mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

Basic Assessment Report
And
Environmental Management Programme

for Environmental Authorisation for the Proposed Rehabilitation and Phytoremediation Plantation at the Eskom Kilbarchan Colliery, Newcastle, KwaZulu-Natal

DRAFT FOR PUBLIC REVIEW

SUBMITTED FOR ENVIRONMENTAL AUTHORISATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) (NEMA) AND THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT, 2008 (ACT NO. 59 OF 2008) (NEM:WA) IN RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (ACT NO. 28 OF 2002) (MPRDA) (AS AMENDED).

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This document has been prepared by Digby Wells Environmental.

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Project Name:	**Basic Assessment Report and Environmental Management Programme Report for the Rehabilitation and Construction of a Phytoremediation Plantation at the Kilbarchan Colliery**
Project Code:	**ESK 3520**

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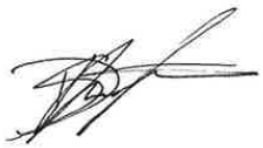
Duncan Pettit	Report Reviewer		March 2016
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IMPORTANT NOTICE

In terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002 as amended) (MPRDA), the Minister must grant a prospecting or mining right if among others the mining "will not result in unacceptable pollution, ecological degradation or damage to the environment".

Unless an Environmental Authorisation can be granted following the evaluation of an Environmental Impact Assessment (EIA) and an Environmental Management Programme (EMP) report in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), it cannot be concluded that the said activities will not result in unacceptable pollution, ecological degradation or damage to the environment.

In terms of section 16(3)(b) of the EIA Regulations, 2014, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of section 17 (1) (c) the competent Authority must check whether the application has taken into account any minimum requirements applicable or instructions or guidance provided by the competent authority to the submission of applications.

It is therefore an instruction that the prescribed reports required in respect of applications for an environmental authorisation for listed activities triggered by an application for a right or a permit are submitted in the exact format of, and provide all the information required in terms of, this template. Furthermore please be advised that failure to submit the information required in the format provided in this template will be regarded as a failure to meet the requirements of the Regulation and will lead to the Environmental Authorisation being refused.

It is furthermore an instruction that the Environmental Assessment Practitioner must process and interpret his/her research and analysis and use the findings thereof to compile the information required herein. (Unprocessed supporting information may be attached as appendices). The EAP must ensure that the information required is placed correctly in the relevant sections of the Report, in the order, and under the provided headings as set out below, and ensure that the report is not cluttered with un-interpreted information and that it unambiguously represents the interpretation of the applicant.

OBJECTIVE OF THE BASIC ASSESSMENT PROCESS

The objective of the basic assessment process is to, through a consultative process—

- determine the policy and legislative context within which the proposed activity is located and how the activity complies with and responds to the policy and legislative context;
- identify the alternatives considered, including the activity, location, and technology alternatives;
- describe the need and desirability of the proposed alternatives,
- through the undertaking of an impact and risk assessment process inclusive of cumulative impacts which focused on determining the geographical, physical, biological, social, economic, heritage , and cultural sensitivity of the sites and locations within sites and the risk of impact of the proposed activity and technology alternatives on the these aspects to determine:
- the nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and
- the degree to which these impacts—
    - can be reversed;
    - may cause irreplaceable loss of resources; and
    - can be managed, avoided or mitigated;
- through a ranking of the site sensitivities and possible impacts the activity and technology alternatives will impose on the sites and location identified through the life of the activity to—
    - identify and motivate a preferred site, activity and technology alternative;
    - identify suitable measures to manage, avoid or mitigate identified impacts; and
    - identify residual risks that need to be managed and monitored.

EXECUTIVE SUMMARY

Introduction

The Kilbarchan Colliery is located 14 km south of Newcastle, KwaZulu-Natal and falls within the Newcastle Local Municipality (NLM) and Amajuba District Municipality (ADM). Plans 1 and 2, Appendix A depict the regional and local setting of Kilbarchan Colliery. Kilbarchan Colliery was commissioned in 1954 and consisted of underground mining sections, as well as open pit areas where the coal seam was less than 20 metres below ground level (mbgl). Kilbarchan Colliery, operated by Trans Natal (later Ingwe Coal), supplied coal to the Natal inland market and to the adjacent Eskom Holdings SOC Limited (Eskom) Ingagane Power Station until its decommissioning in 1992. Rehabilitation activities on site were undertaken until 2012 which included the rehabilitation of the Discard Dump and Open Pit areas, following which Eskom assumed responsibility for the liability of Kilbarchan Colliery. However over the years in which the colliery was non-operational, the underground workings, as well as open pit areas, began filling up with water resulting in decant of mine affected water. Eskom proposes to obtain environmental authorisation for the proposed phytoremediation plantation for the management of mine affected water and maintenance/ aftercare of areas that were previously rehabilitated within the project boundaries (proposed project)

In terms of section 24 and 24D of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), as read with the Environmental Impact Assessment (EIA) Regulations (2014): Government Notices R982 and R983, a Basic Assessment is required to be undertaken. Eskom has appointed Digby Wells Environmental (Digby Wells) to undertake the various specialist studies and authorisation applications for the Basic Assessment. This report aids in the identification of impacts associated with the rehabilitation and construction of the phytoremediation plantation at the Kilbarchan Colliery and should be read in conjunction with the full Rehabilitation Plan for detailed background information.

Project applicant

The particulars for Eskom are detailed in the table below.

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Project overview

Kilbarchan Colliery consisted of two underground mining sections: Roy Point[1] in the north and Kilbarchan in the south. Underground mining commenced at the Kilbarchan Colliery in 1954 and utilised the bord and pillar mining method with an average coal seam height of 3.5 m. Early reports indicated that the extraction rate for the Colliery was 73% to 76%, but more recent reports suggested that the extraction rate was 50%; no detailed plans of the underground workings are available.

Construction of Eskom's Ingagane Power Station began in 1959 and was completed and began operations in April 1963 (Leech, 2003). Kilbarchan Colliery supplied coal to the Natal inland market as well as to the Ingagane Power Station, however, the Colliery served to supply coal solely to the Power Station from 1981 to 1987. The Ingagane Power Station began decommissioning in 1990 and Kilbarchan Colliery ceased all mining activities in 1992, with rehabilitation undertaken up until 2012.

Following the decommissioning of Kilbarchan Colliery in 1992, the underground workings, as well as open pit areas, began filling up with water at a rate of approximately 4 000 m^3 per day (Vermeulen and Van Zyl, 2011). Decant of mine affected water was first recorded in April 2004 and is predominantly taking place to the south, southeast and east of the discard dump, underground workings and Open Pit sections (Proxa, 2014). The mine affected water is characterised as having high sodium and sulfate levels resulting in high Electrical Conductivity (EC) and Total Dissolved Solids (TDS). In addition, there are also elevated levels of chloride, iron and manganese (Proxa, 2014). The mine affected water has a negative impact on the surrounding water courses it comes into contact with, as it does not meet the Interim Water Quality Objectives 2008 (IWQO) of the Ngagane Catchment.

The potential impacts associated with the maintenance/ aftercare of areas that were previously rehabilitated within the project boundaries are assessed, in addition to the infrastructure and decant management activities which include the construction of the phytoremediation plantation, in this Basic Assessment Report (BAR) for the project. The following activities discussed in Table 5-2 will be rehabilitated to minimise and mitigate the impacts caused by mining and industrial activities and to restore land back to a satisfactory standard. The properties are to be rehabilitated to grazing standard and will remain within Eskom ownership, unless indicated otherwise. The components of the rehabilitation activities are detailed for the areas listed in Table I.

It should be noted that remnant infrastructure and derelict buildings, that were once part of the Kilbarchan Colliery, are located north of the Discard Dump and west of the substation on site. The property on which the remnant infrastructure is situated has subsequently been sold to Blazing Sun Investments 35 (Pty) Ltd. (Blazing Sun) and is no longer the liability of Eskom. In the Agreement of Sale, Blazing Sun records that they are aware of possible environmental risks involved with the property and undertake to indemnify Eskom against any claims should any of the risk events occur.

[1] Roy Point does not form part of this application as the liability does not fall under Eskom's ambit.

Table I: Summary of rehabilitation actions per focus area

Zone	Target Area	Summary of current state	Proposed Rehabilitation Action
Previously Rehabilitated Areas	Discard Dump	The discard dump which was previously rehabilitated needs to be maintained / up kept again due to erosion issues as well as high compaction and a limited soil layer (less than 150 mm in places).	Replace topsoil on area to achieve a minimum of 300 mm depth; thereafter establish successful vegetation cover.
	Open pit area 1C and 2	Although most of the areas are stable and showing signs of successful restoration, erosion hotspots are present and need to be addressed.	Erosion hotspots are to be levelled with additional topsoil and vegetation cover needs to be re-established.
	Open pit area 1A and 1B		
Areas still to be rehabilitated	Landfill site	Exposed waste materials were discovered on the east side of the natural ridge line and this constitutes a possible landfill site. Depending on the contents of the possible landfill, different rehabilitation measures will be required.	If waste is found to be non-hazardous, re-soiling and revegetation should take place. If the waste is found to be hazardous, all waste will need to be removed and the underlying material evaluated. Soil remediation may need to take place, followed by re-soiling and revegetation.
Areas affected by mine affected water	Preliminary areas set for phytoremediation project	Decant is predominantly taking place to the east, south and southeast of the discard dump. The mine affected water is negatively impacting on the receiving catchment area.	Planting of specific species to address the decanting acidic mine water passively through high evapotranspiration rates and high salt accumulation abilities.

Purpose of this report

The overarching objectives of this BAR are to:

- Identify and assess potential environmental impacts associated with the proposed project; and
- Recommend mitigation and management measures to ensure that the activities are undertaken in such a way as to minimise negative impacts.

This report also describes the *status quo* of the biophysical and socio-economic environments of the project area through specialist studies undertaken. Furthermore, an Environmental Management Plan Report (EMPr) has been developed to mitigate and manage environmental impacts associated with each project activity.

This BAR will be submitted to the public for input and comments which will then be addressed and incorporated into the updated BAR to be submitted to the DMR for consideration. The Updated BAR is also available to stakeholders for a commenting period of 21-day public comment period.

Environmental consultants

Digby Wells has been appointed by Eskom as the independent Environmental Assessment Practitioner (EAP) to conduct the Basic Assessment Process according to the NEMA, as well as the required Public Participation Process (PPP). Digby Wells is a South African company with international expertise in delivering comprehensive environmental and social solutions, with specific focus on the mining and energy industries. The particulars of the EAP undertaking the Basic Assessment Process is supplied in Table 1-1.

Table 1-1: Contact details of the EAP

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Public Participation Process

A PPP has been designed not only to comply with the regulatory requirements set out in Regulation 44 and 45 of the Environmental Impact Assessment Regulations, 2014[2] (EIA

[2] Published in GN R982 of 4 December 2014

Regulations 2014), and as required in terms of Chapter 5 of NEMA, but is also designed to provide Interested and Affected Parties (I&APs) with an opportunity to evaluate all aspects of the proposed Project. The aim is to maximise the Project benefits while minimising its adverse effects. This BAR has been made available for public review from Friday, 14 October 2016 to Monday, 14 November 2016.

Project alternatives

Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives aid in identifying the most appropriate method of developing the project, taking into account location or site alternatives, rehabilitation alternatives, as well as the no-project alternative. Alternatives also aid in determining the activity with the least environmental impact.

Some of the potential alternatives that have been identified to date are provided below.

Location Alternative

The rehabilitation and maintenance/ aftercare are restricted to areas requiring such activities. The rehabilitation of the Discard Dump, landfill sites and Open Pit areas is, thus, limited to the location of these facilities. As a result, these activities will be undertaken where identified and required; the rehabilitation activities will be specific to the location of the infrastructure or area to be rehabilitated.

Rehabilitation Alternative

Landfill Site

A possible alternative rehabilitation method that was considered included the identification and extraction of all hazardous material that was previously disposed of at the landfill sites. This material would have to be removed and dispose of at another licensed hazardous waste facility. Once all hazardous material has been removed the landfill site would need to be rehabilitated to an acceptable level.

This alternative could potentially disrupt an environment that is currently not releasing any identified pollution to the environment. The extent and content of the landfill sites are unknown as there are no records for these sites. It is proposed that the landfill site be rehabilitated through re-vegetation which will address the erosion and compaction issues that are being experienced. Groundwater and surface water monitoring will need to occur at various points around the site to ensure no leaching of the landfill occurs or that there are no hazardous materials contained in the landfill sites.

Phytoremediation Plantation

A number of different flora species were considered when selecting the vegetation required for the Phytoremediation Planation. Species that were considered but not included as the preferred species due to regional suitability and lack of research trials included *Cynodon*

dactylon, *Acacia karroo*, *Rhus lancea* and *Berkheya coddii*. Five species have been selected due the role played in the absorption and passive treatment of the mine affected water:

- *Combretum erythrophyllum* – River Bush-willow;
- *Eucalyptus camaldulensis* – Red River Gum;
- *Tamarix usneoides* – Wild Tamarix;
- *Sporobolus spicatus* – Salt Grass; and
- *Chrysopogon zizanioides* – Vetiver Grass.

No Go Option

Should the rehabilitation not proceed, or the no go approach, the current state of Kilbarchan Colliery will continue to deteriorate resulting in continued environmental impacts due to erosion and compaction of the discard dump, open pits and landfills. In addition, the mine will continue to decant and mine affected water will continue to be discharged directly into the Ngagane Catchment causing significant degradation of aquatics, wetlands, fauna and flora, surface and groundwater resources. This may have a significant economic impact on the surrounding communities and downstream water users that rely on the Ingagane River for their livelihoods.

The Kilbarchan Colliery will continue to pose a health and safety risk to the community and the surrounding landowners due to the risk and uncertainty of subsidence. The no-go option is not considered viable due to the health and safety implications and impacts occurring on the environment.

Summary of the Potential Environmental Impacts/ Risks

The rehabilitation activities and construction of the phytoremediation plantation to be undertaken at the Kilbarchan Colliery may result in environmental risks which, should they occur, will impact on environmental aspects. Both environmental risks and environmental impacts have been identified as part of the rehabilitation activities. An environmental risk is an uncertain event that may result in an environmental impact, should the event occur. Due to the nature of risks in comparison to impacts, risks have not been rated according to the nature, significance, extent, duration and probability of them occurring but have been assessed qualitatively. In addition, mitigation measures have been provided to prevent and manage the potential identified risks from resulting in an environmental impact.

Only rehabilitation and the construction of the phytoremediation plantation will be assessed, no construction or operation activities will be taking place and therefore these have not been considered as part of this qualitative assessment. The potential risks associated with the project have been identified as part of the specialist investigations undertaken for the Kilbarchan Colliery. The significance of the potential risk has been assessed by the specialists in a qualitative manner.

The risks associated with the project include the NEMA EIA Regulations Listed Activities which include all rehabilitation activities to take place at the Kilbarchan Colliery. A summary of the rehabilitation activity and the most significant impact per activity have been discussed in Table 12-1 II.

Table II: Project Activities and Impact Summary

Activity No.	Activity	Risk Identification
Rehabilitation Phase		
1	The rehabilitation of the Discard Dump	Risks associated with the rehabilitation of the Discard Dump: ■ Surface water contamination; ■ Groundwater contamination; ■ Loss of usable soil as a resource – disturbance, erosion, and compaction as well as loss of land capability, and land use; ■ Loss of natural vegetation due to alien invasive species; ■ Loss of fauna due to noise and vehicle movement
2	The rehabilitation of the Open Pits	Risks associated with the rehabilitation of the Open Pits: ■ Surface water contamination; ■ Groundwater contamination; ■ Loss of usable soil as a resource – disturbance, erosion, and compaction as well as loss of land capability, and land use; and ■ Subsidence.
3	The rehabilitation of the Landfill Sites	Risks associated with the rehabilitation of the Landfill Sites: ■ Loss of natural vegetation due to alien invasive species; ■ Loss of fauna due to noise and vehicle movement; ■ Contamination of groundwater from leachates of PCBs, Asbestos etc.; and

Activity No.	Activity	Risk Identification
		■ Loss of usable soil as a resource – disturbance, erosion, and compaction as well as loss of land capability, and land use.
4	Underground Mine Voids	Risks associated with the rehabilitation of the Underground Mine Voids: ■ Rehabilitated Areas: Health and safety risk for all personnel and property from possible subsidence; and ■ Areas associated with the general public, specifically the mine village, the substation and the N11 road: Health and safety risk for all personnel and property from possible subsidence.

The Environmental Impact Statement for the Phytoremediation Plantation is utilised to summarise all of the potential environmental impacts identified during the rehabilitation phase. The most significance Negative and Positive of the impacts associated with the biophysical environment, pre-mitigation and post-mitigation, is summarised in Table III.

Table III: Summary of the Potential Impacts on the Biophysical Environment

Receiving Environment	Impact	Pre-Mitigation Significance	Post-Mitigation Significance
Surface water	Decrease in mine affected water due to phytoremediation that aims to improve quality of surface water	Minor Positive	Minor Positive
Groundwater	Decrease in mine affected water due to phytoremediation that aims to drop with groundwater level	Minor Positive	Minor Positive
Fauna and Flora	The loss of biodiversity as a result of the removal of fauna species	Moderate negative	Moderate negative
Wetland	Loss of Wetland Habitat due to the establishment of the Phytoremediation Plantation	Major negative	Major negative
	Decrease in mine affected water due to phytoremediation that aims to reduce impact on	Minor Positive	Minor Positive

Receiving Environment	Impact	Pre-Mitigation Significance	Post-Mitigation Significance
	wetlands		
Social	Improvement to health and safety to surrounding communities	Moderate Positive	Moderate Positive

Conclusions and Recommendations

The impacts identified are expected to be confined to site specific impacts and the significance of such impacts is greatly reduced with the implementation of mitigation and management measures. This Project is critical in the attempt to address the social and environmental impacts currently being experienced at the Kilbarchan Colliery and surrounding communities. With the implementation of the mitigation and management measures, it is recommended that the proposed project be granted Environmental Authorisation.

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Part A: Scope of Assessment and Basic Assessment Report

1 Introduction

The Kilbarchan Colliery is located 14 km south of Newcastle, KwaZulu-Natal and falls within the Newcastle Local Municipality (NLM) and Amajuba District Municipality (ADM). Plans 1 and 2, Appendix A depict the regional and local setting of Kilbarchan Colliery. Kilbarchan Colliery was commissioned in 1954 and consisted of underground mining sections, as well as open pit areas where the coal seam was less than 20 metres below ground level (mbgl). Kilbarchan Colliery, operated by Trans Natal (later Ingwe Coal), supplied coal to the Natal inland market and to the adjacent Eskom Holdings SOC Limited (Eskom) Ingagane Power Station until it was decommissioned in 1992.

Rehabilitation activities on site were undertaken until 2012 which included the rehabilitation of the Discard Dump and Open Pit areas, following which Eskom assumed responsibility for the liability of Kilbarchan Colliery. However over the years in which the colliery was non-operational, the underground workings, as well as open pit areas, began filling up with water resulting in decant of mine affected water. Eskom proposes to obtain environmental authorisation for the proposed phytoremediation plantation for the management of mine affected water and maintenance/ aftercare of areas that were previously rehabilitated within the project boundaries (proposed project).

In terms of section 24 and 24D of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), as read with the Environmental Impact Assessment (EIA) Regulations (2014): Government Notices R982 and R983, a Basic Assessment is required to be undertaken. Eskom has appointed Digby Wells Environmental (Digby Wells) to undertake the various specialist studies and authorisation applications for the Basic Assessment. This report aids in the identification of impacts associated with the rehabilitation and establishment of the phytoremediation plantation at the Kilbarchan Colliery and should be read in conjunction with the full Rehabilitation Plan for detailed background information.

2 Project applicant

Eskom's particulars are detailed in Table 2-1.

Table 2-1: Particulars of the Applicant

Applicant Name:	Eskom Holdings SOC Limited
Contact Person:	Nandha Govender
Telephone No:	+27 11 800 4834
Email Address:	govendna@eskom.co.za
Physical Address:	Megawatt Park, Maxwell Drive, Sunninghill, Johannesburg

2.1 Details of Environmental Assessment Practitioner

Digby Wells has been appointed by Eskom as the independent Environmental Assessment Practitioner (EAP) to conduct the Basic Assessment process according to the NEMA, as well as the required Public Participation Process (PPP). Digby Wells is a South African company with international expertise in delivering comprehensive environmental and social solutions, with specific focus on the mining and energy industries. The particulars of the EAP undertaking the Basic Assessment process is supplied in Table 2-2.

Table 2-2: Contact details of the EAP

EAP Company Name:	Digby Wells Environmental
EAP:	Mellerson Pillay
Telephone No:	011 789 9495
Fax No:	011 069 6801
Email Address:	mel.pillay@digbywells.com
Physical Address:	Turnberry Office Park, 48 Grosvenor Road, Bryanston, 2191, South Africa.
Postal Address:	Private Bag X10046, Randburg, 2125

2.2 Expertise of the EAP

2.2.1 The qualifications of the EAP

Mel Pillay is currently the Divisional Manager for the Environmental and Legal Services Department and Stakeholder Engagement at Digby Wells Environmental. Mel has almost nine years of professional experience in Environmental Assessment and Planning and Management. Mel obtained a BSc (Honours) degree in Geography & Environmental Management from the University of Natal. Proof of Mel's qualifications is included in Appendix C.

2.2.2 Summary of the EAP's past experience

The CV of Mel Pillay, including the relevant project experience, is included in Appendix C.

3 Location of the overall activity

Kilbarchan is located within the NLM and ADM and is situated in the northwest corner of KwaZulu-Natal, bordering the Free State and Mpumalanga provinces to the west and north respectively. The project area is located between Newcastle town which is 14 km to the north, and Ntshingwayo Dam (previously known as Chelmsford Dam) 10 km to the south. Appendix A, Plans 1 and 2 depict the regional and local setting.

The Kilbarchan Colliery mining area is approximately 3 322 ha however the area to be rehabilitated / maintained / aftercare is approximately 306 ha. The Kilbarchan Colliery mining

surface consists of a discard dump and an adjacent Pollution Control Dam (PCD) and electrical substation to its north. Remnant infrastructure and derelict buildings, that were once part of the Kilbarchan Colliery, are located west of the PCD and substation. The property on which the remnant infrastructure is situated has subsequently been sold to Blazing Sun Investments 35 (Pty) Ltd. (Blazing Sun) and is no longer the liability of Eskom. In the Agreement of Sale, Blazing Sun records that they are aware of possible environmental risks involved with the property and undertake to indemnify Eskom against any claims should any of the risk events occur. Additional housing is located further west of the remnant infrastructure and is currently occupied. This village is also partially located on the property sold to Blazing Sun.

The Kilbarchan Country Club golf course and associated residential area is located to the north east of the discard dump and does not form part of the mine. The N11 national road transects the mining area and is situated to the east of the discard dump, with the iNgagane River flowing northwards alongside the N11. An aggregate quarry, owned and operated by Afrisam (Pty) Ltd (Afrisam), transects the most-southern extent of the mining area's northern boundary. This property is owned by Afrisam and is excluded from the study. The decommissioned Ingagane Power Station is located to the east of the Ingagane River, with the Ingagane community located further east.

The properties associated with the proposed prospecting activities are detailed in Table 3-1.

Table 3-1: Description of the Directly Affected Farm Portions

Farm Name:	The following farms falls part of the mining area and have been listed below: ■ Portion 12 of the farm Kilbarchan 2969; ■ Portion 15 of the farm Kilbarchan 2969; ■ Remaining Extent of the farm Kilbarchan 2969; ■ Portion 6 of the farm Kilbarchan 2969; ■ Portion 16 of the farm Kilbarchan 2969; ■ Portion 20 of the farm Kilbarchan 2969; and ■ Remaining Extent of Portion 3 of the farm Tiger Kloof 3333.
Application Area (Ha):	306 ha
Magisterial District:	Amajuba District Municipality Newcastle Local Municipality Newcastle Magisterial District
Distance and direction from nearest town:	14 km south of Newcastle

<table>
<tr><td>21 digit Surveyor General Code for each farm portion:</td><td>The following 21 Digit Surveyor General Codes falls part of the mining area and have been listed below:
<table>
<tr><th>Farm Name</th><th>21 digit SG Code</th></tr>
<tr><td>Portion 12 of the farm Kilbarchan 2969</td><td>N0HS00000000296900012</td></tr>
<tr><td>Portion 15 of the farm Kilbarchan 2969</td><td>N0HS00000000296900015</td></tr>
<tr><td>Remaining Extent of the farm Kilbarchan 2969</td><td>N0HS00000000296900000</td></tr>
<tr><td>Portion 6 of the farm Kilbarchan 2969</td><td>N0HS00000000296900006</td></tr>
<tr><td>Portion 16 of the farm Kilbarchan 2969</td><td>N0HS00000000296900016</td></tr>
<tr><td>Portion 20 of the farm Kilbarchan 2969</td><td>N0HS00000000296900020</td></tr>
<tr><td>Remaining Extent of Portion 3 of the farm Tiger Kloof 3333</td><td>N0HS00000000333300003</td></tr>
</table></td></tr>
</table>

4 Locality map

The regional and local setting of the project area is displayed in Plan 1 and Plan 2, Appendix A.

5 Description of the scope of the proposed overall activity

5.1 Project background

The description of the historic mining activities at Kilbarchan Colliery was predominantly sourced from Hodgson (2006). The historical Mine Plan was not available to feed into the project background.

Kilbarchan Colliery consisted of two underground mining sections: Roy Point[3] in the north and Kilbarchan in the south. Underground mining commenced at the Kilbarchan Colliery in 1954 and utilised the bord and pillar mining method with an average coal seam height of 3.5 m. Early reports indicated that the extraction rate for the Colliery was 73% to 76%, but more recent reports suggested that the extraction rate was 50%; no detailed plans of the underground workings are available. The lower and more probable extraction rate of 50% is possibly due to the considerably greater depths of mining in the western extent of the Colliery, due to the increase in topography in this area, as well as the angle of the coal seam.

[3] Roy Point does not form part of this application as the liability does not fall under Eskom's ambit.

In addition to the predominant bord and pillar method utilised at Kilbarchan Colliery, stooping was undertaken in selected areas. To extend the life of the mine, open pit mining was implemented where the coal seam was less than 20 mbgl. Open Pits 1A and 1B are connected to the underground workings. The underground, stooped and open pit areas, as well as areas where fly ash has been backfilled, are displayed in Plan 3, Appendix A. The areas of each of the above mining methods are summarised in Table 5-1.

Table 5-1: Mining method areas

Description	Area (ha)
Underground workings	1 262
Stooped areas	118
Area connecting the Open Pit with the underground workings	21
Ash-filled areas	101

Construction of Eskom's Ingagane Power Station began in 1959 and was completed and began operations in April 1963 (Leech, 2003). Kilbarchan Colliery supplied coal to the Natal inland market as well as to the Ingagane Power Station, however, the Colliery served to supply coal solely to the Power Station from 1981 to 1987. The Ingagane Power Station began decommissioning in 1990 and Kilbarchan Colliery ceased all mining activities in 1992, with rehabilitation undertaken up until 2012.

Following the decommissioning of Kilbarchan Colliery in 1992, the underground workings, as well as open pit areas, began filling up with water at a rate of approximately 4 000 m^3 per day (Vermeulen and Van Zyl, 2011). Decant of mine affected water was first recorded in April 2004 and is predominantly taking place to the south, southeast and east of the discard dump, underground workings and open pit sections (Proxa, 2014). The mine affected water is characterised as having high sodium and sulfate levels resulting in high Electrical Conductivity (EC) and Total Dissolved Solids (TDS). In addition, there are also elevated levels of chloride, iron and manganese (Proxa, 2014). The mine affected water has a negative impact on the surrounding water courses it comes into contact with, as it does not meet the Interim Water Quality Objectives 2008 (IWQO) of the Ngagane Catchment.

5.2 Description of the activities to be undertaken

The potential impacts associated with the rehabilitation activities and establishment of the phytoremediation plantation has been assessed, in this Basic Assessment Report (BAR) for the project. The activities and infrastructure that will be rehabilitated to minimise and mitigate the impacts caused by mining and industrial activities to restore land back to a satisfactory standard are detailed in Figure 5-1.

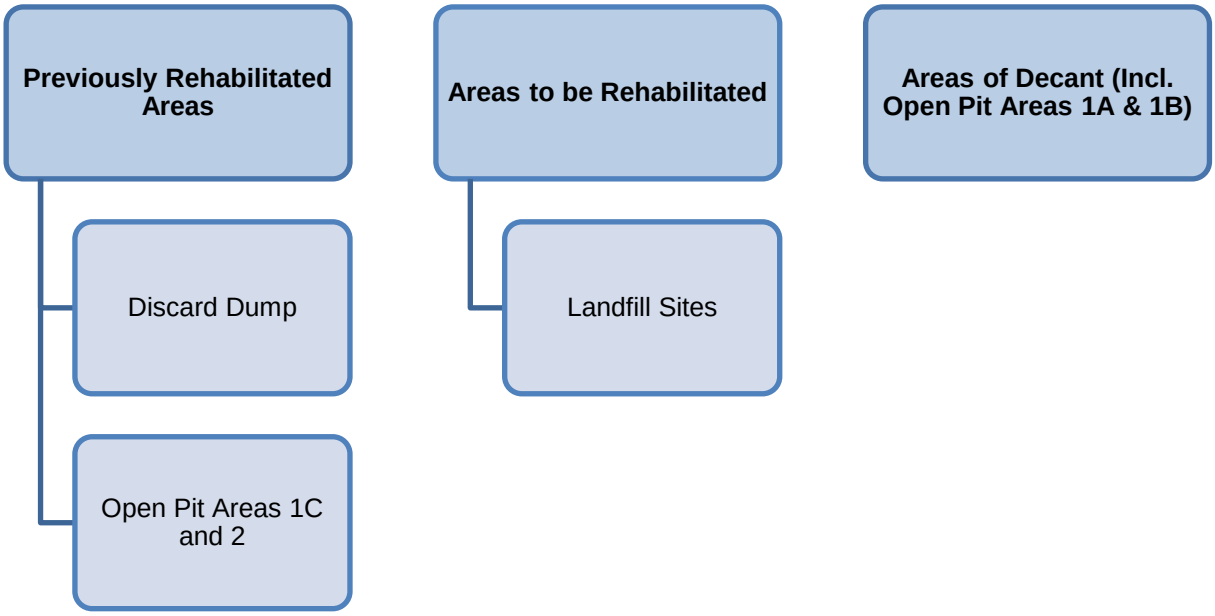

Figure 5-1: List of the three main areas that are the focus of rehabilitation efforts

5.2.1 Previously rehabilitated areas

A Rehabilitation Assessment was undertaken by Digby Wells as part of this assessment and has been included as part of the Rehabilitation Plan, Appendix B.

5.2.1.1 Discard Dump

The Discard Dump is approximately 70 ha in size and is adjacent to the N11 national road which runs along the dump's eastern border. It is evident from the site visit that a significant effort has been made towards long-term sustainability in its engineering design. Substantial down-drains have been constructed which make use of concrete structures with supporting gabion baskets in certain locations.

Two down-drains are present and a number of contour banks have been constructed in intervals down the slopes of the Discard Dump to lead runoff water into these down-drains. Some of the runoff channels are not effective, as they do not convey water into the down-drains due to poor maintenance practices. Ineffective surface water runoff allows water to infiltrate into the Discard Dump, resulting in seepage zones and the leaching of contaminants at the base of the dump.

The Discard Dump and its northern down-drain are displayed in Figure 5-2 (A) and the south-western down-drain shown in Figure 5-2 (B), with evidence of the concrete structures and gabion baskets utilised. Evidence of soil erosion was noted on the eastern side (left) of the northern down-drain.

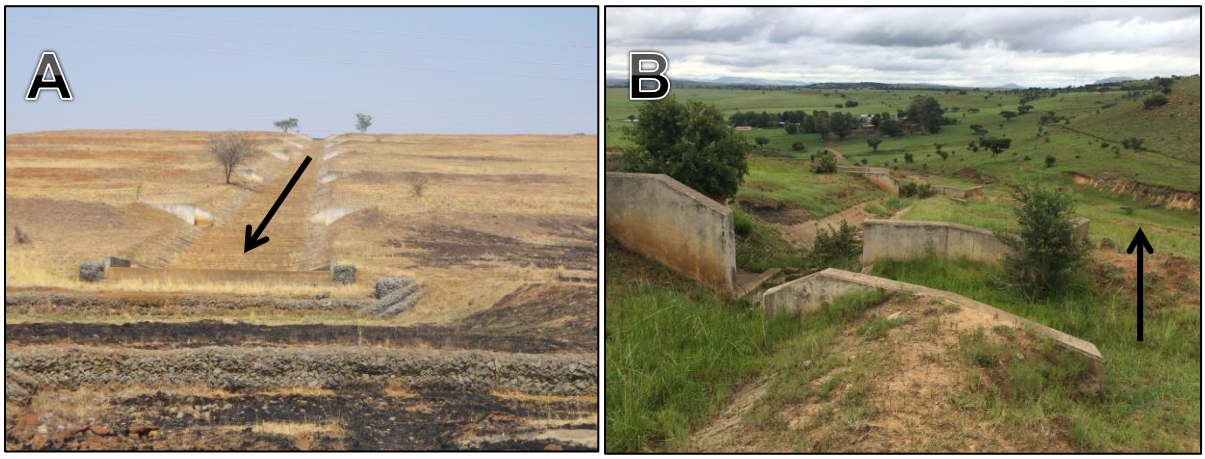

Figure 5-2: Northern face of the Discard Dump and the down-drains

The design criteria for the soil cover, during initial rehabilitation measures, were not made available to Digby Wells, however it was evident that a multi-layered soil cover strategy was employed, as areas where soil erosion had taken place revealed the following:

- An overlying loamy soil material approximately 100 mm to 150 mm in depth; and
- An underlying clay-containing material approximately 100 mm to 150 mm in depth.

It is anticipated that the above soil thickness depths were not achieved consistently throughout the Discard Dump. The current soil cover appears to be incapable of providing a sustainable, erosion-resistant surface without a significant modification to the maintenance regime. The long-term sustainability for the Discard Dump will be its ability to convey water to the concrete down-drain structures with its contour banks and avoid seepage zones and the leaching of contaminants at the base of the dump.

The upper slope of the dump's contour banks is reasonably well vegetated; however, the outer slopes of the contour banks are frequently denuded and are subject to additional erosion pressure. In addition, large numbers of cattle are present on the Discard Dump and have generated footpaths over the contour banks that significantly decrease the effective height of the contour banks, exacerbating the erosion control and water conveyance inefficiencies. Furthermore, the overgrazing activities have resulted in decreased vegetation cover on the Discard Dump, further contributing to the erosion potential.

The vegetative cover on the slopes of the Discard Dump is relatively sparse, although a satisfactory diversity of grass species, conducive to the establishment of sustainable grass cover, is present. The current cover, however, is inadequate in terms of basal cover and vegetation vigour to prevent erosion from occurring. There are significant patches of denuded vegetation where sheet erosion is taking place and, as a result, the underlying discard material is exposed in several areas on the dump, as indicated in Figure 5-3.

Currently Eskom is undertaking maintenance of the Discard Dump by applying additional soil cover over the entire area of the dump which will contribute to a more sustainable vegetation cover in the long-term. The Discard Dump needs to be rehabilitated again due to erosion

issues as well as high compaction and a limited soil layer (less than 150 mm in places). It is proposed that all rehabilitation / maintenance / aftercare activities will be focussed on the areas were the original rehabilitation efforts have failed specifically were signs of erosion has occurred as a result of overgrazing.

Figure 5-3: Sheet erosion and underlying discard material on the Discard Dump

5.2.1.2 Open Pit Areas

Overburden materials have been reshaped at Open Pit area 1A and a layer of topsoil has been applied to the surface. The final void highwall has been shaped down and all slopes were less than a 1:3 gradient. One concrete down-drain has been constructed and contours lead runoff from the Open Pit area into the down-drain. Rehabilitation on Open Pit area 1A shows limited evidence of erosion, with the exception of the highwall that has lost all soil cover and is eroding significantly. The down-drain and area of erosion at Open Pit area 1A are depicted in Figure 5-4 A and B respectively.

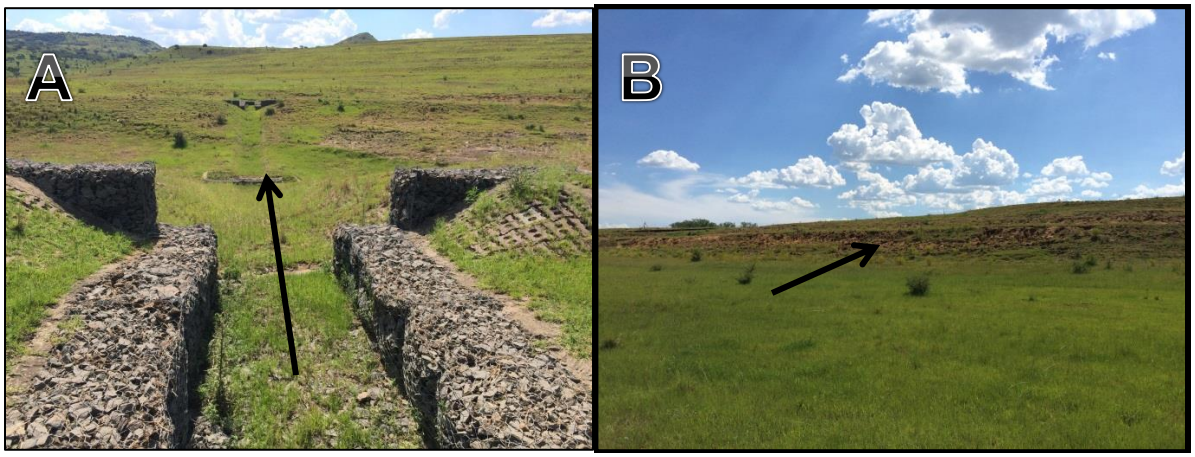

Figure 5-4: Open Pit area 1A down-drain (A) and soil erosion (B)

Open Pit area 2 does not consist of a final void highwall. All areas have been sloped to a gradient of less than 1:3 and the constructed contours lead water runoff into drainage channels to the south of the Open Pit area. The drainage channels consist of gabion baskets at contour intervals but did not have concrete structures. The Open Pit area 2 was reasonably vegetated and the main drainage channel is not currently subjected to erosion. There is evidence of poorer vegetation growth on the downslope of the contours; these areas have not been subjected to significant erosion, however. There was evidence of surface subsidence at Open Pit area 2, with one particular instance occurring at a key point in a contour bank. It is likely that this contour bank will fail in the future due to weakening in the overall structure and as a result of erosion.

These areas require additional rehabilitation actions and are not found within the proposed phytoremediation areas (see Section 5.2.3). Although most of the areas are stable and showing signs of successful restoration, erosion hotspots are present and need to be addressed.

5.2.2 Areas still in need of rehabilitation

The remnant infrastructure, housing village and Waste Water Treatment Plant (WWTP) as discussed below are no longer the responsibility of Eskom. As detailed in Section 3, the property on which the remnant infrastructure and portion of the housing village is situated has subsequently been sold to Blazing Sun. In the Agreement of Sale, Blazing Sun records that they are aware of possible environmental risks involved with the property and undertake to indemnify Eskom against any claims should any of the risk events occur. The below areas are discussed to provide a detailed description of Kilbarchan Colliery; however Eskom will not undertake any work on these areas.

5.2.2.1 Remnant infrastructure

Decommissioned surface infrastructure is located approximately 500 m north of the Discard Dump and includes buildings and a decommissioned WWTP. The buildings have been stripped and vandalised of all value and only the brick and concrete structures remain. The

decommissioned infrastructure and its foundations will need to be demolished, all rubble removed off site and the area rehabilitated to ensure there are no health and safety issues. This is the responsibility of Blazing Sun. An example of the remnant infrastructure on site is included in Figure 5-5.

Figure 5-5: Remnant infrastructure north of the Discard Dump

5.2.2.2 Mine Villages

A functioning village is located within the Kilbarchan Colliery mining area and is situated to the north and west of the Kilbarchan golf course. Although the Kilbarchan community is located within the mining area, it does not form part of Kilbarchan Colliery and is not associated with the mine. The buildings associated with this village are occupied by members of the Kilbarchan community and the village does not pose a risk to the successful rehabilitation of Kilbarchan Colliery as the village is occupied and well run; according to historic mine plans, Kilbarchan community was not undermined. Kilbarchan community is within proximity to Newcastle and is a suitable dormitory suburb for the town and provides a satisfactory long term accommodation option.

A second village exists approximately 1 km northwest of the Discard Dump. These buildings have been legally sold to the local municipality and are occupied by members of the community, according to Eskom. According to historical mine plans, these areas have been undermined although the extent and location of bord and pillars are not known. Digby Wells attempted to source this historical information from the DMR but the information could not be sourced due to confidentiality constraints cited by the DMR. This village is also partially located on the property sold to Blazing Sun.

5.2.2.3 Decommissioned Waste Water Treatment Plant (WWTP)

A decommissioned WWTP remains to the north of the Discard Dump, adjacent to the remnant infrastructure listed above. The decommissioned WWTP has been fenced off to prevent public access. Due to the presence of sewage, soil remediation will need to occur in addition to the removal of infrastructure and rehabilitation thereafter. The WWTP was included in the Agreement of Sale to Blazing Sun and the liability thereof does not belong to Eskom. An example of the decommissioned WWTP on site is included in Figure 5-6.

Figure 5-6: Decommissioned WWTP north of the Discard Dump

5.2.2.4 Landfill Sites

Two apparent landfill sites were identified in the project area consisting of waste materials such as tyres, concrete and other refuse. One landfill site is located on the western flank of the Discard Dump, with the second landfill site being located to the east of the Discard Dump between the N11 highway and the Ingagane River, as depicted in Figure 5-7.

The full extent of the landfill sites, as well as the nature of materials contained within the landfills, will have to be ascertained before the sites can be closed. The western landfill site is subject to erosion, with the eastern landfill site displaying evidence of subsidence and both requiring rehabilitation. The possibility of Polychlorinated Biphenyls (PCBs) and asbestos being buried within these landfill sites poses a potential risk to the successful rehabilitation of Kilbarchan Colliery.

Figure 5-7: Landfill sites (A: Located to the east of the N11 and Discard Dump; and B: Located to the west of the Discard Dump)

5.2.2.5 Subsidence

As a result of stooping of underground areas the possibility exists of physical surface disturbance which could lead to surface subsidence and damage to the natural environment as well as physical surface infrastructure. The exact locations of stooped areas need to be investigated further as this is not currently available. This will allow for the identification of possible subsidence areas.

5.2.3 Decant of mine affected water

Decant of mine affected water began at the defunct Kilbarchan Colliery in April, 2004 (Proxa, 2014), with decant predominantly taking place to the east, south and southeast of the Discard Dump. Decant is a result of a combined flow of seepage from the Discard Dump and underground and Open Pit sections of Kilbarchan Colliery (Proxa, 2014). In addition, a number of existing water monitoring locations have become decant locations, three of which have been identified at the southern foot of the Discard Dump. The mine affected water is negatively impacting on the receiving catchment area. Decant to the southeast of the Discard Dump is depicted in Figure 5-8. In an effort to remove the heavy metals from the mine affected water, Eskom has set up a pre-treatment facility (Figure 5-9) located at foot of the discard dump. However further water treatment is still required to ensure the water currently being released is treated to an acceptable standard prior to discharging it to the environment.

Figure 5-8: Decant emanating southeast of the Discard Dump

Figure 5-9: Pre-treatment Facility

5.2.3.1 Phytoremediation Plantation

An active water treatment facility have been proposed by Eskom to manage the mine affected water, as well as a passive treatment option that will make use of phytoremediation by planting trees in strategically selected locations at Kilbarchan Colliery.

Active water treatment is currently being assessed and will be subject to a separate EIA process. The proposed passive treatment option has however been included as part of this BAR and all impacts and mitigation measures associated with it has been assessed.

Phytoremediation is being proposed to manage the impact of decanting mine affected water on the soil and surface water resources, as well as to lower the volume of water required for active treatment, as detailed in Appendix D.

It is proposed that the Phytoremediation Plantation is located upstream of the decant locations and within 52 ha of wetland habitat. The tree plantation is expected to absorb approximately 1 Ml of mine affected water per day based on forestry spacing, although it is expected that this quantity can increase should tree spacing be reduced. This reduction in decant volumes, along with water abstraction for active treatment, will aid in the decrease in underground water elevation below the decant elevation of 1 192 m.

The following tree and grass species have been proposed to be planted for the passive treatment of the mine affected water:

- *Combretum erythrophyllum* – River Bush-willow;
- *Eucalyptus camaldulensis* – Red River Gum;
- *Tamarix usneoides* – Wild Tamarix;
- *Sporobolus spicatus* – Salt Grass; and
- *Chrysopogon zizanioides* – Vetiver Grass.

5.2.4 Graveyards

Graveyards and heritage resources identified could potentially be impacted on by the rehabilitation activities required.

A graveyard was identified during the site visit in 2015 and is located on the border of Open Pit area 2 (Plan 3, Appendix A). There are no potential impacts expected to occur on the identified graveyard due to its location to the Open Pit 2. Should further rehabilitation activities be required at Open Pit area 2, the graveyard site may need to be fenced off to ensure that any potential impacts are prevented. All requirements in terms of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) will be implemented should further activities be required near Open Pit 2.

Figure 5-10: Graveyard located at Open Pit area 2

5.3 Listed and specified activities

The NEMA provides the environmental legal framework for South Africa. The listed activities that require environmental authorisation have been outlined in the EIA Regulations 2014. Together with the EIA Regulations, 2014, the Minister published the following Regulations in terms of Sections 24 and 24D of the NEMA:

- Regulation GN R. 983 – Listing Notice 1: This listing notice provides a list of various activities which require environmental authorisation and must follow the Basic Assessment process as described in Regulation 19 and Regulation 20 of the NEMA EIA Regulations;
- Regulation GN R. 984 – Listing Notice 2: This listing notice provides a list of various activities which require environmental authorisation and must follow an EIA process as described in Regulation 21 to Regulation 24 of the NEMA EIA Regulations; and
- Regulation GN R. 985 – Listing Notice 3: This notice provides a list of various environmental activities which have been identified by provincial governmental bodies. The undertaking of such activities within the stipulated provincial boundaries will require environmental authorisation and the Basic Assessment process as described in Regulation 19 and Regulation 20 of the NEMA EIA Regulations will need to be followed.

The Listed Activities, as defined in the EIA Regulations, 2014, and specified activities applicable to the rehabilitation and establishment of a phytoremediation plantation at the Kilbarchan Colliery are outlined in Table 5-2 and their locations in Plan 3, Appendix A.

Table 5-2: Listed and Specified Activities for the Project

Name of Activity	Aerial extent of the activity	Listed Activity	Applicable Listing Notice
Maintenance of historic rehabilitation measures completed on the Discard Dump	70 ha	Yes	Activity 19 - GNR 983
Maintenance of historic rehabilitation measures completed on the Open Pit area 1C and 2	58.24	Yes	Activity 19 - GNR 983
Maintenance of historic rehabilitation measures completed on the East	Eastern Landfill Site - 2.27ha[4]	Yes	Activity 19 - GNR 983

[4] The extent of the landfill site in the east cannot be determined without intrusive investigation, potential contamination will be determined through groundwater monitoring

Name of Activity	Aerial extent of the activity	Listed Activity	Applicable Listing Notice
and West Landfill Sites			
The establishment of the phytoremediation Plantation	175ha	Yes	Activity 30 – GNR 983

6 Policy and legislative context

This section aims to provide a description of the national and provincial policy and legislative context within which the project is being proposed. The legislative guidelines directing the project are outlined in further detail in Table 6-1.

Table 6-1: Applicable Policies and legislation Context for this Propose Project

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996) Section 24 of the Constitution provides 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 – i. Prevent pollution and ecological degradation; ii. Promote conservation; and iii. Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.	The Rehabilitation and establishment of a phytoremediation plantation at the Kilbarchan Colliery will minimise and mitigate the impacts caused by historic mining and industrial activities and to restore land back to a satisfactory standard. The implementation of the mitigation and management measures to minimise and prevent negative impacts associated with this rehabilitation project, have been included in Part B, Section 5.	The environmental management objectives of the project is to ensure that Kilbarchan Colliery is rehabilitated in a manner that is socially and environmentally sustainable, which will aid in the protection of ecologically sensitive areas, prevention of any future pollution events and help promote justifiable economic and social development.
Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) In terms of Section 43 of the MPRDA, the holder of a prospecting right, mining right, retention permit or mining permit remains responsible for any environmental liability, pollution or ecological degradation, and the management thereof, until the Minister has issued a closure certificate to the holder concerned. However, Kilbarchan Colliery was decommissioned in 1992, prior to the promulgation of the MPRDA. Thus, Eskom is not required to apply for a	In terms of Section 16 (3) (b) of the EIA Regulations, 2014, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority. This Report has been compiled as per the requirements of the DMR.	This Rehabilitation BAR has been compiled in accordance with the requirements of the NEMA EIA Regulations, 2014, with the environmental management objective to protect ecologically sensitive areas.

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
Closure Certificate in terms of GNR 527, Regulation 57 of the MPRDA but is compiling a rehabilitation Plan to align with national legislative requirements and good practice.		
National Environmental Management Act, 1998 (Act No. 107 of 1998) The NEMA, as amended was set in place in accordance with section 24 of the Constitution of the Republic of South Africa. Certain environmental principles under NEMA have to be adhered to, to inform decision making for issues affecting the environment. Section 24 (1)(a) and (b) of NEMA state that: *The potential impact on the environment and socio-economic conditions of activities that require authorisation or permission by law and which may significantly affect the environment, must be considered, investigated and assessed prior to their implementation and reported to the organ of state charged by law with authorizing, permitting, or otherwise allowing the implementation of an activity.* The EIA Regulations, Government Notice Regulation (GN) R.982 were published on 04 December 2014 and promulgated on 08 December 2014. Together with the EIA Regulations, the Minister also published GN R.983 (Listing Notice No. 1), GN R.984 (Listing Notice No. 2) and GN R.985 (Listing Notice No. 3) in terms of sections	Environmental authorisation is required for listed activities in terms of the EIA Regulations (2014) of the NEMA. The listed activities are listed in Table 5-2.	This BAR has been compiled in accordance with the requirements of the NEMA EIA Regulations (2014).

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
24(2) and 24D of the NEMA, as amended.		
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA) regulates the management and conservation of the biodiversity of South Africa within the framework provided under NEMA. This Act also regulates the protection of species and ecosystems that require national protection and also takes into account the management of alien and invasive species. This Act works in accordance to the framework set under NEMA. The following regulations which have been promulgated in terms of the NEM: BA are also of relevance: ■ Alien and Invasive Species Lists, 2014 published (GN R.599 in GG 37886 of 1 August 2014) ; ■ National Environmental Management: Biodiversity Act, 2004: Threatened and Protected Species Regulations; ■ National list of Ecosystems Threatened and in need of Protection under Section 52(1) (a) of the Biodiversity Act (GG 34809, GN R.1002, 9 December 2011).	Environmental authorisation is required in terms of NEM: BA as a result of the proposed establishment of the Phytoremediation plantation due to the introduction of alien invasive tree species for the absorption of mine affected water.	This BAR has been compiled in accordance with the requirements of the NEMA EIA Regulations (2014) due to the authorisation required in terms of NEMA: BA. The mitigation and management measures to be implemented as part of the project aim to manage and conserve biological diversity, as well as to minimise alien invasive species.

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
National Water Act, 1998 (Act No. 36 of 1998) (NWA) NWA makes provision for water resource management, protection of the quality of water resources and recognising the need for the integrated management of all aspects of water resources to achieve sustainable use of water. The following legislation is also found to be applicable and will be abided by during the rehabilitation process: ■ Best Practice Guide H1: Series H – Hierarchy Guidelines: Integrated Mine Water Management in accordance with the National Water Act, 1998 (Act No. 36 of 1998). ■ Best Practice Guide H2: Series H – Hierarchy Guidelines: Pollution Prevention and Minimisation of Impacts in accordance with the National Water Act, 1998 (Act No. 36 of 1998). ■ Best Practice Guide H3: Series H – Hierarchy Guidelines: Water Reuse and Reclamation in accordance with the National Water Act, 1998 (Act No. 36 of 1998). ■ Best Practice Guide H4: Series H – Hierarchy Guidelines: Water Treatment in accordance with the	The implementation of the mitigation and management measures to minimise and prevent negative impacts associated with this rehabilitation project on surface and groundwater, have been included in Part B, Section 5.	Eskom will be applying for a Water Use Licence for the establishment of the Phytoremediation Plantation. The potential water uses triggered under Section 21 of the NWA in relation to the proposed project are listed below: ▪ S21(c) – Impeding or diverting the flow of water in a watercourse; ▪ S21(d) – engaging in a streamflow reduction activity contemplated in Section 36 of the Act; and ▪ S21 (i) – Altering the bed, banks, course or characteristics of a watercourse; This water use license application has been excluded from the scope of the BAR and will be addressed as part of the EIA process for the construction of infrastructure used to treat mine affected water. Mitigation and management measures have however been included as part of this BAR to manage and conserve water quality.

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
National Water Act, 1998 (Act No. 36 of 1998).		
National Heritage Resources Act, 1999 (Act No. 25 of 1999) The NHRA is the overarching legislation that protects and regulates the management of heritage resources in South Africa. The Act requires that Heritage Resources Agency's in this case the South African Heritage Resources Agency (SAHRA) and Amafa, the Heritage Resource Authority of KwaZulu-Natal, be notified as early as possible of any developments that may exceed certain minimum thresholds.	The Heritage Screening Survey (HSS) was undertaken and Needs and Desirability Application (NDA) was compiled and attached as Appendix F. The heritage baseline is described in Part A Section 11.	A HSS was undertaken and a NDA was compiled and submitted to the South African Heritage Resources Agency (SAHRA) and Amafa, the Heritage Resource Authority of KwaZulu-Natal.
National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM: AQA) According to the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM: AQA) the Department of Environmental Affairs (DEA), the provincial environmental departments and local authorities (district and local municipalities) are separately and jointly responsible for the implementation and enforcement of various aspects of NEM: AQA. A fundamental aspect of the new approach to the air quality regulation, as reflected in the NEM: AQA is the establishment of National Ambient Air Quality Standards (NAAQS). These standards provide the goals for air quality management plans and also provide the	Mitigation measures have been included for the potential impacts on the air quality. The mitigation measures will be in compliance with the NEM: AQA, as referred to in Part B, Section 5.	The mitigation and management measures to be implemented as part of the project aim to manage and prevent potential impacts to air quality.

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
benchmark by which the effectiveness of these management plans is measured.		
Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA) CARA aims to provide for the conservation of the natural agricultural resources of the country through the maintenance of the production potential of land, by combatting and preventing erosion and the weakening of water sources. In addition, this Act aims to protect vegetation, while combatting weeds and invader plants	Mitigation measures have been included for the potential impacts on soils and land capability. The mitigation measures will be in compliance with the CARA, as referred to in Part B, Section 5.	Section 12 of the CARA details the maintenance of soil conservation in which every land user will be responsible for the maintenance and conservation of soil. The mitigation measures recommended as part of this BAR aim to prevent the compaction, erosion and degradation of the soil resources.
Guidelines for the Rehabilitation of Mined Land in accordance with the Chamber of Mines of South Africa, 2007 The guideline aims to combine all "best practice guidelines", both South African and international, to provide the basis for the "how" to go about achieving a satisfactory, sustainable, rehabilitation end-product following mining.	The Rehabilitation Report was compiled and included in Appendix B.	The mitigation and management measures recommended as part of this guideline have been included in Section 12 of this report and can also be found within the Rehabilitation report found in Appendix B.
Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) (OHSA) To provide for the health and safety of persons at work and for the health and safety of persons in connection with the use of plant and machinery; the protection of persons other than persons at work against hazards to	The OHSA has been taken into consideration during the development of the project.	The Eskom Internal Safety, Health, Environment and Quality guidelines and standards have been considered as part of this BAR to ensure that all health and safety standards are met during the rehabilitation of the Kilbarchan Colliery.

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
health and safety arising out of or in connection with the activities of persons at work; to establish an advisory council for occupational health and safety; and to provide for matters connected therewith.		
Mining and Biodiversity Guideline (DEA *et al*., 2013) This Guideline provides a tool to facilitate the sustainable development of South Africa's mineral resources in a way that enables regulators, industry and practitioners to minimise the impact of mining on the country's biodiversity and ecosystem services. It provides the mining sector with a practical, user friendly manual for integrating biodiversity considerations into the planning processes and managing biodiversity during the operational phases of a mine, from exploration through to closure.	The Rehabilitation and phytoremediation Report was compiled and included in Appendix B and Appendix D respectively.	The mitigation and management measures recommended as part of this guideline have been included in Section 12 of this report and can also be found within the Rehabilitation and phytoremediation report found in Appendix B and Appendix D respectively.

7 Need and desirability of the proposed activities

Section 24 of the Constitution provides that everyone has the right to an environment that is not harmful to their health or well-being and to have the environment protected through reasonable legislative and other measures that prevents pollution and ecological degradation.

Kilbarchan Colliery was commissioned in 1954 and subsequently decommissioned in 1992; rehabilitation activities were undertaken at Kilbarchan Colliery up until 2012. As a result of numerous factors, such as severe overgrazing and the uncontrolled decant of mine affected water, the environmental conditions on site have deteriorated. Consequently, further maintenance / aftercare of areas that were previously rehabilitated within the project boundaries are required as a best practice initiative to prevent continued impacts on the surrounding environment. The Rehabilitation plan (Appendix B) must be implemented to ensure effective rehabilitation / maintenance / aftercare to ensure effective protection of natural resource on site (e.g. soil, water, biodiversity etc.), in the surrounding environment and minimise any potential health and safety risks to the surrounding community. The proposed rehabilitation activities aim to achieve a socially and environmental safe and sustainable project area.

Rehabilitation of the area will ultimately result in the following:

- Allow for the re-introduction of indigenous plant species that were lost in the disturbed area, and removal of invasive species which will in turn encourage the return of some animal species when the habitat is suitable;
- The reshaping and re-vegetation of the various areas will improve the aesthetic appearance of this area;
- Decant and treatment via phytoremediation of mine affected water will ensure the water quality is improved prior to discharge to the catchment area; and
- There is a need that the environment is left in a safe manner that is not harmful to the neighbouring community.

7.1 Socio-Economic consideration

The Kilbarchan Colliery is currently impacting on the surrounding environment due to the deterioration of the rehabilitated site and decanting of mine affected water. The decanting of mine affected water has occurred on privately owned land which was previously used for cattle grazing. The grazing areas are impacted by precipitates from the mine affected water, reducing available grazing land. As a result, grazing activities have been undertaken on the Discard Dump and surrounding areas, increasing the susceptibility of erosion of topsoil and subsequent exposure of carbonaceous material. The erosion of the topsoil has led to the potential sedimentation of surrounding surface water resources, increased infiltration and subsequent seepage and decanting from the Discard Dump and exposure of carbonaceous material which results in impacted surface water runoff.

In addition, the mine affected water is impacting on surface water quality in the catchment for downstream users and livestock, the Present Ecological Status (PES) of the surrounding wetlands and on aquatic ecology. Furthermore, the undermined areas may be susceptible to subsidence which could impact on residents located northwest of the Discard Dump and on the N11 national road. Should subsidence occur, this may result in significant health and safety concerns to the general public.

The proposed project aims to address health and safety issues that are associated with a decommissioned mine and related infrastructure. The implementation of the rehabilitation measures for the mining area will promote the utilisation of land for sustainable grazing once vegetation has been re-established. Significant health and safety risks may be considerably reduced once the Discard Dump, Open Pits and landfill sites have been rehabilitated. Thus, the rehabilitation of Kilbarchan Colliery will prevent the indefinite contamination of water resources and sterilisation of land which will have positive economic impacts to the community and downstream users, as well as minimise potential health and safety risks for the general public residing within the mining area or utilising the N11 national road.

The Kilbarchan area has been identified in the SDF for the municipality as a strategic residential expansion area. The residential expansion is earmarked to occur to the north of the current Kilbarchan community and is likely to increase westwards across the N11 national road, as well as eastwards to the Ingagane River. The treatment and management of decant at Kilbarchan Colliery, as well as the associated infrastructure, will not impact on the SDF proposed expansion. The treatment of the water will prevent the continued discharge of mine affected water into the Ingagane River and reduce the risk of impacting existing or future downstream water users. The proposed project will have long-term positive impacts for the immediate surroundings, as well as downstream water users by ensuring sustainable rehabilitation at Kilbarchan Colliery.

7.2 Environmental consideration

The mine affected water that is currently decanting at Kilbarchan does not meet the IWQO (2008) for the Ngagane Catchment, or the South African National Standards (SANS) 241:2011 Drinking Water Standards. As a result, the mine affected water is currently a source of pollution and ecological degradation on the surrounding water courses, environment and downstream water uses. There are numerous activities in the region that are responsible for contributing to the pollution of the water quality within the Ngagane Catchment, such as agricultural, historical and existing mining and industrial activities. Eskom has identified the need to treat and manage decant at Kilbarchan Colliery to ensure that the discharge meets the IWQO (2008) standards and prevents further pollution and contamination of the catchment. The treatment of the mine affected water will, therefore, ameliorate existing water quality impacts on the Ngagane Catchment and downstream water users, and ensure a sustainable rehabilitation for Kilbarchan Colliery.

Eskom has proposed that some of the mine affected water be treated through a Phytoremediation Plantation. Therefore, prior to the mine affected water entering the

Ngagane Catchment, it will be treated and thereby removing potential pollutants from being released into the river system.

8 Motivation for the overall preferred site, activities and technology alternative

The rehabilitation / maintenance / aftercare activities are restricted to areas requiring further rehabilitation. The maintenance / aftercare of the already rehabilitated Discard Dump and Open Pit areas are limited to the location of these facilities. Therefore alternative to these rehabilitation / maintenance / aftercare activities could not be provided.

8.1 Phytoremediation

Phytoremediation and active treatment has been proposed as a means treating the mine affected water currently decanting from Kilbarchan Colliery. The proposed active water treatment will be subject to a separate EIA process, with the Phytoremediation Plantation application being included in this BAR.

The location of the Phytoremediation Plantation was considered based on two premises: 1) where decant is occurring to abstract and reduce mine affected water; or 2) areas where infiltration into groundwater resources from rainwater occurs which will reduce groundwater recharge and the subsequent contamination of groundwater. Due to the limited information of the underground mine plan and geotechnical studies, it was not possible to determine areas of high infiltration and fractures in the underlying geology that may result in the recharge of the groundwater resources. As a result, the location of the Phytoremediation Plantation was positioned within and adjacent to the area of decant, where mine affected water could be abstracted by the tree plantation.

9 Full description of the process followed to reach the proposed preferred alternatives within the site

9.1 Details of the development footprint alternatives considered

Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives aid in identifying the most appropriate method of developing the project, taking into account location or site alternatives, rehabilitation alternatives, as well as the no-project alternative. Alternatives also aid in determining the activity with the least environmental impact.

Some of the potential alternatives that have been identified to date are provided below.

9.1.1 Location alternative

Please refer to Section 8 Part A for an explanation as to why no location alternative could be provided for the rehabilitation of the Kilbarchan Colliery.

9.1.2 Rehabilitation alternative

9.1.2.1 Discard dump

As significant effort has been made towards long term sustainable rehabilitation of the discard dump, no alternative rehabilitation method has been considered other than addressing areas of erosion through re-vegetating and replacement of top soil to prevent compaction and sedimentation of the catchment area.

9.1.2.2 Open pits

As significant effort has been made towards long term suitable rehabilitation of the open pits, no alternative rehabilitation method has been considered other than addressing areas of erosion through re-vegetating and replacement of top soil to prevent compaction and sedimentation of the catchment area.

9.1.2.3 Landfill site

A possible alternative rehabilitation method that was considered included the identification and extraction of all potential hazardous material that was previously disposed of at this landfill site. This material would have to be removed and dispose of at another licensed hazardous waste facility. Once all hazardous material has been removed the landfill site would need to be rehabilitated to an acceptable level.

This alternative could potentially disrupt an environment that is currently not releasing any identified pollution to the environment. The extent and content of the landfill is unknown as there are no records for these sites. It is proposed that the landfill site is rehabilitated through re-vegetation which will address the erosion and compaction issues that are being experienced. Groundwater and surface water monitoring will need to occur at various points around the site to ensure no leaching of the landfill occurs and that hazardous materials are not contained within the landfill sites.

9.1.2.4 Phytoremediation plantation

A number of different flora species were considered when selecting the vegetation required for the Phytoremediation Planation. Species that were considered but not included as the preferred species due to regional suitability and lack of research trials included *Cynodon dactylon*, *Acacia karroo*, *Rhus lancea* and *Berkheya coddii*. Five species have been selected due the role played in the absorption and passive treatment of the mine affected water:

- *Combretum erythrophyllum* – River Bush-willow;
- *Eucalyptus camaldulensis* – Red River Gum;
- *Tamarix usneoides* – Wild Tamarix;
- *Sporobolus spicatus* – Salt Grass; and
- *Chrysopogon zizanioides* – Vetiver Grass.

9.1.2.4.1 Combretum erythrophyllum – River Bush-willow

The *Combretum erythrophyllum* (River Bush-willow) tree is an indigenous South African tree species that is commonly identified within riparian forests along rivers or streams, as described by common English name.

The tree is able to grow in elevated salinity and/or alkalinity and survive to bear seeds. This tree species is suited for high water volume and salinity uptakes and furthermore does not pose an invasive threat. This plant does not need to be removed as it is a naturally occurring plant in the Newcastle area.

9.1.2.4.2 Eucalyptus camaldulensis – Red River Gum

The *Eucalyptus camaldulensis* (Red River gum) tree is, as all *Eucalyptus* species in South Africa, a listed alien invasive plant. *E. camaldulensis* is listed as a Category 1b alien invasive plant which means that the plant may not be propagated without a permit. This tree is able to withstand and survive high salt and acidic conditions and a vast array of other conditions including drought. This species is a hyperaccumulator of Manganese and Lead among other metals.

This plant species is suitable for rehabilitation as it can tolerate high salt concentration in the soil and water. It is important that sterile plants are planted for phytoremediation to minimise the risk of invasion of the surrounding environment. The planted trees cannot reproduce and as such may be left indefinitely.

9.1.2.4.3 Tamarix usneoides – Wild Tamarix

Tamarix usneoides (Wild Tamarix) is the only *Tamarix* species that is native to South Africa. The plant is an evergreen shrub to tree that is adapted to living in highly saline environments. The plant has an adapted root system that is able to penetrate deep water tables in arid environments and with adaptive salt glands the plant can exude excess salts. The plant is widely utilised as a Phytoremediation Plantation in South Africa with success around tailings dams. The Wild Tamarix is one of the most effective and readily available species for phytoremediation and it is recommended that this plant be considered for phytoremediation.

9.1.2.4.4 Sporobolus spicatus – Salt Grass

This species is an African grass species, also known as the Salt grass, which grows in salty conditions. This grass species is adapted to growing in wet conditions such as salt pan edges, marsh and river edges as perennial grass. This plant is proposed to be utilised as a phytoremediation option as the plant has a high tolerance for soil and wet conditions. The plant grows in clumps that create a dense grass mat and as such can be grown as water retaining barrier as water moves slowly through the dense vegetation and also minimise areas of exposed soils. The grass is recommended for its dual purpose in phytoremediation.

9.1.2.4.5 Chrysopogon zizanioides – Vetiver Grass

According to Melato *et al.* (2015), Vetiver grass is a fast-growing, perennial and sterile plant that can grow in a pH between 3.3 and 9.5 and in saline soil with a wide range in metals and an electrical conductivity of up to 47.5 dS/m.

9.1.3 No Go Option

Should a no go approach be considered, the current state of Kilbarchan Colliery will continue to deteriorate resulting in continued environmental impacts due to erosion and compaction of the discard dump, open pits and landfills. In addition, the mine will continue to decant and mine affected water will continue to be discharged directly into the Ngagane Catchment causing significant degradation of aquatics, wetlands, fauna and flora, surface and groundwater resources. This may have a significant economic impact on the surrounding communities and downstream water users that rely on the Ingagane River for their livelihoods.

The Kilbarchan Colliery will continue to pose a health and safety risk to the community and the surrounding landowners due to the risk and uncertainty of subsidence. The no-go option is not considered viable due to the health and safety implications and impacts occurring on the environment.

10 Details of the public participation process followed

A PPP is a statutory requirement in terms of the NEMA and the main objective being to provide a platform for the applicant, Interested and Affected Parties (I&APs) and relevant organs of state who work together to make an informed decision on the project. Through the PPP, I&APs are able to contribute local knowledge and raise comments applicable to the project planning and design.

The Public Participation (PP) for the Rehabilitation process consists of three phases, namely:

- Formal project announcement;
- Public comment period for the BAR and open house meeting and
- Announcement of the Environmental Authorisation.

The activities undertaken during each phase are described below. All comments received from I&APs will be recorded in the Comment and Response Report (CRR). In addition, copies of the Background Information Document (BID) with Registration and Comment Form, sites notice and newspaper advertisements are included in Appendix E.

10.1 Formal project announcement

As part of the announcement phase details of the proposed project together with availability of the BAR were provided to stakeholders. Details of the Open House Meeting were included into the announcement materials distributed. Below are the key activities for Phase 1.

10.1.1 Identification of stakeholders

Stakeholders interested in or affected by the proposed project were identified by means of the methods indicated below:

- Conducting Windeed and related desktop searches in and around the project area to verify landownership and obtain landowner contact details;
- Use of an existing stakeholder database applicable to the project;
- Responses on the distribution of the BID, site notices or newspaper advertisement placed;
- Telephonic consultations with landowners to identify additional I&APs; and
- Attendance at Open House Meeting.

Stakeholders for the proposed project are grouped into the following categories:

- **Government:** National, Provincial, District and Local authorities;
- **Landowners:** Directly affected, adjacent or indirectly affected landowners;
- **Parastatals:** Such as Transnet and SANRAL;
- **Non-Governmental Organisations (NGOs):** Environmental and social organisations; and
- **Business:** Small and medium enterprises, mining and industrial companies.

A stakeholder database was compiled and will be updated throughout the environmental regulatory process (see Appendix E 1).

10.1.2 Public participation media

Considering the legislative requirements and good practice the following methods have been implemented to make project information available to stakeholders.

- **Background Information Document:** a BID which included a project description, information about the required legislation, the competent authorities and details of the appointed EAP was prepared. The BID is also accompanied by a Registration and Comment Form for stakeholders to use for formal registration as I&APs or to submit comments. Information regarding the availability of the BAR and Open House Meetings was also provided.
- **Newspaper advertisement:** a newspaper advertisement was placed in the Newcastle Advertiser which is a local newspaper that distributes to Newcastle and

surrounding areas. The advert was published in English and IsiZulu and included a brief project description, information about the required legislation, the competent authorities, details of the appointed EAP, registration process for I&APs, and information regarding the availability of the Draft BAR for public comment and the Open House Meeting.

- **Site notices:** site notices were put up at various places as indicated in Table 10-1. The site notices contained a brief project description, information about the required legislation, the competent authorities and details of the EAP, registration process for I&APs and information regarding the availability of the BAR for public comment and details about the Open House Meeting.
- **Maps:** illustrative maps will be displayed at the Open House Meeting which will provide context to the regional setting of the full project. Specialist maps sharing details about studies completed for the rehabilitation will also be made available.
- **Presentation:** a PowerPoint presentation will be used as part of the Open House Meeting. It is envisaged that the presentation will contain the following content:
  - Project history and motivation;
  - Overview of project with various phases;
  - Regional locality of the project;
  - Details of the rehabilitation process;
  - Findings, impacts and proposed mitigation measures;
  - Applicable environmental legislation;
  - Timing of the environmental regulatory process; and
  - Contacts details for Digby Wells.

The BAR is available for a public comment period of 30 days from Friday, 14 October 2016 to Monday, 14 November 2016 at publically accessible places, and on the Digby Wells website: www.digbywells.com (under Public Documents). During the 30-day comment period, engagement with I&APs will be undertaken by means of telephonic consultations and Open House Meeting to obtain comments. With lapse of the 30-day public comment period the BAR will be updated and submitted to the DMR for consideration. Simultaneously, the updated BAR will be made available to I&APs on the Digby Wells website and informed of such by means of a letter (email and post). This enables I&APs to verify that their comments have been captured and responded to.

10.1.3 Consultation with stakeholders

It is planned that an Open House Meeting will be held with stakeholders affected by and/or interested in the proposed project during the 30-day comment period. This meeting format provides for an informal setting where the project team can engage with stakeholders in an effort to address comments and issues of concern. Furthermore, telephonic discussions will

be held with key stakeholders prior to the Open House Meeting to confirm attendance and identify key concerns. Translation of discussions will be available at the Open House Meeting.

10.1.4 Public participation activities undertaken

Table 10-1 below provides a summary of the PPP activities undertaken thus far, together with referencing materials included as annexures in Appendix E.

Table 10-1: Public Participation Activities

Activity	Details	Reference in Report
Identification of stakeholders	Stakeholder database was developed which represents various sectors of society, including directly affected and adjacent landowners, in and around the proposed project area.	Appendix E 1: Public Participation materials
Distribution of BIL	A BID with registration and comment form was emailed and posted to stakeholders on 14 October 2016. An SMS was also sent to stakeholders on 14 October 2016 announcing availability of the BAR.	Appendix E 2: Public Participation materials
Placing of newspaper advertisement	A newspaper advertisement was placed in the Newcastle Advertiser on 13 October 2016.	Appendix E 3: Public Participation materials
Putting up of site notices	Site notices were put up at the proposed project site, local libraries and other public places on 14 October 2016. A site notice placement report and map will be developed to indicate the locations of site notices in and around the project area.	Appendix E 4: Public Participation materials
Announcement of the Draft BAR availability	Announcement of availability of the Draft BAR was emailed and posted to stakeholders together with the formal project announcement on 14 October 2016. Copies of the Draft BAR were available to stakeholders at: ▪ Newcastle Library; ▪ Ingagane Library ▪ Kilbarchan Golf Club. The Draft BAR is available on the Digby Wells website: www.digbywells.com (under Public Documents). *(The comment period for the Draft BAR is from Friday, 14 October 2016 to Monday, 14 November 2016)*	To be included as part of the Final BAR
Obtained comments from stakeholders	Comments, issues of concern and suggestions received from stakeholders will be captured in the CRR.	To be included as part of the Final BAR
Open House Meeting	During the 30-day public comment period engagement with directly and adjacent landowners will be undertaken by means of telephonic	N/A

Activity	Details	Reference in Report
	consultations in an effort to obtain comments. During this public comment period it is planned to undertake an Open House Meeting which has been schedule to be held at the Blue Ridge Guest Farm - On the N11 Ladysmith Road (27°47'54.82"S; 29°57'21.95"E) on 2 November 2016 from 11:00 – 13:00.	
Announcement of the updated BAR availability	An announcement letter for availability of the updated BAR will be emailed and posted to the full database. SMS to notify stakeholders of availability of the updated BAR will also be done. The updated BAR will be available on the Digby Wells Website www.digbywells.com (under Public Documents).	To be included as part of the Final BAR
Obtaining comments from stakeholders	Comments, issues of concern and suggestions received from stakeholders will be detailed in the summary of issues (Table 10-2, Table 10-3 and Table 10-4).	N/A

10.2 Decision-making

Once the competent authority has taken a decision regarding the Rehabilitation application, results thereof, together with information about the regulated appeals procedure, will be communicated to stakeholders as prescribed under the NEMA legislation. As such, notification to stakeholders will be done by means of a letter via email and post, and placement of an advertisement in the relevant local newspaper.

10.3 Summary of issues raised by I&APs

At the time of completion of the BAR, no comments from stakeholders were received. With completion of the Open House Meeting, as set out under Section 10.1.3, the CRR and Table 10-2, Table 10-3 and Table 10-4 will be updated. As mentioned, the updated BAR will be made available to stakeholders once final submission has been made to the DMR with lapse of the 30-day comment period. This will be done in an effort to afford stakeholders the opportunity to view comments gathered from the various sectors of society and associated responses provided.

Table 10-2: Interested and Affected Parties

Interested and Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and/or responses were incorporated
Name of Individual	**Consulted**				
Landowners					
No comments received to date					
Lawful occupier/s of the land					
No comments received to date					
Landowners or lawful occupiers on adjacent properties					
No comments received to date					
Municipal councillor					
No comments received to date					
Municipality					
No comments received to date					
Organisations of state (Responsible for Infrastructure that may be affected Roads Department, Eskom, Telkom, DWA etc.					
No comments received to date					
Communities					
No comments received to date					
Traditional Leaders					
No comments received to date					
Department of Land Affairs					
No comments received to date					
Department of Environmental Affairs					
No comments received to date					
Other Competent Authorities Affected					
No comments received to date					

Table 10-3: Other Affected Parties

Other Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and/or responses were incorporated
Name of Individual	**Consulted**				
No comments received to date					

Table 10-4: Interested Parties

Interested Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and/or responses were incorporated
Name of Individual	**Consulted**				
No comments received to date					

11 The environmental attributes associated with the preferred alternatives

A summary of the baseline environment in the proposed project area is provided in the sections below.

11.1 Climate

Newcastle falls within the Drakensberg climatic region of South Africa; the climate is temperate to warm and humid with the temperature fluctuating seasonally and on a daily basis. The humid climate is associated with chemical weathering of rock as opposed to mechanical disintegration.

Rainfall occurs predominantly during the summer months from November to March, with an average of 12 to 13 rain days per month during this period. The annual rainfall for the region is 878 mm per annum with a maximum recorded annual precipitation of 1 322 mm (1943) and a minimum of 464 mm (1982) (BHP, 2012). Rainfall predominantly consists in the form of thunderstorms, although mist and drizzle are also experienced due to Kilbarchan's topography (proximity to mountains and valleys). Hail storms occur on an average of five times per annum.

The daily maximum temperature for summer is approximately 27ºC, with the winter daily maximum approximately 19 ºC. The daily minimum temperature is approximately 15ºC and 3ºC for summer and winter respectively. Frost predominantly occurs from April to September.

11.2 Surface Water

Kilbarchan Colliery is located in the Thukela Water Management Area (WMA) and lies predominantly in quaternary catchments V31K and V31J, with a very limited portion of the south western corner of the mining area falling within quaternary catchment V31F. No activities will be taking place in this south western corner of the mining area and, therefore, the surface water baseline will be described for quaternary catchments V31K and V31J only.

Kilbarchan Colliery is approximately 10 km downstream from the Ntshingwayo Dam (formerly known as the Chelmsford Dam). The Ingagane River originates in the Drakensberg escarpment and flows northeast towards the town of Newcastle, before flowing into the Buffalo River. The Ntshingwayo Dam was constructed on the Ingagane River in 1961 and serves as the predominant source of raw water for Newcastle and its surrounds.

The project site is located predominantly in the V31K quaternary catchment, with the V31J quaternary catchment watershed separating the project site towards its western extent. The V31K and V31J quaternary catchments form part of the Lower Ngagane and Ncandu catchments respectively, according to the DWS Water Management Units. The quaternary catchments for the project site are displayed in Plan 4, Appendix A.

The Mean Annual Runoff (MAR), Mean Annual Precipitation (MAP) and Mean Annual Evaporation (MAE) for quaternary catchments V31K and V31J are detailed in Table 11-1, according to the Water Research Commission (WRC) (2005) database.

Table 11-1: Quaternary catchment characteristics

Catchment	Area (km^2)	MAP (mm)	MAR (Mcm)	MAR (mm)	MAE (mm)
V31J	358	874	34.41	96	1450
V31K	227	796	13.59	60	1500

11.2.1 Surface water quality

11.2.1.1 Existing monitoring data

The water quality information was obtained from available recent studies by GCS Water and Environmental (Pty) Ltd. (GCS). GCS had been appointed to conduct a surface and groundwater quality monitoring campaign extending over a 12 month period, starting in October 2013. The monitoring campaign includes surface water points as described in Table 11-2.

Table 11-2: Existing Sampling Sites (GCS, 2013)

Sample point	Description	Longitude	Latitude
D1	Decant stream close to N11, east of PCD	29.95994	-27.8609
D2	Stream below KPCD, upstream of D4	29.95888	-27.8615
D3	Decant, appears at surface and flows into main channel	29.9596	-27.8621
D4	Midstream between D2 and D5	29.95940	-27.86203
HN UP2	River downstream of Ballengeich mine along N11	29.96495	-27.8889
KLDS4	Knockbrexspruit at junction in N11, downstream of Kilbarchan and up stream of Roy Point	29.95847	-27.823
KLDS1	Downstream of D1 along N11	29.96277	-27.8622
D5	Downstream of D3 and D4, below small bridge	29.95977	-27.86227
KPCD	Pollution control dam, south of discard damp	29.95858	-27.86137

The existing water quality data was benchmarked against the DWA Domestic Use Standards and the SANS 241 Drinking Water Standards by GCS. The water quality data is summarised from the various monitoring reports (GCS, 2014 and GCS, 2013) for the following sampling periods:

- 25 October 2013 and 31 October 2013:
  - The parameters of concern were the chloride, EC, magnesium, manganese, sodium, sulfate and the TDS for most sampling sites which are associated with mining and mining waste;
  - The point KLDS4 was relatively cleaner than most of the sampling sites;
  - The sites associated with decant, the D1, D3 and D5 and KSLD1 are characterised by very high sulfate levels in the ranges of 3 266 mg/L, 3 315 mg/L, 2 774 mg/L and 3 477 mg/L respectively. However the pH levels in the neutral ranges and the neutral pH is attributed to the exposure of the mine affected water to the base potential within the coal seam, as the mine progressively floods.
- 12 December 2013:
  - Not all the parameters were analysed for, however of the analysed parameters, the results indicates that the chloride, EC, nitrate and TDS as the parameters of concern; and
  - The sites associated with decant: the D1, D3 and D5 and KSLD1 are characterised by very high sulfate levels.

Digby Wells benchmarked the water quality standards against the IWQO (Table 11-3) and the data indicated that all samples with the exception of the sample KLDS4 were exceeding the IWQO standards for TDS, chloride, sulfate, magnesium, sodium, iron, manganese and EC.

Sample HNDUP2 located on a river downstream of Ballengeich mine along N11 shows acidic water on two separate occasions which could be attributed to some accidental discharges as the water's pH return to normal afterwards. The rest of the time the pH levels are within acceptable values.

Table 11-3: Existing Monitoring Data Benchmarked Against the IWQO Guidelines

Sample ID		Total Dissolved Solids	Nitrate NO3 as N	Chlorides as Cl	Sulfate as SO4	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Iron as Fe	Manganese as Mn	Conductivity at 25° C in mS/m	pH-Value at 25° C	Fluoride as F
Interim WQO Ngagane		**800**	**10**	**137.5**	**250**	**150**	**30**	**92.5**	**50**	**0.2**	**0.4**	**120**	**6.5-8.4**	**0.75**
D1	2013/10/10	5934	0.00	402.0	3402.0	445.0	201.0	1188.0	30.00	0.09	3.59	707.0	6.93	0.70
D1	2013/10/18	6025	0.00	380.0	3117.0	441.0	214.0	1111.0	30.40	0.27	3.27	702.0	6.90	0.65
D1	2013/10/25	5703	0.00	404.0	3266.0	0.0	228.0	1073.0	43.60	0.06	3.87	699.0	6.95	0.59
D1	2013/11/01	6049	0.00	409.0	3179.0	0.0	218.0	1082.0	42.30	0.78	3.99	707.0	7.22	0.77
D2	2013/10/10	623	0.00	16.4	214.0	75.0	52.1	74.5	2.44	0.05	0.13	94.6	7.80	0.29
D2	2013/10/18	582	0.00	18.4	196.0	71.0	47.0	52.9	2.51	0.05	0.06	91.7	7.92	0.32
D2	2013/10/25	547	0.00	18.3	220.0	0.0	51.3	53.6	4.28	0.05	0.34	94.7	7.77	0.25
D2	2013/11/01	620	0.00	21.8	265.0	0.0	58.0	60.2	5.54	0.03	0.75	106.0	8.10	0.32
D3	2013/10/10	5781	0.00	447.0	3033.0	302.0	166.0	1327.0	34.90	0.05	0.00	738.0	7.38	1.00
D3	2013/10/18	6232	0.00	493.0	3258.0	311.0	167.0	1307.0	36.20	0.05	0.25	768.0	7.53	0.86
D3	2013/10/25	6227	0.00	489.0	3315.0	0.0	197.0	1354.0	55.30	0.05	0.08	763.0	7.59	0.81
D3	2013/11/01	5795	0.00	452.0	3034.0	0.0	92.8	1274.0	20.70	0.03	0.22	723.0	8.00	0.98
D5	2013/10/10	5265	0.00	413.0	2989.0	326.0	162.0	1280.0	21.70	0.05	0.01	673.0	7.67	0.52
D5	2013/10/18	5502	0.00	409.0	2898.0	294.0	158.0	1177.0	20.30	0.09	3.31	678.0	7.29	0.44

Sample ID		Total Dissolved Solids	Nitrate NO3 as N	Chlorides as Cl	Sulfate as SO4	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Iron as Fe	Manganese as Mn	Conductivity at 25° C in mS/m	pH-Value at 25° C	Fluoride as F
Interim WQO Ngagane		**800**	**10**	**137.5**	**250**	**150**	**30**	**92.5**	**50**	**0.2**	**0.4**	**120**	**6.5-8.4**	**0.75**
D5	2013/10/25	5188	0.00	398.0	2774.0	0.0	175.0	1071.0	34.30	0.34	0.32	642.0	7.32	0.38
D5	2013/11/01	5136	0.00	395.0	2701.0	0.0	177.0	1089.0	34.20	0.03	3.75	649.0	7.89	0.48
KLDS1	2013/10/25	6290	0.00	412.0	3477.0	0.0	246.0	1165.0	51.20	0.04	0.01	709.0	7.91	0.52
KLDS1	2013/11/01	6099	0.00	404.0	3436.0	0.0	253.0	1150.0	46.20	0.04	0.19	717.0	8.15	0.57
KLDS4	2013/10/10	102	0.00	5.8	4.2	7.8	5.7	4.3	0.36	0.18	0.01	10.0	7.95	0.09
KLDS4	2013/10/18	254	0.00	1.0	3.0	7.4	5.8	3.4	0.40	0.19	0.01	10.1	8.18	0.09
KLDS4	2013/10/25	97	0.00	1.5	2.8	0.0	5.9	5.1	0.03	0.14	0.00	9.6	8.63	0.09
KLDS4	2013/11/01	153	0.00	3.4	6.7	0.0	6.6	6.2	0.62	0.24	0.01	10.9	7.33	0.09
HNUP2	2013/10/10	2153	0.00	20.6	1466.0	186.0	174.0	267.0	11.10	13.30	6.25	241.0	4.07	0.09
HNUP2	2013/10/18	3252	0.00	37.6	526.0	262.0	250.0	197.0	16.90	51.40	7.38	342.0	3.56	0.09
HNUP2	2013/10/25	1047	0.00	13.5	821.0	0.0	108.0	81.3	8.90	0.03	4.90	157.0	6.69	0.10
HNUP2	2013/11/01	460	0.00	14.5	241.0	0.0	39.6	20.3	6.35	0.04	0.88	65.3	7.16	0.16
KPCD	2013/10/10	836	0.00	31.4	446.0	61.0	57.6	144.0	5.06	0.05	0.05	122.0	7.97	0.35
KPCD	2013/10/18	882	0.00	34.9	432.0	62.0	60.3	109.0	6.33	0.05	0.01	127.0	7.93	0.36
KPCD	2013/10/25	610	0.00	38.1	439.0	0.0	63.4	150.0	10.60	0.04	0.06	129.0	7.70	0.35

Sample ID		Total Dissolved Solids	Nitrate NO3 as N	Chlorides as Cl	Sulfate as SO4	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Iron as Fe	Manganese as Mn	Conductivity at 25° C in mS/m	pH-Value at 25° C	Fluoride as F
Interim WQO Ngagane		**800**	**10**	**137.5**	**250**	**150**	**30**	**92.5**	**50**	**0.2**	**0.4**	**120**	**6.5-8.4**	**0.75**
KPCD	2013/11/01	843	0.00	39.7	418.0	0.0	62.7	149.0	11.50	0.05	1.20	129.0	8.27	0.43
D3	2013/10/25	6227	0.08	489.0	3315.0	0.0	197.0	1354.0	55.30	0.47	0.08	763.0	7.59	0.00
D5	2013/10/25	5188	0.32	398.0	2774.0	0.0	175.0	1071.0	34.30	0.34	0.32	642.0	7.32	0.00
KLDS4	2013/10/25	0	0.00	1.5	2.8	0.0	5.9	5.1	0.29	0.14	0.00	9.6	8.63	0.00
D2	2013/10/25	0	0.34	18.3	220.0	0.0	51.3	53.6	4.28	0.05	0.34	94.7	7.77	0.00
KPCD	2013/10/25	0	0.06	38.1	439.0	0.0	63.4	150.0	10.60	0.04	0.06	129.0	7.70	0.00
D1	2013/10/25	0	3.57	404.0	3266.0	0.0	228.0	1073.0	43.60	0.06	3.57	699.0	6.95	0.00
HNUP2	2013/10/25	0	4.90	13.5	821.0	0.0	108.0	81.3	8.90	0.03	4.90	157.0	6.69	0.00
KLDS1	2013/10/25	6290	0.01	412.0	3477.0	0.0	246.0	1165.0	51.20	0.04	0.01	709.0	7.91	0.00
D3	2013/10/31	5795	0.05	452.0	3034.0	0.0	92.8	1274.0	20.70	0.03	0.22	7.2	8.00	0.00
D5	2013/10/31	5136	0.08	396.0	2701.0	0.0	177.0	1089.0	34.20	0.03	3.75	649.0	7.89	0.00
KLDS4	2013/10/31	153	0.04	3.4	6.7	0.0	6.6	6.2	0.62	0.24	0.01	10.9	7.33	0.00
D2	2013/10/31	620	0.02	21.8	265.0	0.0	58.0	60.2	5.54	0.03	0.75	106.0	8.10	0.00
KPCD	2013/10/31	843	0.03	39.7	418.0	0.0	62.7	149.0	11.50	0.05	1.20	129.0	8.27	0.00
D1	2013/10/31	6049	0.02	409.0	3179.0	0.0	218.0	1082.0	42.30	0.78	3.99	707.0	7.22	0.00

Sample ID		Total Dissolved Solids	Nitrate NO3 as N	Chlorides as Cl	Sulfate as SO4	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Iron as Fe	Manganese as Mn	Conductivity at 25° C in mS/m	pH-Value at 25° C	Fluoride as F
Interim WQO Ngagane		**800**	**10**	**137.5**	**250**	**150**	**30**	**92.5**	**50**	**0.2**	**0.4**	**120**	**6.5-8.4**	**0.75**
HNUP2	2013/10/31	460	0.13	14.5	241.0	0.0	39.6	20.3	6.35	0.04	0.88	65.3	7.16	0.00
KLDS1	2013/10/31	6099	0.92	404.0	3436.0	0.0	253.0	1150.0	46.20	0.04	0.19	717.0	8.15	0.00

Within acceptable water quality standards
Exceeding IWQO (2008) Standards

11.2.1.2 Additional Monitoring Data

Digby Wells conducted water quality analysis in October 2014. The EC, pH, TDS and temperatures indicated were recorded during the sampling undertaken in October 2014. The monitoring locations are provided in Table 11-4. The surface water monitoring locations are depicted in Plan 5, Appendix A.

The water quality from the sampling in October 2014 is displayed in Table 11-5 for the IWQO (2008).

Table 11-4: Surface water sampling locations

New Site Name	Description	Longitude	Latitude	EC (mS/cm)	pH	Temp (°C)	TDS (mg/l)
KSW01	Decant stream close to N11.	29.95994	-27.86091	61.8	6.96	19.6	4340
KSW02	Stream west of KSW01, south of pan/wetland.	29.95888	-27.86151	896	8.25	16	627
KSW03	Decant, appears at surface and flows into main channel.	29.9596	-27.86208	53.2	6.91	16.6	3530
KSW04	River downstream of Ballengeich mine along N11.	29.96495	-27.88888	845	6.75	17.5	577
KSW05	Knockbrexspruit at junction in N11, downstream of Kilbarchan and up stream of Roy Point.	29.95847	-27.82304	96.9	7.9	18.2	66.9
KSW06	Downstream of KSW01 along N11.	29.96277	-27.8622	62.6	8.1	15.3	4390
KSW07	Upstream of the Power Station.	29.97476	-27.84476	478	7.93	19.8	278

Table 11-5: Surface water quality data (Digby Wells, 2014) compared with the Interim Water Quality Objectives (2008) for the Ngagane Catchment

Sample ID		Total Dissolved Solids	Nitrate NO3 as N	Chlorides as Cl	sulfate as SO4	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Iron as Fe	Manganese as Mn	Conductivity at 25° C in mS/m	pH-Value at 25° C	Free and Saline Ammonia as N	Fluoride as F	Suspended Solids as SS	Turbidity	Total Alkalinity as $CaCO_3$	Total Hardness
IWQO Ngagane Catchment		**800**	**10**	**137.5**	**250**	**150**	**30**	**92.5**	**50**	**0.2**	**0.4**	**120**	**6.5-8.4**	**0.058**	**0.75**	**20**	**3**	**450**	**300**
KSW01	2014-10-02	5343	0.27	429.0	2932.0	432.0	171.0	983.0	15.90	0.00	3.83	674.0	7.43	2.71	0.45	73	96	613	1784
KSW02	2014-10-02	808	0.35	28.3	376.0	95.3	61.9	84.8	4.92	0.00	0.00	120.0	8.37	0.35	0.30	48	19	253	493
KSW03	2014-10-02	3996	0.28	370.0	2084.0	287.0	153.0	752.0	6.23	0.00	2.28	561.0	7.99	0.93	0.07	278	379	559	1346
KSW04	2014-10-02	833	0.30	9.8	560.0	92.6	65.4	50.2	4.04	0.16	2.42	110.0	6.93	0.28	0.20	19	42	79.9	500
KSW05	2014-10-02	68	0.30	8.6	4.6	10.1	6.6	4.6	0.98	0.03	0.00	13.5	8.06	0.02	0.16	0	3	51.4	52
KSW06	2014-10-02	5361	0.48	433.0	2963.0	431.0	191.0	1001.0	16.70	0.00	2.02	671.0	8.25	1.18	0.37	54	4	528	1861
KSW07	2014-10-02	300	0.41	17.0	117.0	30.2	20.9	47.0	3.54	0.00	0.09	56.2	7.85	0.05	0.20	103	80	103	161

Within acceptable water quality standards
Exceeding IWQO (2008) Standards

The water quality for sampling sites KWS01, KWS03 and KWS06 displayed high TDS, sulfate and sodium, EC, hardness and turbidity, as well as magnesium and manganese concentrations. These sampling sites directly downstream of the decant area failed to meet the IWQO (2008) standards for the abovementioned constituents and had lower water quality than the remaining sample locations; however all sampling locations displayed relatively neutral pH values.

Sampling site KSW02 indicated elevated levels of TDS, chloride, sulfate, magnesium and turbidity and hardness which is characteristic of waste water. The KWS02 sampling site is upstream of the decant location and downstream of the pan/wetland to the south of the Discard Dump which could be influencing the quality of this water.

The water quality from sampling sites KSW05 and KSW07 indicated cleaner water with all of the parameters, with the exception of turbidity at KSW07, within the IWQO standards. Sampling site KSW04 is located downstream of the Ballengeich Mine and indicates water affected by mining activities due to elevated levels of TDS, chloride, sulfate, magnesium and turbidity and hardness.

It should be noted that KSW01 is located within to the vicinity of decant (v-notch) surface water sample undertaken as part of the Groundwater Assessment. The v-notch water quality indicates low pH values in comparison with sampling site KSW01. It is anticipated that these water quality samples have different chemistry due to the water emanating from different sources.

11.3 Groundwater

Digby Wells commenced with and completed a groundwater investigation at the Kilbarchan Colliery in November 2014.

11.3.1 Decant assessment

A stage curve was compiled to display the capacity of Kilbarchan Colliery to hold water at the different coal seam floor elevations.

11.3.1.1 Stage curve

The underground coal seam floor elevations are indicated in Plan 6, Appendix A, with the stage curve displayed in Figure 11-1. The maximum storage capacity of the underground mining voids is 44 million m^3 and is obtained at an underground coal seam elevation of 1 190 metres above mean sea level (mamsl), assuming an average coal seam of 3.5 m and an extraction rate of 50%.

The underground mining voids that have been backfilled with fly ash from the Ingagane Power Station have not been considered in the stage curve as information is not available regarding the volumetric amount of ash that was backfilled. The backfilled zones are only a small portion of the underground voids, and are unlikely to affect the accuracy of the stage curve adversely.

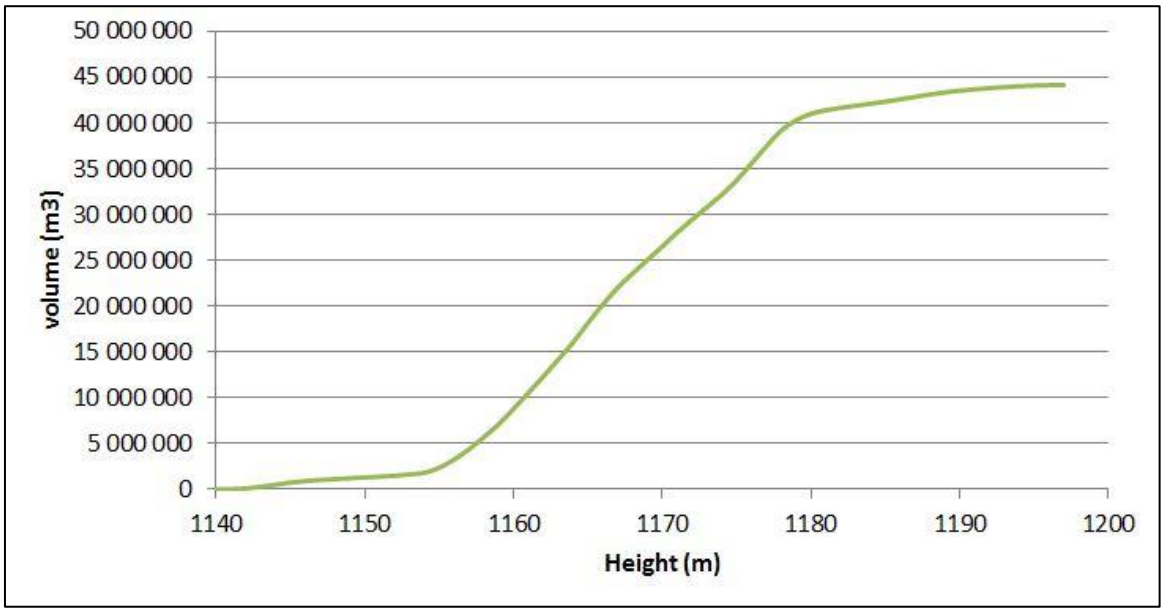

Figure 11-1: Stage curve for the underground workings at Kilbarchan Colliery

11.3.1.2 Water flooding

Groundwater elevation monitoring has been undertaken at selected boreholes within Kilbarchan Colliery since 1994, as indicated in Figure 11-2. The groundwater level was measured at 1 160 mamsl at the time of mine closure in 1992, indicating that 20% of the underground workings were already flooded. The water level had risen to 1 175 mamsl in 1999 and to a further 1 183 mamsl in June 2002. Subsequent to the 2002 monitoring measurements, the water level rose suddenly by 3.5 m. The sudden rise in water levels could be as a result of a collapse of the underground workings (Hodgson, 2006) or due to recharge from excessive rainfall volumes (Vermeulen, 2011).

The water level rose to 1 190 mamsl in 2004 and the Colliery began to decant mine affected water. As displayed in Figure 11-2, the water level has fluctuated by approximately 3 m subsequent to the decanting in 2004. The water level fluctuation is expected to be as a result of mine dewatering (records indicate that water was pumped from Kilbarchan Colliery to Roy Point Colliery to minimise decant) or due to the influence of variable recharge. The water level in the underground workings will not rise above 1190 mamsl due to this being the decant level. It is noteworthy that all of the boreholes monitored have the same piezometric head[5], which indicates that the underground voids are likely hydraulically connected. The location of the groundwater monitoring boreholes is displayed in Plan 7, Appendix A.

[5] Hydraulic head or piezometric head is a specific measurement of liquid pressure above a geodetic datum.

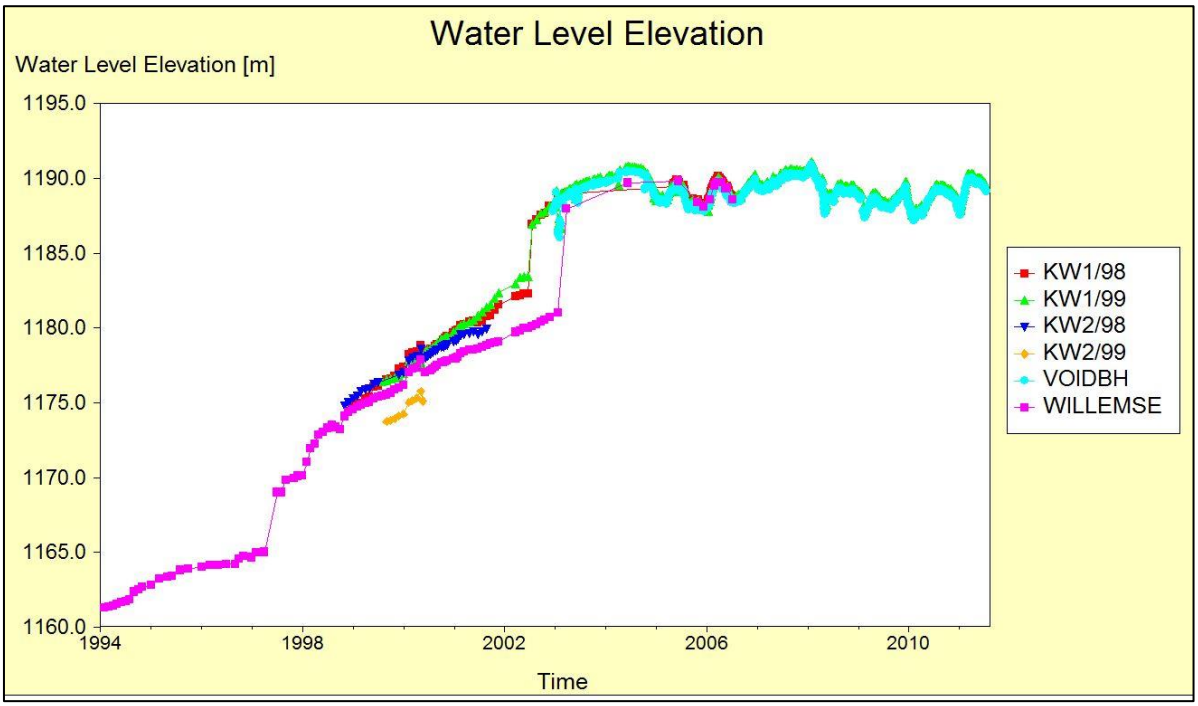

Figure 11-2: Time-series water levels of the monitoring boreholes

A schematic diagram indicating the flooding of the underground workings is displayed in Figure 11-3. Kilbarchan Colliery took twelve years to flood, taking cognisance of the water level in 1992 (20% of the underground voids). This translates into an average influx/recharge rate of 4 000 m^3 per day, reiterating the conclusion reached by Hodgson (2006). It should be noted, however, that the recharge rate can change in the future based on possible subsidence.

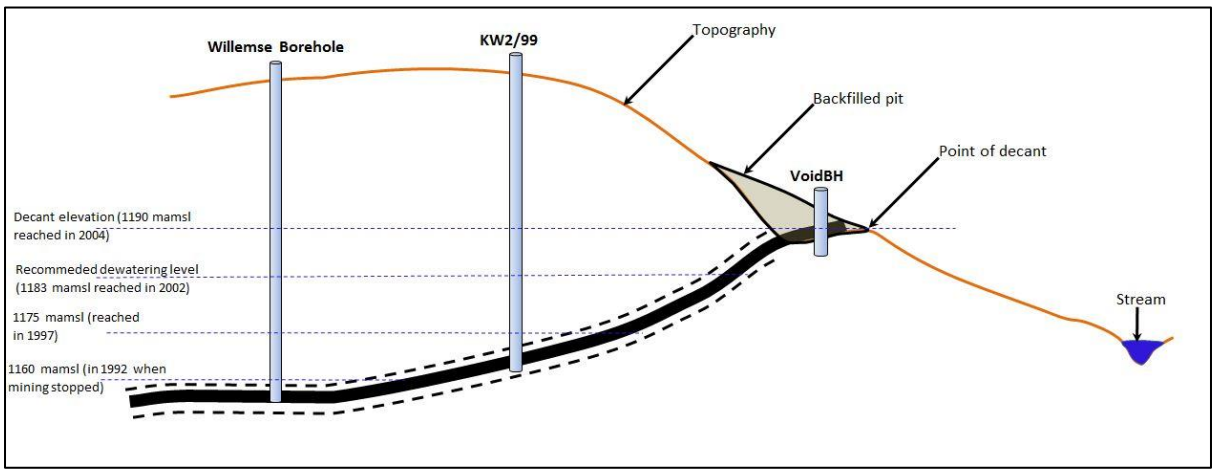

Figure 11-3: A simplified conceptual model of the underground workings

11.3.1.3 Decant management

Decant of mine affected water predominantly occurred where Open Pit 1A and Open Pit 1B are connected to the underground workings and at 1 190 mamsl. Although the Open Pit

areas are where the predominant decant is taking place, further decant should be expected along the weathered rocks and coal seam outcrops around this elevation.

The decant rate is seasonally controlled; the total volume could be as little as 1 megalitre (Ml) per day in late winter to as much as 6 ml/d in months following heavy rainfall periods. An average annual value of approximately 3.4 mega litres per day is expected for Kilbarchan Colliery. The expected rainfall and recharge dependency is illustrated in Table 11-6.

Table 11-6: Recharge values for various mean annual rainfall conditions at Kilbarchan

Rainfall (mm)	Recharge (% of Rainfall)	Recharge Rate (m^3 per day)	Recharge Rate (ML/day)
600	4.8	1 010	1
800	12	3 367	3.4
1000	17	5 962	6

Hodgson (2006)

11.3.1.4 Groundwater chemistry

The groundwater samples were taken in May 2014 and have been compared with the SANS 241:2015 for Drinking Water, as indicated in Table 11-7. The groundwater quality standards have not been benchmarked against the IWQO standards as the IWQO standards are considered for surface water resources. According to the SANS 241:2015 standards, water quality have two benchmarks namely Acceptable and Unacceptable:

- Concentrations that are below the recommended limits are categorised as Acceptable and are considered of good quality and suitable for human consumption; and
- Concentrations that are above the standards are categorised as Unacceptable and are not desired for human consumption, either due to aesthetic, acute or chronic effects.

In addition, decant (v-notch) water quality was compared to the IWQO (2008), as displayed in Table 11-8. The decant water (v-notch) is characterised as having a pH of 3.4 and high levels of TDS, sulfate, calcium, magnesium, sodium, iron, manganese, EC and aluminium. The pH of this water sample does not correlate with surface water sampling points KSW01 and KSW02 which had neutral or near-neutral pH. It is expected that the decanting from the open pit areas and decant from the underground voids have different pH, with the underground voids having buffering potential in comparison to the open pit areas. The mine affected water is decanting and the decant water is negatively impacting upon the water quality and does not meet the IWQO (2008) of the Ngagane Catchment.

Table 11-7: Water quality results compared with the SANS 241:2015 Standards

		Total Dissolved Solids	Conductivity at 25° C in mS/m	pH-Value at 25° C	Nitrate NO_3 as N	Chlorides as Cl	sulfate as SO_4	Fluoride as F	Free and Saline Ammonia as N	Total Alkalinity as $CaCO_3$	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Aluminium as Al	Iron as Fe	Manganese as Mn
Boreholes	**SANS 2015**	**1200**	**170**	**5-9.7**	**11**	**300**	**250**	**1.5**	**1.5**	**N/A**	**N/A**	**N/A**	**200**	**N/A**	**0.3**	**0.3**	**0.1**
Decant (v-notch)	2014/05/30	4912	551.00	3.41	0.28	120.00	3561.00	-0.06	0.42	-2	453.00	138.00	584	53	25.9	317.0	81.6
Kw1/98	2014/05/30	267	44.30	7.83	0.31	8.84	0.92	0.42	0.13	243	32.00	18.30	54	3	-0.003	-0.003	-0.001
Kw1/99	2014/05/28	1442	190.00	7.30	0.39	141.00	606.00	0.45	0.94	401	108.00	59.30	273	7	-0.003	-0.003	0.141
Kw2/99	2014/05/30	323	50.40	7.45	0.23	22.00	54.20	0.35	0.35	202	49.40	15.40	41	16	-0.003	-0.003	0.053
VOIDBH	2014/05/27	4950	548.00	3.45	0.33	116.00	3574.00	-0.06	0.44	-2	483.00	137.00	586	54	26.2	325.0	84.2
KMH7	2014/05/28	4102	443.00	6.05	0.35	175.00	2682.00	-0.06	0.24	83	493.00	63.20	583	53	-0.003	78.400	7.340

Within acceptable water quality standards
Unacceptable

Table 11-8: The decant water quality results compared to the Interim Water Quality Objects (2008) for the Ngagane Catchment

Sample ID	Total Dissolved Solids	Nitrate NO3 as N	Chlorides as Cl	Sulfate as SO4	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Iron as Fe	Manganese as Mn	Conductivity at 25° C in mS/m	pH-Value at 25° C	Free and Saline Ammonia as N	Fluoride as F
IWQO (2008)	**800**	**10**	**137.5**	**250**	**150**	**30**	**92.5**	**50**	**0.2**	**0.4**	**120**	**6.5-8.4**	**0.058**	**0.75**
Decant (v-notch)	4912	0.28	120.0	3561	453	138	584	53.1	317	81.6	551	3.41	0.424	<0.06

NS denotes Not Specified.

Within acceptable water quality standards
Exceeding IWQO (2008) Standards

The water quality at Kilbarchan can be classified into two distinct water types: those with pH around 6.5 (all boreholes intersecting the mine void) and those with a value of about 3.5 (borehole VOIDBH and decant).

The fact that the mine water pH is around 6.5 indicates that calcium carbonate in the flooded mine voids buffers water from becoming acid. This confirms that sufficient base potential still exists in the mine to prevent current acidification of the mine water.

VOIDBH is drilled in the backfilled pit where sufficient oxygen and water exists to generate acid. This borehole has very high sulfate concentrations, together with a number of other elements such as Ca, Mg, Na, K, Al, Fe and Mn.

Although the mine affected water is predominantly decanting from the underground void, the water drains through the backfilled Open Pit where the water is exposed to oxygen and the pyrite is oxidised. This results in the lowering of the decant pH to the same pH level of the water in the backfilled Open Pit. The similarity of the water quality of the decant water and borehole VOIDBH is illustrated in the Stiff diagrams (Figure 11-4) and the Expanded Durov diagram (Figure 11-5).

The sodium levels evident in the mine affected water are considerable and this is as a result from the release of connate water from the pores in the sediments (Hodgson, 2006). Sodium is likely to be released for many years and it can only be removed by membrane treatment, such as reverse osmosis.

The majority of the elevated TDS values are a result of the high sulfate concentrations. The rate of sulfate generation should decrease due to the underground workings being completely flooded. It will take many years, however, before the sulfate is diluted by natural processes due to the volume of water stored in the underground voids.

Historical data indicates that the mine affected water is stratified, with the water in the upper sections of the boreholes intersecting the underground voids being generally higher quality than the water in the bottom section of the boreholes. Boreholes KW1/99 and KW1/98 were within the SANS 241:2015 standard, but the bottom sampled chemistry indicated high EC together with high sulfate. The water stratification will have an implication for the proposed treatment plants and they should take into account that the worst quality of water may have to be treated. The better the quality of water treated the lower water treatment costs should be.

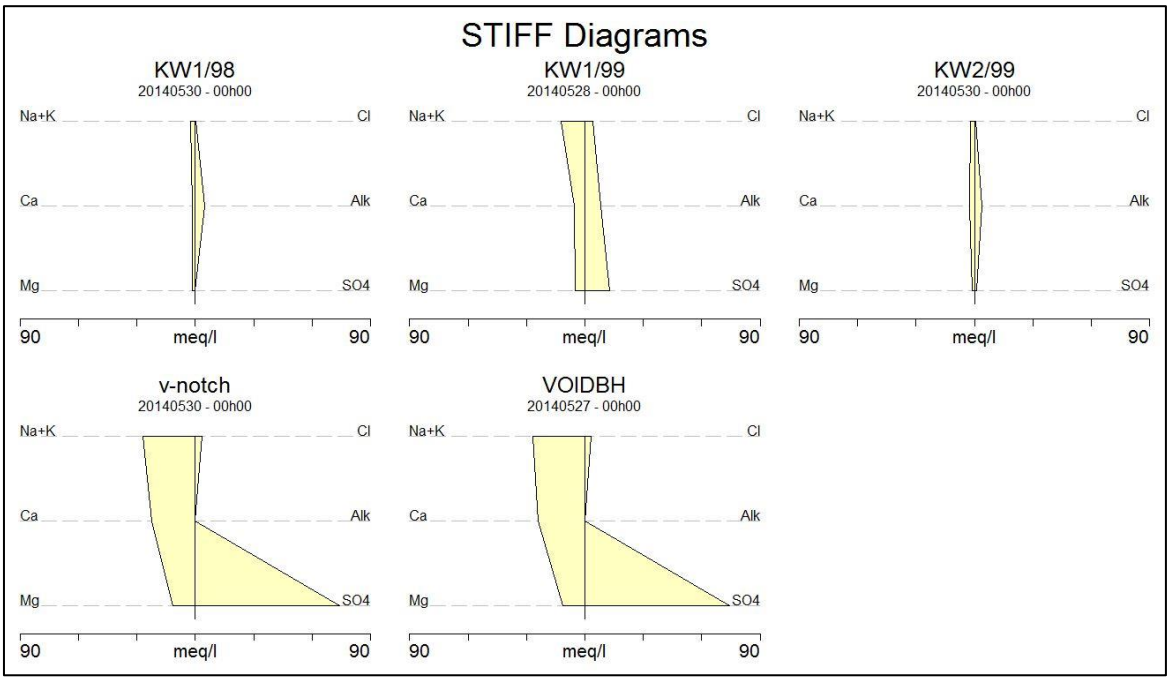

Figure 11-4: Stiff diagram of the hydrocensus boreholes

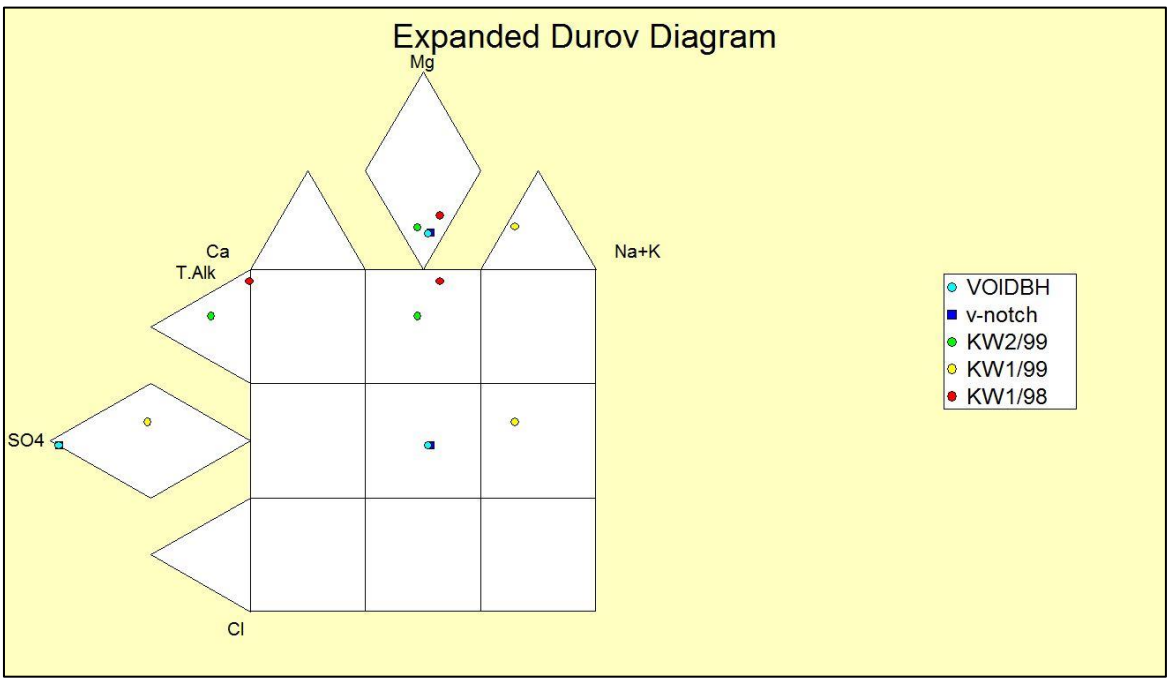

Figure 11-5: Expanded Durov diagram of the hydrocensus boreholes

11.4 Aquatics

One high flow aquatic survey was conducted in March 2014 with a low flow survey conducted in June 2014.

The primarily affected catchment is the Ngagane Catchment. A total of 11 sampling sites were selected as part of the aquatic assessment. The sampling sites can be seen in relation to the project area as well as the decanting boreholes in Plan 8, Appendix A.

11.4.1 Habitat quality

The sites assessed comprised of a variety of biotopes, the region is mainly comprised of the typical features associated with high energy streams such as bedrock and large stones. These sites were typically not associated with mining practises in these upper catchment as those assessed closer to the point of decant had far more silty substrates likely as a result of erosion from cattle grazing.

The lower reaches of the watercourses assessed, particularly in the Ingagane River, were silty. These areas coincided with road and rail crossings, however, further downstream bed rock and stones were observed.

Overhanging vegetation was also present in the form of alien invasive trees. Aquatic macrophytes were largely absent except for small areas of upland rivers typically with better *in situ* water quality. The habitat would appear to be moderately (class C) to largely modified (class D).

The entire habitat is not as impacted as might be thought from the Intermediate Habitat Integrity Assessment (IHIA) result. Near pristine areas still remain higher in the catchment of the assessed rivers. These streams have had no industrial or urban impacts inflicted on them. The better areas such as NGA 6, 7 and 8 (Plan 8, Appendix A) remain vital refuge areas for aquatic biota, allowing for the recruitment of more sensitive aquatic organisms.

However, their contribution to the overall catchment is greatly reduced due to their limited scale. The majority of the catchment is in a worse status.

11.4.2 Fish assessment

Fyke netting and electroshocking were carried out at specific sites and the results are detailed in Table 11-9 where they are compared against expected species from quaternary catchment V31J as no data exists for catchment V31K.

The River Health Programme (RHP) uses fish in the Fish Response Assessment Index (FRAI). The FRAI protocol is based upon the preferences of various fish species as well the frequencies of occurrence in which the species occur. The FRAI score is calculated and expressed in Table 11-10.

Table 11-9: Expected fish species for quaternary catchment V31J compared against species caught for the high flow

Fish species	Common name	Captured	IUCN Red data status
Expected species			
Amphilius natalensis	Natal mountain catfish	No	Not Assessed
Barbus Anoplus	Chubbyhead barb	Yes	Least concern
Labeobarbus natalensis	Kwazulu Natal Yellowfish	No	Least concern
Barbus paludinosus	Straightfin barb	Yes	Least concern
Labeo rubromaculatus	Tugela labeo	No	Least concern
*Oreochromis mossambicus**	Mozambique tilapia	No	Near threatened
Additional species			
Clarius gariepinus	Sharptooth catfish	Yes	Not assessed
Tilapia sparrmanii	Banded tilapia	Yes	Least concern
Barbus neefi	Sidespot barb	Yes	Least concern
Pseudocrenulabris philander	Southern Mouthbrooder	Yes	Not assessed
*Micropterus salmoides**	Largemouth bass	Yes	Least concern
Anguilla mossambica	Longfin Eel	Yes	Least concern

* Denotes an alien invasive or none endemic species

Table 11-10: FRAI results for the Kilbarchan assessment

Category	Rating
FRAI (%)	75.2
FRAI Category	C
Interpretation	Moderately modified

Only one IUCN (international Union for Conservation of Nature) listed fish species was listed as of concern that is *Oreochromis mossabicus,* which is listed as Near Threatened. All other

fish species have either not been assessed or are of least concern. The presence of *Anguilla mossambica* is a good indication of the relative unobstructed nature of the river. These species migrate between the quiet or fast flowing river and the ocean where they spawn and once hatched they migrate upstream.

11.4.3 Aquatic invertebrate assessment

As a result of aquatic macroinvertebrates integrating the effects of physical and chemical changes in the aquatic ecosystems, they are good, short-term indicators of ecological integrity. Integration of biological indicators (like aquatic invertebrates) with chemical and physical indicators will ultimately provide information on the ecological status of the river (RHP, 2001).

11.4.3.1 SASS version 5

The findings of the rapid macroinvertebrate assessment are recorded below in Table 11-11. The sites assessed during the high flow range from category B (mostly natural) to category D (largely modified). While the low flow survey recorded one site as a Class A while the other sites were either Class C or D.

Table 11-11: SASS[6] scores and categories from the high and low flow survey

Site	NGA 1	NGA 2	NGA 6	NGA 7	NGA 8	NEW 1	GOLF COURSE
High Flow							
Taxa	16	18	21	19	21	14	20
SASS Score	75	82	108	115	115	75	107
ASPT	4.68	4.39	5.14	6.05	5.48	5.36	5.35
Category	**D**	**D**	**B**	**B**	**B**	**D**	**C**
Low Flow							
Taxa	10	17	19	10	15	22	Incomplete
SASS Score	53	87	97	56	82	132	Incomplete
ASPT	5.3	5.12	5.11	5.6	5.47	6	Incomplete

[6] South African Scoring System version 5

Site	NGA 1	NGA 2	NGA 6	NGA 7	NGA 8	NEW 1	GOLF COURSE
Category	**D**	**D**	**C**	**C**	**C**	**A**	Incomplete

The SASS score categories range between A or unmodified sites and D's for largely modified sites. The greatest change was seen at NEW 1 where SASS scores increased during the low flow (usually the trend is reversed with scores improving in the high flow, less water leading to lower scores). This is likely due to difficulties in sampling during the high flow resulting is a skewed result.

11.4.3.2 MIRAI

The Macroinvertebrate Assessment Index (MIRAI) was conducted for the high land regions and the low land regions

The sites have been divided into two categories due to the difference between the high energy, steeper gradient streams (NGA 2, NGA 6, NGA 8 and Golf Course) which are found in the upland areas of the catchment and the slower flowing Ingagane River (NGA 1, New 1 and NGA 7) which is likely to have more deposition taking place than erosion and therefore provides different habitat options when compared with the faster flowing streams. The results of the upland assessment can be found in Table 11-12. The low land can be found in the table below that Table 11-13.

Table 11-12: Upland MIRAI results for the Kilbarchan study area

Sites: NGA 2, NGA 6, NGA 8 and Golf Course	
Component	**Results**
MIRAI (%)	52.3
EC: MIRAI	D
Category	Largely Modified

Table 11-13: Lowland MIRAI results for the Kilbarchan study area

Sites: NGA 1, New 1 and NGA 7	
Component	**Results**
MIRAI (%)	61.0
EC: MIRAI	C
Category	Moderately Modified

The moderately disturbed class of the MIRAI is not a full picture of the catchment though it does indicate that a degree of sensitive species have been lost. Sensitive taxa do still exist in the catchment within the upper reaches where the water quality, flow dynamics and habitat can support them.

11.4.4 Vegetation assessment

Table 11-14 below demonstrates the Riparian Vegetation Response Assessment Index (VEGRAI) score for the Ingagane River during the 2014 assessment.

Table 11-14: VEGRAI Score for the V31K catchment

Component	Score
VEGRAI (%)	53.3
VEGRAI (Class)	Class D
Category	Largely modified

The VEGRAI class of D indicates largely modified vegetation cover. This is easy to understand as large areas alongside the tributaries and main Ingagane River have been transformed by stock farming, mining and industrial activities.

11.4.5 Ecological description

The integrated ecological state for catchment V31K is expressed below in Table 11-15.

Table 11-15 Integrated ecological state

Index	Class
IHI	C/D
MIRAI	C/D
FRAI	C
VEGRAI	D
Present Ecological State (PES)	C/D

The Present Ecological State (PES) was found to be class C/D. The instream environment is not yet so degraded as can be seen from the class C rating of the FRAI, however habitat modification is of concern which has led to lower scores in MIRAI and VEGRAI. It is thought that once the water treatment program begins that water quality will improve potentially raising the stretch of the river concerned to a Class C, which according to the Attainable Management Class (seen in Table 11-16) is in line with its intended management Class.

Table 11-16: The ecological and management categories for the quaternary catchment V31K (Kleynhans, 2000)

Category	Description	State
EISC	Ecological importance and sensitivity category	Moderate
DEMC	Default ecological management class	Moderately Sensitive System
PESC	Present ecological status category	Class D (Largely modified)
AEMC	Attainable ecological management class	Class C (Moderately sensitive system)

11.5 Wetlands

The project area was studied over three days where the wetlands were identified, delineated and classified into Hydrogeomorphic (HGM) units. Thereafter their ecological health as well as the ecological service they provide was assessed.

A total of eight wetland units were identified in the mining area, totalling 493 ha. The largest wetland was the floodplain associated with the Ingagane River, which is designated as a National Freshwater Ecosystems Priority Areas (NFEPA) wetland. The identified wetlands and their ecological status are summarised in Table 11-17 and depicted in Plan 9, Appendix A. The rehabilitation activities were only associated with wetlands for the proposed Phytoremediation Plantation.

Table 11-17: Summary of wetlands identified

Wetland HGM unit		Description	PES	EISC
1	Floodplain, 279 ha	These wetlands are associated with the Ingagane River that runs through the project area.	D	High
2	Channelled Valley Bottom Wetlands; Tributary leading to mining areas, 147 ha	These wetlands are channelled valley bottom tributary wetlands that drain in an easterly direction towards the Ingagane River. These tributaries also drain into the mine impacted area.	D	Moderate
3	Channelled Valley Bottom Wetlands; Tributary below the Discard Dump, 8 ha	This wetland is a channelled valley bottom tributary wetland that also drains in an easterly direction towards the Ingagane River and is found below the Discard Dump.	D	Moderate
4	Mine impacted wetland area, 25 ha	This area is delineated as mine impacted as it has been previously mined on surface and these wetland are now impacted by acid mine	E	Low

Wetland HGM unit		Description	PES	EISC
		water that is decanting and draining into the Ingagane River.		
5	Channelled Valley Bottom Wetlands; Tributary leading to the golf course, 11 ha	This wetland is an unnamed tributary to the Ingagane River that runs under the N11 road and through the Kilbarchan golf course. The wetland is assessed in two parts (before it enters the golf course and within the golf course).	D	Moderate
6	Channelled Valley Bottom Wetlands; Tributary in the golf course, 8 ha		D	Moderate
7	Seep connected to Channelled Valley Bottom Wetlands of Wetland 3, 5 ha	This is a small hillslope seep wetland that drains into the unnamed tributary described as wetland 6.	D	Moderate
8	Seep connected to floodplain, 10 ha	This is a largely impacted seep area that is found below the Ingagane Power Station. It is likely that this area was once connected to the floodplain wetlands of the Ingagane River.	D	Moderate

The wetlands were dominated in the areas of open water by typical wetland vegetation such as *Typha capensis* (common Bulrush)*, Schoenoplectus corymbosus* and *Juncus spp.* These areas were not in abundance and mostly restricted to the Ingagane River and the section of tributary wetlands close to the river. The wetland indicator grass *Imperata cylindrica* (Cottonwool Grass) was widespread throughout the site and was a major indicator in areas outside of the permanent wetland bodies. The wetland ecosystems had a variety of forbs, contributing to biodiversity of these areas; of which most were found in the Ingagane River floodplain wetlands and wetlands in connection to it. One of these was the *Crinum bulbispermum* (Orange River Lilly), which is listed as a Declining species according to IUCN and is protected in Kwazulu-Natal (Figure 11-6).

Figure 11-6: Examples of wetland flora observed: A) *Schoenoplectus corymbosus*; B) *Juncus* spp.; C) *Crinum bulbispermum* (Orange River Lilly); D) *Imperata cylindrica* (Cottonwool Grass); & E) *Cyperaceae* spp (Sedge).

The wetland soils found in the area varied greatly from sandy alluvial soils with evidence of mottling to highly structure pedocutanic black soils with very high clay content that were difficult to auger into (see section 11.6 Part A for the soil and land capability).

11.6 Soil, Land Use and Land Capability

Land type information and maps relevant to the terrain, soils and climate of the area were obtained from the Institute for Soil, Climate and Water (ISCW) of the Agricultural Research Council (ARC) (Land Type Survey Staff, 1972 – 2006). However, the land type information is based on 1:250 000 maps and does not take cognisance of the disturbed nature of the Kilbarchan Colliery but is representative of a regional baseline. Thus, the land type and land capability of the project site may not be accurately reflected in the land type survey data.

The soils occupying the Kilbarchan site are mainly derived from sandstone, shale and dolerite, which dominate the underlying geology. Due to the undulating topographical landscape features causing variation in soil forming factors, soils of the study area are expected to be varying in nature and will be mostly of mixed agricultural potential (ARC).

The dominant land types representing the Kilbarchan site is defined as Ac, Bb, Dc and Ea land types.

- The Ac land type consists of a catena where red soils are widespread within the dominant terrain forms;
- The Bb land type consists of a plinthic catena where red soils are not widespread. Plinthic properties occur in subsoil horizons, especially in the crest and midslope terrain units;
- The Dc land type consists of midslope and valley bottom terrain units. These terrain units are occupied and dominated by clay soils; and
- The Ea land type is dominated by crest and midslope terrain units. The dominating soils occupying these terrain units are structured clayey soils.

11.6.1 Land capability

The land capability is expected to be dominated by grazing. Soils are expected to be sandy with low to medium agricultural potential based on profile depth. The soils will generally be acidic with low natural fertility due to their sandy nature and low cation exchange capacity. Nutrient deficiencies will be common.

11.6.2 Land use

Post mining land use and agricultural potential depends to a large extent on the rehabilitation efforts. It was found during field visits that the rehabilitation at Kilbarchan yielded thin soil covers. Erosion is common throughout the rehabilitated sites, possibly due to overgrazing.

Erosion prevention should be a priority, especially on sandy soils, as well as the rehabilitated areas occupying the mine site. Surface runoff must be prevented from accumulating in large volumes by using appropriate soil conservation methods on roads and rehabilitated areas.

11.7 Flora

11.7.1 Regional vegetation

Kilbarchan Colliery is located within two of South Africa's nine plant biomes (Mucina and Rutherford, 2006), namely Grassland and Savanna. The project area is located within the regional vegetation types of the Northern KwaZulu-Natal Moist Grassland, the Northern KwaZulu-Natal Shrubland and the KwaZulu-Natal Highland Thornveld.

11.7.1.1 Northern KwaZulu-Natal Moist Grassland

The Northern KwaZulu-Natal Moist Grassland is situated entirely within the Tugela River Catchment and lies between the drier KwaZulu-Natal Highland Thornveld and the moist upland vegetation. This vegetation type occupies the western areas of the project site and consists of undulating landscapes supporting tail tussock grassland dominated by *Themeda triandra* and *Hyparrhenia hirta.*

11.7.1.2 Northern KwaZulu-Natal Shrubland

The Northern KwaZulu-Natal Shrubland is distributed in patches within the sub-escarpment grasslands from Ladysmith in the west to Vryheid in the northeast. Large portions of this vegetation unit are found within the surrounds of Newcastle, with small pockets of shrubs found on scattered dolerite dykes and consist of minimal grass cover.

11.7.1.3 KwaZulu-Natal Highland Thornveld

The KwaZulu-Natal Highland Thornveld occurs as scattered patches throughout the central-northern regions of KwaZulu-Natal, where it occurs within dry valleys and moist uplands. This vegetation type occupies the eastern areas of Kilbarchan and the landscape comprises of hilly, undulating plains and broad valleys of grasslands and savanna.

11.7.2 Vegetation communities

Vegetation communities were delineated based on the similarity of species, composition and habitat. A large portion of the project area (81%) had been altered from its natural state due to mining activities and subsequent rehabilitation. Owing to the effects of fragmentation, as well as the impacts from grazing cattle, much of the remaining natural vegetation on site had been infested with alien invasive vegetation. In addition, heavy grazing activities result in the loss of palatable species and an increase in non-palatable species.

The identified vegetation communities within the project area are the following:

- *Diospyros lycioides – Euphorbia clavarioides* Rocky Outcrops;
- Rehabilitated Grassland; and
- Natural Grassland.

Only the rehabilitated and natural grassland is relevant to the rehabilitation plan and discussed in further detail below.

11.7.2.1 Rehabilitated and natural grassland

The project site consists predominantly of Rehabilitated Grasslands in varying stages of colonisation, with an example of the community displayed in Figure 11-7. Species diversity was low, although the basal groundcover was found to be adequate (greater than 30%). The dominant species within the Rehabilitated Grasslands were *Sporobolus africanus* (African

Dropseed), *Paspalum dilitatum* (Dallis Grass) and *Hyparrhenia hirta* (Common Thatching Grass).

The native invasive species, *Seriphium plumosum* (Bankrupt Bush), had colonised areas of Rehabilitated Grassland in proximity to wetland systems. Alien invasive vegetation have colonised this unit and were made up of predominantly forb species such as *Gomphrena celesioides* (Balloon Plant) and *Bidens pilosa* (Black Jacks).

Figure 11-7: Landscape examples of the Rehabilitated Grassland

Natural Grassland covers the lower-lying areas of the project area and includes an assemblage of grasses, as well as patches of *Acacia karoo*. Wetland areas were found to occur interspersed throughout the grassland habitat and comprised of hydromorphic plant species, such as *Andropogon eucomus* (Snowflake Grass), *Lipocarpha nana* and *Schoenoplectus spp*. The native invader, *Seriphium plumosum* (Bankrupt Bush), was found in proximity to monospecific patches adjacent to the wetlands.

11.7.3 Alien invasive vegetation

Alien invasive vegetation for the project area was extensive and well established, including alien invasive bushclumps greater than 6 m in height, as well as an abundance of alien invasive forbs.

Alien invasive vegetation are categorised according to the Alien and Invasive Species Lists, 2014 of the NEM: BA. The national list of invasive plant species listed in NEM: BA represents the following categories:

- Category 1a: Species requiring compulsory control;
- Category 1b: Invasive species controlled by an invasive species management programme;
- Category 2: Invasive species controlled by area; and
- Category 3: Invasive species controlled by activity.

Certain species have different alien invasive categories for different provinces within South Africa. Three Category 2 plants and six Category 1b plants were recorded on site, the

majority of which was *Eucalyptus camuldulensis* and covered an area of approximately 116 ha.

11.7.3.1 Floral Species of Special Concern

The International Union of Conservation of Nature (IUCN) is the international authority for Red Data species, with the Threatened Species Programme (TSP), in collaboration with the SANBI, undertaking this role in South Africa. Species of Special Concern (SSC) includes any Red Data, Nationally and Provincially Protected species recorded on site.

A total of ten floral SSC are expected to occur within the project site; three of which are listed as declining and nine species are provincially protected. All members of the Amaryllidaceae family and *Gladiolus* genus are protected according to the KwaZulu-Natal Nature Conservation Act, 1999 (Act No. 5 of 1999). Table 11-18 lists the floral SSC for the Kilbarchan area, none of which were identified during the field investigations. The lack of identification does not infer that the species, as well as additional Red Data species, do not occur within the project area.

Table 11-18: Floral species of special concern

Family	Species	Status (SA)
Amaryllidaceae	*Brunsvigia grandiflora*	LC; Protected
	Crinum bulbispermum	Declining; Protected
	Cyrtanthus breviflorus	LC; Protected
	Haemanthus humilis Jacq. subsp. hirsutus	LC; Protected
	Scadoxus puniceus	LC; Protected
	Crinum bulbispermum	Declining; Protected
Hypoxidaceae	*Hypoxis hemerocallidea*	Declining
Iridaceae	*Gladiolus crassifolius*	LC; Protected
	Gladiolus papilio	LC; Protected
	Gladiolus permeabilis	LC; Protected

Least Concern (LC) – Lowest risk. Does not qualify for a more at risk category. Widespread and abundant taxa are included in this category.

11.7.4 Key floral sensitivities

11.7.4.1 Threatened ecosystems

The Threatened Ecosystems programme is aimed at meeting explicit biodiversity targets as defined in a systematic biodiversity plan. The southern extent of the project site coincides with the Chelmsford North Grasslands Threatened Ecosystems. The Chelmsford North

Grassland is regarded as Vulnerable and is a priority area for meeting explicit biodiversity targets, as defined in a systematic biodiversity plan (Goodman, 2007).

11.7.4.2 Site-specific biodiversity value assessment

Very High sensitivity is traditionally assigned to areas occurring within a Threatened Ecosystem, as well as areas that were pristine or close to pristine, with low or no anthropogenic impacts. The only areas considered to be of High sensitivity within the project site are the rocky outcrops and Hydromorphic Grassland.

Areas of medium sensitivity include natural areas with some anthropogenic change or degradation, with high numbers of SSC and moderate rocky slopes. Low sensitivity is usually assigned to areas that are completely transformed or heavily degraded, as well as being on relatively flat topography. The project area was found to be in different states of disturbances, with grassland areas designated as medium low sensitivity.

The project area does not occur within any formally protected areas or any areas that have been allocated future protected status.

11.8 Fauna

11.8.1 Avifauna

The surroundings of Kilbarchan show signs of avifaunal interest, with Chelmsford Nature Reserve 17 km to the south and the Important Bird Area (IBA) from Memel in the west to Wakkerstroom to the northeast having recently gained recognition for bird areas of international importance. Many of the grassland, wetland and rocky outcrop habitats associated with Kilbarchan Colliery are similar to the above mentioned IBA. A total of 66 bird species were recorded on-site during the field investigations undertaken in April 2014.

11.8.2 Mammals

During the site visit undertaken by the fauna and flora specialist actual sightings of spoor, calls, droppings and nesting sites were used to establish the presence of mammals within the project site. The evidence of dung and spoor suggests that animals were present in the area, although very few were recorded during the surveys. The observations of local land owners were used to supplement the findings of the mammal survey. No small mammals, such as rodents, were caught in the Sherman traps, although some of the traps had been disturbed, possibly from larger species.

The majority of the farms within the project area are utilised for agriculture and cattle grazing and the local farmers were able to provide an indication on a number of larger mammal species that are found within the area. Mammal activity is most prominent in the Natural Grassland habitat, although it is expected that small mammal activity will also be high in the Rehabilitated Grassland habitat. *Atilax paludinosus* (Water Mongoose), *Sylvicapra grimmia* (Common Duiker) and *Alcelaphus caama* (Red Hartebeest) were recorded during the field

investigations, with evidence of mole activity also observed, although identification was not possible as individuals were not seen.

11.8.3 Herpetofauna

Amphibians are viewed to be good indicators of changes to the whole ecosystem as they are sensitive to changes in the aquatic and terrestrial environments. Most species of amphibians are dependent on the aquatic environment for reproduction (Duellman and Trueb, 1986), whilst activities such as feeding and dispersal are spent in terrestrial environments (Waddle, 2006).

Red Data amphibian species are expected to occur within the project site. The expected frog species are all classified as Least Concern (LC) according to the Red Data Book of Amphibians of Southern Africa. Three frog species were identified on site, namely *Anhydrophryne hewitti* (Natal Chirping Frog), *Tomopterna marmorata* (Natal Sand Frog) and *Amietia angolensis* (Common River Frog).

Similarly to amphibians, the reptiles within the project area will prefer certain habitats and are important ecological indicators. Due to amphibians being a major food source for a number of reptile species, the investigation on the microhabitats can be beneficial in understanding the propensity for both reptiles and amphibians to occur.

Reptiles are ectothermic and control their body through external means. As a result, reptiles are dependent on environmental heat sources (Savage, 2005) and regulate their body temperature by basking in the sun or in warmer areas. According to Carruthers (2007), substrate is an important factor determining which habitats are suitable for particular species of reptiles. The limited availability of rocky outcrops within the lower lying regions of the project site may indicate that only a few reptile species are present.

11.8.4 Invertebrates

Thirteen butterfly species were recorded for the project site, according to the South African Butterfly Conservation Assessment (2011).

Figure 11-8 represents examples of invertebrates that were recorded on site and includes a newly developing, or previously undocumented, relationship between the Agelenidae or Dipluridae family (commonly known as funnel spiders) and the succulent plant, *Euphorbia clavarioides* (Lion's Spore). Owing to the location of the study area in northern Kwazulu-Natal, the funnel spider in question is likely to be *Agelena zuluana*.

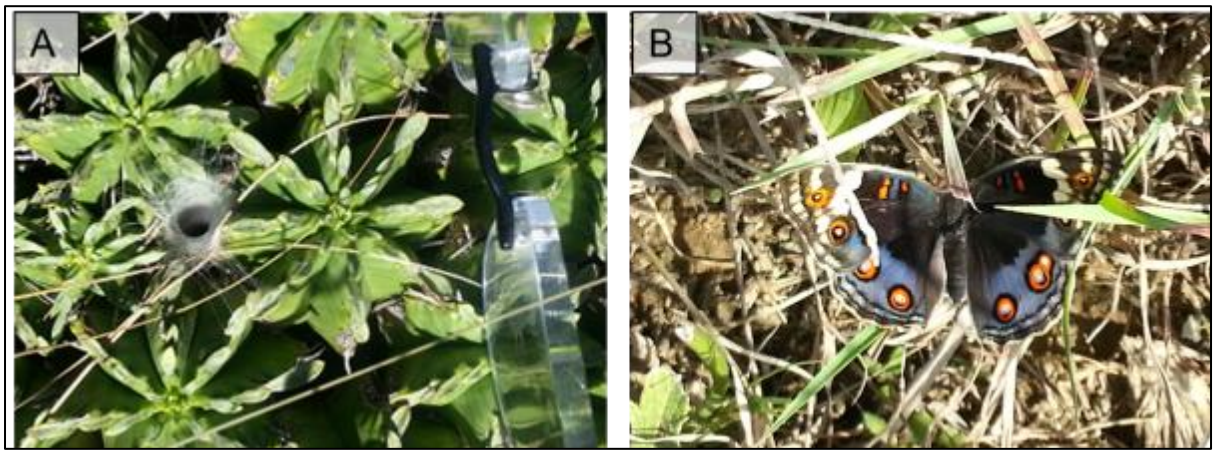

Figure 11-8: Examples of Invertebrate Sightings (A: Funnel Spider Web (Belonging to either of the Family Agelenidae or Dipluridae) and B: Junonia orithya madagascariensis (Ox-Eyed Pansy))

11.8.5 Fauna species of special concern

No mammal or herpetofauna SSC were recorded on site during the survey in April 2014. Additional SSC may occur and their absence during this investigation does not infer that they do not occur at all. Two bird SSC of international concern and an additional two birds of national conservation concern were recorded for the Kilbarchan site (African March Harrier (*Circus ranivorous*), Southern Bald Ibis (*Geronticus calvus*), African Snipe (*Gallinago nigripennis*) and (Grey Crowned Crane (*Balearica regulorum*)). Twenty six birds have the potential to occur on site. Sixteen potentially occurring mammal SSC have been listed, five of which are bat species.

11.9 Socio-Economic profile

The socio-economic data for this section was obtained from the following sources:

- NLM Integrated Development Plan (IDP), 2013/2014;
- NLM Spatial Development Framework (SDF), 2012/2013; and
- Stats SA, 2011.

Kilbarchan is located within the NLM and ADM. The NLM is one of the three local municipalities that make up ADM and is located on the northwest corner of KwaZulu-Natal, bordering the Free State and Mpumalanga provinces to the west and north respectively. The Utrecht and Dannhauser Local Municipalities are located along the NLM's eastern and southern boundaries.

11.9.1 Population

The population of NLM was estimated at 363 235 people in 2011 (Census, 2011), with the ADM being estimated at 500 000 people, thus NLM accounts for approximately 73% of the

District population. The population of NLM increased at an annual rate of 0.87% between 2001 and 2011; a marked reduction in the annual increase of 2.93% between 1996 and 2001 (NLM IDP, 2013/2014).

Newcastle accounts for the majority of households within the ADM, with 84 272 recorded in 2011 (Stats SA). Average household size in 2011 was 4.3 people, which is a slight decline from the 4.6 people in 2001. The population of NLM is unevenly distributed among thirty-one municipal wards, with Ward 1, which consists of Kilbarchan and Ingagane communities, being the third most populated (15 843).

11.9.2 Age and gender

NLM population is relatively young, with 46% of the population under the age of nineteen, with a further 27% of the population being between twenty and thirty-four years of age. The age distribution of the NLM places pressure on the provision of educational facilities, social welfare and health services, as well as the stimulation of the economy to provide job opportunities and economic development (NLM IDP 2013/2014).

Males account for 48% of the population, with females making up the remaining 52%. The gender distribution conforms to the Nation's norms.

11.9.3 Educational and unemployment profile

The educational profile for NLM has displayed significant improvement since 2001. The percentage of the population who do not have any formal education declined from 13% in 2001 to 7.8% in 2011, coupled with the substantial increase in the percentage of the population with secondary education (Matric) from 25.8% to 32.8% in the same period. The percentage of the population with higher education is a concern, however, as this declined from 8.2% in 2001 to 4.4% in 2011. This is attributed to the lack of tertiary institutions and employment opportunities in the region, limiting the ability for Newcastle to attract and keep highly qualified individuals (NLM IDP, 2013/2014).

The unemployment rate in NLM has declined from 54.1% in 2001 to 37.4% in 2011, with the percentage of unemployed youth[7] declining from 64% to 49% during the same time period.

11.9.4 Industry employment

The primary sectors of the economy contribute only 2% to the total employment within the NLM, with agriculture and mining contributing 1.3% and 0.7% respectively. The manufacturing sector contributed 17.9% to total employment within the municipality. All three sectors have seen the annual growth rate of employment decline, with mining (7.5%), agriculture (16%) and manufacturing (17.9%) employment declining since 2000. Such trends highlight the decline in employment within the primary and secondary sectors, which forms

[7] Youth denotes persons between the ages of 15 and 34 years.

the foundations of the economy and are generally more labour intensive than tertiary sectors.

11.9.5 Access to basic services

Access to basic household services within NLM has improved substantially since 2001, with piped water inside dwellings increasing from 28.5% to 50% in 2011 and 87.2% of the population having electricity for lighting, increasing from the 84.2% in 2001 (NLM IDP, 2013/2014).

The NLM, with the assistance of Eskom, has made substantial progress with the provision of electricity throughout the region, with 69 800 and 73 449 households utilising electricity for cooking and lighting, respectively.

11.9.6 Site specific and surrounding social profile

The Kilbarchan community is situated approximately 14 km south of Newcastle, with the Ingagane community located 3 km to the east of Kilbarchan. The Kilbarchan community includes the Kilbarchan Country Club golf course, with the Ingagane community located to the east of the Ingagane Power Station. In addition, a small mine village is located 1 km to the northwest of the Discard Dump and is currently occupied by residents; the houses were sold by Eskom to the municipality. Thus, the residents of the mine village and Kilbarchan and Ingagane communities are the closest sensitive receptors to the proposed project.

The land uses surrounding the project area are dominated by a combination of agricultural, mining and industrial activities. The Land Use within the Kilbarchan Colliery mining area, as well as the immediate surroundings, is predominantly grazing activities, with cultivated crops dominating to the southwest of the project site within the surrounds of the Ntshingwayo Dam.

A sewage treatment plant is in operation to the east of Kilbarchan community and west of the railroad and iNgagane River. An additional water treatment plant, the uThukela Water Treatment Plant, is located approximately 4 km to the northeast of the Kilbarchan sewage treatment plant.

11.10 Cultural heritage

A Heritage Screening Survey (HSS) was undertaken and a Needs and Desirability Application (NDA) was compiled and submitted to the South African Heritage Resources Agency (SAHRA) and Amafa, the Heritage Resource Authority of KwaZulu-Natal.

11.10.1 Geology and palaeontology

The project area is underlain by the Karoo Dolerite Suite and the Madzaringwe Formation. The Karoo Dolerite Suite has no significance with regards to palaeontological potential (SAHRIS, 2014) and is characterised by the presence of intrusive dolerite dykes and sills with associated diatremes (volcanic pipes) (Lavin, 2013a). Dolerite intrusions are often

sources of raw material for lithic production during the Middle Stone Age (MSA) (Wadley and Jacobs, 2006).

The Madzaringwe Formation consists of fluvial sandstones, siltstone and shales and fossils associated within the Formation includes *Glossopterid* coal flora (Lavin, 2013b). According to the PalaeoSensitivity map on the South African Heritage Resources Information System (SAHRIS), Kilbarchan is located in a highly sensitive area with regards to palaeontological potential.

11.10.2 Site-specific project area

The project area was dominated by agricultural fields and open grazing land in 1944 (Figure 11-9), with documents pertaining to Kilbarchan Colliery and its associated infrastructure, including employee quarters, hospital, school and overall plans for the Colliery, being available from 1955. Construction of the Ingagane Power Station began in 1959 and was completed in 1963 (Leech, 2003). Development in the area had increased by 1970, with the construction of Kilbarchan village and the growth in mining activities in the surrounding areas, as depicted in Figure 11-10.

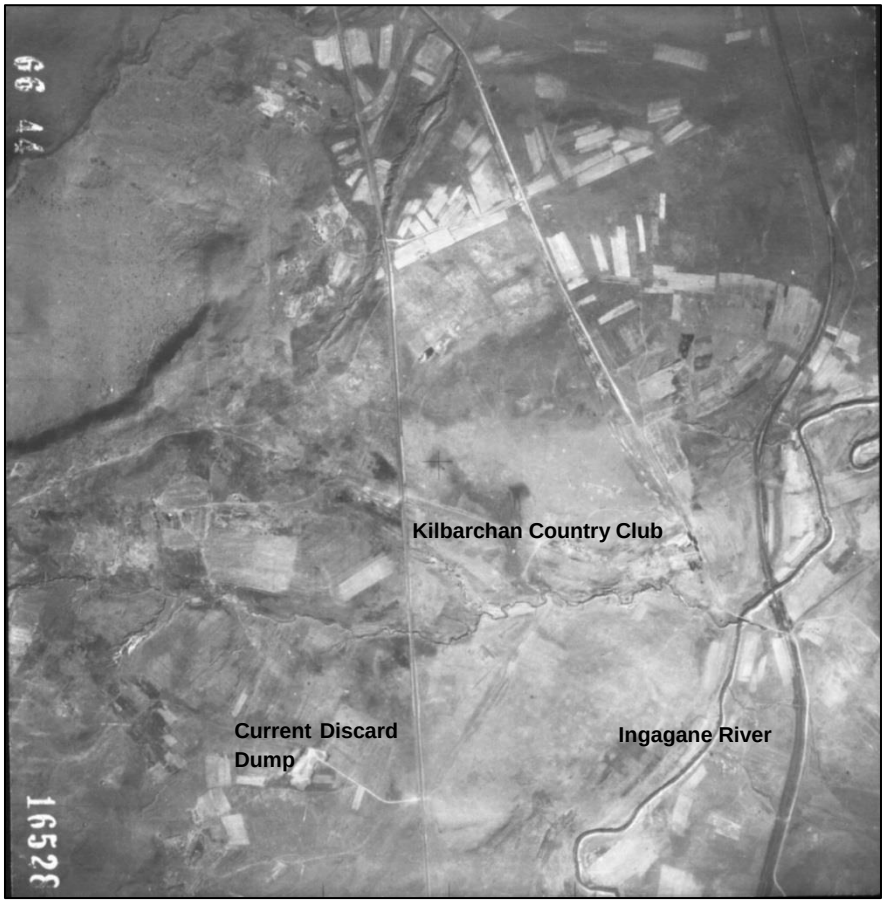

Figure 11-9: 1944 Aerial photograph of Kilbarchan Project Area

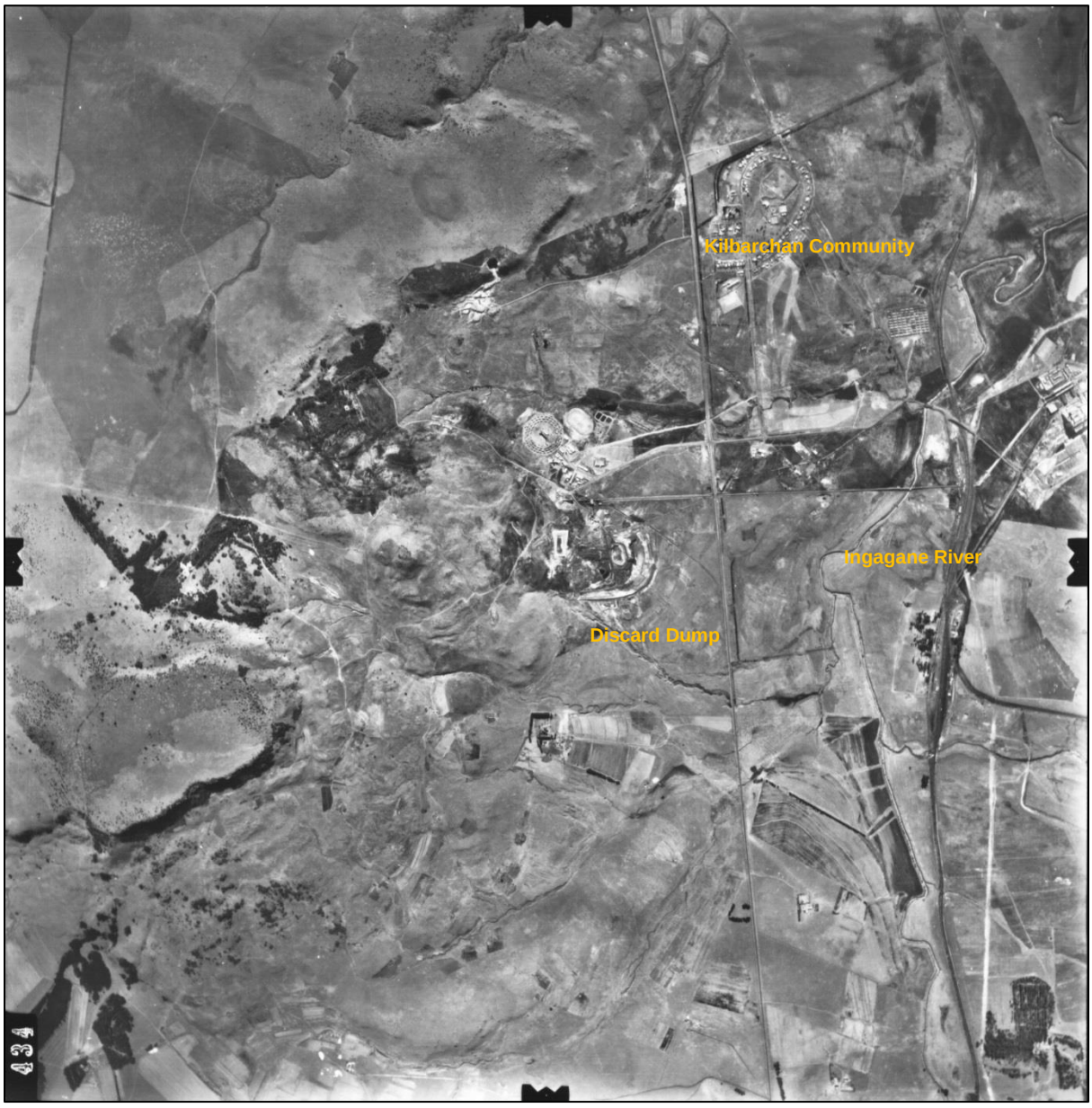

Figure 11-10: 1970 Aerial photograph of the Kilbarchan Project Area

During the HSS heritage resources were identified and outlined in Table 11-19 and Plan 10, Appendix A. The heritage resources are not located within areas that require direct rehabilitation activities; however the heritage resources are within proximity of areas where activities may be required. Currently, there are no anticipated impacts to heritage resources.

Table 11-19: Identified Heritage Resources

Site ID	Site type	Co-ordinates	Description
6605/2729DD/St/001	Historical/ Iron Age site	**St/001** Between -27.849006/	A stonewalled site measuring 300 m along the length of a ridge within the project area. Approximately 4 clusters

Site ID	Site type	Co-ordinates	Description
		29.968375 and (-27.849766/ 29.965639 **BGG/001a** (-27.849079/ 29.967226) **BGG/001b** (-27.849308/ 29.966034)	of stone walls were identified with two graves within the site. One grave was surrounded by a stone wall and had aloes (*A. maculata*) growing on the grave. The existing power line is located in close proximity to the site. The stone-walled stone packed grave is located 150 m from the proposed pipeline. The second stone packed grave and site boundary is located approximately 40 m from the proposed pipeline.
6605/2729DD/St/002	Historical site	-27.852983/ 29.964705	A stonewalled structure and a possible grave was identified adjacent a modern homestead.
6605/2729DD/BGG/003	Recent	-27.846571/ 29.971541	Cemetery measuring 800 m x 500 m located to the east of the eastern landfill site. The cemetery has been in use since 1978 until current times. Approximately 100 graves are located within the cemetery.
To be confirmed	Recent	To be confirmed	An additional grave site was identified during the rehabilitation site visit and is located adjacent to Open Pit 2. The extent of the grave site will be confirmed.
6605/2729DD/Ste/004	Historical	-27.844005/ 29.975158	Historical sandstone bridge dating from approximately 1900. The bridge supports had been constructed from large sandstone blocks with iron beams running across the bridge and corrugated iron as the walls of the bridge. The plaque that would have usually depicted the date of the bridge had been removed.

11.11 Description of the current land uses

The current land use is described in Section 11.6 Part A.

The land uses surrounding the project area is a combination of agricultural, mining and industrial activities. Cultivation dominates the landscape to the south-west of the project site in the surroundings of Ntshingwayo Dam, with grazing activities prominent throughout the region. There are several existing and decommissioned coal collieries upstream of the project site which, along with the agricultural activities, could be a source for surface water

contamination. Heavy industrial activities are present to the north of Kilbarchan Colliery and include Lanxess CISA (Pty) Ltd chrome chemicals production facility, Karbochem (Pty) Ltd. synthetic rubber production facility and ArcelorMittal SA steel production facility. In addition, there is an AfriSam quarry located on the northern boundary of the mining area. The uThukela Water Treatment Plant is located approximately 4.5 km to the north of the Ingagane Power Station and is the water and sanitation services provider for the region.

Significant erosion and overgrazing has been experienced. Rehabilitation activities aim to implement erosion control measures and revegetate the area to allow sustainable cattle grazing in the future. . The properties are to be rehabilitated to grazing standard and will remain within Eskom ownership, unless indicated otherwise.

11.12 Description of specific environmental features and infrastructure on the site

11.12.1 Water resources

Kilbarchan Colliery is located in the Thukela WMA and lies predominantly in quaternary catchments V31K and V31J, with a very limited portion of the south western corner of the mining area falling within quaternary catchment V31F. The water quality for sampling sites KWS01, KWS03 and KWS06 displayed high TDS, sulfate and sodium, EC, hardness and turbidity, as well as magnesium and manganese concentrations.

The maximum storage capacity of the underground mining voids is 44 million m^3 and is obtained at an underground coal seam elevation of 1 190 mamsl, assuming an average coal seam of 3.5 m and an extraction rate of 50%. The water level rose to 1190 mamsl in 2004 and the Colliery began to decant mine affected water. Decant of mine affected water predominantly occurred where Open Pit 1A and Open Pit 1B. The water quality at Kilbarchan can be classified into two distinct water types: those with pH around 6.5 (all boreholes intersecting the mine void) and those with a value of about 3.5 (borehole VOIDBH and decant).

11.12.2 Terrestrial and aquatic environment

The project area is characterised by significant NFEPA wetlands, mostly associated with Mbazo and Ingagane River for the study area. The NFEPA wetlands associated with the project area have a rank of 5. There are many NFEPA wetlands within the catchment and some with a high rank of 2. The project area and surrounding landscapes can be concluded to be important from a national wetland ecological perspective.

The soils occupying the Kilbarchan site are mainly derived from sandstone, shale and dolerite, which dominate the underlying geology. Due to the undulating topographical landscape features causing variation in soil forming factors, soils of the study area are expected to be varying in nature and will be mostly of mixed agricultural potential.

Kilbarchan Colliery is located within two of South Africa's nine plant biomes (Mucina and Rutherford, 2006), namely Grassland and Savanna. A total of ten floral SSC are expected to occur within the project site; three of which are listed as declining and nine species are provincially protected.

No mammal or herpetofauna SSC were recorded on site during the survey in April 2014. Additional SSC may occur and their absence during this investigation does not infer that they do not occur at all. Two bird SSC of international concern and an additional two birds of national conservation concern were recorded for the Kilbarchan site

11.12.3 Cultural heritage

The project area is underlain by the Karoo Dolerite Suite and the Madzaringwe Formation. The Karoo Dolerite Suite has no significance with regards to palaeontological potential. Grave sites and stone walls were located within the project area, although impacts to such heritage resources are not expected as part of the rehabilitation and maintenance activities. The grave site located adjacent to the Open Pit 2 may require fencing to avoid potential impacts should rehabilitation activities be required. A sandstone bridge is located to the east of the Kilbarchan Colliery and crosses the Ingagane River; the sandstone bridge dates from approximate 1900 and is protected in accordance with Section 36 of the NHRA.

11.12.4 Infrastructure and facilities

Table 11-20 provides a list of the facilities to be rehabilitated on site.

Table 11-20: Summary Rehabilitation Actions

Zone	Target Area
Previously Rehabilitated Areas	Discard Dump
	Open Pit area 1C and 2
Areas still to be rehabilitated	Landfill site
Areas that do not require rehabilitation	Graveyard
Areas Affected by Mine Affected Water	Preliminary areas set for phytoremediation project

11.13 Environmental and current land use map

The Plans indicating the environmental features of the project site are summarised in Table 11-21.

Table 11-21: Summary of the Plans indicating the Environmental Features of the Project Site

Environmental Feature	Plan Number (Appendix A)
Quaternary Catchment	Plan 4
Wetlands	Plan 9
Heritage Resources	Plan 10

12 Impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts can be mitigated

The rehabilitation / maintenance / aftercare activities to be undertaken at Kilbarchan Colliery may result in environmental risks which, should they occur, will impact on environmental aspects. Both environmental risks and environmental impacts have been identified as part of the rehabilitation / maintenance / aftercare activities. An environmental risk is an uncertain event that may result in an environmental impact, should the event occur. Due to the nature of risks in comparison to impacts, risks have not been rated according to the nature, significance, extent, duration and probability of them occurring but have been assessed qualitatively. In addition, mitigation measures have been provided to prevent and manage the potential identified risks from resulting in an environmental impact. All impacts associated with the phytoremediation plantation has been quantitatively assessed according to the nature, significance, extent, duration and probability of them occurring.

Only rehabilitation will be assessed, no construction or operation activities will be taking place and therefore have not been considered as part of this qualitative assessment. The potential risks associated with the project have been identified as part of the specialist investigations undertaken for the Kilbarchan Colliery. The significance of the potential risk has been assessed by the specialists in a qualitative manner.

The potential risk and mitigation and management measure for each risk has been summarised in this section and is addressed in further detail with in the attached Rehabilitation Plan (Appendix B). The risks associated with the project include the NEMA EIA Regulations Listed Activities which include all rehabilitation activities to take place at the Kilbarchan Colliery. A list of rehabilitation activities has been summarised in Table 12-1.

Table 12-1: Project Activities Summary

Activity No.	Activity
Rehabilitation Phase	
1	Maintenance of historic rehabilitation measures completed on the Discard Dump

Activity No.	Activity
2	Maintenance of historic rehabilitation measures completed on the Open Pit area 1C and 2
3	Maintenance of historic rehabilitation measures completed on the East and West Landfill Sites
4	Subsidence management linked to the underground Mine Voids
5	The treatment of mine affected water (Phytoremediation Plantation)

12.1 The rehabilitation of the discard dump

12.1.1 Activity

It is proposed that all rehabilitation / maintenance / aftercare activities will be focussed on the areas were the original rehabilitation efforts have failed specifically were signs of erosion has occurred as a result of overgrazing. The following rehabilitation, maintenance and aftercare activities will be undertaken to address the issues of overgrazing, compaction, limited soil layer and soil erosion currently being experienced at the Discard Dump. The following actions are therefore suggested:

- Address the causes of the erosion to rectify and prevent further erosion, such as;
  - The down-drains, gabion baskets that have been used in several locations need to be re-assessed and repaired as necessary;
  - The contour drains need to be repaired. Contour drains which should primarily convey water to the down-drains have been eroded and hence subject to additional erosion pressure;
  - Repair gulley erosion; and
  - Prevent cattle from accessing and grazing.
- Check slope length and gradient, adjust if necessary;
- Re-soil the Discard Dump, particularly the erosion hot-spots. This should be done to at least a 300 mm depth. Topsoil should be bought or acquired legally. If the soil is sourced from a borrow pit, the borrow pit should be rehabilitated, and revegetated to create sustainable cover that prevents erosion and enhances natural succession. This must be included in the monitoring programme. Should Eskom source topsoil from a supplier, the management and liability of that soil borrow pit will be the responsibility of that supplier;
- Compaction should be avoided and reduced (Soils and Land Capability Report (Digby Wells, 2016)) as compaction limits the effectiveness of replaced soils;

- Reseed with grass (Refer to Rehabilitation Plan Appendix B for recommendation of which species to be utilised); and
- These rehabilitated areas are to remain as “No Go” areas and all livestock animals must be kept out of rehabilitated areas for at least 5 years.

12.1.2 Risk identification

There are potential risks associated with the rehabilitation activities that, should they occur, may result in additional environmental impacts onsite. The risks associated with the rehabilitation activities on the Discard Dump include:

- The use of heavy vehicles and machinery, as well as the potential storage of hydrocarbons on site, may result in hydrocarbon spills and leaks which could result in soil and water contamination should the hydrocarbons become mobilised;
- During the re-soiling of the Discard Dump, there is a risk of seedlings used for re-vegetation being washed away resulting in soil erosion during heavy rainfall events which may lead to the sedimentation of nearby water courses and potential loss in aquatic ecology and biodiversity;
- The long term stability of the dump needs to be taken into consideration prior to allowing cattle grazing to take place on the dump. Grazing should not be permitted on the dump for the first five years, after that consideration could be given with respect to cattle grazing. If cattle are allowed to graze on the dump, this needs to be managed very closely only allowing cattle to graze on the dump for very short periods of time. Prolonged grazing could result in damage to the dump and increase the risk of erosion, thus the stability and suitability of allowing cattle to graze needs to be assessed prior to grazing taking place. Grazing can be utilized as a mechanism to “cut” the grass, however it is common practice to restrict grazing from dumps and the use of heavy machinery to cut grass as there is potential that cattle and/or heavy machinery can damage the rehabilitation on the dump and could impact on the long term stability of the dump;
- Fertilisers may be used to promote the establishment of vegetation on the Discard Dump; vegetation will aid in the binding of soils which will prevent potential erosion. The use of fertilisers may have an impact on water resources should nutrient rich runoff enter the catchment;
- Establishment of alien invasive plant species on rehabilitated areas;
- Noise and increased vehicular movement on site could result in the displacement of fauna and result in the loss of biodiversity;
- Runoff from a rainfall event could result in seepage of water through the Discard Dump into the groundwater. Contamination of this water may occur from the exposure to hazardous material located within the dump thereby potentially affecting water quality; and

- The use of heavy vehicles and machinery during rehabilitation activities may lead to compaction and erosion of soils on the Discard Dump. This could result in poor vegetation establishment, exposed surfaces and increase the risk of erosion.

12.1.3 Mitigation and management measure

The following mitigation and management measures have been proposed to reduce the risks associated with the rehabilitation of the Discard Dump:

- Development of a spill response plan to mitigate against potential hydrocarbon spillages from machinery and vehicles;
- The substantial down-drains that have been constructed which make use of concrete structures with supporting gabion baskets in certain locations must be regularly monitored and if required maintenance effort must be undertaken to ensure adequate stormwater management;
- Ongoing monitoring must be undertaken at the Discard Dumps once rehabilitation efforts have been undertaken to ensure erosion has not occurred in certain areas. Erosion control measure must be implemented if erosion has been identified;
- Management of the dump shape to control the ease with which water can run off from the facility;
- The Discard Dump should be covered with additional soil and vegetation to minimise the impact associated with the infiltration of water from a rainfall event that could result in the mobilisation of dissolved metals;
- Continuous groundwater monitoring and rehabilitation of the Discard Dump to avoid acid generation and release of heavy metals from seepage;
- Ideally the establishment of vegetation should be done in the dry season to limit the effect that surface water runoff could have on establishing vegetation;
- Berms and sediment traps must be employed to capture soil runoff and prevent runoff of nutrients into the aquatic ecosystem;
- Precision farming techniques should be used to calculate the right amount of fertiliser to be used, to prevent excess application. Topsoil should be fertilised with 2:3:2 at 350 kg/ha, if necessary, and ripped to 200 mm;
- Ensure continual monitoring and maintenance. Continuous monitoring and rehabilitation is necessary to avoid acid generation and release of heavy metals as well as soil erosion and loss of vegetation. Basal cover should be a minimum of 30%. Assessments should be carried out after each growing season, for at least three years until it can be proven that this measure is sustainable. Bare areas of more than 4 m^2 need to be reseeded;
- If erosion has occurred, usable soil should be sourced and replaced and shaped to reduce the recurrence of erosion;

- Only the designated access routes for vehicles used for the rehabilitation activities are to be used to reduce any unnecessary compaction and loss of vegetation;
- Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated;
- The usable soil should be moved by means of an excavator bucket, and loaded onto dump trucks; The soil should only be moved when the soil is dry, so as to reduce compaction;
- After the completion of the project, the area is to be cleared of all infrastructure to avoid any further damage to the environment;
- Ensure that contouring is done correctly and avoid creating steep slopes. Slopes steeper that 1:7 should be avoided. If slopes are steep contour banks need to be created;
- The handling of the stripped usable soil will be minimised to ensure the soil's structure does not deteriorate;
- An alien invasive plant management plan should be implemented whereby a qualified ecologist will monitor the disturbed areas biannually for two to five years for alien invasive vegetation establishment. Monitoring during the wet season should preferably take place between November and March. All alien invasive plant species should be identified, demarcated and removed; and
- Vehicular movement should be restricted to existing roads to reduce further impact to flora; no vehicles should access the site at night to prevent the disruption of nocturnal fauna.

Management of hydrocarbon spillages:

- Hydrocarbons and hazardous materials must be stored in bunded areas and refuelling should take place in contained areas;
- Ensure that oil and silt traps are well maintained;
- Vehicles and heavy machinery should be serviced and checked in a demarcated area on a regularly basis to prevent leakages and spills;
- Hydrocarbon spill kits must be available on site at all locations where hydrocarbon spills could take place; and
- If a considerable amount of fluid is accidentally spilled, the contaminated soil must be scraped off and disposed of at an acceptable disposal facility. The excavation should be backfilled with soil of good quality.

12.2 The rehabilitation / maintenance / aftercare of the open pits

12.2.1 Activity

A Geotechnical Study must be undertaken to determine the level of stability of the underground environment to assess the possibility of subsidence. Although most of the areas appear stable and showing signs of successful restoration, surface subsidence has been identified, with one particular instance occurring at a key point in a contour bank. Erosion has also been identified along various drainage lines. The following actions are therefore suggested:

- Soil must be replaced to a depth of at least 300 mm in erosion hotspots and areas of subsidence. Topsoil should be bought or acquired legally;
- Topsoil should be fertilised with 2:3:2 at 350 kg/ha, if necessary, and ripped to 200 mm;
- Reshape the landform where necessary to ensure it remains a stable landform:
  - Shape and profile rehabilitated areas to be free draining and roughly emulate the surrounding surface topography;
  - Encourage a free-draining facility thereby limiting ingress and contributing towards the long-term integrity of local water resources;
  - Ensure that soil handling and the placement of soil is carried out as outlined in this Rehabilitation Plan (Appendix B); and
  - Ensure maintaining the fertility within the soil, as this material is crucial for vegetation establishment as a growth medium. If soils have been contaminated it must be cleaned up and disposed of appropriately or the rehabilitation of soils *in situ*.
- Reseed with grass (Refer to Rehabilitation Plan Appendix B for recommendation of which species to be utilised); and
- Controlled grazing will be permitted after 5 years, once the areas are stable and established.

12.2.2 Risk identification

The following risks have been identified should poor or limited rehabilitation / maintenance / aftercare activities be undertaken or risks associated with the rehabilitation / maintenance / aftercare activities that have been proposed:

- Refer to risks associated with the Discard Dump Section 12.1.2, Part A; and
- Subsidence could occur resulting in sink holes which could lead to the loss of life and destruction to the environment and surrounding infrastructure.

12.2.3 Mitigation and management measure

The following mitigation and management measures have been proposed to reduce the risks associated with the rehabilitation / maintenance / aftercare of the Open Pits:

- Refer to mitigation measures associated with the Discard Dump Section 12.1 Part A;
- Undertake a Geotechnical Study and implement the recommended monitoring and mitigation measures proposed to manage long term subsidence; and
- Surface water runoffs are recommended to be diverted from the open pits areas using a stormwater management plan.

12.3 The rehabilitation / maintenance / aftercare of the landfill sites

12.3.1 Activity

Two apparent landfill sites were identified in the project area consisting of visible waste materials such as tyres, concrete and other refuse. There is a potential that such landfill sites may contain hazardous materials such as PCBs, asbestos, hydrocarbons and other hazardous substances. Groundwater monitoring around the landfill site must be undertaken to assess whether PCBs, asbestos and other hazardous substances are leaching into the groundwater causing contamination. Depending on whether groundwater contamination has occurred or not, different rehabilitation measures will be required. Until the monitoring results prove otherwise, it is recommended that the landfill sites be closed and rehabilitated without intrusive investigations as to the content of the sites. The following rehabilitation / maintenance / aftercare actions are recommended:

- Investigate causes of erosion and undertake appropriate measures to correct;
- Soil must be replaced to a depth of at least 300 mm in erosion hotspots and areas of subsidence. Topsoil should be bought or acquired legally. If the soil is sourced from a borrow pit, the borrow pit should be rehabilitated, and revegetated to create sustainable cover that prevents erosion and enhances natural succession. This must be included in the monitoring programme. Should Eskom source topsoil from a supplier, the management and liability of that soil borrow pit will be the responsibility of that supplier;
- Revegetate with indigenous grasses. Rocky outcrops may need to be planted with different grass species than the lower lying areas;
- Post-investigation of contents: if groundwater monitoring results found to be hazardous:
    - Remove all contents of landfill. This must be done in a safe manner. Hazardous material locations and deposits require specialised assessment and analysis to determine how these materials should be decontaminated and to ensure that all residual hazardous materials are deposited in officially-sanctioned hazardous waste deposit sites.

- Evaluate the condition of underlying material;
- Remediate soil and rocky edges;
- Reshape and place soil where necessary; and
- Reseed with indigenous grasses. Rocky outcrops may need to be planted with different grass species than the lower lying areas.

12.3.2 Risk identification

There are potential risks associated with the rehabilitation / maintenance / aftercare activities that, should they occur, may result in additional environmental impacts on site. The risks associated with the rehabilitation / maintenance / aftercare activities on the landfill sites include:

- The movement of heavy vehicles onsite may affect the current surface water drainage patterns caused by compaction of soils which may result in reduced infiltration and increased velocity of runoff into the surface water resources;
- Rehabilitation / maintenance / aftercare activities will expose soils making them susceptible to erosion which may cause sedimentation of the river system;
- During demolition, dust may be generated which could potentially impact the environment and pose a health risk and irritation to surrounding communities;
- The rehabilitation / maintenance / aftercare activities from vehicle movement and machinery may result in the generation of noise which could result in a disturbance to fauna and resultant loss in biodiversity; and
- Hydrocarbon spills may occur from use of heavy vehicles, machinery and storage of hydrocarbons on site; this could lead to soil and water contamination.
- Potential contamination of groundwater may occur as a result of leachates from PCBs, asbestos and other hazardous material. Suitable PPE and management procedures must be followed.

12.3.3 Mitigation and management measures

The following mitigation and management measures have been proposed to reduce the risks associated with the rehabilitation / maintenance / aftercare of the landfill sites:

- Refer to risks associated with the Discard Dump Section 12.1, Part A; and
- Groundwater monitoring should be undertaken to determine whether contamination of groundwater is occurring from material stored in the landfill site such as PCBs, asbestos and other hazardous material.

12.4 Subsidence management of the underground mine voids

12.4.1 Activity

The underground mine voids have filled with water and are currently decanting near Open Pits 1A and 1B. Digby Wells has attempted to source the underground mine plan from BHP Billiton Energy Coal South Africa (BECSA), which undertook the rehabilitation / maintenance / aftercare of Kilbarchan following decommissioning, as well as from the DMR to ascertain the extent of the underground mining, the location of bord and pillars and the safety factors used. Digby Wells was only able to source underground mine plans up until 1968 and was not privy to and could not access or review confidential reports and plans archived at the DMR. As a result, the potential risk of subsidence for all areas associated with the mine is not known. All activities undertaken within the project area may be susceptible to the risk of subsidence.

12.4.2 Risk identification

As a result of stooping of underground areas the possibility exists of physical surface disturbance which could lead to surface subsidence and damage to the natural environment as well as physical surface infrastructure.

The severity of the impact on the drainage lines and/or surface infrastructures is dependent on the unevenness of the subsidence and crack formation on the surface.

An attempt should be made to identify current areas of subsidence as well as areas likely to be affected by subsidence. It is recommended that information associated with stooped and bord and pillar areas be obtained through a Geotechnical Assessment to identify areas susceptible to subsidence and put in place measures to prevent any injury and/or fatality to humans and/or animals as well as physical destruction of surface infrastructure including rehabilitated areas.

12.4.3 Mitigation and management

The following mitigation and management measures have been proposed to reduce the risks associated with the risk of subsidence:

- A geotechnical investigation must be undertaken to determine areas of risk, specifically for the general public; and
- The recommendations provided in the geotechnical investigation must be implemented.

12.5 The treatment of mine affected water

12.5.1 Activity

Decant of mine affected water began at the Kilbarchan Colliery in April, 2004, with the decanting predominantly taking place to the east, south and southeast of the Discard Dump.

The decant is a result of a combined flow of seepage from the Discard Dump and underground and Open Pit sections of Kilbarchan Colliery. In addition, a number of existing water monitoring locations have become decant locations. The mine affected water is negatively impacting on the receiving catchment area. It is proposed that this decant water needs to be treated prior to entering the catchment system to prevent the degradation of the environment. The water treatment mechanisms have been proposed namely:

- Phytoremediation passive treatment; and
- Active treatment of decant at a bioremediation and reverse osmosis plant.

Only phytoremediation passive treatment has been investigated as part of this BAR, the active water treatment will be investigated during a separate EIA phase.

12.5.1.1 Phytoremediation

Phytoremediation is being proposed to manage the impact of decanting mine affected water on the soil and surface water resources, as well as to lower the volume of water required for active treatment. This is fully detailed in Appendix D. Please refer to this report for full details; however a summary of the proposed planting scheme is below, which is shown in Plan 11, Appendix A:

- *Eucalyptus camaldulensis* (Red River gum) and *Combretum erythrophyllum* (River Bush-willow) will be planted at the source point due to their deep penetrating roots to intercept mine affected water at the underground level. The aerial extent of the *Eucalyptus* and *C. erythrophyllum* potential plantation is approximately 42 ha. In addition, *C. erythrophyllum* and *Chrysopogon zizanioides* (Vetiver grass) is recommended for a further 11 ha;
- *Tamarix usneoides* (Wild Tamarix) is planted as an intermediate plant that will address both surface flowing and groundwater and also hyperaccumulate the salt. The area identified for the potential *Tamarix* plantation is 66 ha; and
- *Sporobolus spicatus* (Salt grass) and *Chrysopogon zizanioides* (Vetiver grass) will be planted to deal with surface flowing mine affected water and also act as a water diffuse barrier before water enters nearby water resources. This accounts for approximately 56 ha.

The Phytoremediation Plantation may result in a potential impact to the environment which has been assessed below. The impacts were assessed using the methodology outlined in Section 13 Part A.

12.5.2 Impact Assessment

12.5.2.1 Surface Water

The impacts, significance rating and potential mitigation associated with the Phytoremediation Plantation on surface water have been investigated and detailed in Table 12-2.

Table 12-2: Pre-Mitigation and Post-Mitigation Significance Ratings for Impacts associated with the establishment of a Phytoremediation Plantation on Surface Water

Surface Water Quantity and Quality					
Criteria	**Details / Discussion**				
Description of impact	■ The potential impact of using the larger trees such as *Eucalyptus* and *Combretum* is that they may substantially reduce streamflow reporting to the tributary of the Ingagane River; and ■ The reduction in stream flow may increase the concentration of salts in the water, although the salt load will reduce. An elevated salt concentration in the mine affected water may lead to higher salt levels flowing into nearby water resources.				
Mitigation required	■ No mitigation measures				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significant rating*
Pre-Mitigation	3	6	3	5	Minor (negative)(-60)
Post-Mitigation	3	6	3	5	Minor (negative)(-60)
Improvement of Surface Water Quality					
Criteria	**Details / Discussion**				
Description of impact	■ The phytoremediation plantation is expected to absorb approximately 1 Ml of mine affected water per day. This reduction in decant volumes will aid in the decrease of mine impacted water being released into the catchment. It should be noted that during extreme rainfall events there may be a neutralising effect as rainfall reduces the retention time of mine affected water in the Phytoremediation Plantation.				
Mitigation required	■ This is seen as a positive impact and no further improvements can be made at this point.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significant rating*
Pre-Mitigation	3	6	3	6	Minor (Positive) (+72)
Post-Mitigation	3	6	3	6	Minor (Positive) (+72)

12.5.2.2 Groundwater

The Phytoremediation Plantation will reduce the quantity of decant occurring by approximately 1 Ml per day. Despite the reduction of decant, the groundwater table are not expected to be lowered due to the Phytoremediation as the recharge rate is approximately 4 Ml per day. As a result, there are no anticipated impacts to the groundwater due to the development of the Phytoremediation Plantation.

12.5.2.3 Fauna and Flora

The impacts, significance rating and potential mitigation associated with the Phytoremediation Plantation on fauna and flora have been investigated and detailed in Table 12-3.

Table 12-3: Pre-Mitigation and Post-Mitigation Significance Ratings for Impacts associated with the establishment of a Phytoremediation Plantation on Fauna and Flora

Transformation of habitat					
Criteria	**Details / Discussion**				
Description of impact	■ The establishment of *Eucalyptus* will result in a loss of native species and the potential destruction of habitats. Disturbed and transformed areas may be susceptible to alien invasive vegetation establishment. ■ Although sterile *Eucalyptus spp*. trees have been recommended for use in the phytoremediation plantation, *Tamarix* is highly invasive indigenous species and may spread beyond the footprint area. This may reduce the overall ecological integrity of the vegetation habitat.				
Mitigation required	■ To reduce the spread of invasive species, an alien invasive management plan should implemented by removing all invasive species that may become established by the disturbed environment; ■ Develop and implement a monitoring programme (Section 9.1) to ensure all species proposed to be used for the phytoremediation plantation remain within the proposed footprint. Should species start to grow elsewhere they should be removed and disposed of.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significant rating*
Pre-Mitigation	2	6	3	5	Minor (negative) (-55)
Post-Mitigation	2	4	3	4	Minor (negative) (-36)
Transformation of habitat and potential loss of biodiversity					
Criteria	**Details / Discussion**				
Description of impact	■ During the establishment of the Phytoremediation Plantation, the habitats of the project area will be transformed which may result in a potential loss of biodiversity.				
Mitigation required	■ No mitigation measures can be determined for flora species however phase planting can be implemented to allow fauna species to relocate to already established areas.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significant rating*
Pre-Mitigation	2	4	3	6	Moderate (negative) (-54)
Post-Mitigation	2	4	3	6	Moderate (negative) (-54)

12.5.2.4 Aquatics

The impacts, significance rating and potential mitigation have been detailed in Table 12-4.

Table 12-4: Pre-Mitigation and Post-Mitigation Significance Ratings for Aquatics

Removal of vegetative cover and removal of soil as a function of site preparation and planting					
Criteria	**Details / Discussion**				
Description of impact	■ During the establishment of the Phytoremediation Plantation, localised vegetation clearance may be undertaken in certain areas. As a result, soil erosion due to wind and surface water runoff may occur which may result in the transportation of sediment loads into the river where sensitive biota may be affected.				
Mitigation required	■ A phased approach should be implemented where only the vegetation in the footprint of the Phytoremediation Plantation should be impacted upon, thereby limiting the exposure of soil to wind and surface water runoff erosion; ■ Ideally planting should be done in the dry season to limit the effects of surface water runoff as a result of rain; ■ Berms and sediment traps should be employed to capture soil runoff; and ■ A minimum of a 100m buffer from the edge of the riparian zone should be enforced to avoid impacts, or vehicles driving in sensitive riparian areas.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significant rating*
Pre-Mitigation	4	3	3	6	Minor (negative) (-60)
Post-Mitigation	3	3	2	3	Negligible (negative) (-24)
Water quality impacts resulting from pollution emanating from the fertiliser use					
Criteria	**Details / Discussion**				
Description of impact	■ Fertilisers may be used to promote the establishment of vegetation associated with the phytoremediation plantation. The use of fertilisers may have an impact on water resources should nutrient rich runoff enter the catchment.				
Mitigation required	■ A minimum of a 100m buffer from the edge of the riparian zone should be enforced to avoid impacts, or vehicles driving in sensitive riparian areas; ■ The use of berms to prevent the runoff of nutrients into the aquatic ecosystem; and ■ Precision farming techniques should be used to calculate the right amount of fertiliser to be used, to prevent excess application.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significant rating*

Pre-Mitigation	4	4	4	6	Minor (negative) (-72)
Post-Mitigation	3	4	3	4	Minor (negative) (-40)

12.5.2.5 Wetland

The impacts, significant rating and potential mitigation associated with the Phytoremediation Plantation on wetland have been investigated and detailed in Table 12-5.

Table 12-5: Pre-Mitigation and Post-Mitigation Significance Ratings for Impacts associated with the establishment of a Phytoremediation Plantation on Wetland.

Loss of Wetland Habitat due to the establishment of the Phytoremediation Plantation					
Criteria	**Details / Discussion**				
Description of impact	■ It is anticipated that wetlands could be impacted upon or lost as a result of the Phytoremediation Plantation. It is anticipated a maximum expected rate of 1Ml of mine affected water will be lost a day through evapotranspiration thereby causing desiccation of the surrounding wetlands. A total of 52 ha of wetlands will potentially be lost due to the Phytoremediation Plantation.				
Mitigation required	■ There is no mitigation for the loss of these wetlands. ■ A wetland offset strategy is recommended.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significant rating*
Pre-Mitigation	3	6	4	6	Major (negative) (-78)
Post-Mitigation	3	6	4	6	Major (negative) (-78)
Decrease in mine affected water due to phytoremediation that aims to reduce impact on wetlands					
Criteria	**Details / Discussion**				
Description of impact	■ The phytoremediation Plantation expected to absorb approximately 1 Ml of mine affected water per day, reducing the quantity of mine affected water from flowing into the surrounding wetlands. The mine affected water currently impacts on the ecological integrity of the wetlands. This reduction in mine affected water will reduce the impact on wetlands.				
Mitigation required	■ This is seen as a positive impact and no further improvements can be made at this point.				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significant rating*
Pre-Mitigation	3	6	3	6	Minor (Positive) (+72)
Post-Mitigation	3	6	3	6	Minor (Positive) (+72)

12.5.2.6 Soil, Land Use and Land Capability

The impacts, significance rating and potential mitigation associated with the Phytoremediation Plantation on Soil, Land Use and Land Capability have been investigated and detailed in Table 12-6.

Table 12-6: Pre-Mitigation and Post-Mitigation Significance Ratings for Impacts associated with the establishment of a Phytoremediation Plantation on Soil, Land Use and Land Capability.

The loss of usable soil as a resource as a result of erosion and compaction					
Criteria	**Details / Discussion**				
Description of impact	■ Phytoremediation plantation could cause compaction and erosion if rehabilitation / maintenance / aftercare is not done correctly. This could be as a result of poor vegetation establishment which would result in exposed surfaces and increase the risk of erosion. Heavy machinery driving continuously over plantation areas may result in compaction, which would impact on plant rooting depth which then would have a further impact to vegetation establishment.				
Mitigation required	■ Ensure proper storm water management designs are in place; ■ If erosion occurs, corrective actions (erosion berms) must be taken to minimise any further erosion from taking place; ■ If erosion has occurred, usable soil should be sourced and replaced and shaped to reduce the recurrence of erosion; and ■ Rehabilitate in accordance with the Rehabilitation Plan (Appendix B).				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significant rating*
Pre-Mitigation	2	6	5	3	Minor (negative) – 39
Post-Mitigation	2	2	3	2	Negligible (negative) – 12

12.5.2.7 Social

The impacts, significance rating and potential mitigation associated with the Phytoremediation Plantation on Social have been investigated and detailed in Table 12-7.

Table 12-7: Pre-Mitigation and Post-Mitigation Significance Ratings for Impacts associated with the establishment of a Phytoremediation Plantation on Social.

Improvement to health and safety to surrounding communities	
Criteria	**Details / Discussion**

Description of impact	■ The rehabilitation / maintenance / aftercare will ultimately result in a positive impact on the sense of place of the area. It will also reduce health and safety risks associated with open voids and mine affected water resulting in the reduction of contamination to both surface and groundwater. The management and maintenance of the Phytoremediation Plantation will result in limited, but long term employment opportunities.				
Mitigation required	■ No mitigation Required				
Parameters	*Spatial*	*Duration*	*Intensity*	*Probability*	*Significant rating*
Pre-Mitigation	3	7	6	6	Moderate (positive) (+96)
Post-Mitigation	3	7	6	6	Moderate (positive) (+96)

13 Methodology used in determining and ranking the nature, significance, consequence, extent, duration and probability of potential environmental impacts and risks

The methodology utilised to assess the significance of potential impacts associated with the phytoremediation plantation is discussed in detail below. The significance rating formula is as follows:

Significance = Consequence x Probability

Where

Consequence = Type of Impact x (Intensity + Spatial Scale + Duration)

And

Probability = Likelihood of an Impact Occurring

In addition, the formula for calculating consequence:

Type of Impact *(Nature) =* ***+1*** *(Positive Impact) or* ***-1*** *(Negative Impact)*

The matrix (Table 13-2) calculates the rating out of 147, whereby intensity, extent, duration and probability are each rated out of seven as indicated in Table 13-1. The weight assigned to the various parameters is then multiplied by +1 for positive and -1 for negative impacts.

Impacts are rated prior to mitigation and again after consideration of the mitigation has been applied; post-mitigation is referred to as the residual impact. The significance of an impact is determined and categorised into one of seven categories (The descriptions of the significance ratings are presented in Table 13-3).

It is important to note that the pre-mitigation rating takes into consideration the activity as proposed, (i.e., there may already be some mitigation included in the engineering design). If the specialist determines the potential impact is still too high, additional mitigation measures are proposed.

Table 13-1: Impact assessment parameter ratings

Rating	Intensity/ Replaceability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
7	Irreplaceable loss or damage to biological or physical resources or **highly** sensitive environments. Irreplaceable damage to **highly sensitive** cultural/social resources.	Noticeable, on-going natural and / or social benefits which have improved the overall conditions of the baseline.	International The effect will occur across international borders.	Permanent: The impact is irreversible, even with management, and will remain after the life of the project.	Definite: There are sound scientific reasons to expect that the impact will definitely occur. >80% probability.
6	Irreplaceable loss or damage to biological or physical resources or **moderate to highly** sensitive environments. Irreplaceable damage to cultural/social resources of **moderate to highly** sensitivity.	Great improvement to the overall conditions of a large percentage of the baseline.	National Will affect the entire country.	Beyond project life: The impact will remain for some time after the life of the project and is potentially irreversible even with management.	Almost certain / Highly probable: It is most likely that the impact will occur. <80% probability.

Rating	Intensity/ Replaceability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
5	Serious loss and/or damage to physical or biological resources or **highly** sensitive environments, limiting ecosystem function. Very serious widespread social impacts. Irreparable damage to highly valued items.	On-going and widespread benefits to local communities and natural features of the landscape.	<u>Province/ Region</u> Will affect the entire province or region.	Project Life (>15 years): The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Likely: The impact may occur. <65% probability.
4	Serious loss and/or damage to physical or biological resources or **moderately** sensitive environments, limiting ecosystem function. On-going serious social issues. Significant damage to structures / items of cultural significance.	Average to intense natural and / or social benefits to some elements of the baseline.	<u>Municipal Area</u> Will affect the whole municipal area.	Long term: 6-15 years and impact can be reversed with management.	Probable: Has occurred here or elsewhere and could therefore occur. <50% probability.

Rating	Intensity/ Replaceability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
3	Moderate loss and/or damage to biological or physical resources of **low to moderately** sensitive environments and, limiting ecosystem function. On-going social issues. Damage to items of cultural significance.	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.	Local Local extending only as far as the development site area.	Medium term: 1-5 years and impact can be reversed with minimal management.	Unlikely: Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur. <25% probability.
2	**Minor loss and/or effects** to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	Low positive impacts experience by a small percentage of the baseline.	Limited Limited to the site and its immediate surroundings.	Short term: Less than 1 year and is reversible.	Rare / improbable: Conceivable, but only in extreme circumstances. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures. <10% probability.

Rating	Intensity/ Replaceability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
1	**Minimal to no loss** and/or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	Some low-level natural and / or social benefits felt by a very small percentage of the baseline.	Very limited/Isolated Limited to specific isolated parts of the site.	Immediate: Less than 1 month and is completely reversible without management.	Highly unlikely / None: Expected never to happen. <1% probability.

Table 13-2: Probability/consequence matrix

Significance																																				
-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Consequence																																				

Table 13-3: Significance rating description

Score	Description	Rating
109 to 147	A very beneficial impact that may be sufficient by itself to justify implementation of the project. The impact may result in permanent positive change	Major (positive) (+)
73 to 108	A beneficial impact which may help to justify the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and / or social) environment	Moderate (positive) (+)
36 to 72	A positive impact. These impacts will usually result in positive medium to long-term effect on the natural and / or social environment	Minor (positive) (+)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the natural and / or social environment	Negligible (positive) (+)
-3 to -35	An acceptable negative impact for which mitigation is desirable. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the natural and / or social environment	Negligible (negative) (-)
-36 to -72	A minor negative impact requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the natural and / or social environment	Minor (negative) (-)
-73 to -108	A moderate negative impact may prevent the implementation of the project. These impacts would be considered as constituting a major and usually a long-term change to the (natural and / or social) environment and result in severe changes.	Moderate (negative) (-)
-109 to -147	A major negative impact may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects. The impacts are likely to be irreversible and/or irreplaceable.	Major (negative) (-)

13.1 The positive and negative impacts that the proposed activity (in terms of the initial site layout) and alternatives will have on the environment and the community that may be affected

To date, no comments, concerns or issues have been raised by I&APs. The most significant potential impacts are associated with the rehabilitation / maintenance / aftercare of the Kilbarchan Colliery and the Phytoremediation Plantation that has been proposed as a means to treat mine affected water decanting into the catchment.

13.1.1 Rehabilitation

After the decommissioning in 1992, the Kilbarchan colliery underwent rehabilitation efforts however over time issues have been identified that are currently posing a significant risk to the environment. Therefore, by addressing these issues through the rehabilitation / maintenance / aftercare measures proposed in this report an overall positive impact is anticipated both at a social and biophysical level. The most significant positive impacts include the rehabilitation / maintenance / aftercare of the Discard Dump, landfills and open pits, as well as the treatment of mine affected water that has impacted surface and groundwater resources. Once removed it will result in a positive impact on health and safety for the community and provide a suitable mixed land use. The properties are to be rehabilitated to grazing standard and will remain within Eskom ownership, unless indicated otherwise.

Negative impacts such as compaction and erosion have been identified that may arise as part of this rehabilitation / maintenance / aftercare process however these impacts are not considered significant as mitigation measures have been proposed which should significantly reduce the risk of these impacts occurring. It should be noted that the rehabilitation / maintenance / aftercare activities aim to address impacts that are currently occurring, such as erosion, from these facilities. The rehabilitation / maintenance / aftercare activities may result in short term impacts, however are expected to have a long term significant positive impact.

13.1.2 Phytoremediation

The Phytoremediation Plantation has a number of positive and negative impacts associated with its establishment. At a more local scale the most significant negative impact refers to the loss of flora and wetland species due to the growth of alien invasive tree species to be used for the treatment of mine affected water, as well as the transformation of the vegetation on site to species recommended in Section 5.2.3. It must be noted that sterile Eucalyptus species have been recommended, with the remaining species indigenous to South Africa. The invasive species could also reduce ground and surface water retention therefore causing desiccation of the surrounding wetlands.

In the long term however the Phytoremediation Plantation proposes to reduce and treat approximately 1Ml of mine affected water a day which will have a significant positive impact

on the overall environment specifically wetlands, fauna and flora, aquatics surface and groundwater due to the reduction of the mine affected water reporting to these environments.

13.2 The possible mitigation measures that could be applied and the level of risk

This section refers to the mitigation measures provided by I&APs, as well as mitigation measures provided and recommended based on issues and concerns raised by I&APs during the public review period of the project. Based on the issues and concerns received by I&APs following the public review of this EIA report, this section will be updated to detail how the mitigation measures proposed addresses the I&APs concerns.

13.3 Motivation where no alternatives sites were considered

The rehabilitation / maintenance / aftercare activities are restricted to areas requiring such activities. The rehabilitation / maintenance / aftercare of the Discard Dump, landfill sites and Open Pit areas is, thus, limited to the location of these facilities. As a result, these activities will be undertaken where identified and required; the rehabilitation / maintenance / aftercare activities will be specific to the location of the infrastructure or area to be rehabilitated.

13.4 Statement motivating the alternative development location within the overall site

13.5 Phytoremediation

Phytoremediation and active treatment have been proposed as means to treating the mine affected water currently decanting from Kilbarchan Colliery. The proposed active water treatment will be subject to a separate EIA process, with the Phytoremediation Plantation application being included in this BAR.

The location of the Phytoremediation Plantation has been considered based on two criteria: where decant is occurring to abstract and reduce mine affected water, or areas where infiltration into groundwater resources from rainwater occurs which will reduce groundwater recharge and the subsequent contamination of groundwater. Due to the limited information of the underground mine plan and geotechnical studies, it was not possible to determine areas of high infiltration and fractures in the underlying geology that may result in the recharge of the groundwater resources. As a result, the location of the Phytoremediation Plantation was positioned within and adjacent to the area of decant, where mine affected water could be abstracted by the tree plantation.

14 Full description of the process undertaken to identify, assess and rank the impacts and risks the activity will impose on the

preferred site (In respect of the final site layout plan) through the life of the activity

The rehabilitation / maintenance / aftercare activities are specific to where rehabilitation / maintenance / aftercare required based on existing impacts that are occurring due to deteriorated or unsuccessful historic rehabilitation. Therefore no changes have been made to the layout of where rehabilitation activities will occur.

The location of the Phytoremediation Plantation was informed by previous environmental and technical studies, as well as due to the location of where the decanting is occurring. The initial layout has not changed substantially during the PPP or impact ranking. The impacts and risks identified in Section 12 are therefore applicable to the final site layout plan (Appendix A, Plan 12).

15 Assessment of each identified potentially significant impact and risk

The project involves the rehabilitation / maintenance / aftercare of the Kilbarchan Colliery therefore impacts as a result of the rehabilitation / maintenance / aftercare process is associated with the Phytoremediation Plantation only. Identified risks associated with the rehabilitation activities have been discussed and assess qualitatively, as per Section 12 Part A. As a result, the significance of the risks was not determined and has not been included in this section.

The impacts associated with the establishment of the Phytoremediation Plantation have been outlined in Section 12.4 Part A above and indicate the mitigation measures proposed, as well as the impact, significance, pre-mitigation and post mitigation. Table 15-1 assessed each identified impact and provides a summary of the assessment above.

Table 15-1: Assessment of Each Identified Impact

Activity	Potential Impact / Risk	Aspects Affected	Phase	Significance Pre-Mitigation	Mitigation Type	Significance Post-Mitigation
Maintenance of Discard Dump	Surface Water Contamination	Surface Water	Rehabilitation / maintenance / aftercare Phase Phase	No significant rating can be provided	Control through: ▪ Stormwater Management Plan	No significant rating can be provided
	Ground water contamination	Groundwater	Rehabilitation / maintenance / aftercare Phase	No significant rating can be provided	Control through: Vegetation establishment	No significant rating can be provided
	Loss of usable soil as a resource – Disturbance, Erosion, and Compaction as Well as Loss of Land capability, and Land Use	Soil, Land Use and Land Capability	Rehabilitation / maintenance / aftercare Phase	No significant rating can be provided	Control through: ▪ Rehabilitation Plan	No significant rating can be provided
	Loss of natural vegetation due to alien invasive species	Fauna and Flora	Rehabilitation / maintenance / aftercare Phase	No significant rating can be provided	Control through: ▪ Alien Invasive Management Plan; ▪ Monitoring Programmes	No significant rating can be provided
	Loss of fauna due to noise and vehicle movement	Fauna and Flora	Rehabilitation / maintenance / aftercare Phase	No significant rating can be provided	Avoid through: ▪ Limitation of vehicle movement; Control through:	No significant rating can be provided

Activity	Potential Impact / Risk	Aspects Affected	Phase	Significance Pre-Mitigation	Mitigation Type	Significance Post-Mitigation
					▪ Noise Monitoring	
Maintenance of Open Pits	Surface Water Contamination	Surface Water	Rehabilitation / maintenance / aftercare Phase	No significant rating can be provided	Control through: ▪ Stormwater Management Plan	No significant rating can be provided
	Groundwater Contamination	Groundwater	Rehabilitation / maintenance / aftercare Phase	No significant rating can be provided	Control through: ▪ Groundwater monitoring	No significant rating can be provided
	Loss of usable soil as a resource – Disturbance, Erosion, and Compaction as Well as Loss of Land capability, and Land Use	Soil, Land Use and Land Capability	Rehabilitation / maintenance / aftercare Phase	No significant rating can be provided	Control through: ▪ Rehabilitation Plan	No significant rating can be provided
	Subsidence	Groundwater	Rehabilitation / maintenance / aftercare Phase	No significant rating can be provided	Control through: ▪ Implement monitoring and management of geotechnical study; and ▪ Subsidence monitoring	No significant rating can be provided
		Social	Rehabilitation / maintenance / aftercare Phase	No significant rating can be provided	Control through: ▪ Implement monitoring	No significant rating can be provided

Activity	Potential Impact / Risk	Aspects Affected	Phase	Significance Pre-Mitigation	Mitigation Type	Significance Post-Mitigation
					and management of geotechnical study; and ▪ Subsidence monitoring	
Maintenance of Landfill Sites	Loss of natural vegetation due to alien invasive species	Fauna and Flora	Rehabilitation / maintenance / aftercare Phase	No significant rating can be provided	Control through: ▪ Alien Invasive Management Plan; ▪ Monitoring Programmes	No significant rating can be provided
	Loss of fauna due to noise and vehicle movement				Avoid through: ▪ Limitation of vehicle movement; Control through: ▪ Noise Monitoring	
	Contamination of groundwater from leachates pf PCBs, Asbestos etc.	Groundwater	Rehabilitation / maintenance / aftercare Phase	No significant rating can be provided	Control through: ▪ Groundwater Monitoring	No significant rating can be provided
	Loss of usable soil as a resource – Disturbance, Erosion, and Compaction as Well as Loss of Land capability, and Land Use	Soil, Land Use and Land Capability	Rehabilitation / maintenance / aftercare Phase	No significant rating can be provided	Control through: ▪ Rehabilitation Plan	No significant rating can be provided

Activity	Potential Impact / Risk	Aspects Affected	Phase	Significance Pre-Mitigation	Mitigation Type	Significance Post-Mitigation
Underground Mine Voids	Rehabilitated Areas: Health and safety risk for all personnel and property from possible subsidence	Social	Rehabilitation / maintenance / aftercare Phase	No significant rating can be provided	Control through: ▪ Geotechnical Specialist Study	No significant rating can be provided
	Areas associated with the general public, specifically the mine village, the substation and the N11 road: Health and safety risk for all personnel and property from possible subsidence.	Social	Rehabilitation / maintenance / aftercare Phase	No significant rating can be provided	Control through: Geotechnical Specialist Study	No significant rating can be provided
Establishment of the Phytoremediation Plantation	Reduction in the Quantity of Water Available	Surface Water	Rehabilitation / maintenance / aftercare Phase	Minor negative	No Mitigation Measure	Minor negative
	Decrease in mine affected water due to phytoremediation that aims to improve quality of surface water	Surface Water	Rehabilitation / maintenance / aftercare Phase	Minor Positive	No mitigation Measure	Minor Positive
	Release of untreated water into the catchment area during high rainfall event	Surface Water	Rehabilitation / maintenance / aftercare Phase	Minor Negative	Control through: ▪ Berm establishment	Negligible Negative
	Decrease in mine affected water due to	Ground water	Rehabilitation / maintenance /	Minor Positive	No mitigation Measure	Minor Positive

Activity	Potential Impact / Risk	Aspects Affected	Phase	Significance Pre-Mitigation	Mitigation Type	Significance Post-Mitigation
	phytoremediation that aims to drop with groundwater level		aftercare Phase			
	Spread of alien plant species that are being planted for Phytoremediation	Fauna and Flora	Rehabilitation / maintenance / aftercare Phase	Minor negative	Control through: ▪ Alien Invasive Management Plan; ▪ Monitoring Programmes	Minor negative
	The loss of biodiversity as a result of the removal of fauna species	Fauna and Flora	Rehabilitation / maintenance / aftercare Phase	Moderate negative	No Mitigation Measure	Moderate negative
	Removal of vegetative cover and removal of soil as a function of site preparation and planting	Aquatics	Rehabilitation / maintenance / aftercare Phase	Minor negative	Control through: ▪ Berm establishment Avoid through: ▪ Implementation of buffer zones;	Negligible Negative
	Water quality impacts resulting from pollution emanating from the fertiliser use	Aquatics	Rehabilitation / maintenance / aftercare Phase	Minor negative	Control through: ▪ Berm establishment; ▪ Specified farming techniques Avoid through: ▪ Implementation of	Minor negative

Activity	Potential Impact / Risk	Aspects Affected	Phase	Significance Pre-Mitigation	Mitigation Type	Significance Post-Mitigation
					buffer zones;	
	Loss of Wetland Habitat due to the establishment of the Phytoremediation Plantation	Wetland	Rehabilitation / maintenance / aftercare Phase	Major negative	Control through: ▪ Alien Invasive Management Plan; ▪ Monitoring Programmes	Major negative
	Decrease in mine affected water due to phytoremediation that aims to reduce impact on wetlands	Wetland	Rehabilitation / maintenance / aftercare Phase	Minor Positive	No mitigation Measure	Minor Positive
	The loss of usable soil as a resource as a result of erosion and compaction	Soil, Land Use and Land Capability	Rehabilitation / maintenance / aftercare Phase	Minor negative	Control through: ▪ Rehabilitation Plan	Negligible negative
	Improvement to health and safety to surrounding communities	Social	Rehabilitation / maintenance / aftercare Phase	Moderate Positive	No mitigation Measure	Moderate Positive

16 Summary of specialist reports

Numerous specialist impact assessments were undertaken for the project, as set out in Table 16-1. Separate specialist reports were compiled and have been attached as appendices to this report. The specialist input included the baseline environment, potential impacts and the recommended mitigation measures.

Table 16-1: Specialist Studies undertaken for Kilbarchan Colliery

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report (mark with an X)	Reference to applicable section of report where specialist recommendations have been included
Surface Water Impact Assessment	▪ Identified risks associated with rehabilitation activities; ▪ Significance of impacts associated with the Phytoremediation plantation; and ▪ Mitigation measures for all risks and impacts; and ▪ Monitoring Programmes	X	Mitigation and management measures included in this report were recommended by the Surface Water Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 12, as well as the recommendations provided in Part B Sections 5, 6, 7and the monitoring provided in Section 9.
Groundwater Impact Assessment	▪ Significance of impacts ▪ Mitigation measures; and ▪ Monitoring Programmes	X	Mitigation and management measures included in this report were recommended by the Groundwater Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 12, as well as the recommendations provided in Part B Sections 5, 6, 7and the monitoring provided in Section 9.
Aquatics Impact Assessment	▪ Significance of impacts	X	Mitigation and management measures included in this report were

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report (mark with an X)	Reference to applicable section of report where specialist recommendations have been included
	▪ Mitigation measures; and ▪ Monitoring Programmes.		recommended by the Aquatic Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 12, as well as the recommendations provided in Part B Sections 5, 6, 7and the monitoring provided in Section 9.
Wetland Impact Assessment	▪ Significance of impacts ▪ Mitigation measures; and ▪ Monitoring Programmes.	X	Mitigation and management measures included in this report were recommended by the Wetland Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 12, as well as the recommendations provided in Part B Sections 5, 6, 7and the monitoring provided in Section 9.
Soil, Land Use and Land Capability Impact Assessment	▪ Significance of impacts ▪ Mitigation measures; and ▪ Monitoring Programmes.	X	Mitigation and management measures included in this report were recommended by the Soil, Land Use and Land Capability Specialist, as well as the monitoring programmes. This includes the impact assessment and

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report (mark with an X)	Reference to applicable section of report where specialist recommendations have been included
			mitigation measures as discussed in Section 12, as well as the recommendations provided in Part B Sections 5, 6, 7and the monitoring provided in Section 9.
Flora and Fauna Impact Assessment	▪ Significance of impacts ▪ Mitigation measures; and ▪ Monitoring Programmes.	X	Mitigation and management measures included in this report were recommended by the Flora and Fauna Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 12, as well as the recommendations provided in Part B Sections 5, 6, 7and the monitoring provided in Section 9.
Rehabilitation Plan	▪ Mitigation and management measures; ▪ Rehabilitation activities.	X	The activities, mitigation and management measures provided in this report are included in the Rehabilitation Plan in Appendix B.

17 Environmental impact statement

17.1 Summary of the key findings of the environmental impact assessment

The rehabilitation / maintenance / aftercare Phase activities to be undertaken at Kilbarchan Colliery may result in environmental risks which, should they occur, will impact on environmental aspects. Both environmental risks and environmental impacts have been identified as part of the rehabilitation / maintenance / aftercare activities. An environmental risk is an uncertain event that may result in an environmental impact, should the event occur. Due to the nature of risks in comparison to impacts, risks have not been rated according to the nature, significance, extent, duration and probability of them occurring but have been assessed qualitatively. The qualitative assessment of the risks identified per activity has been discussed in Section 12 Part A.

The Environmental Impact Statement for the Phytoremediation Plantation is utilised to summarise all of the potential environmental impacts identified during the rehabilitation / maintenance / aftercarephase. The significance of the impacts associated with the biophysical environment, pre-mitigation and post-mitigation, is summarised in Table 17-1.

Table 17-1: Summary of the Potential Impacts on the Biophysical Environment

Project Phase	Receiving Environment	Impact	Pre-Mitigation Significance	Post-Mitigation Significance
rehabilitation / maintenance / aftercare Phase Phase	Surface Water	Reduction in the Quantity of Water Available	Minor negative	Minor negative
		Decrease in mine affected water due to phytoremediation that aims to improve quality of surface water	Minor Positive	Minor Positive
	Groundwater	Decrease in mine affected water due to phytoremediation that aims to drop with groundwater level	Minor Positive	Minor Positive
	Fauna and Flora	Spread of alien plant species that are being planted for Phytoremediation	Minor negative	Minor negative
		The loss of biodiversity as a	Moderate	Moderate

Project Phase	Receiving Environment	Impact	Pre-Mitigation Significance	Post-Mitigation Significance
		result of the removal of fauna species	negative	negative
	Aquatics	Removal of vegetative cover and removal of soil as a function of site preparation and planting	Minor negative	Negligible Negative
		Water quality impacts resulting from pollution emanating from the fertiliser use	Minor negative	Minor negative
	Wetland	Loss of Wetland Habitat due to the establishment of the Phytoremediation Plantation	Major negative	Major negative
		Decrease in mine affected water due to phytoremediation that aims to reduce impact on wetlands	Minor Positive	Minor Positive
	Soil, Land Use and Land Capability	The loss of usable soil as a resource as a result of erosion and compaction	Minor negative	Negligible Negative
	Social	Improvement to health and safety to surrounding communities	Moderate Positive	Moderate Positive

17.2 Final site map

The composite plan for the project area, indicating sensitive areas, heritage resources watercourse buffers, is included as Plan 12, Appendix A.

17.3 Summary of the positive and negative implications and risks of the proposed activity and identified alternatives

The potential positive impacts of the rehabilitation / maintenance / aftercare activities can be summarised as follows:

- **Health and Safety –** The rehabilitation / maintenance / aftercare will ultimately result in a positive impact on the sense of place of the area. It will also reduce health and safety risks associated with potential subsidence and mine affected water resulting in the contamination of surface, groundwater and wetlands;
- **Treatment of Mine Affected Water** – Mine affected water will be reduced and treated by the Phytoremediation Plantation as opposed to reporting to the environment which will ultimately result in an improvement to aquatics, wetlands, surface and groundwater quality;
- **Rehabilitation / maintenance / aftercare of the Kilbarchan Colliery** – The project results in an overall positive impact on both the environment and the surrounding communities as all impacts currently resulting from the project site, such as erosion and compaction will be addressed through the rehabilitation / maintenance / aftercare of the Discard Dump, Open Pits, landfill sites and treatment of mine affected water.

The potential negative impacts of the proposed project can be summarised as follows:

- **Dust Generation** – During the rehabilitation / maintenance / aftercare activities, dust may be generated which could have a negative impact on air quality. Demolition of infrastructure may result in fugitive dust emissions;
- **Noise Generation** – Machinery and vehicles, will be used in the rehabilitation / maintenance / aftercare phase which will result in an increase in the ambient noise levels;
- **Loss of Fauna and Flora Habitat –** The rehabilitation / maintenance / aftercare phase may result in the disturbance of indigenous fauna and flora species through vehicle movement. The establishment of the Phytoremediation Plantation may result in the spread of alien invasive tree species that will be utilised for this treatment facility;
- **Surface Water Contamination –** During rehabilitation / maintenance / aftercare activities erosion and sedimentation may occur which can contribute to a change in quality of surface water. The development of the Phytoremediation Plantation may result in the reduction in quantity of surface water entering the catchment area;
- **Loss of wetland habitat –** The Phytoremediation Plantation is proposed to be established within a wetland therefore ecological function of this wetland will be significantly impaired.

18 Proposed impact management objectives and the impact management outcomes for inclusion in the EMPR

The EMP seeks to achieve a required end state and describes how activities that have, or could have, an adverse impact on the environment will be mitigated, controlled and monitored.

This EMP addresses the environmental impacts during the rehabilitation / maintenance / aftercare Phase of the project. Due regard must be given to environmental protection during the entire project; a number of environmental recommendations are made to achieve environmental protection. These recommendations are aimed at ensuring that the contractor maintains adequate control over the project to:

- Minimise the extent of an impact during the life of the project;
- Ensure appropriate restoration of areas affected by the project; and
- Prevent long term environmental degradation.

This project involves the rehabilitation / maintenance / aftercare and establishment of a phytoremediation plantation at the Kilbarchan colliery therefore the rehabilitation / maintenance / aftercare objectives have been formalised by a rehabilitation specialist, divided into eight categories as follows:

- Physical stability:
  - To remove and/or stabilise surface infrastructure, rehabilitated land and mining residue according to the planned land use plan.
- Environmental quality:
  - To manage the impact of physical effects and chemical contaminants on the environment such that the environmental quality is not adversely affected.
- Health and safety:
  - To limit, as far as reasonably possible, health and safety risks to humans accessing the reclaimed mine site.
- Land capability/land-use:
  - To re-instate the mixed-land use through the implementation and maintenance of the post rehabilitation land use plan.
- Aesthetic quality:
  - To leave behind a reclaimed mine site that gives an acceptable overall aesthetic appearance.

- Biodiversity:
  - To encourage the re-establishment of native and/or appropriate flora and fauna on the reclaimed mine site such that the biodiversity is largely re-instated by natural succession over time.
- Social:
  - To involve local community members in rehabilitation maintenance programmes that should contribute towards the socio-economic sustainability of the local communities.
- Stakeholder Management:
  - To follow an appropriate stakeholder engagement process with all I&APs and authorities.

19 Aspects for inclusion as conditions of authorisation

The following aspects must be included as part of the conditions for authorisation:

- Environmental monitoring must take place as recommended in Section 9 Part B;
- Regular maintenance must occur as an ongoing requirement to ensure no loss of vegetation occurs which can result in erosion hotspots and all drainage lines remain free of debris and in a functional working condition;
- The long term stability of the rehabilitation / maintenance / aftercare areas needs to be taken into consideration prior to allowing cattle grazing to take place on the rehabilitation / maintenance / aftercare areas. Grazing should not be permitted on the rehabilitation / maintenance / aftercare areas for the first five years, after that consideration could be given with respect to cattle grazing. If cattle are allowed to graze on the rehabilitation / maintenance / aftercare areas, this needs to be managed very closely only allowing cattle to graze on the rehabilitation / maintenance / aftercare areas for very short periods of time. Prolonged grazing could result in damage to the rehabilitation / maintenance / aftercare areas and increase the risk of erosion, thus the stability and suitability of allowing cattle to graze needs to be assessed prior to grazing taking place. Grazing can be utilized as a mechanism to “cut” the grass, however it is common practice to restrict grazing from rehabilitation / maintenance / aftercare areas and the use of heavy machinery to cut grass as there is potential that cattle and/or heavy machinery can damage the rehabilitation on the rehabilitation / maintenance / aftercare areas and could impact on the long term stability of the rehabilitation / maintenance / aftercare areas;
- A wetland offset strategy is recommended for the loss of wetland habitat associated with the establishment of the Phytoremediation Plantation. The wetland offset strategy must be implemented within one year of a wetland being impacted upon;

- An alien invasive plant management plan must be implemented to ensure the spread of alien invasive species especially referring to the trees planted for the Phytoremediation Plantation is kept to a minimum;
- A Geotechnical Investigation must be undertaken to determine areas at risk of subsidence. The recommendations provided by the geotechnical specialist must be implemented; and
- All mitigation measures provided in this report must be implemented. Should the mitigation measures be deemed impractical, ineffective or cost prohibitive, Eskom may apply to the DMR to alter such mitigation measures accordingly. Any change in mitigation measures must be approved by the competent authority.

20 Description of any assumptions, uncertainties and gaps in knowledge

This section highlights the assumptions, uncertainties, limitations and knowledge gaps relevant to the various specialist studies undertaken.

20.1 General assumptions, limitations and uncertainties

- The active water treatment of the mine affected water (apart from the Phytoremediation Plantation) has been excluded from the BAR and will be discussed in a separate EIA process;
- A geotechnical specialist study has not been undertaken and has been included as a recommendation so that stability and structural integrity of the mining area can be determine;
- No underground mine plans were provided for the completion of this BAR; and
- Monitoring of groundwater around landfill sites has not taken place and the contents of landfill sites are not known

20.2 Fauna and flora impact assessment

The following limitations were encountered during this study:

- Due to the timing and the brevity of the site investigation being in early April, the majority of the summer migrant species had already departed Southern Africa and this had an impact on the full representative species diversity for the project site;
- Many of the identifying features of plants (such as seeds, flowers and leaves) were not present due to the time of sampling and as a result of this, not all plant species were recorded; and
- Field investigations did not include a night survey, and for this reason, nocturnal species (specifically bat species) were not recorded.

20.3 Aquatics impact assessment

During the aquatic impact assessment study the specialists were prevented from accessing the golf course due to site access issues which is why the low flow data was not able to be collected.

20.4 Wetland impact assessment

The main assumptions and limitations of the wetland assessment are:

- Only the wetlands that are expected to be directly affected by the Project, as well as a 500 m buffer surrounding these areas, were assessed;
- The project area is found within a highly impacted urban, industrial and agricultural area. This has the potential to affect the results as the soil, landscape and vegetation indicators have been disturbed;
- It is important to note that not all wetland floral indicators or important species may have been identified as the sampling methodology aims to be representative of the project site and does not cover the entire surface area; and
- The project area was assessed during site visits in November 2015 and, at the time of sampling, dry conditions was prevalent. This was a limitation as it is assumed many floral and faunal indicators were absent.

21 Reasoned opinion as to whether the proposed activity should or should not be authorised

21.1 Reasons why the activity should be authorised or not

The project aims to address all issues that could or is currently causing environmental degradation on the site and return this degraded environment to an acceptable, sustainable and natural state. The impacts specifically associated with contamination of ground and surface water poses a risk to the communities in this area and as such rehabilitation / maintenance / aftercare efforts will assist in improving the water quality to an acceptable drinking standard. The rehabilitation / maintenance / aftercare of the Landfill site, Open Pits and Discard Dump will not only address erosion and overgrazing issues currently being experienced, it will also reduce any health and safety risk associated with a redundant mining area.

Although the rehabilitation / maintenance / aftercare activities may result in environmental risks and impacts, these are short term; the activities are expected to have a long term positive impact on the project site and surroundings. The implementation of mitigation measures and monitoring programmes will ensure all rehabilitation / maintenance / aftercare activites are undertaken effectively and ensure ongoing improvement of the rehabilitated areas. The project will result in an overall positive impact to the natural environment and community.

21.2 Conditions that must be included in the authorisation

The following aspects must be included as part of the conditions for authorisation:

- Environmental monitoring must take place as recommended as proposed in Section 9 Part B;
- Regular maintenance must occur as an ongoing requirement to ensure no loss of vegetation occurs which can result in erosion hotspots and all drainage lines remain free of debris and in a functional working condition;
- All areas that have undergone rehabilitation / maintenance / aftercare should remain free from cattle grazing for approximately five years or until vegetation has been established;
- A wetland offset strategy is recommended for the loss of wetland habitat associated with the establishment of the Phytoremediation Plantation. The wetland offset strategy must be implemented within one year of a wetland being impacted upon;
- An alien management plan must be implemented to ensure the spread of alien invasive species especially referring to the trees planted for the Phytoremediation Plantation is kept to a minimum;
- A Geotechnical Investigation must be undertaken to determine areas at risk of subsidence. The recommendations provided by the geotechnical specialist must be implemented; and
- All mitigation measures provided in this report must be implemented. Should the mitigation measures be deemed impractical, ineffective or cost prohibitive, Eskom may apply to the DMR to alter such mitigation measures accordingly. Any change in mitigation measures must be approved by the competent authority.

22 Period for which the environmental authorisation is required

The environmental authorisation for the rehabilitation of the Discard Dump, open pits and landfill sites is required for a period of three years.

The environmental authorisation of the Phytoremediation Plantation is required for a period of 25 years as this is a long term solution and will be required for continuous treatment of the mine affected water.

23 Undertaking

An undertaking is provided in Part B, Section 13 of the EMPr and is applicable to the EIA and EMPr sections of this report.

24 Financial provision

Eskom proposes to obtain environmental authorisation for the proposed phytoremediation plantation and maintenance/ aftercare of areas that were previously rehabilitated within the

project boundaries. Therefore, a closure plan doesn't form part of this application process, and will be handled as a separate process, by Eskom.

24.1 Explain how the aforesaid amount was derived

As a closure plan does not form part of this BAR process therefore this section is not applicable.

24.2 Confirm that this amount can be provided for from operating expenditure

As a closure plan does not form part of this BAR process therefore this section is not applicable.

25 Specific Information required by the competent Authority

Compliance with the provisions of sections 24(4)(a) and (b) read with section 24 (3) (a) and (7) of the NEMA and the EIA report must include the:-

25.1 Impact on the socio-economic conditions of any directly affected person

- Positive impacts of the proposed project can be summarised as follows:
  - **Health and Safety –** The rehabilitation / maintenance / aftercare will ultimately result in a positive impact on the sense of place of the area. It will also reduce health and safety risks associated with open voids and mine affected water resulting in the contamination of both surface and groundwater.
- Negative impacts of the proposed project can be summarised as follows:
  - **Social Nuisance** – The increased dust levels due to demolition and vehicular activity as well as the increase in ambient noise levels from machinery and the movement of vehicles will result in social nuisance.

25.2 Impact on any national estate referred to in section 3(2) of the National Heritage Resources Act.

A HSS was undertaken and a NDA was compiled and submitted to the SAHRA and Amafa, the Heritage Resource Authority of KwaZulu-Natal.

Although no impacts to heritage resources are anticipated, graveyards and heritage resources identified could potentially be impacted on by the rehabilitation / maintenance / aftercare activities due to their proximity to the rehabilitation / maintenance / aftercare activities to be undertaken. A graveyard was identified as part of the site visit and is located on the border of Open Pit area 2. Should further rehabilitation / maintenance / aftercare activities be required at Open Pit area 2, the graveyard site may need to be fenced off to

ensure that any potential impacts are prevented. All requirements in terms of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) will be implemented.

26 Other matters required in terms of sections 24(4)(a) and (b) of the Act

Section 24(4)(b)(i) of the NEMA (as amended), provides that an investigation must be undertaken of the potential consequences or impacts of the alternatives to the activity on the environment and assessment of the significance of those potential consequences or impacts, including the option of not implementing the activity. The outcome of the investigation has been provided in Section 7 to Section 18 Part A of this Basic Assessment Report.

Part B: Environmental Management Programme Report

1 Details of the Environmental Assessment Practitioner

The details of the EAP have been provided in Section 2.1, Part A of this Report.

2 Description of the aspects of the activity

The aspects of the activity as described in Section 11 Part A are covered by the environmental management programme.

3 Composite map

The composite plan for the project area, indicating sensitive areas, heritage resources watercourse buffers, is included as Plan 12, Appendix A.

4 Description of impact management objectives including management statements

4.1 Determination of rehabilitation objectives

This project involves the rehabilitation / maintenance / aftercare of the Kilbarchan colliery therefore the rehabilitation objectives have been formalised by a rehabilitation specialist and are divided into eight categories as follows:

- Physical stability:
  - To remove and/or stabilise surface infrastructure, rehabilitated land and mining residue according to the planned land use plan.
- Environmental quality:
  - To manage the impact of physical effects and chemical contaminants on the environment such that the environmental quality is not adversely affected.
- Health and safety:
  - To limit, as far as reasonably possible, health and safety risks to humans accessing the reclaimed mine site.
- Land capability/land-use:
  - To re-instate the mixed-land use through the implementation and maintenance of the post rehabilitation land use plan.
- Aesthetic quality:
  - To leave behind a reclaimed mine site that gives an acceptable overall aesthetic appearance.
- Biodiversity:

- To encourage the re-establishment of native and/or appropriate flora and fauna on the reclaimed mine site such that the biodiversity is largely re-instated by natural succession over time.

- Social:
  - To involve local community members in rehabilitation maintenance programmes that should contribute towards the socio-economic sustainability of the local communities.

- Stakeholder Management:
  - To follow an appropriate stakeholder engagement process with all I&APs and authorities.

4.2 Volumes and rate of water use required for the operation

The project involves rehabilitation / maintenance / aftercare activities therefore water may be used during this phase on an ad hoc basis however once this project has been completed it is not expected that any water will be utilised by the site. The Phytoremediation Plantation is expected to treat approximately 1ML of water per day.

4.3 Has a water use licence has been applied for

Eskom will be applying for a WUL for the establishment of the Phytoremediation Plantation. The potential water uses triggered under Section 21 of the NWA in relation to the proposed project are listed below:

- S21(c) – Impeding or diverting the flow of water in a watercourse;
- S21(d) – engaging in a streamflow reduction activity contemplated in Section 36 of the Act; and
- S21 (i) – Altering the bed, banks, course or characteristics of a watercourse;

The WULA has been excluded from the scope of the BAR and will be addressed as part of the EIA process required for the construction of infrastructure for the active treatment of the mine affected water.

5 Impacts to be mitigated in their respective phases

The proposed mitigation measures for the risks associated with rehabilitation / maintenance / aftercare of the Kilbarchan Colliery and the impacts associated with the Phytoremediation Plantation and its compliance with the relevant standards are presented in Table 5-1.

Table 5-1: Impacts to be Mitigated

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
Maintenance of the Discard Dump	Surface Water	Rehabilitation / maintenance / aftercare Phase	70ha	▪ Development of a spill response plan to mitigate against potential hydrocarbon spillages from machinery and vehicles; ▪ The substantial down-drains that have been contracted which make use of concrete structures with supporting gabion baskets in certain locations must be regularly monitored and if required maintenance effort must be undertaken to ensure adequate stormwater management; ▪ Management of the dump shape to control the ease with which water can run off from the facility; and ▪ Ideally the establishment of vegetation should be done in the dry season to limit the effects of surface water runoff as a result of rain.	▪ Surface Water Monitoring in accordance with NWA	▪ Surface Water monitoring should be undertaken on a quarterly basis from the start of rehabilitation / maintenance / aftercare until a sustainable situation is reached and after it has been signed off by the authorities
	Groundwater			▪ The Discard Dump should be covered with additional soil and vegetation to minimise the impact associated with the infiltration of water from a rainfall event that could result in the mobilisation of dissolved metals; and ▪ Continuous groundwater monitoring and rehabilitation of the Discard Dump to avoid acid generation and release of heavy metals from seepage.	▪ Groundwater Monitoring in accordance with NWA;	▪ Ground water monitoring should be undertaken on a quarterly basis from the start of rehabilitation / maintenance / aftercare until a sustainable situation is reached and after it has been signed off by the authorities
	Fauna and Flora			▪ Precision farming techniques should be used to calculate the right amount of fertiliser to be used, to prevent excess application. Topsoil should be fertilised with 2:3:2 at 350 kg/ha, if necessary, and ripped to 200 mm; ▪ Ensure continual monitoring and maintenance. Continuous monitoring and rehabilitation / maintenance / aftercare is necessary to avoid acid generation and release of heavy metals as well as soil erosion and loss of vegetation. Basal cover should be a minimum of 30%. Assessments should be carried out after each growing season, for three years. Bare areas of more than 4 m^2 need to be reseeded; ▪ Only the designated access routes for vehicles used for the rehabilitation / maintenance / aftercare activities are to be used to reduce any unnecessary compaction and loss of vegetation;	▪ Alien Invasive Management Plan in accordance with: Alien and Invasive Species Lists, 2014 (GN R599 in GG 37886 of 1 August 2014) of the NEMBA	▪ All disturbed areas should be monitored for the establishment of alien plant species for 2-5 years biannually

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				▪ Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; ▪ An alien management plan should be implemented whereby a qualified vegetation ecologist will monitor the disturbed areas biannually for two to five years for alien invasive vegetation establishment. Monitoring during the wet season should preferably take place between November and March. All alien invasive plant species should be identified, demarcated and removed; and ▪ Vehicular movement should be restricted to existing roads to reduce further impact to flora; no vehicles should access the site at night to prevent the disruption of nocturnal fauna.		
	Soil, Land Use and Land Capability			▪ Ensure proper storm water management designs are in place; ▪ If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place; ▪ If erosion has occurred, usable soil should be sourced and replaced and shaped to reduce the recurrence of erosion; ▪ Only the designated access routes are to be used to reduce any unnecessary compaction; ▪ Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; ▪ Implement land rehabilitation / maintenance / aftercare measures as defined in rehabilitation report. ▪ Follow rehabilitation guidelines; ▪ The usable soil should be moved by means of an excavator bucket, and loaded onto dump trucks; ▪ Ensure that contouring is done correctly and avoid creating steep slopes. Slopes steeper that 1:7 should be avoided. If slopes are steep contour banks need to be created; ▪ Usable soil is to be moved when the soil is dry, as to reduce compaction; ▪ After the completion of the project the area is to be cleared of all infrastructure; ▪ The foundations to be removed; ▪ Ongoing monitoring must be undertaken at the	▪ Soil Management in terms of the Chamber of Mines Guidelines for Rehabilitation; ▪ Erosion Control Management Plan in accordance with best practise principles.	▪ Erosion control measures should be implemented during the rehabilitation / maintenance / aftercare phase and 2-5 years.

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				Discard Dumps once rehabilitation / maintenance / aftercare efforts have been undertaken to ensure erosion has not occurred in certain areas. Erosion control measure must be implemented if erosion has been identified; ▪ Usable soil to be replaced for rehabilitation / maintenance / aftercare purposes; ▪ The handling of the stripped usable soil will be minimized to ensure the soil's structure does not deteriorate; and ▪ Stockpiles should only be used for their designated final purposes.		
Maintenance of the Open Pits	Surface Water	Rehabilitation / maintenance / aftercare Phase	58 ha	▪ Development of a spill response plan to mitigate against potential hydrocarbon spillages from machinery and vehicles; ▪ The substantial down-drains that have been contracted which make use of concrete structures with supporting gabion baskets in certain locations must be regularly monitored and if required maintenance effort must be undertaken to ensure adequate stormwater management; ▪ Management of the dump shape to control the ease with which water can run off from the facility; ▪ Surface water runoffs are recommended to be diverted from the open pits areas using a stormwater management plan; and ▪ Ideally the establishment of vegetation should be done in the dry season to limit the effects of surface water runoff as a result of rain.	▪ Surface Water and Groundwater Monitoring in accordance with NWA; ▪ Stormwater management Plan in accordance with the NWA	▪ Surface Water monitoring should be undertaken on a quarterly basis from the start of rehabilitation / maintenance / aftercare until a sustainable situation is reached and after it has been signed off by the authorities
	Groundwater			▪ The open pits should be covered with additional soil and vegetation to minimise the impact associated with the infiltration of water from a rainfall event that could result in the mobilisation of dissolved metals; ▪ Undertake a Geotechnical Study and implement the recommended monitoring and mitigation measures proposed to manage long term subsidence; and ▪ Continuous groundwater monitoring and rehabilitation / maintenance / aftercare of the open pits to avoid acid generation and release of heavy metals from seepage.	▪ Groundwater Monitoring in accordance with NWA; and ▪ Subsidence monitoring plan in accordance with the Mine Health and Safety Act of 1996 (MHSA) and MPRDA.	▪ Ground water monitoring should be undertaken on a quarterly basis from the start of rehabilitation / maintenance / aftercare until a sustainable situation is reached and after it has been signed off by the authorities
	Fauna and			▪ Precision farming techniques should be used to	▪ Alien Invasive Management Plan in	▪ All disturbed areas should be monitored

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
	Flora			calculate the right amount of fertiliser to be used, to prevent excess application. Topsoil should be fertilised with 2:3:2 at 350 kg/ha, if necessary, and ripped to 200 mm; ▪ Ensure continual monitoring and maintenance. Continuous monitoring and rehabilitation / maintenance / aftercare is necessary to avoid acid generation and release of heavy metals as well as soil erosion and loss of vegetation. Basal cover should be a minimum of 30%. Assessments should be carried out after each growing season, for three years. Bare areas of more than 4 m^2 need to be reseeded; ▪ Only the designated access routes for vehicles used for the rehabilitation / maintenance / aftercare activities are to be used to reduce any unnecessary compaction and loss of vegetation; ▪ Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; ▪ An alien management plan should be implemented whereby a qualified vegetation ecologist will monitor the disturbed areas biannually for two to five years for alien invasive vegetation establishment. Monitoring during the wet season should preferably take place between November and March. All alien invasive plant species should be identified, demarcated and removed; and ▪ Vehicular movement should be restricted to existing roads to reduce further impact to flora; no vehicles should access the site at night to prevent the disruption of nocturnal fauna.	accordance with: Alien and Invasive Species Lists, 2014 (GN R599 in GG 37886 of 1 August 2014) of the NEMBA.	for the establishment of alien plant species for 2-5 years biannually
	Soil, Land Use and Land Capability			▪ Ensure proper storm water management designs are in place; ▪ If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place; ▪ If erosion has occurred, usable soil should be sourced and replaced and shaped to reduce the recurrence of erosion; ▪ Only the designated access routes are to be used to reduce any unnecessary compaction; ▪ Compacted areas are to be ripped to loosen the soil	▪ Erosion Control Management Plan in accordance with best practise principles; and ▪ Soil Management in terms of the Chamber of Mines Guidelines for Rehabilitation.	▪ Erosion control measures should be implemented during the rehabilitation / maintenance / aftercare phase and 2-5 years; ▪ Subsidence monitoring plan must be undertaken annually during and after rehabilitation / maintenance / aftercare.

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				structure and vegetation cover re-instated; ▪ Implement land rehabilitation / maintenance / aftercare measures as defined in rehabilitation report. ▪ Follow rehabilitation guidelines; ▪ The usable soil should be moved by means of an excavator bucket, and loaded onto dump trucks; ▪ Ensure that contouring is done correctly and avoid creating steep slopes. Slopes steeper that 1:7 should be avoided. If slopes are steep contour banks need to be created; ▪ Usable soil is to be moved when the soil is dry, as to reduce compaction; ▪ After the completion of the project the area is to be cleared of all infrastructure; ▪ The foundations to be removed; ▪ Usable soil to be replaced for rehabilitation purposes; ▪ The handling of the stripped usable soil will be minimized to ensure the soil's structure does not deteriorate; and ▪ Stockpiles should only be used for their designated final purposes.		
Maintenance of the Landfill Sites	Groundwater	Rehabilitation / maintenance / aftercare Phase		▪ The Landfill Sites should be covered with additional soil and vegetation to minimise the impact associated with the infiltration of water from a rainfall event that could result in the mobilisation of dissolved metals; ▪ Continuous groundwater monitoring and rehabilitation / maintenance / aftercare of the Landfill Sites to avoid acid generation and release of heavy metals from seepage; ▪ Groundwater monitoring should be undertaken on a regular basis to determine whether contamination of groundwater quality is occurring ▪ Groundwater monitoring should be undertaken to determine whether contamination of groundwater is occurring from material stored in the landfill site such as PCBs, asbestos and other hazardous material.	▪ Groundwater Monitoring in accordance with NWA	▪ Groundwater monitoring should be undertaken on a quarterly basis from the start of rehabilitation / maintenance / aftercare until a sustainable situation is reached and after it has been signed off by the authorities.
	Fauna and Flora			▪ Precision farming techniques should be used to calculate the right amount of fertiliser to be used, to prevent excess application. Topsoil should be fertilised with 2:3:2 at 350 kg/ha, if necessary, and	▪ Alien Invasive Management Plan in accordance with: Alien and Invasive Species Lists, 2014 (GN R599 in GG 37886 of 1 August 2014) of the NEMBA.	▪ All disturbed areas should be monitored for the establishment of alien plant species for 2-5 years biannually

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				ripped to 200 mm; ▪ Ensure continual monitoring and maintenance. Continuous monitoring and rehabilitation / maintenance / aftercare is necessary to avoid acid generation and release of heavy metals as well as soil erosion and loss of vegetation. Basal cover should be a minimum of 30%. Assessments should be carried out after each growing season, for three years. Bare areas of more than 4 m^2 need to be reseeded; ▪ Only the designated access routes for vehicles used for the rehabilitation / maintenance / aftercare activities are to be used to reduce any unnecessary compaction and loss of vegetation; ▪ Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; ▪ An alien management plan should be implemented whereby a qualified vegetation ecologist will monitor the disturbed areas biannually for two to five years for alien invasive vegetation establishment. Monitoring during the wet season should preferably take place between November and March. All alien invasive plant species should be identified, demarcated and removed; and ▪ Vehicular movement should be restricted to existing roads to reduce further impact to flora; no vehicles should access the site at night to prevent the disruption of nocturnal fauna.		
	Soil, Land Use and Land Capability			▪ Ensure proper storm water management designs are in place; ▪ If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place; ▪ If erosion has occurred, usable soil should be sourced and replaced and shaped to reduce the recurrence of erosion; ▪ Only the designated access routes are to be used to reduce any unnecessary compaction; ▪ Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; ▪ Implement land rehabilitation / maintenance /	▪ Erosion Control Management Plan in accordance with best practise principles	▪ Erosion control measures should be implemented during the rehabilitation / maintenance / aftercare phase and 2-5 years.

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				aftercare measures as defined in rehabilitation report. ▪ Follow rehabilitation guidelines; ▪ The usable soil should be moved by means of an excavator bucket, and loaded onto dump trucks; ▪ Ensure that contouring is done correctly and avoid creating steep slopes. Slopes steeper that 1:7 should be avoided. If slopes are steep contour banks need to be created; ▪ Usable soil is to be moved when the soil is dry, as to reduce compaction; ▪ After the completion of the project the area is to be cleared of all infrastructure; ▪ The foundations to be removed; ▪ Usable soil to be replaced for rehabilitation purposes; ▪ The handling of the stripped usable soil will be minimized to ensure the soil's structure does not deteriorate; and ▪ Stockpiles should only be used for their designated final purposes.		
Underground Mine Voids	Social	Rehabilitation / maintenance / aftercare Phase		▪ A geotechnical investigation must be undertaken to determine areas of risk, specifically for the general public; and ▪ The recommendations provided in the geotechnical investigation must be implemented.	▪ Subsidence Monitoring should be in accordance with the standards proposed by the geotechnical investigation	▪ The geotechnical Investigation should be undertaken prior to the commencement of the rehabilitation / maintenance / aftercare activities.
Treatment of Mine Water – Phytoremediation Plantation	Surface Water	Rehabilitation / maintenance / aftercare Phase	175ha	▪ No mitigation measures	▪ Surface Water Monitoring in accordance with NWA	▪ Surface Water monitoring should be undertaken on a quarterly basis from the start of rehabilitation / maintenance / aftercare until a sustainable situation is reached and after it has been signed off by the authorities;
	Groundwater			▪ No mitigation measures	▪ Groundwater Monitoring in accordance with NWA	▪ The mine water decant rate and quality of the water is recommended to be monitored monthly until the mine affected water until a sustainable situation is reached and after it has been signed off by the authorities
	Fauna and Flora			▪ To reduce the spread of invasive species an alien invasive management plan should implemented by removing all invasive species that may become established by the disturbed environment;	▪ Alien Invasive Management Plan in accordance with: Alien and Invasive Species Lists, 2014 (GN R599 in GG 37886 of 1 August 2014) of the NEMBA.	▪ All disturbed areas should be monitored for the establishment of alien plant species for 2-5 years biannually.

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				▪ Ensure that a monitoring programme is implemented to ensure all tree species proposed to be used for the phytoremediation plantation remain within the proposed footprint. Should species start to grow elsewhere they should be removed and disposed of.		
	Soil, Land Use and Land Capability			▪ Ensure proper storm water management designs are in place; ▪ If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place; ▪ If erosion has occurred, usable soil should be sourced and replaced and shaped to reduce the recurrence of erosion; ▪ Only the designated access routes are to be used to reduce any unnecessary compaction; ▪ Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; ▪ Implement land rehabilitation / maintenance / aftercare measures as defined in rehabilitation report. ▪ Follow rehabilitation guidelines; ▪ The usable soil should be moved by means of an excavator bucket, and loaded onto dump trucks; ▪ Ensure that contouring is done correctly and avoid creating steep slopes. Slopes steeper that 1:7 should be avoided. If slopes are steep contour banks need to be created; ▪ Usable soil is to be moved when the soil is dry, as to reduce compaction; ▪ After the completion of the project the area is to be cleared of all infrastructure; ▪ The foundations to be removed; ▪ Usable soil to be replaced for rehabilitation purposes; ▪ The handling of the stripped usable soil will be minimized to ensure the soil's structure does not deteriorate; and ▪ Stockpiles should only be used for their designated final purposes.	▪ Erosion Control Management Plan in accordance with best practise principles	▪ Erosion control measures should be implemented during the rehabilitation / maintenance / aftercare phase and 2-5 years.
	Wetland			▪ There is no mitigation for the loss of these wetlands. ▪ An offset strategy is recommended.	▪ Alien Invasive Management Plan in accordance with: Alien and Invasive Species Lists, 2014 (GN R599 in GG	▪ All disturbed areas should be monitored for the establishment of alien plant species for 2-5 years biannually.

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
					37886 of 1 August 2014) of the NEMBA.	
	Aquatic			▪ A phased approach should be implemented where only the vegetation in the footprint of the Phytoremediation Plantation should be impacted upon, thereby limiting the exposure of soil to wind and surface water runoff erosion; ▪ Ideally planting should be done in the dry season to limit the effects of surface water runoff as a result of rain; ▪ Berms and sediment traps should be employed to capture soil runoff; and ▪ A minimum of a 100 m buffer from the edge of the riparian zone should be enforced to avoid impacts, or vehicles driving in sensitive riparian areas; ▪ A minimum of a 100 m buffer from the edge of the riparian zone should be enforced to avoid impacts, or vehicles driving in sensitive riparian areas; ▪ The use of berms to prevent the runoff of nutrients into the aquatic ecosystem; and ▪ Precision farming techniques should be used to calculate the right amount of fertiliser to be used, to prevent excess application	▪ Buffer zones in accordance with: NWA.	▪ Rehabilitation / maintenance / aftercare Phase

6 Impact management outcomes

A description of the objectives and outcomes of the EMP is outlined in Table 6-1, taking into account the impact and mitigation type.

Table 6-1: Outcomes and Objectives of the EMP

Activities	Potential impacts/risk	Aspects affected	Phase	Mitigation type	Standard to be achieved
Maintenance of the Discard Dump	Surface Water Contamination	Surface Water	Rehabilitation / maintenance / aftercare Phase	Control through: ▪ Stormwater Management Plan	▪ To avoid erosion and sedimentation of surface water ▪ Surface water quality should be assessed against the IWQO standards for the Ngagane River Catchment
	Ground water contamination	Groundwater	Rehabilitation / maintenance / aftercare Phase	Control through: Vegetation establishment	▪ The Discard Dump should be covered with additional soil and vegetation to minimise the impact associated with the infiltration of water from a rainfall event resulting in the mobilisation of dissolved metals; ▪ The groundwater quality should be assessed against the SANS Standards 2015
	Loss of usable soil as a resource – Disturbance, Erosion, and Compaction as Well as Loss of Land capability, and Land Use	Soil, Land Use and Land Capability	Rehabilitation / maintenance / aftercare Phase	Control through: ▪ Rehabilitation Plan	▪ To prevent the loss of usable soil as a resource through disturbance, erosion, and compaction as Well as Loss of Land capability, and Land Use
	Loss of natural vegetation due to alien invasive species	Fauna and Flora	Rehabilitation / maintenance / aftercare Phase	Control through: ▪ Alien Invasive Management Plan; ▪ Monitoring Programmes	▪ The control of alien invasive species should be monitored against the Alien Invasive Management Plan
	Loss of fauna due to noise and vehicle movement	Fauna and Flora	Rehabilitation / maintenance / aftercare Phase	Avoid through: ▪ Limitation of vehicle movement; Control through: ▪ Noise Monitoring	▪ To prevent and minimise the loss of fauna species from the rehabilitation activities ▪ To prevent the noise emanating from the construction machinery and vehicles impacting on fauna species
Maintenance of the Open Pits	Surface Water Contamination	Surface Water	Rehabilitation / maintenance / aftercare Phase	Control through: ▪ Stormwater Management Plan	▪ To avoid erosion and sedimentation of surface water
	Groundwater Contamination	Groundwater	Rehabilitation / maintenance / aftercare Phase	Control through: ▪ Groundwater monitoring	▪ To prevent the contamination of groundwater from the rehabilitation of the Open Pits
	Loss of usable soil as a resource – Disturbance, Erosion, and Compaction as Well as Loss of Land capability, and Land Use	Soil, Land Use and Land Capability	Rehabilitation / maintenance / aftercare Phase	Control through: ▪ Rehabilitation Plan	▪ To prevent the loss of usable soil as a resource through disturbance, erosion, and compaction as Well as Loss of Land capability, and Land Use
	subsidence	Groundwater	Rehabilitation / maintenance / aftercare Phase	Control through: ▪ Implement monitoring and management of geotechnical study; and ▪ Subsidence monitoring	▪ Subsidence area should be rehabilitated to minimise the water recharge to the underground voids and subsequently the decant volumes.
		Social		Control through:	▪ To prevent the development of sink holes that could

Activities	Potential impacts/risk	Aspects affected	Phase	Mitigation type	Standard to be achieved
				▪ Implement monitoring and management of geotechnical study; and ▪ Subsidence monitoring	lead to loss of life and damage to infrastructure
Maintenance of the Landfill Sites	Loss of natural vegetation due to alien invasive species	Fauna and Flora	Rehabilitation / maintenance / aftercare Phase	Control through: ▪ Alien Invasive Management Plan; ▪ Monitoring Programmes	▪ To prevent the influx and establishment of alien invasive vegetation
	Loss of fauna due to noise and vehicle movement			Avoid through: ▪ Limitation of vehicle movement; Control through: ▪ Noise Monitoring	▪ To prevent and minimise the loss of fauna species from the rehabilitation activities ▪ To prevent the noise emanating from the construction machinery and vehicles impacting on fauna species
	Contamination of groundwater from leachates pf PCBs, Asbestos etc.	Groundwater	Rehabilitation / maintenance / aftercare Phase	Control through: ▪ Groundwater Monitoring	▪ To determine whether contamination of groundwater is occurring from material stored in the landfill site such as PCBs, Asbestos and other hazardous material and mitigating the impact
	Loss of usable soil as a resource – Disturbance, Erosion, and Compaction as Well as Loss of Land capability, and Land Use	Soil, Land Use and Land Capability	Rehabilitation / maintenance / aftercare Phase	Control through: ▪ Rehabilitation Plan	▪ To prevent the loss of usable soil as a resource through disturbance, erosion, and compaction as Well as Loss of Land capability, and Land Use
Underground Mine Voids	Rehabilitated Areas: Health and safety risk for all personnel and property from possible subsidence	Social	Rehabilitation / maintenance / aftercare Phase	Control through: ▪ Undertaking of a geotechnical Investigation and implementation of the proposed control measures	▪ To prevent the loss of infrastructure and life in the event that subsidence may occur.
	Areas associated with the general public, specifically the mine village, the substation and the N11 road: Health and safety risk for all personnel and property from possible subsidence.				
Treatment of Mine Water – Phytoremediation Plantation	Reduction in the Quantity of Water Available	Surface Water	Rehabilitation / maintenance / aftercare Phase	No Mitigation Measure	No Mitigation Measure
	Release of untreated water into the catchment area during high rainfall event	Surface Water	Rehabilitation / maintenance / aftercare Phase	Control through: ▪ Berm establishment	▪ To reduce the release of untreated mine affected water into the catchment area which can result in pollution
	Spread of alien plant species that are being planted for Phytoremediation	Fauna and flora	Rehabilitation / maintenance / aftercare Phase	Control through: ▪ Alien Invasive Management Plan; ▪ Monitoring Programmes	▪ To prevent the spread and establishment of alien invasive vegetation in areas other than the Phytoremediation Plantation

Activities	Potential impacts/risk	Aspects affected	Phase	Mitigation type	Standard to be achieved
	The loss of biodiversity as a result of the removal of fauna species		Rehabilitation / maintenance / aftercare Phase	No Mitigation Measure	No Mitigation Measure
	Site clearance and topsoil removal resulting in sedimentation and effecting sensitive biota	Aquatics	Rehabilitation / maintenance / aftercare Phase	Control through: ▪ Establish Berms ▪ Vegetation establishment and management	▪ To reduce soil erosion resulting in the sedimentation in the river systems which can result in loss of sensitive biota
	Change in the water quality of the aquatic environment			Control through: ▪ Establishment of buffer ▪ Establish Berms ▪ Fertilizer usage must be kept to a minimum	▪ To reduce contamination of the river systems originating from nutrients within fertiliser used to promote growth for the establishment of the treatment plant
	The loss of usable soil as a resource as a result of erosion and compaction	Soil, Land Use and Land Capability	Rehabilitation / maintenance / aftercare Phase	Control through: ▪ Rehabilitation Plan; ▪ Vegetation Establishment	▪ To prevent the loss of topsoil through erosion that can lead to sedimentation of the catchment areas and loss of vegetation establishment
	Loss of Wetland Habitat due to the establishment of the Phytoremediation Plantation	Wetland	Rehabilitation / maintenance / aftercare Phase	No mitigation	▪ The loss of wetlands is unavoidable at the phytoremediation treatment plant is located within a wetland environment
	Improvement to health and safety to surrounding communities	Social	Rehabilitation / maintenance / aftercare Phase	No mitigation	▪ To improve the ground and surface water quality for human consumption and use.

7 Impact management actions

A description of impact management actions, identifying the manner in which the impact management objectives and outcomes referenced in Sections 5 and 6 will be achieved, is provided in Table 7-1.

Table 7-1: Impact Management Actions

Activities	Potential impacts/Risks	Mitigation type	Time period for implementation	Compliance with standards
Maintenance of the Discard Dump	Surface Water Contamination	Control through: ▪ Stormwater Management Plan	▪ Surface Water monitoring should be undertaken on a quarterly basis from the start of rehabilitation / maintenance / aftercare until a sustainable situation is reached and after it has been signed off by the authorities	▪ Surface Water Monitoring in accordance with NWA
	Ground water contamination through seepage	Control through: ▪ Vegetation establishment	▪ Ground water monitoring should be undertaken on a quarterly basis from the start of rehabilitation / maintenance / aftercare until a sustainable situation is reached and after it has been signed off by the authorities	▪ Groundwater Monitoring in accordance with NWA
	Loss of usable soil as a resource – Disturbance, Erosion, and Compaction as Well as Loss of Land capability, and Land Use	Control through: ▪ Rehabilitation Plan	▪ Erosion control measures should be implemented during the rehabilitation / maintenance / aftercare phase and 2-5 years	▪ Soil Management in terms of the Chamber of Mines Guidelines for rehabilitation / maintenance / aftercare ▪ Erosion Control Management Plan in accordance with best practise principles
	Loss of natural vegetation due to alien invasive species	Control through: ▪ Alien Invasive Management Plan; ▪ Monitoring Programmes	▪ All disturbed areas should be monitored for the establishment of alien plant species for 2-5 years biannually	▪ Alien Invasive Management Plan in accordance with: Alien and Invasive Species Lists, 2014 (GN R599 in GG 37886 of 1 August 2014) of the NEM: BA
	Loss of fauna due to noise and vehicle movement	Avoid through: ▪ Limitation of vehicle movement; Control through: ▪ Noise Monitoring		
Maintenance of the Open Pits	Surface Water Contamination	Control through: ▪ Stormwater Management Plan	▪ Surface Water monitoring should be undertaken on a quarterly basis from the start of rehabilitation / maintenance / aftercare until a sustainable situation is reached and after it has been signed off by the authorities	▪ Surface Water and Groundwater Monitoring in accordance with NWA ▪ Stormwater management Plan in accordance with the NWA

Activities	Potential impacts/Risks	Mitigation type	Time period for implementation	Compliance with standards
	Groundwater Contamination	Control through: ▪ Groundwater monitoring	▪ Ground water monitoring should be undertaken on a quarterly basis from the start of rehabilitation / maintenance / aftercare until a sustainable situation is reached and after it has been signed off by the authorities	▪ Groundwater Monitoring in accordance with NWA ▪ Subsidence monitoring plan in accordance with the Mine Health and Safety Act of 1996 (MHSA) and MPRDA
	Loss of usable soil as a resource – Disturbance, Erosion, and Compaction as Well as Loss of Land capability, and Land Use	Control through: ▪ Rehabilitation Plan	▪ Erosion control measures should be implemented during the rehabilitation / maintenance / aftercare phase and 2-5 years ▪ Subsidence monitoring plan must be undertaken annually during and after rehabilitation / maintenance / aftercare	▪ Erosion Control Management Plan in accordance with best practise principles ▪ Soil Management in terms of the Chamber of Mines Guidelines for rehabilitation / maintenance / aftercare
	Loss of natural vegetation due to alien invasive species	Control through: ▪ Alien Invasive Management Plan; ▪ Monitoring Programmes	▪ All disturbed areas should be monitored for the establishment of alien plant species for 2-5 years biannually	▪ Alien Invasive Management Plan in accordance with: Alien and Invasive Species Lists, 2014 (GN R599 in GG 37886 of 1 August 2014) of the NEM: BA
	Loss of fauna due to noise and vehicle movement	Avoid through: ▪ Limitation of vehicle movement; Control through: ▪ Noise Monitoring		
	Subsidence	Control through: ▪ Implement monitoring and management of geotechnical study; and ▪ Subsidence monitoring	▪ The geotechnical Investigation should be undertaken prior to the commencement of the rehabilitation / maintenance / aftercare activities	▪ Subsidence Monitoring should be in accordance with the standards proposed by the geotechnical investigation
		Control through: ▪ Implement monitoring and management of geotechnical study; and ▪ Subsidence monitoring		
Maintenance of the Landfill Sites	Loss of natural vegetation due to alien invasive species	Control through: ▪ Alien Invasive Management Plan; ▪ Monitoring Programmes	▪ All disturbed areas should be monitored for the establishment of alien plant species for 2-5 years biannually	▪ Alien Invasive Management Plan in accordance with: Alien and Invasive Species Lists, 2014 (GN R599 in GG 37886 of 1 August 2014) of the NEM: BA
	Loss of fauna due to noise and vehicle movement	Avoid through: ▪ Limitation of vehicle movement; Control through:		

Activities	Potential impacts/Risks	Mitigation type	Time period for implementation	Compliance with standards
		▪ Noise Monitoring		
	Contamination of groundwater from leachates pf PCBs, Asbestos etc.	Control through: ▪ Groundwater Monitoring	▪ Groundwater monitoring should be undertaken on a quarterly basis from the start of rehabilitation / maintenance / aftercare until a sustainable situation is reached and after it has been signed off by the authorities	▪ Groundwater in accordance with NWA
	Loss of usable soil as a resource – Disturbance, Erosion, and Compaction as Well as Loss of Land capability, and Land Use	Control through: ▪ Rehabilitation Plan	▪ Erosion control measures should be implemented during the rehabilitation / maintenance / aftercare phase and 2-5 years ▪ Subsidence monitoring plan must be undertaken annually during and after rehabilitation / maintenance / aftercare	▪ Erosion Control Management Plan in accordance with best practise principles ▪ Soil Management in terms of the Chamber of Mines Guidelines for rehabilitation / maintenance / aftercare
Underground Mine Voids	Rehabilitated Areas: Health and safety risk for all personnel and property from possible subsidence.	Control through: ▪ Geotechnical Specialist Study	▪ The geotechnical Investigation should be undertaken prior to the commencement of the rehabilitation / maintenance / aftercare activities	▪ Subsidence Monitoring should be in accordance with the standards proposed by the geotechnical investigation
	Areas associated with the general public, specifically the mine village, the substation and the N11 road: Health and safety risk for all personnel and property from possible subsidence.			
Treatment of Mine Water – Phytoremediation Plantation	Reduction in the Quantity of Water Available	No Mitigation Measure	▪ Surface Water monitoring should be undertaken on a quarterly basis from the start of rehabilitation / maintenance / aftercare until a sustainable situation is reached and after it has been signed off by the authorities	▪ Surface Water Monitoring in accordance with NWA
	Release of untreated water into the catchment area during high rainfall event	Control through: ▪ Berm establishment		
	Spread of alien plant species that are being planted for Phytoremediation	Control through: ▪ Alien Invasive Management Plan; ▪ Monitoring Programmes	▪ All disturbed areas should be monitored for the establishment of alien plant species for 2-5 years biannually	▪ Alien Invasive Management Plan in accordance with: Alien and Invasive Species Lists, 2014 (GN R599 in GG 37886 of 1 August 2014) of the NEM: BA
	The loss of biodiversity as a result of the removal of fauna species	No Mitigation Measure		
	Site clearance and topsoil removal resulting in	Control through:	▪ Erosion control measures should	▪ Erosion Control Management

Activities	Potential impacts/Risks	Mitigation type	Time period for implementation	Compliance with standards
	sedimentation and effecting sensitive biota	▪ Establish Berms ▪ Vegetation establishment and management	be implemented during the rehabilitation / maintenance / aftercare phase and 2-5 years	Plan in accordance with best practise principles
	Change in the water quality of the aquatic environment	Control through: ▪ Establishment of buffer ▪ Establish Berms ▪ Fertilizer usage must be kept to a minimum	▪ Rehabilitation / maintenance / aftercare Phase	▪ Buffer zones in accordance with: NWA
	The loss of usable soil as a resource as a result of erosion and compaction	Control through: ▪ Rehabilitation Plan; and ▪ Vegetation Establishment	▪ Erosion control measures should be implemented during the rehabilitation / maintenance / aftercare phase and 2-5 years	▪ Erosion Control Management Plan in accordance with best practise principles
	Loss of Wetland Habitat due to the establishment of the Phytoremediation Plantation	No mitigation	No Implementation	No Standards

8 Financial provision

8.1 Determination of the amount of Financial Provision

8.1.1 Describe the closure objectives and the extent to which they have been aligned to the baseline environment described under the Regulation

Eskom proposes to obtain environmental authorisation for the proposed phytoremediation plantation and maintenance/ aftercare of areas that were previously rehabilitated within the project boundaries. Therefore, a closure plan doesn't form part of this application process, and will be handled as a separate process, by Eskom.

8.1.2 Confirm specifically that the environmental objectives in relation to closure have been consulted with landowner and interested and affected parties

As a closure plan does not form part of this BAR process therefore this section is not applicable. However this BAR will be made available for public review for a period of 30 days.

8.1.3 Provide a rehabilitation plan that describes and shows the scale and aerial extent of the main mining activities, including the anticipated mining area at the time of closure

A Rehabilitation Plan has been undertaken and included under Appendix B.

8.1.4 Explain why it can be confirmed that the rehabilitation plan is compatible with the closure objectives

The Rehabilitation Plan has been compiled in support of the primary rehabilitation objectives (Section 4.1 Part B) which are to remove unwanted infrastructure and rehabilitate the land to a suitable mixed end land use which provides a safe and stable environment for surrounding receptors.

8.1.5 Calculate and state the quantum of the financial provision required to manage and rehabilitate the environment in accordance with the applicable guideline

As a closure plan does not form part of this BAR process therefore this section is not applicable.

8.1.6 Confirm that the financial provision will be provided as determined

As a closure plan does not form part of this BAR process therefore this section is not applicable.

9 Monitoring compliance with and performance assessment

Eskom will be responsible for the implementation of all of the monitoring, mitigation and management measures, as well as compliance with the EMP. The recommended monitoring for the identified impacts and risks is detailed below. Eskom will keep a record of all environmental monitoring taken on site. A summary of the environmental monitoring to be undertaken is included in Table 9-6.

9.1 Monitoring of impact management actions

9.1.1 Rehabilitation Monitoring

The purpose of monitoring is to ensure that the objectives of rehabilitation / maintenance / aftercare are met and that the rehabilitation / maintenance / aftercare process is followed. The physical aspects of rehabilitation / maintenance / aftercare should be carefully monitored during the operational phase as well as during the progress of establishment of desired final ecosystems. The following items should be monitored continuously:

- Alignment of actual final topography to agreed planned landform;
- Depth of topsoil stripped and placed;
- Chemical, physical and biological status of replaced soil;
- Erosion status;
- Surface drainage systems and surface water quality;
- Groundwater quality at agreed locations;
- Vegetation basal cover;
- Vegetation species diversity;
- Faunal re-colonisation (Sherman and pitfall trapping); and
- Proportion of land that has been fully rehabilitated.

9.1.1.1 Final Topography

The topography that is achieved during rehabilitation / maintenance / aftercare should be monitored and compared to the planned topography. The final profile achieved should be acceptable in terms of the surface water drainage requirements and the end land use objectives.

9.1.1.2 Erosion

Erosion monitoring of rehabilitated areas should be undertaken and zones with active erosion should be identified.

9.1.1.3 Vegetation

9.1.1.3.1 Basal Cover

Basal cover refers to the proportion of ground at root level which is covered by vegetation and by the rooting portion of the cover plants. The line-transect (or the quadrat bridge) method can be used to establish sampling positions. A target of at least 30% basal cover should be set for fully established vegetation. It is important to note the difference between basal cover and canopy cover, shown in Figure 9-1.

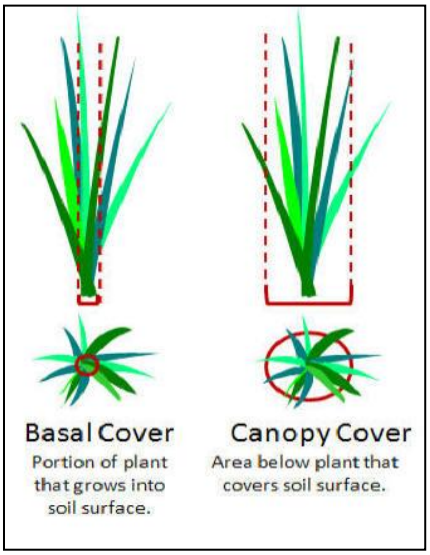

Figure 9-1: Diagram comparing basal cover and canopy cover[8]

9.1.1.3.2 Vegetation Species

Biodiversity assessments and surveys should be undertaken by external experts to establish the full range of plants that have become established. Summer and winter samplings should be done during these assessments.

9.1.1.4 Alien Invasive Plant Control Plan

Alien invasive species tend to out-compete the indigenous vegetation; this is due to the fact that they are vigorous growers that are adaptable and able to invade a wide range of ecological niches (Bromilow, 1995). They are tough, can withstand unfavourable conditions and are easily spread.

9.1.1.4.1 Alien Species Control

Invasive alien plant species are difficult to control. Methods should be used that are appropriate for the species concerned, as well as to the ecosystem in which they occur.

[8] (Image from Principles of Vegetation Measurement and Assessment and Ecological Monitoring & Analysis http://www.webpages.uidaho.edu/veg_measure/index.htm)

When performing the controlling methodology for weeds and invaders, damage to the environment must be limited to a minimum. The methodology must be performed for at least three growing seasons to ensure the seed bank is depleted. Continual monitoring will be needed for seeds that are likely to be blown in from adjacent areas.

9.1.1.4.2 Integrated Control Strategies

The satisfactory control of weeds and other invasive species is usually only achieved when several complementary methods, including biological control, improved land management practices, herbicides and mechanical methods, are carefully integrated. Such a strategy is termed an Integrated Control Strategy (ICS).

Follow-up control of alien plant seedlings, saplings and coppice regrowth is essential to maintain the progress made with initial control work, and to prevent suppression of planted or colonizing grasses. Before starting new control operations on new infestations, all required follow-up control and rehabilitation / maintenance / aftercare work must be completed in areas that are originally prioritized for clearing and rehabilitation / maintenance / aftercare.

9.1.1.4.3 Additional Measures

The following additional measures are recommended to prevent the future introduction or spread of alien species, and to ensure the rehabilitation / maintenance / aftercare of transformed areas:

- There must be no planting of alien plants (e.g. black wattle and pampas grass) anywhere within the project area (except for the phytoremediation areas where specific species will be planted);
- Surveys aimed at updating the alien plant list and establishing and updating the invasive status of each of the alien species, should be carried out (can be done by Kilbarchan Colliery staff);
- The transportation of soils or other substrates that contain alien plant species seed should be carefully controlled;
- Benefits to local communities as a result of the alien plant control programme should be maximised by not only ensuring that local labour is employed and trained, but by also ensuring that cleared alien trees are treated as a valuable wood resource that can be utilised. It must be noted that the sterile *Eucalyptus camaldulensis* trees planted in the Phytoremediation Plan will not be included in this alien plant control programme; and
- It is considered essential that appropriate veld management (particularly appropriate grazing levels and burning frequencies) should be applied to areas of secondary indigenous vegetation (e.g. secondary grassland of historically cultivated areas), and especially the grassland and wetland vegetation of untransformed habitats. Appropriate grazing levels and burning frequencies will not only ensure that good

vegetation condition and biodiversity levels are maintained, but will also serve to control the spread and increase in cover of palatable alien species such as *Paspalum dilatatum*.

9.1.2 Surface Water

Based on the DWS's Best Practice Guidelines (BPG) G3, on water monitoring systems, water monitoring is important.

9.1.2.1 Monitoring Locations

Water monitoring should continue at the existing sites and a few additional sites as listed in Table 9-1.

Table 9-1: Existing Surface Water Sampling Locations (WGS 1984 Datum)

New site name	Historical site name	Description	Longitude	Latitude
KSW01	D1	Decant stream close to N11, east of PCD	29.95994	-27.86091
KSW02	D2	Stream below KPCD, upstream od D4	29.95888	-27.86151
KSW03	D3	Decant, appears at surface and flows into main channel	29.9596	-27.86208
KSW04	HN UP2	River downstream of Ballengeich mine along N11	29.96495	-27.88888
KSW05	KLDS4	Knockbrexspruit at junction in N11, downstream of Kilbarchan and up stream of Roy Point	29.95847	-27.82304
KSW06	KLDS1	Downstream of D1 along N11	29.96277	-27.8622
KSW07	ING-D	Upstream of the Power station	29.97476	-27.84476

The locations of the five additional locations that should be included into the network are listed in Table 9-2.

Table 9-2: Proposed Additional Surface Water Monitoring Points (WGS, 1984 Datum)

Sample ID	Description	Longitude	Latitude
KSW08	Downstream of the Phytoremediation site on Mbazo stream	29.96319155	-27.86402363
KSW09	Ngagane River upstream of confluence with Mbazo stream	29.96883254	-27.85607235
KSW10	Downstream of power station on Ngagane	29.97026646	-27.85515139

Sample ID	Description	Longitude	Latitude
	River		
KSW11	Downstream of the Phytoremediation site on Mbazo stream	29.98225307	-27.83716858

Currently no water discharge is being monitored close to the site. Therefore, water flows should be carried out at appropriate sites along the Mbazo River and the Ngagane River.

9.1.2.2 Sampling Protocols and Quality Control

The water sampling programme must be implemented with strict field Quality Control (QC) measures, including the collection of duplicate samples, correct labelling for the samples and chain of custody documentation from the field to laboratory. Whilst in the field samples should be kept in a cool dark container and dispatched to the laboratory at the earliest opportunity. The chosen laboratory must be accredited.

As part of the overall sampling, QC package chain of custody travel documents need to be completed for each sample. This will allow tracking of the samples from acquisition through to analysis. These forms are enclosed in the sample coolers shipped to the laboratory.

9.1.2.3 Constituents to be analysed

Surface water quality samples should be collected on a quarterly basis whilst surface water monitoring locations must be monitored monthly.

The analytical schedule for inorganic and metal analyses should include the following constituents:

- Alkalinity ($CaCO_3$)
- Hardness ($CaCO_3$)
- TSS
- Ammonia (NH3-N)
- Calcium (Ca)
- Chloride (Cl)
- Conductivity
- NO_2 and NO_3
- pH
- PO_4
- Sodium
- TDS
- Al
- Fe
- Mn
- SO_4
- COD

9.1.2.4 Monitoring Frequency

Monitoring should be implemented throughout the life cycle, more specifically according to the plan detailed in Table 9-3.

Table 9-3 : Water Monitoring Programme

Monitoring Element	Comment	Frequency	Responsibility
Water quality	Ensure that monitoring is implemented to cover all activity areas potential impact areas Water quality parameters that need to be analysed are shown in section 9.1.2.3.	-Monthly during initial years. - This can further be reduced to biannually (wet and dry season). -Monitoring needs to carry on three years after the project has ceased, as is standard practice to detect residual impacts.	Specialist Environmental Quality
Surface Water quantity and water use	Flow monitoring should be carried out in channels and pipelines and at facilities on site.	-Instantaneous where automatic flow meters are in place for real time measurements. -Where there are no automatic flowmeters weekly monitoring needs to be done. -In already rehabilitated areas monitoring can be done monthly and then severe storms are experienced.	Specialist Environmental Quality
Physical structures and SWMP performance	Personnel should walk around facilities to determine the facilities conditions and identify areas of erosion and pooling.	Continuous process and yearly formal report.	Specialist Environmental Quality

9.1.2.5 Reporting and Data Requirements

The water quality results need to be benchmarked against the IWQO set for the Ngagane Catchment in August 2008 by DWS,

Reporting to the DWS should be carried out as stipulated on permits and Licences to be issued. The monitoring programme should be reviews and audited periodically to ensure it remains appropriate.

9.1.3 Groundwater

Groundwater monitoring must occur during rehabilitation / maintenance / aftercare. Borehole monitoring must be undertaken to determine the water level and water quality at the Kilbarchan Colliery. The Willemse Borehole, located at the western end of the project area, far from the rest of the monitoring boreholes provided crucial monitoring information however it has since collapsed and therefore it is recommended that another monitoring borehole is drilled in the same location.

9.1.3.1 Water Level

Groundwater levels must be recorded on a quarterly basis using an electrical contact tape or pressure transducer, to detect any changes or trends in groundwater elevation and flow direction.

9.1.3.2 Sampling Frequency

Groundwater sampling frequency should be undertaken in accordance with the following:

- Groundwater sampling should be conducted quarterly to reflect influences of wet and dry seasons;
- Samples should be collected by a suitably qualified groundwater specialist, using best practice guidelines and should be analysed by a SANAS accredited laboratory;
- The monitoring should continue until a sustainable situation is reached and after it has been signed off by the authorities; and
- The decant rate and quality is recommended to be monitored monthly.

9.1.3.3 Parameters to be Monitored

At coal mining facilities, analyses of the following constituents are recommended:

- Macro Analysis i.e. Ca, Mg, Na, K, SO_4, NO_3, F, Cl;
- Major and trace metals, including Al, Fe, and Mn;
- pH and Alkalinity; and
- TDS and EC.

9.1.3.4 Data Storage

Data capture and storage is important as it provides hydrogeological with accurate information so that informed short and long term plans regarding groundwater can be made. Groundwater contamination detection and minimisation can only be controlled when all good, relevant and timely groundwater data is analysed.

The generation and collection of this data is very expensive as it requires intensive hydrogeological investigations and therefore the data has to be managed in a centralised database if funds are to be used in the most efficient way. Digby Wells has compiled a WISH-based database during the course of this investigation and it is highly recommended that the client utilise this database and continuously update and manage it as new data becomes available.

9.1.4 Fauna and Flora

All disturbed areas should be monitored biannually for the establishment of alien plant species for a period of two to five years.

All alien plants excluding *Eucalyptus* should be removed as soon as possible and should be controlled according to measures in Table 9-4

Table 9-4: Alien Plant Control

Species	Control
Tamarix ramosissima	This species re-sprouts vigorously after being cut down and is also fire-resistant. Hand-pulling is effective.
Eucalyptus camuldulensis	The spread of *Eucalyptus camuldulensis* must be monitored and controlled. Mechanical control for juveniles in the form of hand-pulling. Adults can be cut to stumps and treated with a herbicide: Clopyralid / triclopyr (-amine salt) 90 / 270 g/L SL.

9.1.5 Aquatics

It is recommended that the first aquatic biomonitoring survey is undertaken prior to any rehabilitation / maintenance / aftercare or phytoremediation action being undertaken to set a baseline as the initial baseline data was collected in 2014. Proposed standards for biomonitoring are outlined below in Table 9-5. The impact assessment sites are suitable for biomonitoring. Biannual surveys should be conducted, one in the wet season (November to April) and one dry season (May to October).

Table 9-5: Key performance indicators, thresholds and targets for the monitoring programme

Key Performance Indicator		Threshold of Concern	Target
Macroinvertebrates	SASS5	-25%	No significant changes from baseline conditions
	ASPT	-25%	No significant

Key Performance Indicator		Threshold of Concern	Target
			differences between upstream and downstream regions
	MIRAI	A decrease in class.	MIRAI classes should be maintained as per the respective sites.
Fish	*Barbus anoplus,* *Pseudocrenulabris philander* *Tilapia sparrmanii*	Absence of any of these species within the Ingagane River	All sites
Vegetation	Woody and non-woody vegetation cover	Decrease in VEGRAI class or decrease in cover of 15 %	Maintenance of current vegetation cover as well as VEGRAI scores within class C/D.

9.1.6 Wetland

9.1.6.1 Phytoremediation

A wetland management plan should be implemented whereby a qualified wetland ecologist will monitor the directly impacted areas as well as areas outside of the footprint and downstream of the Ingagane River to monitor the following.

9.1.7 Soil, Land Use and Land Capability

The soils monitoring plan guidelines should be put in place to ensure the best chances of rehabilitative success from a soils perspective.

Progressive monitoring must take place on at least a quarterly basis and should involve the following:

- Inspection of soil surfaces before replacing soil to ensure that contouring is appropriate and has been done properly topography is emulated;
- Random inspection of soil thickness on rehabilitated sections;
- Fertility analysis and amelioration procedures prior to re-vegetation; and
- Evaluating and readjusting the rehabilitation plan.

A final post-mining rehabilitation performance assessment must be completed. This involves:

- Assessment of rehabilitated soil thickness and soil characteristics by means of auger observations using a detailed grid;

- A post-mining land capability map based on soil thickness and characteristics;
- A proposed post-mining land use map;
- Erosion occurrences;
- Soil acidity and salt pollution analyses (pH, electrical conductivity and sulfate) at 0 mm - 250 mm soil depth every 4 ha (200 m x 200 m);
- Fertility analysis (exchangeable cations K, Ca, Mg and Na and phosphorus) every 16 ha (400 m x 400 m); and

9.2 Monitoring and reporting frequency

Table 9-6 discusses the monitoring and reporting frequency.

9.3 Responsible persons

Table 9-6 sets out roles and responsibilities with respecting to the monitoring programme.

9.4 Time period for implementing impact management actions

Table 9-6 captures the time period for implementing impact management actions.

9.5 Mechanism for monitoring compliance

Table 9-6 sets out the method of monitoring the implementation of the impact management actions, the frequency of monitoring the implementation of the impact management actions, an indication of the persons who will be responsible for the implementation of the impact management actions, the time periods within which the impact management actions must be implemented and the mechanism for monitoring compliance with the identified impact management actions.

Table 9-6: Monitoring and Management of Environmental Impacts

Source Activity	Impacts requiring monitoring programmes	Functional requirements for monitoring	Roles and responsibilities (For the execution of the monitoring programmes)	Monitoring and reporting frequency and time periods for implementing impact management actions
All rehabilitation / maintenance / aftercare activities including the Phytoremediation Plantation	Contamination of Surface Water	▪ The following constituents must be tested for: ▪ $CaCO_3$ (Alkalinity and Hardness), TSS, NH_3-N, Ca, Cl, Conductivity, NO_2, NO_3, pH, PO_4, Sodium, TDS, Al, Fe, Mn, SO_4 and COD; ▪ Water monitoring should continue at the prescribed borehole locations and 4 additional boreholes; ▪ Water quality to be monitored monthly for the first year and reduced to biannually thereafter for an additionally three years; ▪ Continuous monitoring of stormwater infrastructure to ensure optimal working condition is established; and ▪ Flowmeters should be installed to monitor water quantity, if not automatic should be monitored weekly until rehabilitation / maintenance / aftercare has been completed, once completed monthly monitoring and after server storms is considered acceptable.	▪ Independent surface water consultant; ▪ Environmental Manager; ▪ Environmental Control Officer	Surface water quality monitoring must take place from the onset of the rehabilitation / maintenance / aftercare Phase for a year and reduced to biannually thereafter for an additionally three years. Surface Water Quantity monitoring Sampling must be undertaken on a weekly basis during the rehabilitation / maintenance / aftercare, once completed monthly monitoring and after server storms is considered acceptable. All sampling results must be recorded to track potential quality changes or deterioration.

	Contamination of Groundwater	▪ Groundwater levels must be recorded on a quarterly basis using an electrical contact tape or pressure transducer;
		▪ Groundwater sampling should be conducted quarterly;
		▪ The following constituents must be tested for:
		  ▪ Macro Analysis i.e. Ca, Mg, Na, K, SO4, NO3, F, Cl;
		  ▪ Major and trace metals, including Al, Fe, and Mn;
		  ▪ pH and Alkalinity; and
		  ▪ TDS and EC.
		▪ The decant rate and quality is recommended to be monitored monthly.
			▪ Independent groundwater consultant and analysed by a SANAS accredited laboratory;
			▪ Environmental Manager;
			▪ Environmental Control Officer
				Groundwater monitoring should take place from the onset of the rehabilitation / maintenance / aftercare activities until a sustainable situation is reached and after it has been signed off by the authorities. Groundwater levels and quality must be monitored on a quarterly basis while the rate of decant must be monitored monthly, once decant has been reduced to an acceptable level sampling can be reduced to a quarterly basis.
				All sampling results must be recorded to track potential quality changes or deterioration. The samples must be taken by an independent groundwater consultant and analysed by a SANAS accredited laboratory.

	Loss of biodiversity	▪ All disturbed areas should be monitored for the establishment of alien plant species for 2-5 years biannually; ▪ The area surrounding the phytoremediation footprint area should be monitored biannually for 2-5 years and then annually until no alien establishment has been documented for two consecutive years	▪ Environmental Manager; ▪ Environmental Control Officer	Monitoring for alien invasive vegetation must take place and managed according to the NEM: BA requirements on a biannual basis and especially during the wet season for 2-5 years. The Phytoremediation Plantation must be monitored on a biannual basis for 2-5 years and then annually for an additional two years. Results of the monitoring must be recorded and compared to previous years' results to keep track of the populations of the faunal and floral species and ensure no spread of alien invasive tress species occur.
	Loss of Wetlands	▪ A wetland management plan should be implemented whereby a qualified wetland ecologist will monitor the directly affected areas and areas downstream of the Ingagane River during	▪ Wetland Ecologist; ▪ Environmental Manager; and	A wetland management plan must be implemented and monitored on a weekly basis during the initiation phase and on a monthly basis during the rehabilitation / maintenance /

Source Activity	Impacts requiring monitoring programmes	Functional requirements for monitoring	Roles and responsibilities (For the execution of the monitoring programmes)	Monitoring and reporting frequency and time periods for implementing impact management actions
		initiation phase on a weekly basis; and ▪ A wetland management plan will monitor the directly affected areas and areas downstream of the Ingagane River on a monthly basis during and until rehabilitation / maintenance / aftercare works are completed	▪ Environmental Control Officer.	aftercare of the project until the project is completed. Monitoring should be undertaken by a qualified wetland ecologist. The results must be recorded to ensure no degradation occurs to the surrounding wetland environments and the catchment area.

	Loss of soil resources and land capability	▪ Rehabilitation / maintenance / aftercare Phase – Undertaken on a Quarterly Basis
		  ▪ Inspection of soil surfaces before replacing soil to ensure that contouring is appropriate and has been done properly topography is emulated;
		  ▪ Random inspection of soil thickness on rehabilitated sections;
		  ▪ Fertility analysis and amelioration procedures prior to re-vegetation; and
		  ▪ Evaluating and readjusting the rehabilitation plan.
		▪ Final Post-mining rehabilitation performance assessment:
		  ▪ Assessment of rehabilitated soil thickness and soil characteristics by means of auger observations using a detailed grid;
		  ▪ A post-mining land capability map based on soil thickness and characteristics;
		  ▪ A proposed post-mining land use map;
		  ▪ Erosion occurrences;
		  ▪ Soil acidity and salt pollution analyses (pH, electrical conductivity and sulfate) at 0-250 mm soil depth every 4 ha (200m x 200m); and
		  ▪ Fertility analysis (exchangeable cations K, Ca, Mg and Na and phosphorus) every 16 ha (400x400m).
			▪ Mine Manager
			▪ Environmental Manager;
			▪ Environmental Control Officer
			▪ Soil Specialist.
				The rehabilitation / maintenance / aftercare activities must be monitored on a quarterly basis and random samples selected for to test for soil thickness. The land must be shaped to ensure that contouring is appropriate and sampled and remediation techniques implemented, if necessary, prior to vegetation establishment. A fertility analysis and amelioration procedure must be undertaken prior to re-vegetation
				A final Post-mining rehabilitation performance assessment must be undertaken.

10 Indicate the frequency of the submission of the performance assessment/ environmental audit report

A performance assessment report for the Kilbarchan Colliery will be submitted on an annual basis to the DMR during rehabilitation / maintenance / aftercare phase.

11 Environmental awareness plan

11.1 Manner in which the applicant intends to inform his or her employees of any environmental risk which may result from their work

Eskom has developed Environmental, Health and Safety Policies. The Environmental Policy will be communicated to all personnel, whether they are contractors or permanent staff, and the policy will be erected at each active mining site.

Employees will receive general environmental awareness training on specific items contained in this EMP, as well as on Best Possible Environmental Practices (BPEP).

11.1.1 Specific environmental training

Environmental Awareness Training will be undertaken to make employees and contractors aware of the following:

- The importance of conforming with the environmental policy and procedures and with the requirements of the EMP;
- The significant social and environmental impacts of their work activities and the environmental benefits of improved personal performance;
- Their roles and responsibilities in achieving conformance with the environmental policy and procedures and with the requirements of the environmental management system;
- The potential consequences of departure from specified operating procedures; and
- Possible archaeological finds action steps for mitigation measures, surface collections, excavations and communication routes to follow in the case of a discovery.

The guidelines for training are summarised below, which are in line with the ISO 14001:2004 guidelines with regards to training and awareness creation.

Table 11-1: Training Guidelines

Types of Training	Audience	Purpose
Raising awareness of the strategic importance of environmental management	Senior management	To gain commitment and alignment to the organisation's environmental policy.
Raising general environmental awareness	All employees	To gain commitment to the environmental policy and objectives and to instil a sense of individual responsibility.
Skill enhancement	Employees with environmental responsibilities	To improve performance in specific tasks.
Compliance	Employees whose actions can affect compliance	To ensure that regulatory and internal requirements for training are met.

The training programme will consist of the following elements:

- Identification of employee training needs;
- Development of a training plan to address defined needs;
- Verification of conformance of the training programme to regulatory or organisation requirements and standards;
- Training of target employee groups;
- Documentation of training received; and
- Evaluation of training received.

This training is undertaken on an annual basis for all personnel, together with the annual required induction programmes. The training material provided will be subject to annual review, based on issues such as incidents, accidents, new legislative requirements, modified processes and environmental and social aspects identified from time to time. This training is to be carried out and coordinated internally by Eskom.

Eskom will, therefore, develop the capabilities and support mechanisms necessary to achieve its environmental policy, objectives and targets.

In addition, an Emergency Preparedness Plan will be communicated and trained to all site personnel during the induction process.

11.2 Manner in which risks will be dealt with to avoid pollution or the degradation of the environment

An Emergency Response Plan has been developed and is the approach used by Eskom to respond to risks that may pollute or degrade the environment during the operational phase.

The unplanned events that may happen at the project site and the proposed mitigation plan are listed in Table 11-2.

Table 11-2: Unplanned events, risks and their management measures

Unplanned event	Mitigation / Management / Monitoring
Hydrocarbon spills from vehicles, heavy machinery and workshop areas.	▪ Hydrocarbons and hazardous substances must be stored in bunded areas and refuelling should take place in contained areas; ▪ Ensure that the bunded areas can contain 110% of the largest container and are constructed according the necessary SANS standards; ▪ Ensure that oil traps are well maintained; and ▪ Vehicles and heavy machinery should be serviced and checked on a regularly basis to prevent leakages and spills.
Spills form hazardous materials or waste storage facilities.	▪ Implementation of storm water management system around hazardous materials or waste storage facilities to contain spills; ▪ Provide sufficient capacities for the storage of waste; ▪ Ensure that an agreement is in place with a suitable qualified service provider to remove the waste on a regular bases; and ▪ All hazardous waste should be removed by a suitably qualified service provider and disposed of to an approved permitted landfill site.

12 Specific information required by the Competent Authority

Eskom proposes to obtain environmental authorisation for the proposed phytoremediation plantation and maintenance/ aftercare of areas that were previously rehabilitated within the project boundaries. Therefore, a closure plan does not form part of this application process, and will be handled as a separate process, by Eskom.

13 Undertaking

The EAP herewith confirms:-

- the correctness of the information provided in the reports
- the inclusion of comments and inputs from stakeholders and I&APs ;
- the inclusion of inputs and recommendations from the specialist reports where relevant; and
- the acceptability of the project in relation to the finding of the assessment and level of mitigation proposed.

Signature of the Environmental Assessment Practitioner:	
Name of Company:	
Date:	

Appendix A: Plans

Appendix B: Rehabilitation Plan

Appendix C: CV and Proof of Qualifications

Appendix D: Phytoremediation Report

Appendix E: Public Participation Process

Appendix E 1: Stakeholder Database

Appendix E 2: Background Information Document

Appendix E 3: Advert

Appendix E 4: Site Notice

Appendix F: Heritage Basic Assessment and Notice of Intent to Develop