database – Pivot version 6
INCIDENTS	An incident is any event that has a negative impact on the physical, chemical or biological environment (air, land, water or habitats); AND / OR; an inconvenience / disturbance / disruption / annoyance (including odour, dust, noise, loss of water supply etc) AND/OR; a release of material (gas, liquid, solid) or energy which has the potential to cause illness, injury or property damage.

ORIGINATOR	HEAD OF DEPARTMENT	GENERAL MANAGER
Real Mining. Real People. Real Difference		

AngloAmerican

THERMAL COAL

Date:	Revision:	Procedure no:	Page:			GREENSIDE COLLIERY
August 2012	12	AATC-GS-EMS-MP-09	2	of	13	Anglo Operations Ltd
Next Review date:	Procedure Name:					DEPARTMENT
August 2015	Environmental Incidents, Non-Conformances and Complaints					Environmental

Abbreviation / Term	Description
	The following are examples of possible environmental incidents: • Spillage of fuel and lubricants; • Spillage of chemicals and hazardous substances; • Soil and water pollution; • Littering / poor housekeeping; • Resources wasted e.g. leaking valves, tap etc.
NON-CONFORMANCE	A non-conformance is an incident, which results in a breach of any legislation or contravenes the requirements of any Greenside Colliery Environmental Standard Procedure. The following are examples of typical non-conformances: • Policy Non-conformance • Old revisions of controlled policies. • No policy training evidence available. • Environmental policy statement not available to the public. • Incident Non-conformance • Incidents signed off but not completed. • Incidents not signed off and reviewed. • System and documentation non-conformance • Using old EMS Procedures. • Having old controlled copies of documentation. • Not being able to produce evidence. • Materials and processes non-conformance • Major proposal risk not identified or controlled. New activities / changes not recorded and assessed

5. RESPONSIBILITIES

The person/s responsible is indicated in section six, in the right hand column.

ORIGINATOR	HEAD OF DEPARTMENT	GENERAL MANAGER
Real Mining. Real People. Real Difference		

AngloAmerican THERMAL COAL

Date:	Revision:	Procedure no:	Page:			GREENSIDE COLLIERY
August 2012	12	AATC-GS-EMS-MP-09	3	of	13	Anglo Operations Ltd
Next Review date:	Procedure Name:					DEPARTMENT
August 2015	Environmental Incidents, Non-Conformances and Complaints					Environmental

6. PROCEDURE / PROCESS

No.	Activity	Responsibility
6.1	**Procedure to be followed**	
6.1.1	**Complaints** Complaints registers are located at Security Checkpoint1 (main entrance to mine), reception at the main offices, the Shaft control room and the manager's office at Nooitgedacht. Complaints may be made at either Security checkpoint1, reception at the main offices, the manager's office at Nooitgedacht or by contacting the Environmental Co-ordinator. In the case of urgent or serious complaints, the Environmental Co-ordinator will direct the complainant to the Mine Manager. Complaints made after hours can be done so at Security Checkpoint1 or if telephonically, will be transferred to the Shaft control room. The control room will contact a senior mine official if the afterhours complaint is urgent or serious. Persons receiving complaints must record the complaints in the Complaints register, recording all details required in the Complaints register. The Environmental Co-ordinator will be informed of complaints as soon as possible and will log the complaint on the EMSD and ensure that the complaint is actioned i.e. ensure that actions are implemented to address the complaint or actions are identified to address the complaint. If the complaint is significant and cannot be addressed within 3 months, then an Objective and Target (with EMPs) should be developed. The Environmental Co-ordinator should be contacted before this is done. Also see AATC-GS-EMS-MP-04: Objectives, Targets and Programmes. Feedback must be provided to the party within 48 hours, be it a	All, Security personnel, Receptionist, Control room operators, Nooitgedacht Manager, Environmental Coordinator, EMS Reps,EMS Mngt Rep, Mine Manager

ORIGINATOR	HEAD OF DEPARTMENT	GENERAL MANAGER

Real Mining. Real People. Real Difference

AngloAmerican THERMAL COAL

Date:	Revision:	Procedure no:	Page:			GREENSIDE COLLIERY
August 2012	12	AATC-GS-EMS-MP-09	4	of	13	Anglo Operations Ltd
Next Review date:	Procedure Name:					DEPARTMENT
August 2015	Environmental Incidents, Non-Conformances and Complaints					Environmental

No.	Activity	Responsibility
	phone call, letter, fax or e-mail. Such feedback will be provided by the Technical Services Manager (EMS Management Representative) or by the Mine Manager. Urgent complaints must be followed up within 12 hours, with at least a telephone call to obtain further information on the complaint, for actions to be taken information and for the time being satisfy the complainant. Also refer to AATC-GS-EMS- MP-06: Environmental Communication. The complainant will be informed of the corrective and preventative action once the complaint has been addressed. This will be done in the form of a letter or a visit by mine personnel, which will be approved by the Mine Manager before being sent. Such correspondence will be filed in the Environmental Department. In cases where the complainant receives compensation, a signature must be obtained from the complainant signifying satisfaction with the outcome.	
6.1.2	**Incidents and Non-conformances** The following steps are to be taken when an incident or non-conformance is identified: • Stop the activity immediately if possible; • Notify your supervisor of the problem; • Take immediate steps to deal with and stop any spread of the problem if possible; • Follow up on the problem to ensure it is dealt with effectively; • Follow steps in the appropriate standard procedure or take action to correct and prevent the incident from re-occurring; Log the environmental incident / non-conformance in a “Boontoe” book (see 6.1.3) or directly into the EMSD. Incidents and non-conformances must be logged in the EMSD within 2 days of the incident/non-conformance being reported. The white copy of the	All Employees

ORIGINATOR	HEAD OF DEPARTMENT	GENERAL MANAGER
Real Mining. Real People. Real Difference		

AngloAmerican THERMAL COAL

Date:	Revision:	Procedure no:	Page:			GREENSIDE COLLIERY
August 2012	12	AATC-GS-EMS-MP-09	5	of	13	Anglo Operations Ltd
Next Review date:	Procedure Name:					DEPARTMENT
August 2015	Environmental Incidents, Non-Conformances and Complaints					Environmental

No.	Activity	Responsibility
	"Boontoe" book needs to be forwarded to the relevant Line Manager, who must make sure that it reaches the EMS Representative for the area, who will capture the incident in the EMSD. The EMS Representative may need to confer with the person reporting the incident and/or line manager, if further information is required for reporting the incident/non-conformance in the EMSD	
6.2	**Reporting**	
6.2.1	**Reporting/Logging the incident, non-conformance or complaints on the EMSD** All incidents, non-conformance and complaints must be logged in the EMSD immediately, or as soon as possible in the case of after-hours-complaints. Incidents and non-conformances must be logged in the EMSD within 2 days of being reported. This is the responsibility of the EMS Representatives and Environmental Co-ordinator. The person logging the incident or non-conformance in the EMSD will have the option of entering corrective action/s. However, if the action required is the responsibility of someone else, this person's designation must be selected from the drop-down menu in the EMSD before saving the incident/non-conformance. This will ensure that the responsible person is notified by e-mail that the incident/non-conformance must be actioned i.e. action is described, with responsibility assigned and a due date given. If the incident is significant and cannot be addressed within 3 months, then an Objective and Target (with EMPs) should be developed. The Environmental Co-ordinator should be contacted before this is done. Also see AATC-GS-EMS-MP-04: Objectives, Targets and Programmes. If the incident is logged on the EMSD, the action for that incident must be included into the system before the end of two weeks	EMS Representative, Environmental Co-ordinator

ORIGINATOR	HEAD OF DEPARTMENT	GENERAL MANAGER

Real Mining. Real People. Real Difference

AngloAmerican THERMAL COAL

Date:	Revision:	Procedure no:	Page:			GREENSIDE COLLIERY
August 2012	12	AATC-GS-EMS-MP-09	6	of	13	Anglo Operations Ltd
Next Review date:	Procedure Name:					DEPARTMENT
August 2015	Environmental Incidents, Non-Conformances and Complaints					Environmental

No.	Activity	Responsibility
	after the incident is logged. The responsible person must enter a progress report into the EMSD on the action progress, at least monthly, or on completion if the action is completed in a period of less than a month. It is essential that the root cause be identified in the progress report/s entered and that preventative actions have been taken or are actioned, before the incident, non-conformance or complaint can be closed out and recorded as complete. The final progress report entered for an action must mention that the action is complete, before the Environmental Co-ordinator can consider closing it out. It is the responsibility of the area EMS Representative to ensure that all actions have been completed before entering a close-out progress report.	
6.2.2	**Electronic Pivot Entries** All employees who have access to a computer have access to the Incident Reporting facility of PIVOT. To enter the database, the person clicks on the PIVOT Incidents shortcut on their desktop and select “Click to report an incident”. The user will be taken to PIVOT Initial Incident Report page. In PIVOT, the word “Incident” is used generically and includes accidents, incidents, non-conformances and complaints. The user must complete all the relevant fields. The fields indicated with a red * are compulsorily and the other fields must be completed when relevant. The electronic system notifies the SHE Department via e-mail that an incident has been logged. The SHE Department then determine if the incident is relevant to their discipline and if it is relevant assigns the incident to the person responsible for the incident. The responsible supervisor person will be notified via e-mail to	EMS Representative, Environmental Co-ordinator

ORIGINATOR	HEAD OF DEPARTMENT	GENERAL MANAGER

Real Mining. Real People. Real Difference

AngloAmerican THERMAL COAL

Date:	Revision:	Procedure no:	Page:			GREENSIDE COLLIERY
August 2012	12	AATC-GS-EMS-MP-09	7	of	13	Anglo Operations Ltd
Next Review date:	Procedure Name:					DEPARTMENT
August 2015	Environmental Incidents, Non-Conformances and Complaints					Environmental

No.	Activity	Responsibility
	conduct the incident investigation and add corrective and preventative actions. The user can select the hyperlink in the e-mail or access the screen through the Incident Manager in PIVOT. For more information and detail on PIVOT, please refer to the PIVOT Manual.	
6.2.3	**Reporting to Authorities** All level 2 and 3 environmental incidents are to be reported to the relevant Government Departments. After immediate action has been taken to control the incident and the relevant Head of Department and Environmental Coordinator have been notified the relevant Government Department has to be notified. This should be done within 48 hrs of the incident occurring or by the second working day following a weekend. Note that for a significant environmental incident it is desirable, where practicable to obtain internal counsel and advice regarding the notification correspondence and communication. No more than 14 days after the initial notification, supply written notification which must include but not limited to the following: • The location of the incident. • The date and time of the incident. • The suspected cause of the incident. • Actions taken to prevent recurrence and mitigate any environmental harm caused by the incident, A copy of the written notification must be filed in file "*Reporting Authorities"*	Environmental Coordinator, EMS Representative
6.2.4	**Overdue actions/Changing the action status** Only the Environmental Co-ordinator can change the status of an	Environmental

ORIGINATOR	HEAD OF DEPARTMENT	GENERAL MANAGER
Real Mining. Real People. Real Difference		

AngloAmerican THERMAL COAL

Date:	Revision:	Procedure no:	Page:			GREENSIDE COLLIERY
August 2012	12	AATC-GS-EMS-MP-09	8	of	13	Anglo Operations Ltd
Next Review date:	Procedure Name:					DEPARTMENT
August 2015	Environmental Incidents, Non-Conformances and Complaints					Environmental

No.	Activity	Responsibility
	action in the EMSD e.g. from overdue to completed. Overdue actions will remain overdue until adequate progress reports are entered into the EMSD to justify changing the action status to complete. In certain circumstances there may be a justifiable reason why an action is overdue and why that action due date should be extended. In such cases, the EMS Representative must request a date change, stating reasons for the request for an extension of the due date. The Environmental Co-ordinator will extend the due date if s/he considers that the reasons for the request are justifiable. If not, the Environmental Co-ordinator will respond, with reasons, in a progress report in the EMSD for the action in question.	Coordinator, EMS Representative
6.2.5	**Action status reminders** The EMSD will send a reminder to the responsible person of actions due in the coming month and a notification to the Environmental Co-ordinator of all actions currently listed as overdue.	Environmental Coordinator
6.2.6	**Actions to be taken by the Environmental Co-ordinator** The Environmental Co-ordinator will review and may change the status of incidents, non-conformances and complaints logged in the EMSD if necessary i.e. whether it is an incident, non-conformance or complaint. The severity rating of the incident, non conformance or complaint logged in the EMSD (i.e. Level 1, 2 or 3. See Appendix 1 for definitions) will be reviewed and modified by the Environmental Co-ordinator if necessary. The Environmental Co-ordinator will review the corrective and preventative actions reported and may require additional actions to be taken before the incident, non-conformance or complaint is signed off.	Environmental Coordinator

ORIGINATOR	HEAD OF DEPARTMENT	GENERAL MANAGER
Real Mining. Real People. Real Difference		

AngloAmerican THERMAL COAL

Date:	Revision:	Procedure no:	Page:			GREENSIDE COLLIERY
August 2012	12	AATC-GS-EMS-MP-09	9	of	13	Anglo Operations Ltd
Next Review date:	Procedure Name:					DEPARTMENT
August 2015	Environmental Incidents, Non-Conformances and Complaints					Environmental

No.	Activity	Responsibility
	The Environmental Co-ordinator will be responsible for closing out incidents, non-conformances and complaints when progress reports entered for corrective and preventative actions have been reviewed and the actions are deemed sufficient. The Environmental Co-ordinator may investigate selected corrective and preventative actions to ensure that there is evidence that these actions have been implemented. A sample of completed incident, non conformance and complaint actions will also be audited during the monthly EMS day audit to ensure that actions reported as complete, have been implemented. The Environmental Co-ordinator will regularly (at least monthly) review the Incidents, non-conformances and complaints reported in the EMSD. Should the incident, non-conformance or complaint have been deemed a legal non-conformance, a notification letter and report will be forwarded to the relevant government department, as per AATC-GS-EMS-MP-06: Environmental Communication	
6.3	**Revision Criteria**	
6.3.1	This document shall be reviewed as follows: • At least every **THREE** years; • When there is a change of method and/or technology that may affect the accuracy of the document; • When there has been a significant event to which this document was relevant; As a result of relevant audit findings.	Note
6.4	**Appendices**	
6.4.1	Appendix 1 refers to the definitions for the different levels of incidents.	Note

ORIGINATOR	HEAD OF DEPARTMENT	GENERAL MANAGER
Real Mining. Real People. Real Difference		

THERMAL COAL

Date:	Revision:	Procedure no:	Page:			GREENSIDE COLLIERY
August 2012	12	AATC-GS-EMS-MP-09	10	of	13	Anglo Operations Ltd
Next Review date:	Procedure Name:					DEPARTMENT
August 2015	Environmental Incidents, Non-Conformances and Complaints					Environmental

7. REFERENCES

ISO 14001: 2004

AATC-GS-EMS-ER-010: Complaints Register

AATC-GS-EMS-MP-02: Environmental Aspects

AATC-GS-EMS-MP-04: Objectives, Targets and Programmes.

AATC-GS-EMS-MP-06: Environmental Communication Procedure.

8. RECORDS

8.5 Records required for this procedure

Record	Frequency	Responsibility
AATC-GS-EMS-ER-010: Complaints Register	As Required	Environmental Co-ordinator

8.6 Procedure History

Revision	Changes	Date
Version 2	New procedure format Adding section 2.3.3 Change some responsibilities Adding electronic reporting of incidents.	November 2003
Version 3	Section 1 Various changes	June 2004

ORIGINATOR	HEAD OF DEPARTMENT	GENERAL MANAGER
Real Mining. Real People. Real Difference		

AngloAmerican THERMAL COAL

Date:	Revision:	Procedure no:	Page:			GREENSIDE COLLIERY
August 2012	12	AATC-GS-EMS-MP-09	11	of	13	Anglo Operations Ltd
Next Review date:	Procedure Name:					DEPARTMENT
August 2015	**Environmental Incidents, Non-Conformances and Complaints**					Environmental

Version 3	Section 2.1 Added definitions and abbreviations and delete and add some examples	June 2004
Version 3	Section 2.2.1. Delete all and re-write	June 2004
Version 3	Section 2.2.2. Various changes	June 2004
Version 3	Section 6.1.3. Rewrite "Boontoe" procedure	June 2004
Version 3	Section 2.2.4.Delete and re-write existing prompting system	June 2004
Version 3	Section 2.3 Delete and re-write	June 2004
Version 4	Changed complaints definition	September 2005
Version 4	Changed Environmental Officer to Environmental Co-ordinator	September 2005
Version 4	Removed internal complaints section	September 2005
Version 4	Reviewed Section 2.4	September 2005
Version 5	2.4 Added "overdue" actions	June 2006
Version 6	No changes made	May 2007
Version 7	2.1 Included version 6	July 2008
Version 7	2.1 Included chemical in the definition of an incident	July 2008
Version 7	2.1 Included a definition of a "Boontoe" book	July 2008
Version 8	2.3 If the incident is logged on the EMSD, the action for that incident must be included into the system before the end of two weeks after the incident is logged.	November 2008

ORIGINATOR	HEAD OF DEPARTMENT	GENERAL MANAGER

Real Mining. Real People. Real Difference

AngloAmerican THERMAL COAL

Date:	Revision:	Procedure no:	Page:			GREENSIDE COLLIERY
August 2012	12	AATC-GS-EMS-MP-09	12	of	13	Anglo Operations Ltd
Next Review date:	Procedure Name:					DEPARTMENT
August 2015	Environmental Incidents, Non-Conformances and Complaints					Environmental

Version 9	Added section 2.4 on Electronic Pivot Entries.	Sept 2009
Version 10	Added section 2.3.3 Reporting to Authorities	May 2010
Revision 11	Updated procedure with new format. Section 6.4. Changed revision interval to 3 yearly. Section 6.1.3 Boontoe prompting system is replaced with the weekly Greenside Boontoe Khulumisana in 8 (BK in 8) audit (EP10 – SHE Auditing)	August 2011
Revision 12	Updated procedure to new numbering systems. Removed BK in 8 audit. Removed SHE incident register, incident sheets as the EMSD is being used to capture these.	August 2012

9. APPENDIX 1

Incidents / non-conformances: Level 1, 2 and 3 Definitions

Level 1 Incident:

Number of incidents during the reporting period that resulted in: a minor impact on the physical or biological environment (air, land, water or habitats) with no significant or long-term impairment of ecosystem function or surface/ground water resource and/or an inconvenience/ disturbance/ disruption/annoyance (including odour, dust, noise, traffic problem, loss of water supply) of short duration and with no long-term effect on the community; and/or a release of material (gas, liquid, solid) or energy which has the potential to cause illness, injury or property damage to the public, or one which causes short-term discomfort or reversible health effect to the public; and/or minor repairable damage to commonplace structures of cultural significance, or minor infringement of cultural values;

ORIGINATOR	HEAD OF DEPARTMENT	GENERAL MANAGER
Real Mining. Real People. Real Difference		

AngloAmerican THERMAL COAL

Date:	Revision:	Procedure no:	Page:			GREENSIDE COLLIERY
August 2012	12	AATC-GS-EMS-MP-09	13	of	13	Anglo Operations Ltd
Next Review date:	Procedure Name:					DEPARTMENT
August 2015	Environmental Incidents, Non-Conformances and Complaints					Environmental

Level 2 Incident:

Number of incidents during the reporting period that resulted in: a moderate impact on the physical or biological environment (air, land, water or habitats) with limited impairment of ecosystem function or surface/ground water resource; and/or a minor impact to fauna or flora in a statutory designated area (e.g.: National Park); and/or an inconvenience/disturbance/disruption /annoyance (including odour, dust, noise, traffic problem, loss of water supply) of moderate duration or with medium-term effect on the community; and/or a release of material (gas, liquid, solid) or energy which causes severe but reversible illness, non-disabling injury or moderate property damage to the public; and/or damage to rare structures of cultural significance, or significant infringement of cultural values/sacred locations; Or where prosecution and conviction has led to fines totalling less than US$ 100 000 per event. An incident is an unplanned occurrence, or event.

Level 3 Incident:

Number of incidents during the reporting period that resulted in a significant impact on the physical or biological environment (air, land, water or habitats) with extensive or long-term impairment of ecosystem function or surface/ground water resource; and/or an impact to unique or protected species or habitats; and/or an inconvenience/disturbance/disruption/annoyance (including odour, dust, noise, traffic problem, loss of water supply) of long duration or with long-term effect on the community; and/or a release of material (gas, liquid, solid) or energy which causes chronic illness, permanent disabling injury, fatality or extensive property damage to the public; and/or irreparable damage to highly valued structures or sacred locations; and/or instances where prosecution has led to conviction and fines totalling more than US$ 100 000 per event.

ORIGINATOR	HEAD OF DEPARTMENT	GENERAL MANAGER
Real Mining. Real People. Real Difference		

10. MONITORING AND AUDITING

This section provides information pertaining to the monitoring and auditing to be implemented as part of the new Discard Facility project including proposed monitoring and auditing commitments.

The aim of environmental monitoring and auditing is to develop a cost-effective approach to monitoring the operations' environmental performance. Certain parameters (e.g. water quality) can be monitored through measurements, others can only be monitored through observation (e.g. maintenance effectiveness). However, in all cases anticipation of environmental problems through assessment of the environmental impact of the operations' working methods, followed by forward planning to prevent problems or at least limit their effects, is seen as the key to successful environmental management.

10.1 MONITORING AT GREENSIDE COLLIERY

10.1.1 Existing monitoring and management procedures

The following Management procedures have been developed and implemented to assist Greenside Colliery and should also be applied to the new Discard Facility:

Table 65: Management Procedures at Greenside Colliery

Procedure Number	Description
EP 01	Environmental Management System Manual
EP 02	Aspects Identification and Management
EP 03	SHE Legal Requirements
EP 04	Targets and Objectives Management and New Procedures
EP 05	Environmental Training
EP 06	Environmental Communication and Reporting
EP 07a & b	Environmental Record keeping and Document Control
EP 08	Emergency Preparedness and Response
EP 09	Environmental Incidents, Non-conformance and Complaints
EP 10	SHE Auditing
EP 11	Management Review Procedures

The following procedures have been developed and implemented in order to manage activities relating to the environmental impacts of the mine and should be applied to the new Discard Facility:

Table 66: Procedures to manage environmental impacts at Greenside Colliery

Procedure Number	Description
EP 12	Waste Management
EP 13	Oil Use and Handling
EP 14	Oil, Fuel and Chemical Spill Cleanup

EP 15	Trenches, Silt traps and Oil Traps Clean-up & Maintenance
EP 16	Controlled release
EP 18	Handling and Storage of hazardous materials
EP 19	Sewage Management Procedure
EP 20	Water monitoring
EP 22	Dust monitoring
EP 23	Coal and Slurry Spillage Monitoring and Clean-up Procedure
EP 24	Surface subsidence identification and rehabilitation procedure

The following procedures are relevant for the monitoring of environmental aspects and should also be applied to the new Discard Facility:

Table 67: Procedures for the monitoring of environmental aspects at Greenside Colliery

Procedure Number	Description
EP 20	Surface and Groundwater Monitoring
EP 22	Dust Suppression and Monitoring

In addition to the above Management and Monitoring procedures currently in place, the following additional surface water, groundwater and bio monitoring should be conducted at the proposed new Discard Facility.

10.1.2 Additional Monitoring

10.1.2.1 Surface water monitoring

Surface water quality monitoring will be conducted, with the objective to quantify the impact on surface water quality associated with the proposed new Discard Facility and all associated activities. Surface water quality sampling will be conducted on a monthly basis. The water quality tests will be analysed by a SANAS certified laboratory. The results of the chemical and biological analysis will be captured in a database that will be made available to management. The additional surface water monitoring locations are illustrated within Table 68. The chemical characteristics and micro constituents of the water samples will be analysed as indicated in Table 69.

Table 68: The surface water monitoring locations

Surface water monitoring	
Location name	Description
SW01	Greensidespruit upstream
SW02	Greensidespruit downstream
SW03	Workshop PCD
SW04	3A North PCD

Table 69: Chemical and Physical constituents

Monitoring	Variable
Monthly	EC, pH, TDS, total alkalinity (HCO_3^-/CO_3^-), calcium, magnesium, sodium, potassium, chloride, sulphate, fluoride, iron, manganese, aluminium, soap, oil and grease, and nutrients (PO_4^-, NO_3^- and NH_4^+).

Surface water use will be monitored and recorded on a monthly basis at the following locations:

- Monitor the quantity of potable water pumped to the Potable Water Tank and Washbay JoJo Tanks,
- Quantity of water pumped from 3A North Pollution Control Dam to the existing Greenside Return Water Dam, and
- Monitor the quantity of water used for dust suppression.

The water monitoring programme will be reviewed and revised on an annual basis so as to be in accordance with the Best Practice Guidelines G3: Water Monitoring System, dated July 2007.

A quarterly report with the surface water and groundwater monitoring data must be compiled. This report must contain as a minimum time-series graphs and statistical analysis (e.g. average, maximum, minimum analysis). The data must also be presented in map format to present a picture of the water quality situation at the proposed Discard Facility. Laboratory results must be analysed against target water quality guidelines for domestic use, aquatic environment, livestock watering and irrigation.

10.1.2.2 Groundwater

Groundwater quality monitoring will be conducted, with the objective to quantify the impact on groundwater quality associated with the proposed new Discard Facility and all associated activities. Groundwater quality sampling will be conducted on a quarterly basis at the locations shown below. The water quality tests will be analysed by a SANAS certified laboratory. The results of the chemical and biological analysis will be captured in a database that will be made available to management. The groundwater water monitoring programme will be updated and reviewed on an annual basis in consultation with DWS policy.

Groundwater monitoring, from a comprehensive borehole network, is required on a regular basis to know what the impact of the activity is.

A source or impact monitoring program is designed to determine the effect of the operation/source on the ambient (unaffected) groundwater quality. The up gradient (incoming) groundwater quality should thus be measured at a few positions to compare with qualities down gradient of the suspected pollution sources.

The water monitoring programme will be reviewed and revised on an annual basis so as to be in accordance with the Best Practice Guidelines G3: Water Monitoring System, dated July 2007.

The groundwater monitoring locations are illustrated within Table 70. These locations should be monitored in addition to the current water monitoring programme implemented by Greenside Colliery.

Table 70: The groundwater monitoring locations

Groundwater monitoring			
Location name	**X-coord**	**Y-coord**	**Description**
PBH1	18350	-2871726	Downgradient of plant area
PBH2	19487	-2871353	Downgradient of 3A North Pollution Control Dam
PBH3	18162	-2872789	Upgradient of current Greenside Dump
PBH4	19067	-2873250	Downgradient of proposed new Discard Facility
PBH5	20296	-2874536	Downgradient of proposed new Discard Facility
PBH6	19755	-2875197	Upgradient of proposed new Discard Facility

The parameters recommended for analysis are listed in Table 71. This monitoring schedule should be re-assessed by a qualified person every year or two.

Table 71: Chemical and Physical constituents

Monitoring	Variable
Quarterly	EC, pH, TDS, total hardness, total alkalinity, calcium, magnesium, sodium, potassium, chloride, sulphate, fluoride, nitrate, iron, manganese, aluminium and turbidity.

Monitoring results must be entered into an electronic database as soon as results are available, and at no less than one monthly interval. This will allow for effective data management and the compilation of the quarterly report (see discussion below).

A quarterly report with the surface water and groundwater monitoring data must be compiled. This report must contain as a minimum time-series graphs and statistical analysis (e.g. average, maximum, minimum analysis). The data must also be presented in map format to present a picture of the water quality situation at the proposed Discard Facility. Laboratory results must be analysed against target water quality guidelines for domestic use, aquatic environment, livestock watering and irrigation.

10.1.2.3 Bio-monitoring

Bio-monitoring needs to be undertaken upstream and downstream in the Greensidespruit. Bio-monitoring will be undertaken biannually (in the summer and winter) by an appointed environmental specialist.

10.2 AUDITING AT GREENSIDE COLLIERY

This section provides information pertaining to the auditing to be implemented at Greenside Colliery including proposed commitments. At the Greenside Colliery auditing is conducted in accordance to the procedure "*SHE Audit Provedure (EP10",* available from the mine upon request.

10.2.1 Audit Types

10.2.1.1 Contractors / Suppliers Audits

All contractor / supplier audits will be organised with the affected parties well in advance of the audit. The contractor / supplier to be audited will be determined based on the potential environmental risk that the contractor / supplier pose to the operation. This will be assessed when updating the mine's annual external audit schedule.

An informal opening meeting will be held before every contractors/suppliers audit. An attendance register will be signed before the audit commences. The meeting will confirm the scope, objective and members of the audit teams.

The audit team shall then conduct the audit using one or more of the following documents provided by the environmental department:

- Previous audit findings,
- Objectives and targets sheets,
- Checklists
- Environmental procedures, and
- Any other documents that may be relevant for the audit.

The findings shall be recorded by the audit team on the observation sheets / check sheets provided. Feedback of the audit results will be done at a close out meeting with the contractor/supplier. The lead auditor for the audit will compile a report that will be submitted to the contractor/supplier and EMS representative responsible for the contractor.

All original audit reports will be forwarded to the environmental department for filing along with the attendance register for the audit. It is the responsibility of the EMS representative, responsible for the contractor activity on the operation, to ensure that the contractor is aware of the issues identified in the audit and that audit actions are addressed.

10.2.1.2 Other External Audits

External audits will be conducted in the agreed format provided by relevant suppliers, consultants and/or auditing bodies. An audit report will be required in both electronic and hard copy format from the external auditors. The audit report must contain the scope of the audit, the findings and recommendations and a detailed list of specific comments as well as the list of the audit team members and the auditees. Where possible a photographic record is kept to illustrate observations, but it is not mandatory.

The following external audits will be periodically conducted on the operation/mine:

- Environmental legal audit or legal review,
- Environmental performance audit,
- Certification / surveillance audit, and
- Any other audits to evaluate compliance with other requirements to which the mine subscribes.

10.2.1.3 Internal Audit Teams / Qualifications / Schedule

10.2.1.3.1 Audit Teams

The EMS management representative shall appoint a suitably qualified and/or experienced person or persons to conduct the audit to ensure objectivity and impartiality of the audit process. The audit team members shall not include members of the area being audited but will be facilitated / guided by a person from that department when on site.

When there is more than one person appointed to conduct an audit the EMS management representative shall appoint one person to act as lead auditor. Should there not be any qualified/experienced persons available at the mine to undertake a specific audit, someone may be sourced from another operation or from a consultancy.

10.2.1.3.2 Lead Auditor

For internal audits, a member of the team will have completed a registered auditing course and / or have a minimum of 2 years' experience in the mining SHE field.

10.2.1.3.3 Internal Audit Schedule

Internal audits will be conducted according to the internal audit schedule. Criteria determining the scope and type of audit shall be based on the environmental importance of the activity concerned and the results of previous audits. Where applicable the frequencies of audits will be determined by potential high risk activities identified during on-site audits, certification audits and/or audits required by head office.

10.2.1.4 Legal Compliance Audit

Environmental legal compliance audits will be performed every two years to determine the status of compliance against all applicable legislation and policies.

10.2.1.5 Audit and report on relevance of the environmental authorisation, environmental management programme and closure plan

Auditing of environmental authorisation, environmental management programme and closure plan must be done in accordance to the Regulation 34 and Appendix 7 of the EIA Regulations (2014) under the NEMA (1998).

10.2.1.5.1 Audit Process

According to Regulation 34 of the EIA Regulation (2014):

“(1) The holder of an environmental authorisation must, for the period during which the environmental authorisation and EMPr, and where applicable the closure plan, remain valid-

(a) ensure that the compliance with the conditions of the environmental authorisation and the EMPr, and where applicable the closure plan, is audited; and

(b) submit an environmental audit report to the relevant competent authority.

(2) The environmental audit report contemplated in subregulation (1) must-

(a) be prepared by an independent person with the relevant environmental auditing expertise;

(b) provide verifiable findings, in a structured and systematic manner, on-

(i) the level of performance against and compliance of an organization or project with the provisions of the requisite environmental authorisation or EMPr and, where applicable, the closure plan; and

(ii) the ability of the measures contained in the EMPr, and where applicable the closure plan, to sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the undertaking of the activity;

(c) contain the information set out in Appendix 7; and

(d) be conducted and submitted to the competent authority at intervals as indicated in the environmental authorisation.

(3) The environmental audit report contemplated in subregulation (1) must determine-

(a) the ability of the EMPr, and where applicable the closure plan, to sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the undertaking of the activity on an ongoing basis and to sufficiently provide for the , avoidance, management and mitigation of environmental impacts associated with the closure of the facility; and

(b) the level of compliance with the provisions of environmental authorisation, EMPr and where applicable the closure plan.

(4) Where the findings of the environmental audit report contemplated in subregulation (1) indicate-

(a) insufficient mitigation of environmental impacts associated with the undertaking of the activity; or

(b) insufficient levels of compliance with the environmental authorisation or EMPr and, where applicable the closure plan; the holder must, when submitting the environmental audit report to the competent authority in terms of subregulation (1), submit recommendations to amend the EMPr or closure plan in order to rectify the shortcomings identified in the environmental audit report.

(5) When submitting recommendation in terms of subregulation (4), such recommendations must have been subjected to a public participation process, which process has been agreed to by the competent authority and was appropriate to bring the proposed amendment of the EMPr and, where applicable the closure plan, to the attention of potential and registered interested and affected parties, including organs of state which have jurisdiction in respect of any aspect of the relevant activity and the competent authority, for approval by the competent authority.

(6) Within 7 days of the date of submission of an environmental audit report to the competent authority, the holder of an environmental authorisation must notify all potential and registered interested and affected parties of the submission of that report, and make such report immediately available-

(a) to anyone on request; and

(b) on a publicly accessible website, where the holder has such a website.

(7) An environmental audit report must contain all information set out in Appendix 7 to these Regulations.

10.2.1.5.1 Audit Report

According to Appendix 7 of the EIA Regualtion(2014):

"1. The environmental audit report must provide for recommendations regarding the need to amend the EMPr, and where applicable, the closure plan.

2. The objective of the environmental audit report is to-

(a) report on-

(i) the level of compliance with the conditions of the environmental authorisation and the EMPr , and where applicable, the closure plan; and

(ii) the extent to which the avoidance, management and mitigation measures provided for in the EMPr, and where applicable, the closure plan achieve the objectives and outcomes of the EMPr, and closure plan. identify and assess any new impacts and risks as a result of undertaking the activity; evaluate the effectiveness of the EMPr, and where applicable, the closure plan; identify shortcomings in the EMPr, and where applicable, the closure plan; and identify the need for any changes to the avoidance, management and mitigation measures provided for in the EMPr, and where applicable, the closure plan.

3. (1) An environmental audit report prepared in terms of these Regulations must contain-

(a) details of-

(i) the independent person who prepared the environmental audit report; and

(ii) the expertise of independent person that compiled the environmental audit report;

(b) a declaration that the independent auditor is independent in a form as may be specified by the competent authority;

(c) an indication of the scope of, and the purpose for which, the environmental audit report was prepared;

(d) a description of the methodology adopted in preparing the environmental audit report;

(e) an indication of the ability of the EMPr, and where applicable, the closure plan to-

(i) sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the undertaking of the activity on an on-going basis;

(ii) sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the closure of the facility; and

(iii) ensure compliance with the provisions of environmental authorisation, EMPr, and where applicable, the closure plan;

(f) a description of any assumptions made, and any uncertainties or gaps in knowledge;

(g) a description of any consultation process that was undertaken during the course of carrying out the environmental audit report;

(j) a summary and copies of any comments that were received during any consultation process; and

(k) any other information requested by the competent authority."

.

11. MINE CLOSURE AND FINANCIAL PROVISIONING

11.1 OBJECTIVES AND SPECIFIC GOALS FOR MINE CLOSURE

Overall objectives for Greenside Colliery which will form the basis of closure planning are provided below, and further detail is provided by means of implementation in Part 8 of this report.

11.1.1 Surface water

Surface water closure objectives relate to the minimization of discharge of contaminated water emanating from the Greenside Colliery mine workings to the surface water environment, as well as the attainment of the stipulated in-stream water quality standards.

11.1.2 Groundwater

Groundwater closure objectives relate to limiting the groundwater quality affected zone, as well as continue of supply of water to landowners affected by impaired groundwater.

11.1.3 Infrastructural areas

This objective is focused on finding alternative uses for all domestic accommodation and its associated infrastructure, as well as the demolition and disposal of infrastructure with no beneficial use.

11.1.4 Mine residue deposits

The remaining residue deposits after mine closure will be rendered stable with a self-sustaining vegetation cover. A minimum topsoil cover of 250-300 mm will be provided for vegetation establishment.

11.1.5 Sealing of underground workings

Shafts and openings will be sealed in accordance with the requirements of the Regional Director of Mineral Resources.

11.1.6 Rehabilitation and maintenance of disturbed areas

Contaminated and stooped areas will be restored to wilderness or better quality. Rehabilitated areas will be managed during life of mine to ensure that long-term goals for the rehabilitated land are attained. A gradual return to agriculture will be followed, and rehabilitated land will be integrated into the surrounding faming system.

11.1.7 Surface subsistence/erosion

No surface subsistence after mine closure is foreseen but, in the unlikely event of this occurring, actions that may be implemented to address the situation include:

- Installation of contour berms to re-route stormwater;
- Filling in of subsistence areas;

- Re-establishment of vegetation;
- Counteracting any surface erosion; and
- Implementation of measures to remediate surface erosion.

11.2 FINANCIAL PROVISION

Money will be set aside and be paid into the Pollution Control Fund on an annual basis. The figures are recalculated on an annual basis to take account of inflation and any variances; subsequently, the annual contribution is adjusted to provide for full closure costs two to three years prior to the actual closure.

A summary of Pollution Control Fund's costs for immediate closure follows in Table 72. For a detailed breakdown of Greenside Colliery's Pollution Control Fund financial provision please see Appendix F.

Table 72: Summary of Closure Cost for the new Discard Facility

ITEM NO.	DESCRIPTION	DECOMMISSIONING COSTS	RESTORATION	SCRAP PROCEEDS	WATER TREATMENT PLANTS
1	Plant	R 3 627 147.83	R 185 511.76	(R 1 075 000.00)	R 0.00
2	Buildings & Structures	R 2 258 508.00	R 8 816.80	(R 778 005.60)	R 0.00
4	General Surface Rehab	R 182 564.80	R 227 092.80	R 0.00	R 0.00
5	Discard and Slime Dumps	R 63 705.60	R 40 842 114.00	R 0.00	R 0.00
6	Maintenance & Monitoring	Excluded	R 1 750 000.00	R 0.00	R 0.00
7	Management	Excluded	R 2 047 928.40	R 0.00	R 0.00
	TOTAL :	**R 6 131 926.23**	**R 45 061 463.76**	**(R 1 853 005.60)**	**R 0.00**
8	**Contingencies (10%)**	**R 613 192.62**	**R 4 506 146.38**		
9	**Preliminaries and General (20%)**	**R 1 226 385.25**	**R 9 012 292.75**		
	TOTAL :	**R 7 971 504.10**	**R 58 579 902.89**		

12. ENVIRONMENTAL AWARENESS PLAN

An environmental awareness plan describing the manner in which the applicant intends to inform his or her employees of any environmental risks which may result from their work and the manner in which the risks must be dealt with in order to avoid pollution or the degradation of the environment.

12.1 ORGANISATIONAL STRUCTURE, RESOURCES AND COMPETENCIES

The organisational structure includes the necessary resources and associated competence for managing the risks to the environment and for implementing the commitments of the EMP and EIA. Where internal resources do not have adequate capacity or competence, external specialists are sourced.

Mine Management has assigned the Environmental Co-ordinator as the competent person in accordance with the relevant legislation.

Refer to the Organogram below, as per the Management Procedure "*Environmental Systems Manual, EP01*", available from the mine upon request, for an indication of the line structure at Greenside Colliery.

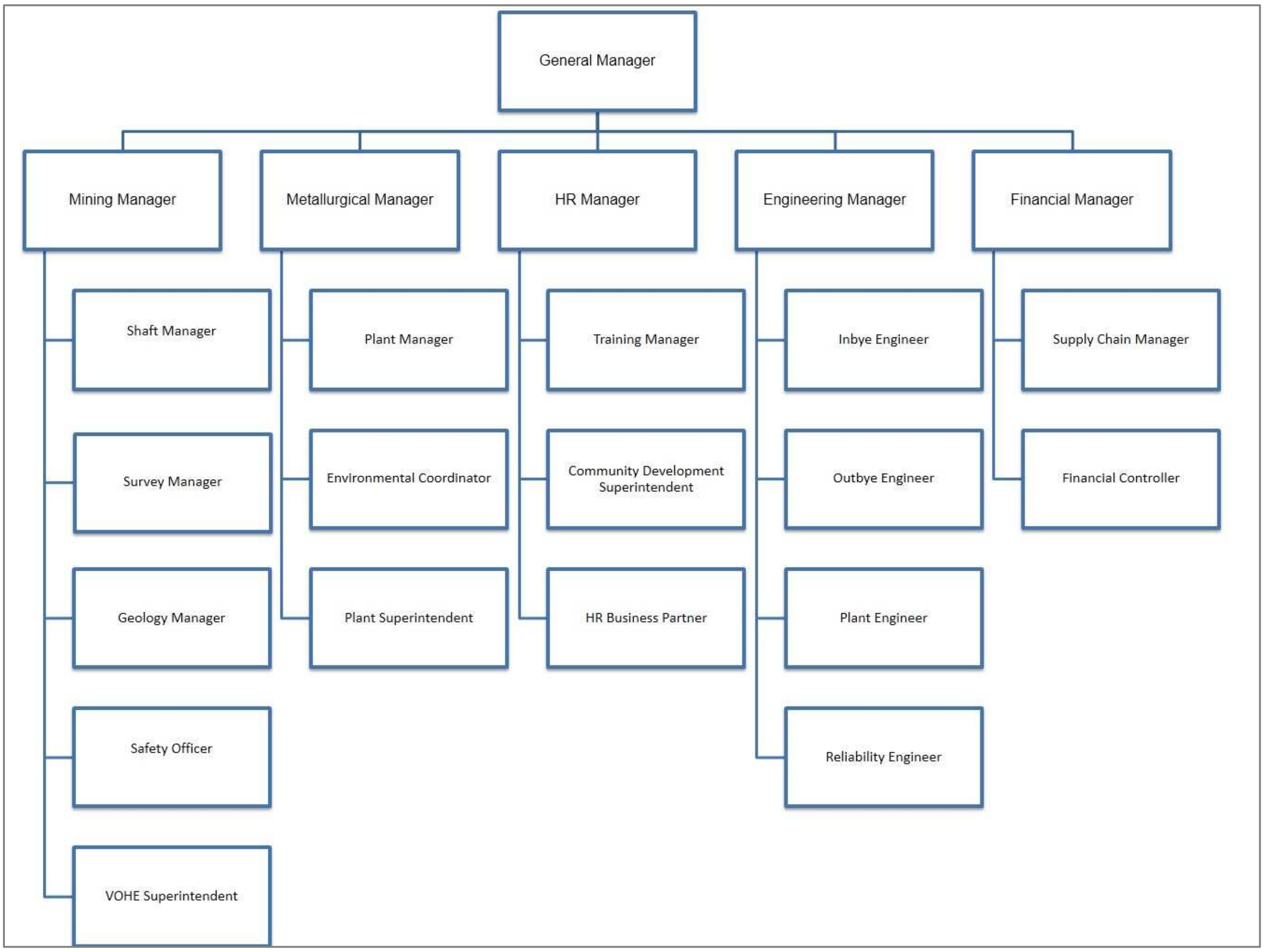


Figure 56: Organogram of the line structure at Greenside Colliery

12.2 EDUCATION AND TRAINING

Environmental conditions are included in any construction contracts, thereby making contractors aware of the potential environmental risks associated with the project and the necessity to prevent accidental spillages by the implementation of good housekeeping practices.

12.3 ENVIRONMENTAL TRAINING

Personnel whose work tasks can impact on the environment is made aware of the requirements of appropriate procedures / work instructions. The environmental manager communicates training requirements to responsible supervisors to ensure that personnel and contractors are trained accordingly.

12.3.1. Scope

The environmental training management procedure: "*Environmental Training, EP 05*", available from the mine upon request, sets out the training objectives regarding the mine's EMS. This procedure serves to improve awareness, training and competency in the environmental field for all persons working for, or on behalf of, Greenside Colliery. The procedure makes provision for the establishment, implementation and training of the SHE policy, significant environmental aspects and EMS procedures.

The following objectives are set for the standard environmental training management procedure:

- To implement an EMS training and awareness course at the mine,
- To identify environmental training and development needs,
- To clarify the EMS training and to ensure that all employees and applicable contractors are correctly instructed with regards to the environment, and
- To train all managers, supervisors and employees as the need arise and where required.

12.3.2. Responsibilities

The training officer and mining training officer are the responsible persons regarding the management / co-ordination of the afore-mentioned management procedure. These persons ensure that the relevant persons, who have responsibilities under the procedure, follow the instructions in the mentioned procedure. Each of the relevant persons has a copy of the environmental training management procedure.

The following legislation and standards apply to the above-mentioned standard procedure:

- EEA , 1998 – Areas where employment equity are defined, including training & development,
- NEMA , 1998– Recommendations for institutional co-operation, and
- MPRDA – Development of an environmental awareness plan.

12.3.3. Induction Programme

Training programmes currently implemented continue to be maintained for newly appointed and permanent staff as well as all permanent contractors. The relevant line manager ensures that all persons working for, or on behalf of, the mine receive training in the following aspects regarding their respective areas of responsibilities:

- SHE Policy,
- Environmental conservation,
- Environmental procedures applicable to each area (as per their related aspects and impacts) and environmental reporting,
- General environmental awareness for mine-related environmental issues, and
- Maintaining conformance with the mine's EMS.

Refresher training on environmental procedures takes place once a year when employees report for induction training. If an employee does not pass the environmental procedure tests, they will be required to re-do the test until they pass. These records are available at the training department.

It is the responsibility of the relevant line manager to ensure that the applicable contractor staff, who works within the supervisor's area of responsibility, are trained and briefed on all environmentally-applicable requirements.

Contractors that are employed at Greenside Colliery completes the contractor's package, prior to any starting of working activities. 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.

12.3.4. Training Needs

Training needs are, and will continue to be identified:

- By management or staff through:
  - Performance appraisal,
  - At the time of recruitment (in the work place),
  - Training needs analysis,
  - In-task observation of performance, and
  - The aspect register.
- Through the analysis of change resulting from:
  - Additions to the scope in services provided, and
  - The updating of procedures (quality, technical and administrative).
- By management and staff for the induction of:
  - New appointed permanent, contract or temporary staff.

Training needs continue to be identified through work performance, requests by employees and work area review. Once training needs have been established it is the responsibility of the supervisor to notify the training department of the requirements. The training department then identify pertinent and relevant courses (if not already taken by the employee / supervisor) and schedule training accordingly.

12.3.5. Training Planning

Identified and agreed training needs are included in budgets and processed as described below. Course attendance (other than at the internal induction courses) is 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 are checked and approved by the head of department. The training department completes a course authorisation form and ensure that the procedures are followed regarding course bookings, confirmations and payments.

Planning of training (done through training needs analysis) is co-ordinated between the training superintendent and the relevant section heads. This results in a training schedule for job-specific training on the mine.

The trainee:

- Obtain approval from the head of department, and
- Request the training department to make an official booking.

External training courses are assessed through:

- Attendance by, and the formal reports and recommendations of staff,
- Recommendation by known competent external personnel, and
- Review of course content, presenters, location and facilities by knowledgeable personnel.

12.3.6. EMS Training

All mine officials, employees and applicable contractor staff has, or where applicable, receive training on the basic environmental awareness course. The mentioned course covers the following basics:

- Water Management,
- Land Management,
- Air and Noise aspects,
- Living things,
- Resource Control,
- Waste Control,
- EMS ISO 14001 and the utilisation of PIVOT for EMS representatives, and
- Legal and other requirements.

All employees, current and new, and contractors undergo induction, a part of which is environmental awareness training and includes the environmental policy. At the end of the training, personnel are required to complete the awareness test.

All personnel performing tasks that can cause significant or major environmental impacts are competent on the basis of training, education and / or experience. This applies to, but is not limited to, supervisor level and above, i.e. operators, artisans.

Awareness training includes the potential consequences of departure from specified operating procedures as well as significant environmental impacts, actual or potential, of their work activities. Furthermore, training is appropriate to the activity of individual employees.

Evaluation of awareness and competency training (implementation of training in the work place) is carried out by the environmental co-ordinator, the environmental officer, activity managers and staff of the training department. The evaluation can also be supplemented by senior management, if required.

12.3.7. Training Evaluation

Evaluation of induction training, procedure training and general awareness and competency are carried out by the SHE day team, environmental officer, environmental co-ordinator, activity managers and staff of the training department.

The following records are maintained by the training department when relevant:

- Personnel qualifications,
- Training needs,
- Certificates,
- Licenses,
- Training programmes / courses attended, and
- Staff induction.

Performance appraisals are kept by the industrial relations department due to their sensitive nature. All foregoing records are maintained in the employee's personnel files, training department records section and site manager's records where applicable.

Induction training as well as all other forms of external training facilities / courses / venues etc., is the responsibility of the training superintendent. EMS training is co-responsibility shared with the EMS co-ordinator.

12.3.8. Reporting

A standard reporting procedure has been formulated for Greenside Colliery. It is the responsibility of the environmental co-ordinator to maintain the mentioned procedure.

Reporting checklists are completed and filed in the site's EMS file on a monthly and annual basis. A copy of the reporting checklists is kept in the EMS master file and a copy kept by the person responsible for the procedure. A short explanatory note is completed on non-conformance and forwarded to the relevant department.

12.4 INTERNAL AND EXTERNAL COMMUNICATION

The Internal and External Communications Management Procedure sets out how internal and external communication should take place at Greenside Colliery.

The mentioned procedure has the following objectives:

- To provide a clear means of information transfer through the organisation and describe the mechanisms used for this purpose, and
- To provide a guideline for the process involved in communication with outside organisations.

The above-mentioned internal and external communications management procedure is available from the mine upon request.

12.4.1 Identification of Stakeholders

Greenside Colliery is committed to communicating effectively with identified I&AP's and stakeholders. The I&AP's identified in terms of the mining and related activities at Greenside Colliery include the following:

- Department of Agriculture, Rural Development, Land and Environmental Affairs,
- Department of Mineral Resources,
- Department of Water and Sanitation,
- Mpumalanga Tourism and Parks Agency,
- National Department of Agriculture,
- Adjacent Surface Owners,
- Witbank Magisterial District, and
- Surface water and groundwater users.

The database of stakeholders is, and will continue to be, updated on an annual basis. The most recent record of identified stakeholders is kept readily available on file by the responsible person for inspections and audits.

12.4.2 Public liaison and forum participation

Public liaison and forum participation form part of external communication undertaken by the mine. This also includes forum development and involvement, stakeholder liaison, annual public meetings and authorities meetings. Greenside Colliery continues to aim at establishing and maintaining good relations with neighbouring surface owners and I&AP's.

12.4.3 Distribution of information

Communication and reporting form an integral part of the implementation of the EMP. Greenside Colliery is therefore committed to communicating and distributing the relevant information effectively to its employees, as well as to all the identified I&AP's.

12.4.4 Public meeting(s)

Public participation is a requirement in terms of the MPRDA, the NWA and the NEMA. Public meetings form an important part of the public participation, since they provide the opportunity for the mine and the identified I&AP's to communicate on issues regarding the environment and social well-being.

12.4.5 Documents for public review

As part of the public participation that is undertaken by Greenside Colliery regarding current and future projects, all documentation pertaining to environmental management are made available upon request to all registered I&AP's.

12.5 AWARENESS RAISING

12.5.1 Personnel

- All employees, current and new and contractors undergo induction, a part of which is environmental awareness training. At the end of this training, personnel are required to complete the awareness test and the level of awareness assessed by the training department. Re-testing or induction may be required.
- All personnel performing tasks which can cause significant or major environmental impacts shall be competent on the basis of training, education and/or experience. This applies to, but is not limited to, supervisor level and above – i.e. operators, artisans.

12.5.2 Type

- Awareness training includes the potential consequences of departure from specified operating procedures as well as significant environmental impacts, actual or potential, of their work activities.
- Training is appropriate to the activity of individual employees.
- Monthly environmental topics are generated to raise awareness of employees on environmental issues.

12.5.3 Evaluation

- Evaluation of awareness and competency training is carried out through questionnaires or post-training tests conducted during training sessions and is done through questioning of employees during audits.

Over and above the environmental awareness procedure, the awareness plan is detailed as follows:

- Induction on environmental issues to all employees starting to work on the mine,

- Induction to all employees coming back from leave and those who have been away from the mine for more than three weeks,
- At least one green flash (short environmental bulletins) is distributed on the mine each month,
- Environmental topics (together with the safety and health) are published on the noticed boards each month, and
- As part of the plan to reach out to the neighbouring communities the Environmental team runs awareness campaigns within the schools on significant environmental calendar days such as World Environment Day, Arbour day, etc.

13. ASSUMPTIONS, UNCERTAINTIES AND KNOWLEDGE GAPS

In accordance with of Regulation 31(m) (of Regulation 543) of the EIA Regulations (2010), under the NEMA, 1998, a description of any assumptions, uncertainties and gaps in knowledge needs to be identified and are discussed in this part of the EIA and EMP Report.

The following knowledge gaps and uncertainties have been identified during the process of the proposed new discard facility and require further investigations:

Table 73: Specialist assumptions and limitations

Specialist	Assumptions and limitations
Floodline Report	• No flow or rainfall data against which the runoff calculations could be calibrated were available. The runoff volumes were therefore calculated theoretically; • Since no flow data was available for estimation of the roughness coefficients, the Mannings's n coefficients were estimated by comparing the vegetation and nature of the channel surfaces to the published data (Barnes, 1967; Chow. 1959); All input data for the dams (specifically dam walls and storage area within the dams) along the Greensidespruit were estimated based on the conversations with personal who had undertaken previous field assessments and on topographical maps. It must be emphasised that the study assumes the dams to be at full capacity during the flood calculations.
Trucking Study	• The truck breakdown was assumed to be a minimal occurrence and not considered at all because the purpose of the simulation was to determine the cycle time and failures would have yield wrong results as they occur stochastically while cycle time in this case is measured from the loading point to offloading and back to loading point
Heritage study	• It is possible that this Phase I HIA study may have missed heritage resources in the Project Area as heritage sites may occur in thick clumps of vegetation or in maize fields while others may lie below the surface of the earth and may only be exposed once development commences. • If any heritage resources of significance is exposed during the Discard Facility Project the South African Heritage Resources Authority (SAHRA) should be notified immediately, all development activities must be stopped and an archaeologist accredited with the Association for Southern African Professional Archaeologist (ASAPA) should be notify in order to determine appropriate mitigation measures for the discovered finds. This may include obtaining the necessary authorization (permits) from SAHRA to conduct the mitigation measures.
Lining Motivation	This report has been prepared for the specific purpose identified herein at the request of and for the use of the Client. Observations, conclusions, and recommendations contained herein are opinions based upon the scope of services, information obtained through observations and measurements taken by Schlumberger Water Services (Schlumberger) at certain points and certain times, and interpretation and extrapolation of secondary information from published and unpublished material. The report may infer the configuration of strata, ground and groundwater conditions both between data points and below the maximum depth of investigation. The report

Specialist	Assumptions and limitations
	also may deduce temporal trends and averages for climatic, hydrological and water quality parameters. Such interpretations and extrapolations are only indicative and no liability is accepted for variations between the opinions expressed herein and conditions which may be identified at a later date through direct measurement and observation. Unless otherwise agreed in writing by Schlumberger, Schlumberger accepts no responsibility for any use of, or reliance on any contents of this report by any person other than Client and shall not be liable to any person other than Client, on any ground, for any loss, damage or expense arising from such use or reliance. Should any information contained in this report be used by any unauthorized third party, it is done so at their own risk.
Stormwater management plan	Whilst all due care has been taken in reviewing the supplied information, the accuracy of the results and conclusions from the SWMP are entirely reliant on the accuracy and completeness of the supplied data. Flood peak calculations assume rainfall intensity is uniform throughout the duration of the storm. Analysis does not account for runoff retention or artificial acceleration within the catchment. Calculations are done for complete sub-catchment areas and should be distributed where there is more than one drainage point within the same built up catchment. Storm water control recommendations are based on industry experience and best practice. Final designs for construction should be authorised by an approved engineer. Contour and elevation data as provided during the analysis are assumed to be accurate and representative of the site and catchment areas. Upstream catchment activities are interpreted according to common practices and no detailed insight is available on possible storm water measures beyond the site. The assessment does not guarantee the integrity of downstream infrastructure in the event of release or discharge from site. The SWMP does not impose preference over proposed measures as this is an operational document to assist in the complete management of all storm water measures. This storm water management plan does not specifically cover considerations relevant to storm water management for the purpose of safety, like mine flooding and loss of life, the primary focus being environmental management. Recommendations represented in this report apply to the site conditions and features as they existed at the time of Shangoni's investigations, and those reasonable foreseeable. The recommendations do not necessarily apply to conditions and features that may arise after the date of this SWMP, for which Shangoni had no prior knowledge nor had the opportunity to evaluate.
Wetland study	Fieldwork for the wetland assessment was conducted during April 2013 and information collected from the survey was used for the findings of this specialist report. Any changes within the proposed area that may affect the integrity and functionality of the delineated wetland post the site investigations have not been identified and therefore the results of such impacts on the wetlands have not been taken into consideration as part of this assessment.

14. DISCUSSION AND CONCLUSION

In accordance with the EIA Regulations GN R543 31 (2) (n), the Environmental Impact Assessment Practitioner (EAP) must provide an reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation must be stated.

An impact assessment has been undertaken using qualified specialists, which has incorporated extensive consultation with and participation of interested and affected parties. Applying the hierarchical approach to impact management, alternatives were firstly considered to avoid negative impacts, but where avoidance was not possible, to better mitigate and manage negative impacts. Where impacts were found to be potentially significant, various mitigation measures to manage and monitor the impacts of the project have been proposed. Furthermore the environmental impact statement (Part 7.5) summarises the key findings of the environmental impact assessment and compares the positive and negative implications of the project.

A number of potential high impacts have been identified associated with the construction and operation of the new discard facility. Risks of special mention relate to the impacts on topography, surface- and groundwater quality, air quality and visual receptors. It is the EAP's opinion that, given the already disturbed state of the environment in which the project will be located, these impacts can be mitigated to prevent the environmental integrity from being compromised. In terms of collectively considering ecological, social and economic impacts the economic development is justifiable, and also considering the social benefit, the EAP is of opinion that this project should be authorised.

Should the Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs. grant authorisation for this project, it should be subject to the following conditions:

- The project should remain in full compliance with the requirements of the EMP and with all regulatory requirements;
- The EMP should be implemented by qualified environmental personnel who have the competence and credibility to interpret the requirements of the EIA and the EMP. Such persons must be issued with a written mandate by mine management to provide guidance and instructions to employees and contractors; and
- Stakeholder engagement must be maintained during the construction, operational and closure/rehabilitation phases of the project.