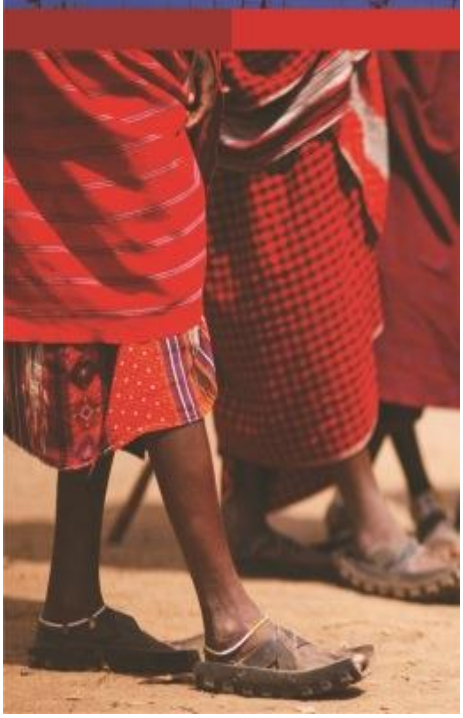

DIGBY WELLS
ENVIRONMENTAL

Exxaro Coal Pty (Ltd) Grootegeluk Short-Term Stockpiles Amendment Project

Rehabilitation Report

Project Number:

EXX3666

Prepared for:

Exxaro Coal (Pty) Ltd (Grootegeluk)

June 2016

Digby Wells & Associates (Pty) Ltd. Co. Reg. No. 1999/005985/07. Turnberry Office Park, 48 Grosvenor Road, Bryanston, 2191. Private Bag X10046, Randburg, 2125, South Africa
Tel: +27 11 789 9495, Fax: +27 11 789 9498, info@digbywells.com, www.digbywells.com

This document has been prepared by Digby Wells Environmental.

Report Type:	**Rehabilitation Report and Closure Cost Assessment**
Project Name:	**Exxaro Coal Pty (Ltd) Grootegeluk Short-Term Stockpiles Amendment Project**
Project Code:	**EXX3666**

Name	Responsibility	Signature	Date
Kathryn Roy	Report Compiler		April 2016
Brett Coutts	Report Reviewer		May 2016
Renee van Aardt	Report Reviewer		June 2016

EXECUTIVE SUMMARY

Digby Wells Environmental (hereafter Digby Wells) was appointed by Exxaro (Pty) Ltd (Exxaro), Grootegeluk Coal Mine (hereafter Grootegeluk) to amend the environmental authorisations for the Grootegeluk Infrastructure Expansion Project in 2014. The permitting documents were submitted to Limpopo Department of Economic Development, Environment and Tourism (LEDET) and Department of Mineral Resources (DMR).Exxaro were granted an Environmental Authorisation in October 2014 and August 2015.

The approved uses of the stockpile areas will need to be changed also to utilise the laydown Area, GG10B, and multiproduct stockyard footprints to stock excess Eskom-grade coal only (in the form of a compacted coal stockpile), for an approximate period of five years, until Medupi station is fully operational. These changes will also include the extension of the GG10B Stockyard footprint by approximately 12.8 hectares (ha) by including the current D8 rail loop area, which will be decommissioned with the construction of the new loadout area, also referred to as the extension area.

The proposed changes will require authorisation in terms of Regulation 31 of the National Environmental Management Act (NEMA), as well as a Section 21(g) Authorisation in terms of the National Water Act, 1998 (Act No 36 of 1998).

Digby Wells has been appointed by Exxaro's to compile an addendum rehabilitation plan (the original plan was undertaken by Golder and Associates (2013)) for the proposed extension of the GG10B Stockyard footprint within the internal area of the discontinued rail loop for the Grootegeluk Coal Mine located near Lephalale, Limpopo Province. This report addresses the aspects particular to the change in coal stockpiling area. This rehabilitation plan needs to be read in conjunction with the Golder Rehabilitation Plan (2013) and Digby Wells Rehabilitation Plan (2014) that was originally submitted with the Grootegeluk Infrastructure Expansion Project in 2014.

The actions contained within this report are to be implemented in conjunction with those contained within the existing Grootegeluk Coal Mine Rehabilitation Plans (Golder and Associates, 2013; Digby Wells, 2014). The rehabilitation actions for the coal stockpiling areas at the Grootegeluk Coal Mine involve:

- Land preparation;
- Vegetation conservation;
- Soil preparation;
- Closure actions; and
- Monitoring and maintenance.

The financial provision estimate was calculated using Digby Wells Matrix Model which is based on first principals. The battery limits of the financial provision calculation were set to only include expansion areas not previously provided for existing Grootegeluk financial

provisions. The only area currently not provided for, is the extension area inside the rail loop. This chapter describes the methodology used in calculating the financial provision and a summary breakdown of the provision estimate.

The 2016 financial provision estimate was calculated by means of the DMR standard method for assessment of mine closure for the end of life of mine. The cost for rehabilitation and closure of the extension area is R4 955 974.90 (Incl. VAT).

Mine rehabilitation must be considered as an on-going process aimed at restoring the physical, chemical and biological quality or potential of air, land and water regimes disturbed by mining to a state acceptable to the regulators and to post mining land users (Whitehorse Mining Initiative, 1994).

The overall objective of the rehabilitation plan is to ensure activities associated with the coal stockpiling area and associated infrastructure will be designed to prevent, minimise or mitigate adverse long-term environmental and social impacts and create a self-sustaining ecosystem.

With respect to what has been recommended in the rehabilitation plan, no major long term post closure liabilities are expected if rehabilitation is undertaken in the appropriate manner and the correct management of soil resources and re-vegetation procedures are implemented.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 Introduction

Digby Wells Environmental (hereafter Digby Wells) was appointed by Exxaro, Grootegeluk Coal Mine (hereafter Grootegeluk) to amend the environmental authorisations for the Grootegeluk Infrastructure Expansion Project in 2014. The permitting documents were submitted to Limpopo Department of Economic Development, Environment and Tourism (LEDET) and Department of Mineral Resources (DMR). Exxaro were granted an Environmental Authorisation in October 2014 and August 2015.

The approved uses of the stockpile areas will need to be changed to also utilise the laydown Area, GG10B, and multiproduct stockyard footprints to stock excess Eskom-grade coal only (in the form of a compacted coal stockpile), for an approximate period of five years, until Medupi station is fully operational. These changes will also include the extension of the GG10B Stockyard footprint by approximately 12.8 hectares (ha) by including the current D8 rail loop area, which will be decommissioned with the construction of the new loadout area, also referred to as the extension area (refer Figure 2-1).

The proposed changes will require authorisation in terms of Regulation 31 of the National Environmental Management Act (NEMA), as well as a Section 21(g) Authorisation in terms of the National Water Act, 1998 (Act No 36 of 1998).

The Grootegeluk operations consist of open pit mining, several plants supplied by extensive stockpiles and tailing storage facilities and discard dump. The site is operational and most of the proposed infrastructure will be in current mining / disturbed areas.

2 Project Description

Exxaro owns multiple mining operations, including Grootegeluk Coal Mine (hereafter Grootegeluk), which has been in operation since 1982 in the Limpopo Province. Grootegeluk is located approximately 20 km outside of Lephalale and is contracted to supply coal to Eskom's Matimba power station and the Medupi power station. Due to delays in the start-up of Medupi off-take of Eskom coal has slowed and Exxaro requires additional stockpiling space to accommodate the excess coal on site.

Exxaro applied to expand certain infrastructure within the mine boundary area, referred to as the Grootegeluk Coal Mine Infrastructure Expansion Project. Exxaro submitted Applications in terms of the National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998) and Minerals and Petroleum Resources Development Act (MPRDA), 2002 (Act No. 28 of 2002) to include the following activities / expansions within the mine boundary:

- Expansion of the rail loop, load out stations and associated infrastructure;
- Expansion of the existing coal stockyard and stockpiles;
- Expansion of the fuel storage depot;
- Expansion of beneficiation plants and associated infrastructure;
- New road and conveyors to fines recovery area;

- New gate and hard park area; and
- Expansion of ancillary infrastructure and new 33 kV power line.

The aforementioned 2014 amendment was also associated with the expansion of the existing coal product stockpiles. The following stockpiles and stockyards were included in the applications and approved:

- GG 6/2 stockyard;
- GG 10 stockyards;
  - Conical Stock pile;
  - Stockyard A and
  - Stockyard B;
- Multi-product overflow stockyard

The Grootegeluk Coal Mine Infrastructure Expansion Project was authorised in terms of the NEMA and the Environmental Impact Assessment Regulations of 2010[1], (which have been repealed). The Limpopo Department of Economic Development, Environment and Tourism (LEDET), and the Record of Decision are dated 27 October 2014, with reference number 12/1/9/1-W89 (refer to Figure 2-1). The Department of Mineral Resources (DMR) Environmental Management Programme (EMP) Amendment approval was granted on the 28 August 2015.

Exxaro proposed a phased authorisation approach for the amendments that are being requested. Exxaro proposes to amend the existing Authorisation relevant to the Grootegeluk Mine Infrastructure Expansion Project (which included the expansion of the GG10 Stockyards and several other stockpile areas).

The purpose of these amendments is to allow Exxaro to legally stockpile Eskom-grade coal currently being mined from the upper coal benches at the Grootegeluk Mine. In summary the two phases included the following:

- Phase 1: Amendment of the GG10A stockyard for temporary use - The amendment of the GG10A stockyard area with the capacity of 400,000m^3 to include the alternative of a temporary 2 Mt compacted Power Station Coal Stockpile in the same footprint area.
- Phase 2: Amend the GG10B stockyard area - The amendment of the GG10B stockyard to include the additional area inside the loop not originally included. To also amend the use of the multi-product overflow stockpiles to stacking and loading areas. The additional 1.1mil stockpiles area in the footprint of the original Coke and Co-gen area will need to be included as an additional area.

[1] Dated 18 June 2010

Further to what has been noted above regarding the requested amendment, Exxaro received approval from Department of Water Affairs (DWS) and DMR for Phase 1 of the project on the 5th May 2016 and 7th July 2016 respectively. This part of the project and associated specialist studies conducted is in support of the Phase 2 amendment that is being requested for in terms Section 31 of the 2014 NEMA Regulations applies as this is an amendment to an existing Environmental Authorisation. Thus the information contained within this specialist report is specific to the Phase 2 amendment process, however does make reference to Phase 1 with respect to the areas assessed.

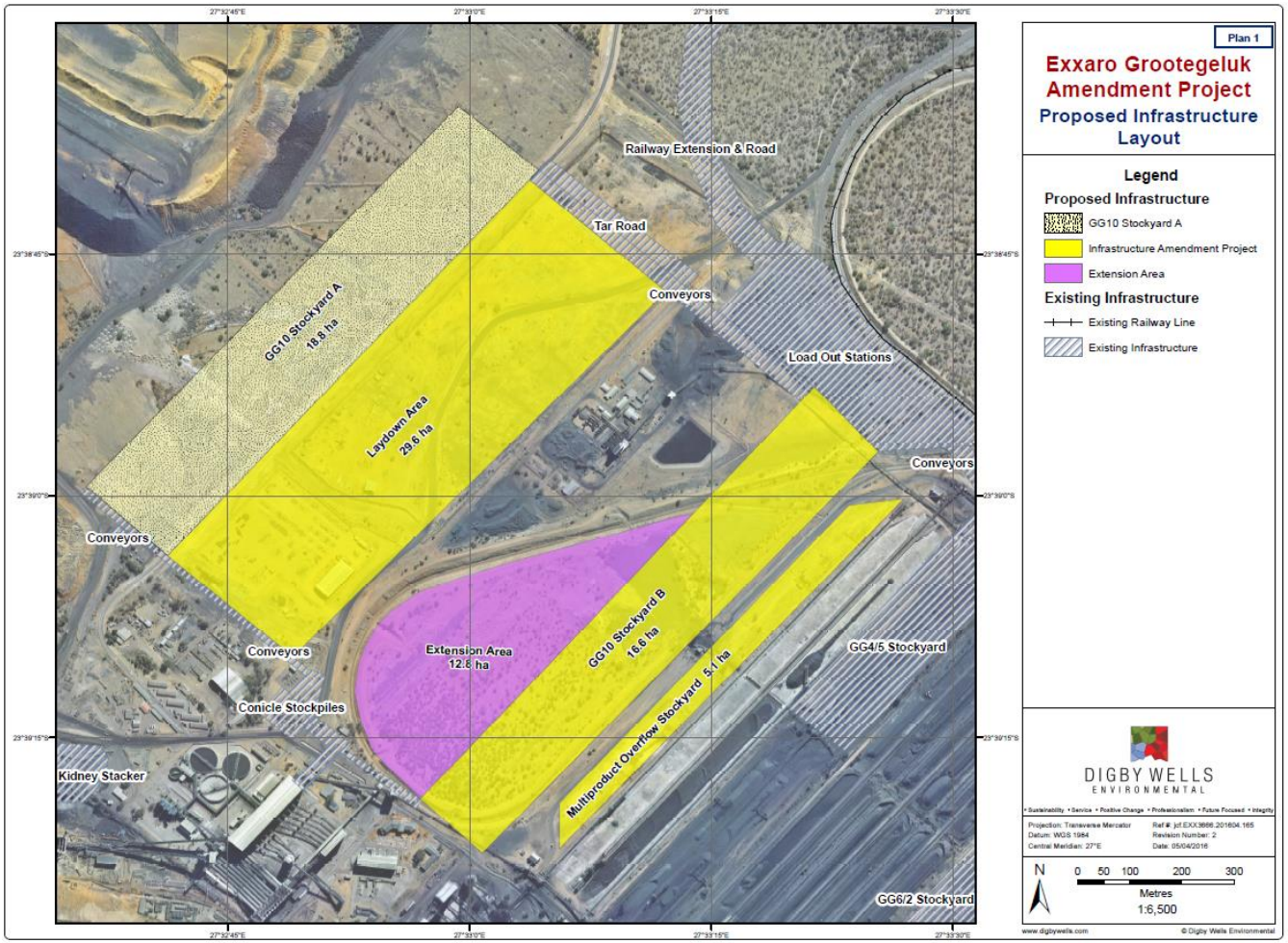

Figure 2-1 Site layout

The purpose of this Project is to utilise the laydown area, GG10B, and Multiproduct Stockyard footprints to stock excess Eskom-grade coal for an approximate period of five years, until Medupi power station is fully operational. This project also includes the extension of the GG10B Stockyard footprint by approximately 12.8 ha by including the current D8 rail loop area, which will be decommissioned with the construction of the new loadout area, also referred to as the extension area(approximate extent shown in purple). The assumed grade of coal to be placed on this proposed consolidated stockpile area has been classified as Type 3 waste, requiring a Class C liner or equivalent liner system. It is assumed the amount of coal to be stockpiled in this area will total six megatons. It must be noted that the liner requirements for Phase 1 and Phase 2 will differ and is based on the waste classification that was undertaken.

The proposed changes will require authorisation in terms of Regulation 31 of the NEMA, as well as a Section 21(g) Authorisation in terms of the National Water Act, 1998 (Act No 36 of 1998).

3 Legislation

Relevant legislation governing mine rehabilitation, closure cost assessment (closure provision), and closure planning is described in National Environmental Management Act, as Amended (NEMA). Section S24(R)(3) of the NEMA now deals with Mine Closure. This Section states that every holder, holder of an old order right or owner of works must plan, manage and implement such procedures and requirements in respect of the closure of a mine as may be prescribed. In support of this is Regulation GN R 982, which provides information associated with what a closure and rehabilitation plan must contain.

There are several guideline documents which provide recommendations on how rehabilitation and closure should be undertaken. For the purpose of the plan the following guideline documents was considered:

- Guidelines for the Rehabilitation of Mined Land. Chamber of Mine of South Africa/ Coaltech. November 2007;
- Surface Strip Coal Mining Handbook. South African Colliery Managers Association, Project SACMA 01/03. Compiled by R J Thompson, 2005; and
- Best Practice Guidelines (BPGs) series developed by the Department of Water Affairs (DWA).

In addition to the abovementioned guideline documents, further regulations must be considered pertaining to closure and rehabilitation. These are as follows:

- Mineral and Petroleum Resources Development Act (Act 28 of 2002): Mineral and Petroleum Resources Development Regulations (2004);
- International Finance Corporation (IFC) Environmental, Health and Safety (EHS) guidelines;

- Mineral and Petroleum Resources Development Act (Act 28 of 2002);
- Mineral and Petroleum Resources Development Act Amendment Bill of 2007;
- Constitution of the Republic of South Africa Act, 1996 (Act 108 of 1996);
- National Environmental Management Act (Act 107 of 1998), as amended;
- National Water Act (Act 36 of 1998);
- National Environmental Management: Waste Act 2008 (Act No. 59 of 2008), as amended;
- Mine Health and Safety Act (Act 29 of 1996);
- National Environmental Management: Air Quality Act (Act 39 of 2004);
- National Heritage Resources Act (Act 25 of 1999); and
- Conservation Agricultural Resources Act (Act 43 of 1983).

The financial provision estimate was developed in line with these requirements.

The proposed Project should also take cognisance of the regulations pertaining to the financial provision for the rehabilitation and management of negative environmental impacts associated with prospecting, exploration, mining and production operations which came into effect on 20 November 2015 (GN R1147).

The Regulations, which apply to a holder under the MPRDA, regulates the “method for determining and making financial provision for the costs associated with the management of environmental impacts” caused by mining activities and operations.

The Regulations require holders to make financial provision for:

- Annual rehabilitation;
- Final rehabilitation, decommissioning and closure at the end of the life of a mine; and
- Remediation and management of latent or residual environmental impacts, which may become known in the future. This includes the pumping and treatment of polluted or extraneous water.

4 Methodology and Terms of Reference

4.1 Terms of Reference

Digby Wells has been appointed by Exxaro’s to compile an addendum rehabilitation plan (the original plan was undertaken by Golder and Associates (2013)) for the proposed extension of the GG10B Stockyard footprint within the internal area of the discontinued rail loop for the Grootegeluk Coal Mine located near Lephalale, Limpopo Province. This report addresses the aspects particular to the new coal stockpiling area. This rehabilitation plan needs to be read in conjunction with the Golder Rehabilitation Plan (2013) and Digby Wells Rehabilitation Plan (2014).

4.2 Assumptions

- This rehabilitation plan is an addendum to the existing rehabilitation plans compiled by Golder (2013) and Digby Wells (2014) and should be read as such;
- It is assumed that the rehabilitation plan will be based on the final end land use, as prescribed in the EIA/EMP and the existing rehabilitation plans compiled by Golder (2013) and Digby Wells (2014);
- The storm water management plan, designed as a component of the EMP, will take into consideration rehabilitation. Storm water management will therefore not be included in the rehabilitation plan. The same principals regarding storm water management as contained in the Golder Rehabilitation Plan (2013) should also be implemented;
- It is assumed that once the temporary stockpiling of coal is complete the area will be cleaned and prepared for the construction of the authorised coal stockyard as documented in the 2014 authorisation. In the event that does not take place this plan contains information associated to how the area should be rehabilitated; and
- The Rehabilitation Plan should be revised and updated annually to take into account further developments.

5 Expertise of Specialists

The following is a list of the Digby Wells' staff that were involved in the update of rehabilitation assessment study and compilation of the action plan for the Grootegeluk Coal Mine

- **Kathryn Roy:** Rehabilitation Specialist; received a Bachelor of Science in Ecology and Environmental Science and an Honours degree in Environmental Management from the University of Cape Town. She also has received her MSc in Restoration Ecology through the University of KwaZulu-Natal. Kathryn’s roles and responsibilities include compiling rehabilitation plans and strategies, costing for financial provision and conducting field work.
- **Brett Coutts:** Rehabilitation Unit Manager; received a Bachelor of Science and Honours degree in Zoology and Environmental Science from the University of Witwatersrand. Brett assists with the management and co-ordination of all relevant studies related to rehabilitation. This includes the compilation of rehabilitation plans and undertaking of rehabilitation assessments. In addition to this, Brett assists within the Biophysical Department with the management of specialist studies that are undertaken by the department and is also responsible for the compilation of the Geographic Information System (GIS) component of Biodiversity Land Management Plans (BLMP) and undertaking ecological assessments. He previously worked for a Hydromulch, a company that specialises in vegetation rehabilitation.

- **Renee van Aardt:** Divisional Manager: Mine Closure and Rehabilitation and compiled the financial provision estimate. Renée's specialization is compilation of practical mine closure plans and development closure liability assessments throughout the mine life cycle. Renée has extensive expertise in rehabilitation and several years' experience in the implementation of closure plans as well as negotiating closure criteria and financial provisions.

6 Rehabilitation Actions

The actions contained within this section are to be implemented in conjunction with those contained within the existing Grootegeluk Coal Mine Rehabilitation Plans (Golder and Associates, 2013; Digby Wells, 2014). The rehabilitation actions for the coal stockpiling areas at the Grootegeluk Coal Mine involve:

- Land preparation;
- Vegetation conservation;
- Soil preparation;
- Closure actions; and
- Monitoring and maintenance.

6.1 Land Preparation

The aim of land preparation is to ensure that the area impacted by the coal stockpiling facilities is kept to an absolute minimum. All infrastructure and mining activities need to be designed with closure in mind. Sensitive areas should be demarcated as no-go areas and managed appropriately. Topsoil stockpile areas are also to be demarcated as no-go areas.

6.2 Vegetation Conservation

Vegetation will be removed with ground clearance and the trees impacted will be removed to and areas where they can either be disposed of or stored for future donation to surrounding communities. It is also suggested that some of the vegetation that is stripped be stored with the stripped topsoil to preserve the organic content of the soil. Protected trees will need to be removed according to the Protected Tree Permit issued by Department of Agricultural, Forestry and Fisheries (DAFF).

6.3 Soil Preparation

The Grootegeluk Coal Mine landscape is dominated by a relatively flat topography. The soil was weathered *in situ* from sandstone parent material and the majority of soils found in the landscape are therefore red and yellow apedal sandy soils. The soil types present are homogeneous in nature. Therefore care must be taken during the reclamation process to prevent compaction and to replace soil volumes back to a level that are representative of the pre-mining soil and land capability whilst also emulating the pre-mining landscape.

The natural fertility and water holding capacity is low due to the low clay content and very sandy nature of the soil. The sandy, and mostly deep soils are of low agricultural potential due to the low rainfall and high evaporation demand in the region**.**

The A-horizon is especially important because it is considered to be the most microbiologically active part of the soil where most plant roots are established. Microbes convert organic material into plant nutrients and nutrients into different plant available ionic species through cycles (e.g. carbon cycle, nitrogen cycle, sulphur cycle). Disturbing the equilibrium by removing soil horizons through opencast mining or other excavation activities influence all soil physical and chemical properties.

Normally topsoil and subsoil should be stockpiled separately at all times because topsoil contains more nutrients and microbes than subsoil. Allowing subsoil to contaminate topsoil dilutes the nutrient and organic matter content causing soil infertility. Infertility imbalances then have to be reclaimed by using costly fertilizers. However, in the case of Grootegeluk Coal Mine, the topsoil and subsoil can be stripped and stockpiled together due to the low inherent fertility status and low clay content of the dominating soils present within the project sites. In terms of stripping, topsoil will be stripped to a minimum of 300 mm down to a maximum of 1.5 m and will be stockpiled together. Anything deeper that may be required to be stripped (deeper than 1.5 m) will be removed and stockpiled separately from the initial stripping that will be undertaken.

More important than chemical imbalances which can be easily restored at cost, is soil compaction and volumes of replacement during soil reclamation. Heavy mining equipment is used during soil reclamation and soil is compacted beyond agricultural reclamation leaving behind areas of low soil and land capabilities. Such areas have limited land use options and specialized management needs.

Post mining soil reclamation is very difficult or near impossible if the stockpiled topsoil materials are of inferior quality due to mismanagement during storage. Good quantity and quality topsoil is an essential ingredient in the process of soil reclamation. Factors leading to decay in soil quality are:

- Contamination that impacts on soil quality;
- Erosion impacts on soil volume;
- Indiscriminate storage impacts on soil quality; and
- Indiscriminate use impacts on soil volume.

Therefore, care must be taken during the reclamation process to prevent compaction on the one hand and to replace soil volumes back to a representative pre-mining soil and land capability while emulating the pre mining landscape.

6.3.1 Soil Types for Stripping and Stockpiling

The land type for the project area is Ah85 (Figure 6-1), which is dominated by the Hutton, Clovelly and Shortlands soil types. These soil types, found underlying the proposed coal

stockpiling facility, can all be stripped and stockpiled together because the inherent soil properties are similar. The soil types are dominated by deep well drained red and yellow sandy soils. In terms of stripping, topsoil will be stripped to a minimum of 300 mm down to a maximum of 1.5 m and will be stockpiled together. Anything deeper that may be required to be stripped (deeper than 1.5 m) will be removed and stockpiled separately from the initial stripping that will be undertaken.

6.3.2 Estimated Available Soil Volumes

It is recommended that the topsoil (usually the top 30 cm of any soil profile) be stripped together with the subsoil to 1.5 m or deeper, depending on practical engineering considerations. The stockpile height should be in the order of 4-5 m limited stockpile height as determined by the maximum height that a truck can dump once. Such a height is ideal for sandy soil but practical for the contractor to tip once without having to drive on top of the stockpile. The stockpile should be re-vegetated and designed according to Chamber of Mines Rehabilitation Guidelines.

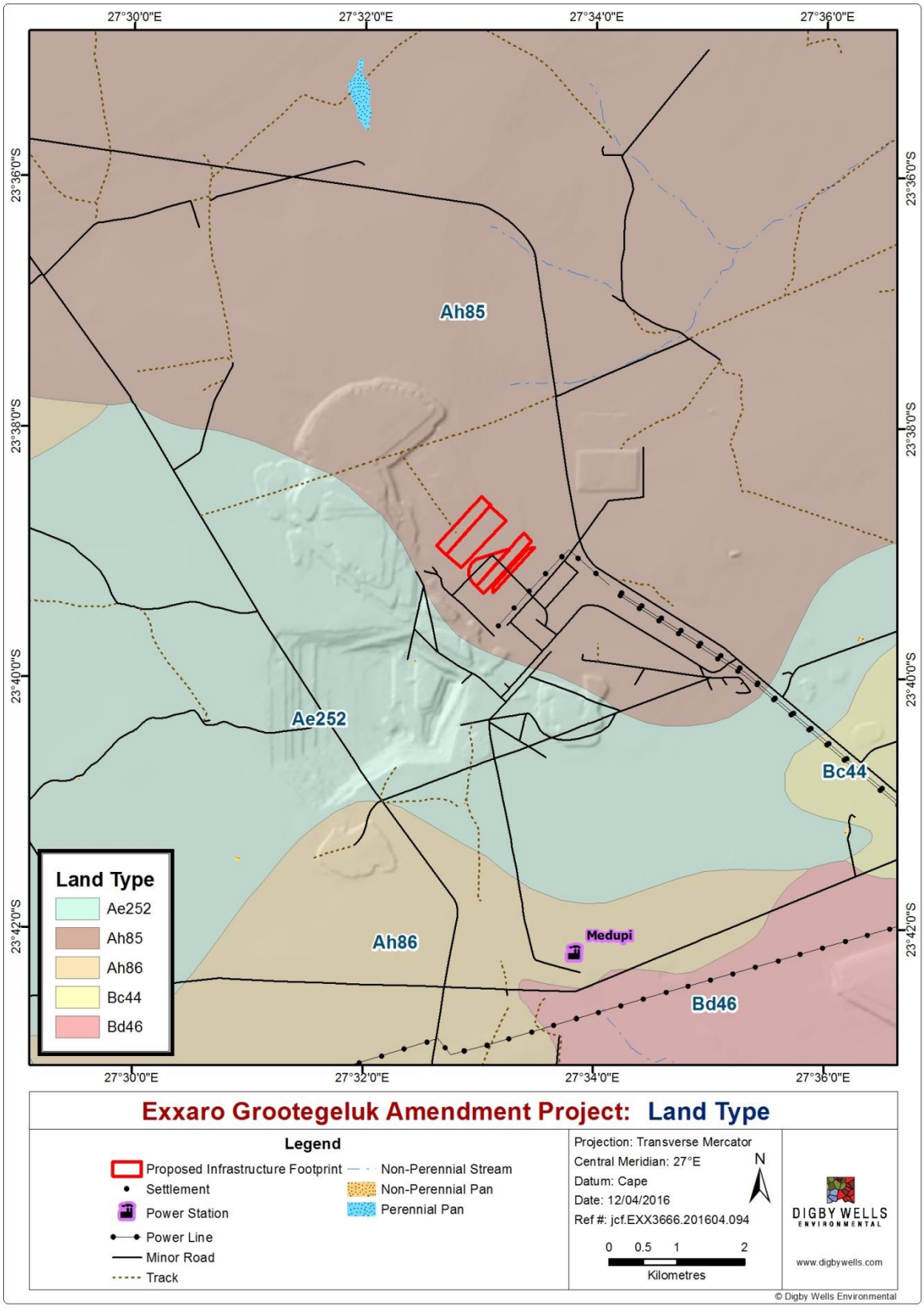

Figure 6-1: Land Type

6.3.3 Soil Stockpiling

This section explains the correct measures to be followed during the stockpiling of soil at the Grootegeluk Coal Mine. Stockpiling should be minimised as far as possible as it increases compaction and decreases the viability of the seed bank.

An important factor in the management of stockpiles impacting on soil quality is the storage height of topsoil. The topsoil stockpile should be constructed with great care to keep within accepted limits for example:

- The sides should be angled ensuring stability at 1:3 (18.5 degrees from horizontal);
- The stockpile area should be clearly demarcated, fenced and strict access control practised to prevent vehicles driving on the stockpile as well as unwanted borrowing of soil material for purposes other than rehabilitation;
- Stockpile height should be limited to 4 - 5 m for sandy soil, which is the case for the Grootegeluk Coal Mine;
- The soils should be stockpiled on the parent soils and as close to the originally stripped and final rehabilitation areas as possible. The top- and sub soils are to be stockpiled in a berm like manner within the project area.
- Soils should be stockpiled loosely to avoid compaction. Achieving this will depend on the equipment being used during the stripping and stockpiling process. Soils should be dumped in a single lift if truck and shovel methods are used. If the dumps are too low, then the height could be increased by using a dozer blade or backacter bucket to raise the materials.
- Topsoil stockpiles should be vegetated to avoid soil loss due to erosion and weed colonisation as well as fertility loss. A similar seed mixture to the final one recommended for rehabilitation should be used. See Section 6.5.1.3 on Re-vegetation and Biodiversity Establishment.

Once established, stockpiles should be managed to ensure that losses from the stockpiles are minimized and that additional damage to the physical, chemical or biotic component is minimised. It must be ensured that the stockpiled soil is only used for its intended purpose. The topsoil stockpiles must be clearly demarcated as “No Go” zones and monitored frequently. Employee awareness programmes are to be carried out to reduce the risk of stockpile “robbery” or contamination. The topsoil stockpile must remain vegetated at all times. The vegetation must be monitored and managed accordingly to avoid erosion losses.

6.4 Physical Closure

This section refers to the recommended actions to be taken when the physical surface structures associated with the mining needs to be decommissioned, demolished, closed and ensured to be safe. This includes the stockpiling area and associated infrastructure.

6.5 Biophysical Closure and Rehabilitation

6.5.1 Final Landform and Ecological Functionality

- In terms of the remaining infrastructure, once the site has been cleared of all infrastructure and rubble the exposed underlying materials should be reshaped to create a gently sloping, free-draining topography.
- The topsoil and sub soil that was removed during the construction phase should be replaced (as the final top layer), fertilised and ripped. In cases where the foundations of the structures are impractical to remove, the foundations should be covered with a combination of soft overburden or B horizon material topped with a layer of topsoil, which should be at least 1 m thick.

6.5.1.1 Final Land Use and Capability

It is advised that the project area be restored as close as possible to wild game grazing potential. The end land uses with respect to this report are aligned with the overall vision set out for Grootegeluk Coal Mine.

6.5.1.2 Soil replacement

Once the final land-form has been created, soil replacement can begin. The soils are to be replaced, if possible, into the original locations of these soils.

- Compaction limits the effectiveness of replaced soils. The equipment used during the replacement of the soils has a major impact on the compaction levels. Ideally heavy machinery should not be used to spread and level soils during replacement. The truck and shovel method should be used since it causes less compaction than, for example, a bowl scraper.
- When using trucks to deposit soils, the full thickness of the soil required can be placed in one lift. This does, however, require careful management to ensure that the correct volumes of soil are replaced. The soils that are deposited with trucks need to be smoothed before re-vegetation can take place. A dozer (rather than a grader) should preferably be used to smooth the soils since it exerts a lower bearing pressure and thus compacts less than wheeled systems.
- The Clovelly/Hutton soils are characterised by well-drained and aerated soil conditions and are thus not highly susceptible to compaction potential.
- Replaced soils require both physical and chemical amelioration as the actions of soil removal, stockpiling and replacement result in high levels of soil compaction and a dilution of the fertility of the soil originally present and concentrated in the surface layers. The actions that should be taken during the amelioration of soils are as follows:
  - The deposited soils must be ripped to ensure reduced compaction;

- An acceptable seed bed should be produced by surface tillage;
- Restore soil fertility;
- Incorporate the immobile fertilisers in to the plant rooting zone before ripping; and
- Apply maintenance dressing of fertilisers on an annual basis until the soil fertility cycle has been restored.

6.5.1.3 Re-vegetation and Biodiversity Establishment

The main aim of re-vegetation for the project area is to restore the area to the indigenous Bushveld. The overall objectives for the re-vegetation of reshaped and top-soiled land are to:

- Prevent erosion;
- Restore the land to the agreed land capability;
- Re-establish eco-system processes to ensure that a sustainable land use can be established without requiring fertilizer additions; and
- Restore the biodiversity of the area as far as possible.

The rehabilitation seed mixes generally consist of grasses as they rapidly establish and provide excellent protection against surface erosion. The area has a relatively low rainfall with evaporation often four times higher than rainfall on an annual basis. Soils are mostly sandy and do not retain water well. Given the extreme conditions, self-seeding and stoloniferous grasses have been suggested. Table 2 is a grass seed mix advised for the rehabilitation areas of the project areas. Table 3 may also be consulted for grass species.

Woody species that are advised to be planted after the grasses are *Sclerocarya birrea, Boscia albitrunca*, *Acacia erioloba, Combretum apiculatum* and *Combretum imberbe (*Refer to Table 2 for additional woody species to be planted). Protected tree species are to be re-planted as described by the Ecologist responsible for the assessment.

Table 6-1: Grass seed mix and tree species recommended for rehabilitation re-vegetation

Grass Species	**Kg/ha**
Eragrostis tef	1
Digitaria eriantha	5
Cynodon dactylon	5
Cenchrus ciliaris	6
Chloris gayana	3
Woody Species	
Sclerocarya birrea	
Boscia albitrunca	

Acacia erioloba
Combretum apiculatum
Combretum imberbe
Grewia species
Acacia nigrescens

Table 6-2: Expected grass species according to Mucina and Rutherford (2006) for Limpopo Sweet Bushveld

Scientific name	Common Name
Digitaria erianthra	Common Finger Grass
Enneapogon cenchroides	Soft Feather Pappus grass
Eragrostis lehmannia	Lehmann Love Grass
Panicum coloratum	White Buffalo Grass
Schmidtia pappophoroides	Sand Quick Grass
Aristida congesta	Tassel Three-awn
Cymbopogon nardus	False Citronella Grass
Eragrostis pallens	Gemsbok Grass
Eragrostis rigidior	Curly Leaf Love Grass
Eragrostis trichophora	Hairy Flower Love Grass
Ischaemum afrum	
Panicum maximum	Guinea Grass
Setaria verticillata	Hooked Bristle Grass
Stipagrostis uniplumis	Silky Bushmangrass
Urochloa mosambicensis	Bushveld signal grass

Given that the area is highly water stressed a Pitting Machine is recommended for this area and climate. The project area is a summer rainfall region and the first significant rains generally occur around October. Therefore the following is advised:

- Seed the grass seed mixture soon after the first rains of the wet summer season. These areas are to remain as “No Go” areas and all grazing animals must be kept out.
- Fertilising of 250kg/ha 2:3:2 is proposed at seeding time and a follow up dose during the first season following good rain.
- Maintenance applications of 100kg/ha LAN can be applied after good rain in the follow up season.

6.5.1.4 Surface and Groundwater

The final profile achieved should be acceptable in terms of the surface water drainage requirements and the end land use objectives.

6.5.2 Air Quality

Revegetation is critical for acceptable closure of the area to achieve sustainable and good air quality. It is recommended in order to minimise the erosion to reduce the potential for fugitive dust generation.

7 Monitoring and Maintenance

The purpose of monitoring is to ensure that the objectives of rehabilitation are met and that the rehabilitation process is followed. The physical aspects of rehabilitation 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 cover;
- Vegetation species diversity;
- Alien invader establishment and control measure;
- Faunal re-colonisation (Sherman and pitfall trapping); and
- Proportion of mined land that has been fully rehabilitated.

7.1 Final Topography

The topography that is achieved during rehabilitation 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. The survey department should do an assessment of the reshaping carried out on the site and signoff should be obtained from the rehabilitation specialist before the topsoil is replaced. Post closure subsidence may be an actor in areas where the railway line was cut in and backfilled. Ensure that a small volume of soil is left available after final rehabilitation to full in areas of subsidence, if they occur.

7.2 Soil

The recovery and effective use of the usable topsoil available is very important. It is also important to undertake regular reconciliation of the volumes stripped, stockpiled and returned to the rehabilitated areas. A topsoil balance can be used to keep track of soil resources on the mine.

The following actions should form part of monitoring soil quality and rehabilitation sustainability:

- Visual assessment should include specialist scoring of water ponding, plant vigour, yield, tilth, earthworms, runoff, ease of tillage, soil colour, soil aroma, soil structure and cloddiness; and
- Soil quality monitoring should include, bulk density, infiltration rate, water holding capacity, electrical conductivity, pH, soil nitrate and microbial activity.
- Assessment of rehabilitated soil thickness and soil characteristics by means of auger observations using a detailed grid; and
- Erosion occurrences; Erosion monitoring of rehabilitated areas should be undertaken and zones with excessive erosion should be identified. Erosion can either be quantified or the occurrence there-of simply recorded for the particular location.

7.3 Surface Water

The functionality of the surface water drainage systems should be assessed on an annual basis. An assessment of these structures will ensure that the drainage on the recreated profile matches the rehabilitation plan as well as to detect early on when any drainage structures are not functioning efficiently. These can then be repaired or replaced before it causes significant erosion damage.

7.4 Flora

The following recommendations have been suggested for post mining rehabilitation and monitoring of the proposed development area. Biodiversity assessments mid wet season should be undertaken by a qualified ecologist / botanist in order to monitor the rehabilitation progress with regards to Flora.

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, 2010). They are tough, can withstand unfavourable conditions and are easily spread.

Alien invasive control methods should be employed for the species identified during the flora assessment, as listed and in accordance with legislation. Alien species in South Africa are categorised according to the Alien and Invasive Species Lists, 2014 (GN R599 in *GG* 37886 of 1 August 2014) of the NEMBA (Act 10 of 2004).

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. 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.

7.4.1 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 re-growth 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 work must be completed in areas that are originally prioritized for clearing and rehabilitation.

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

- There must be no planting of alien plants (e.g. black wattle, eucalyptus and pampas grass) anywhere within the project area;
- Annual 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 Grootegeluk Coal Mine staff);
- The transportation of soils or other substrates infested with alien species should be strictly 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, but by also ensuring that cleared alien trees are treated as a valuable wood resource that can be utilised;
- 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 vegetation of untransformed habitats.

7.5 Fauna

Mid wet season surveys are similarly recommended to undertake the following suggested activities (Table 6-3).

Table 6-3: Fauna Monitoring recommendations post mining/during rehabilitation

Aspect		Suggestion
Fauna	Large Mammals	Camera traps along transect (every 100m) for 2 nights
	Mammals	Sherman along transect (every 100m) for 2 nights
	Avifauna	Bird counts
	Herpetofauna	Pitfall traps along transect (every 100m) for 2 nights
	Invertebrates	Pitfall traps along transect (every 100m) for 2 nights

8 Financial Provision Estimate

The financial provision estimate was calculated using Digby Wells Matrix Model which is based on first principals. The battery limits of the financial provision calculation were set to only include expansion areas not previously provided for existing Grootegeluk financial provisions. The only area currently note provided for, is the extension area inside the rail loop (refer Figure 2-1). This chapter describes the methodology used in calculating the financial provision and a summary breakdown of the provision estimate.

8.1 Infrastructure Measurement

Using the block layout plan provided, the footprint of the extension area was measured using ArcGIS. Measurements that were taken have been standardised to ensure that the costs calculated are easily updatable and that they are consistent.

8.2 Rates and Cost Calculation

The Digby Wells Matrix format makes use of a set template for which using market related rates. The rate

Quantities for certain defined items e.g. plant and related infrastructure, are then inserted and the cost for closure is calculated. Contingencies and VAT are applied to the cost.

8.3 Assumptions

The assumptions made as part of the financial provision estimate are the following:

- Due to the temporary nature of the activities it has been assumed that the removal of the stockpile will form part of the operational costs;
- Although the footprint will be reutilized after the removal of the temporary stockpile, it has been assumed that the liner will be removed and the site shaped to ensure free drainage and vegetation establishment on 50% of the footprint area;
- Maintenance and aftercare costs of rehabilitation have been excluded as the footprint will be reutilized once the temporary stockpile has been removed;
- Survey data (footprints, volumes, etc.) provided by the mine's surveyor is correct;

- No due diligence was undertaken to determine whether the proposed project may be responsible for any other areas not specified in this report.

8.4 Summary of Financial Provision

The 2016 financial provision estimate was calculated by means of the DMR standard method for assessment of mine closure for the end of life of mine. A summary of the calculated environmental liability costs is presented in Table 8-1. The cost for rehabilitation and closure of the extension area is R4 955 974.90 (Incl. VAT). The following assumptions were made in the calculation of the estimate:

- The liner for the entire area will be removed and disposed of at the appropriate site;
- The provision is only for the extension area inside the rail loop as the additional areas such as laydown yard and stockyards have been provided for under the existing Grootegeluk Financial Provision.

Table 8-1: Summary of the Financial Provision Estimate for the Proposed Grootegeluk Amendments

Extension Area					
Rehabilitation					
Remove liner	112	128000	m²	R5.15	R658,831.03
General clean up of stockpile area	124	128000	m²	R23.75	R3,039,773.52
Shaping of stockpile area (to level ground)	123	12.80	ha	R1,897.96	R24,293.91
Laying of soil for vegetation establishment	126	64000	m²	R16.31	R1,043,719.38
Vegetation establishment	128	6.40	Ha	R29,587.04	R189,357.06
Rehabilitation Total					**R 4,955,974.90**

8.5 Recommendations

To improve the accuracy of the financial provision estimate the following actions are recommended once the mine has been commissioned:

- Digby Wells would recommend that a detailed groundwater study be undertaken five years before closure to monitor pollution plumes entering surface and groundwater resources from the open pit. This will enable the refinement of future mitigation measures;
- Concurrent rehabilitation must continue where possible so as to reduce the liability burden when the mine ceases to operate; and
- The liability figures need to be updated on an annual basis as a requirement of the NEMA. This will ensure that costs become more accurate over time and will reflect current market conditions.

The proposed Project should also take cognisance of the regulations pertaining to the financial provision for the rehabilitation and management of negative environmental impacts

associated with prospecting, exploration, mining and production operations which came into effect on 20 November 2015 (GN R1147).

The Regulations, which apply to a holder under the MPRDA, regulates the “method for determining and making financial provision for the costs associated with the management of environmental impacts” caused by mining activities and operations.

The Regulations require holders to make financial provision for:

- Annual rehabilitation;
- Final rehabilitation, decommissioning and closure at the end of the life of a mine; and
- Remediation and management of latent or residual environmental impacts, which may become known in the future. This includes the pumping and treatment of polluted or extraneous water.

This report is based on the Regulations applicable as at 1 December 2014. The following Liability Assessment Report will have to be based on the requirements of GN R1147. In terms of the new Regulations, a holder will have 15 months to assess, review and adjust the sum of the financial provision in accordance with Regulation 9. Failure to do so will mean that the existing approved financial provision will lapse after 45 calendar days after the lapsing of the 15 months period.

9 Conclusion

Mine rehabilitation must be considered as an on-going process aimed at restoring the physical, chemical and biological quality or potential of air, land and water regimes disturbed by mining to a state acceptable to the regulators and to post mining land users (Whitehorse Mining Initiative, 1994).

The overall objective of the rehabilitation plan is to ensure activities associated with the coal stockpiling area and associated infrastructure will be designed to prevent, minimise or mitigate adverse long-term environmental and social impacts and create a self-sustaining ecosystem.

With respect to what has been recommended in the rehabilitation plan, no major long term post closure liabilities are expected if rehabilitation is undertaken in the appropriate manner and the correct management of soil resources and re-vegetation procedures are implemented.

10 References

Bromilow C. (2010) Problem Plants and Alien Weeds of South Africa, Briza Publications

Department of Minerals and Energy, (2008) *MEM Series Guidelines on Mine Closure, Draft Version 1*, 01 January 2008, Pretoria

Golder and Associates (2013) Site Wide Rehabilitation Plan for Grootegeluk Mine

Mine Health and Safety Act (Act 29 of 1996) 1996. Government Gazette. No. 17242. Vol. 967. Cape Town. South Africa

Mineral and Petroleum Resources Development Act (Act 28 of 2002). 2002. Government Gazette. No. 23922. Vol. 448. Cape Town. South Africa

Mineral and Petroleum Resources Development Act (Act 28 of 2002): Mineral and Petroleum Resources Development Regulations (2004). 2004. Government Gazette. No. 26275. Cape Town. South Africa

National Environmental Management Act (Act 107 of 1998). Government Gazette. No 19519. Vol. 401. Cape Town. South Africa

National Environmental Management Amendment Bill. (2007) Government Gazette. No. 30142

National Environmental Management: Waste Act 2008 (Act No. 59 of 2008). Government Gazette. No.32000. Vol. 525. Cape Town. South Africa

National Environmental Management: Waste Act (Act No. 59 of 2008). Government Gazette. No. 27318. Vol. 476. Cape Town. South Africa

National Heritage Resources Act (Act 25 of 1999). Government Gazette. No. 19974. Vol. 406. Cape Town. South Africa.

National Water Act (Act 36 of 1998). Government Gazette. No. 19182. Vol. 398. Cape Town. South Africa

South Africa Department of Mineral Resources, (Act No. 28 of 2002) Government Gazette No. 23922, Mineral and Petroleum Resources Development Act,

Tanner et al. (2007) Guidelines for the Rehabilitation of Mined Land. Chamber of Mines South Africa and Coaltech. South Africa

Whitehorse Mining Initiative (WMI) (1994) *Environment Issues Group, Final Report* published in October

DIGBY WELLS ENVIRONMENTAL REPORTS

Digby Wells Environmental 2014 and 2016. Soil Survey Report, Rehabilitation Plan For Grootegeluk Coal Mine, Randburg

Digby Wells Environmental 2014 and 2016. Flora and Fauna Report for Grootegeluk, Rehabilitation Plan For Grootegeluk Coal Mine, Randburg

Digby Wells Environmental 2014. Protected Tree Permit Application and supporting documentation, Rehabilitation Plan For Grootegeluk Coal Mine, Randburg

Digby Wells Environmental 2014. Rehabilitation Plan For Grootegeluk Coal Mine, Randburg