DIGBY WELLS
ENVIRONMENTAL

Integrated Environmental Impact Assessment for the Proposed Palmietkuilen Mining Project near Springs, Gauteng

Rehabilitation, Decommissioning and Mine Closure Plan

Project Number:

CNC4065

Prepared for:

Canyon Coal (Pty) Ltd

canyoncoal

November 2016

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This document has been prepared by Digby Wells Environmental.

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Project Name:	**Integrated Environmental Impact Assessment for the Proposed Palmietkuilen Mining Project near Springs, Gauteng**
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Name	Responsibility	Signature	Date
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Brett Coutts	Report Reviewer		December 2016
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DECLARATION OF INDEPENDENCE

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I, Kathryn Roy as duly authorised representative of Digby Wells and Associates (South Africa) (Pty) Ltd., hereby confirm my independence (as well as that of Digby Wells and Associates (South Africa) (Pty) Ltd.) and declare that neither I nor Digby Wells and Associates (South Africa) (Pty) Ltd. have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of Canyon Coal (Pty) Ltd, other than fair remuneration for work performed, specifically in connection with the proposed Integrated Environmental Impact Assessment for the Palmietkuilen Coal Mine near Springs, Gauteng.

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Qualification(s):	MSc Restoration Ecology
Experience (years):	4
Registration(s):	N/A

EXECUTIVE SUMMARY

Digby Wells Environmental (hereafter Digby Wells) has been appointed by Pandospan (Pty) Ltd, a subsidiary of the Canyon Group which is in contract with Anglo Operations (Pty) Ltd to undertake a conceptual Rehabilitation, Decommissioning and Mine Closure Plan relating to the proposed development and operation of a new open cast coal mine and associated infrastructure on Portions 1, 2, 4, 9, 13 and 19 of the Farm Palmietkuilen 241 IR, near Springs in the Gauteng Province of South Africa. The proposed Project Area falls within the Sedibeng District Municipality and borders of the Mpumalanga Province.

Closure and rehabilitation is a continuous series of activities that begin with planning prior to the project's design and construction, and end with achievement of long-term site stability and the establishment of a self-sustaining ecosystem. Not only will the implementation of this concept result in a more satisfactory environmental conclusion, but it will also reduce the financial burden of closure and rehabilitation. Rehabilitation and closure objectives have been tailored to the project at hand with the objective of assisting Canyon Coal in carrying out successful rehabilitation. Specific actions to be undertaken during construction and operation of the mine, as well as decommissioning and closure phases for the Project are discussed in this Rehabilitation, Decommissioning and Mine Closure Plan (RCP) and summarized below:

Summary of Main Rehabilitation Actions

Target Area	Main Actions
Construction Phase	
Overburden and Product Stockpiles	Prepare area as a Class C landfill with correct liner should the groundwater assessment recommend that. Follow specific guidelines on land preparation and correct removal of vegetation and possible relocation. Soil must be stripped to the correct depth and stockpiled according to the provided guidelines. Pollution must be controlled and alien invasive species must be removed.
All areas	Follow specific guidelines on land preparation and correct removal of vegetation and possible relocation. Soil must be stripped to the correct depth and stockpiled according to the provided guidelines. Pollution must be controlled and alien invasive species must be removed.
Operational Phase	
Open Pit	Progressive rehabilitation is possible due to the nature of the mining method. Once mining of an open pit strip is completed, the strip is filled with overburden material and compacted. This is followed by the replacement of stockpiled topsoil for the purpose of re-vegetation. Following the filling of open pit strips and replacement of topsoil, the disturbed area is re-vegetated. This is done on a continuous basis throughout the operational phase.

Target Area	Main Actions
Pollution Control Dam	Desilting of the PCD should be done continuously throughout operations.
All areas	Rehabilitation actions that can occur during operation are the restriction of activities to planned areas to reduce the footprint, to control pollution and remove alien invasive vegetation. Remediation of any contamination must take place in this phase.
Wetlands	Monitor wetlands and remediate where possible.
Rehabilitation, Closure and Decommissioning Phase	
Open Pit and Boxcut	Continuous rehabilitation of the mining strips. Infilling of the pit/strips will occur as mining progresses and subsequent spoils rehabilitation will also take place for the areas which can only be accessed at the end. Material will be replaced in the reverse order to which it has been removed. Rehabilitated areas must be shaped to be free draining and roughly emulate the surrounding surface topography. Replace topsoil to 300 mm, thereafter establish successful vegetation cover. An inpit lake may need to be established should there not be sufficient material. Remove alien invasive vegetation. Monitor required aspects according to guidelines stipulated in specialist reports appended to the EIA.
Office and Plant Infrastructure	Infrastructure such as the offices, administration buildings and workshops should be removed, unless the liability is taken over by another party. If complete infrastructure removal is chosen, Infrastructure that can be re-used or sold should be removed to defray costs and remaining structures should be demolished to 1 m below surface and the demolition rubble removed. The conveyor belt and its associated infrastructure will need to be removed. If contamination is discovered, this soil should be removed and disposed of in the appropriate waste disposal facility. Rehabilitated areas must be shaped to be free draining and roughly emulate the surrounding surface topography. Replace topsoil to 300 mm, thereafter establish successful vegetation cover. Remove alien invasive vegetation. Monitor required aspects according to guidelines stipulated in specialist reports appended to the EIA.

Target Area	Main Actions
Roads and Parking Areas	Roads that can and will be used for rehabilitation/monitoring or by other users post-closure should be left *in situ* provided this is agreed upon by all parties concerned. If there is no future use for roads on site soil should be tested for contamination. If contamination is discovered, this soil should be removed and disposed of in the appropriate waste disposal facility. Replace usable topsoil of 300 mm (all usable topsoil stripped from these areas should be placed back in these areas) and rip soil to 200 mm to reduce compaction, thereafter establish successful vegetation cover. Remove alien invasive vegetation. Monitor required aspects according to guidelines stipulated in specialist reports appended to the EIA.
Dams	Desilt the pollution control dams. Remove liners – these should be disposed of at the correct hazardous waste disposal facility. Thereafter, doze the dam walls. Remove supporting plinths for pipeline as well as foundations and other associated infrastructure. Remaining structures should be demolished to 1 m below surface and the demolition rubble removed and any re-usable items should be removed from the site. Soil should be tested for contamination. If contamination is discovered, this soil should be removed and disposed of in the appropriate waste disposal facility. Replace usable topsoil of 300 mm (all usable topsoil stripped from these areas should be placed back in these areas) and rip soil to 200 mm to reduce compaction, thereafter establish successful vegetation cover. Remove alien invasive vegetation. Monitor required aspects according to guidelines stipulated in specialist reports appended to the EIA.
Diesel Storage	Remove tank and associated infrastructure from site. Demolish the concrete bund wall and foundation. These structures should be demolished to 1000 mm below surface and the demolition rubble removed from the site. Soil should be tested for contamination. If contamination is discovered, this soil should be removed and disposed of in the appropriate waste disposal facility. Rehabilitated areas must be shaped to be free draining and roughly emulate the surrounding surface topography. Replace topsoil to 300 mm, thereafter establish successful vegetation cover. Remove alien invasive vegetation. Monitor required aspects according to guidelines stipulated in specialist reports appended to the EIA.
Product Stockpiles	Removal of all stockpiled coal from the site and remove sacrificial coal layer. Rehabilitated areas must be shaped to be free draining and roughly emulate the surrounding surface topography. Replace usable topsoil (all usable topsoil stripped from these areas should be placed back in these areas) and rip soil to 200 mm to reduce compaction, thereafter establish successful vegetation cover. Remove alien invasive vegetation. Monitor required aspects according to guidelines stipulated in specialist reports appended to the EIA.

Target Area	Main Actions
ROM Stockpiles	Remove coal veneer. This must then be disposed of at a hazardous waste facility. If contamination in the soil is discovered, this soil should be removed and disposed of in the appropriate waste disposal facility. Rehabilitated areas must be shaped to be free draining and roughly emulate the surrounding surface topography. Replace usable topsoil (all usable topsoil stripped from these areas should be placed back in these areas) and rip soil to 200 mm to reduce compaction, thereafter establish successful vegetation cover. Remove alien invasive vegetation. Monitor required aspects according to guidelines stipulated in specialist reports appended to the EIA.
Discard Dump	Remove coal veneer from affected area. Contaminated material will then need to be disposed of at a hazardous waste facility. The area will be shaped to reduce the likelihood of ponding occurring on surface and to blend in with the surrounding topography. Rip the soil to reduce compaction. Replace usable topsoil (all usable topsoil stripped from these areas should be placed back in these areas), thereafter establish successful vegetation cover. Remove alien invasive vegetation. Monitor required aspects according to guidelines stipulated in specialist reports appended to the EIA.
Linear Infrastructure	Linear infrastructure will need to be removed unless a future use can be determined. If contamination in the soil is discovered, this soil should be removed and disposed of at the appropriate waste disposal facility. Rehabilitated areas must be shaped to be free draining and roughly emulate the surrounding surface topography Replace 300 mm usable topsoil (all usable topsoil stripped from these areas should be placed back in these areas) and rip soil to 200 mm to reduce compaction, thereafter establish successful vegetation cover. Remove alien invasive vegetation. Monitor required aspects according to guidelines stipulated in specialist reports appended to the EIA.

Monitoring actions are also outlined in this Plan. 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 a desired final ecosystem.

The financial provision estimate for the proposed project at Year 10 is **R 162 441 981 (excl. VAT)** and at the end of life of mine it is estimated to be **R 330 475 001 (excl. VAT)**. The end of life financial provision estimate includes costs to remediate or treat latent risks (also refer to the Environmental Risk Report (ERR) in Appendix A). The financial provision estimates does not include Value Added Tax (VAT). The detailed cost estimate sheets are attached in Appendix B.

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1 Introduction

In June 2016, Pandospan (Pty) Ltd (Pandospan) concluded a contract with Anglo Operations Limited in support of the acquisition of a Prospecting Right for coal (DMR Ref. No. GP 30/5/1/1/2 (201/10026) PR). The Prospecting Right includes Portions 1, 2, 4, 9, 13 and 19 of the Farm Palmietkuilen 241 IR located in Springs, Sedibeng District, Gauteng Province (See Figure 1-1 and Figure 1-2 for the regional and local setting respectively). The mine, and mining-related infrastructure, will be placed on Portion 2 and the proposed future development area is located on Portion 19.

The integrated environmental regulatory processes for the project will be managed by Pandospan on behalf of Anglo Operations Limited (the Applicant), the project applicant. Pandospan forms part of the Canyon Group of Companies for which Canyon Coal functions as the operational division. Canyon Coal is a well-established South African mining company. Since the inception of their first operating mine in 2009, Canyon Coal has brought two additional mines online. The Palmietkuilen project constitutes one of four future mining projects, pending environmental and other authorisations.

This project involves the development of a new open pit coal mine and supporting infrastructure. The raw coal, once extracted, will be transported to a processing plant for crushing, screening and washing. The coal product will either be transported via haul roads from the product stockpile area to the existing Welgedacht siding for distribution by rail or directly to prospective clients by road. The proposed mine will require supporting infrastructure such as water storage, sewage treatment, power supply, fuel storage, hauls roads etc.

The current resource is estimated at 125.98 Mt. The life of mine for the project is 53 years including a 2 year ramp-up period. Once the mine has been established a full production rate of 200 000 t / month will be maintained for 51 years. The progression of the mining operation is depicted in the Life of Mine (LoM) plan, Figure 1-3 below.

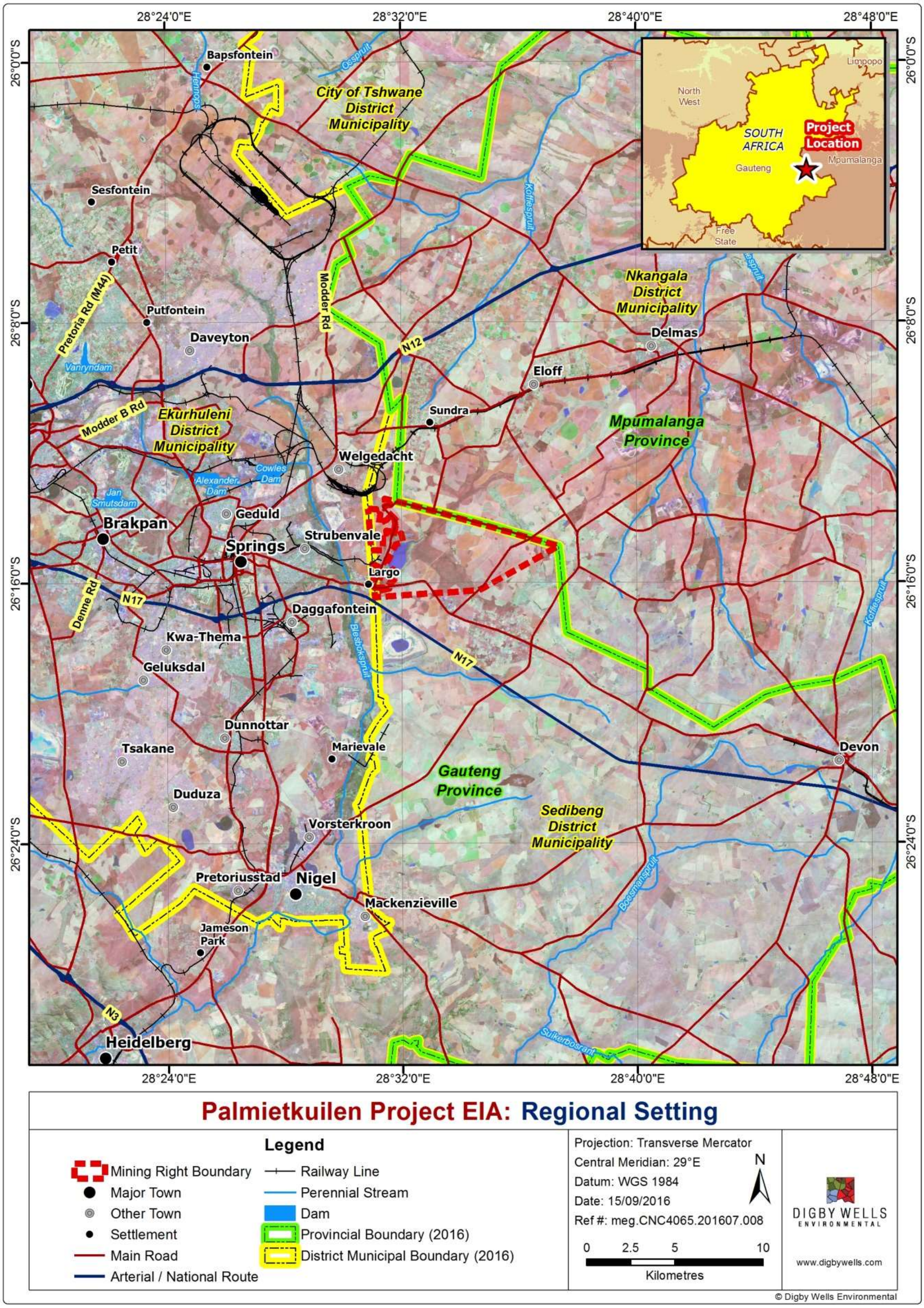

Figure 1-1: Regional Setting

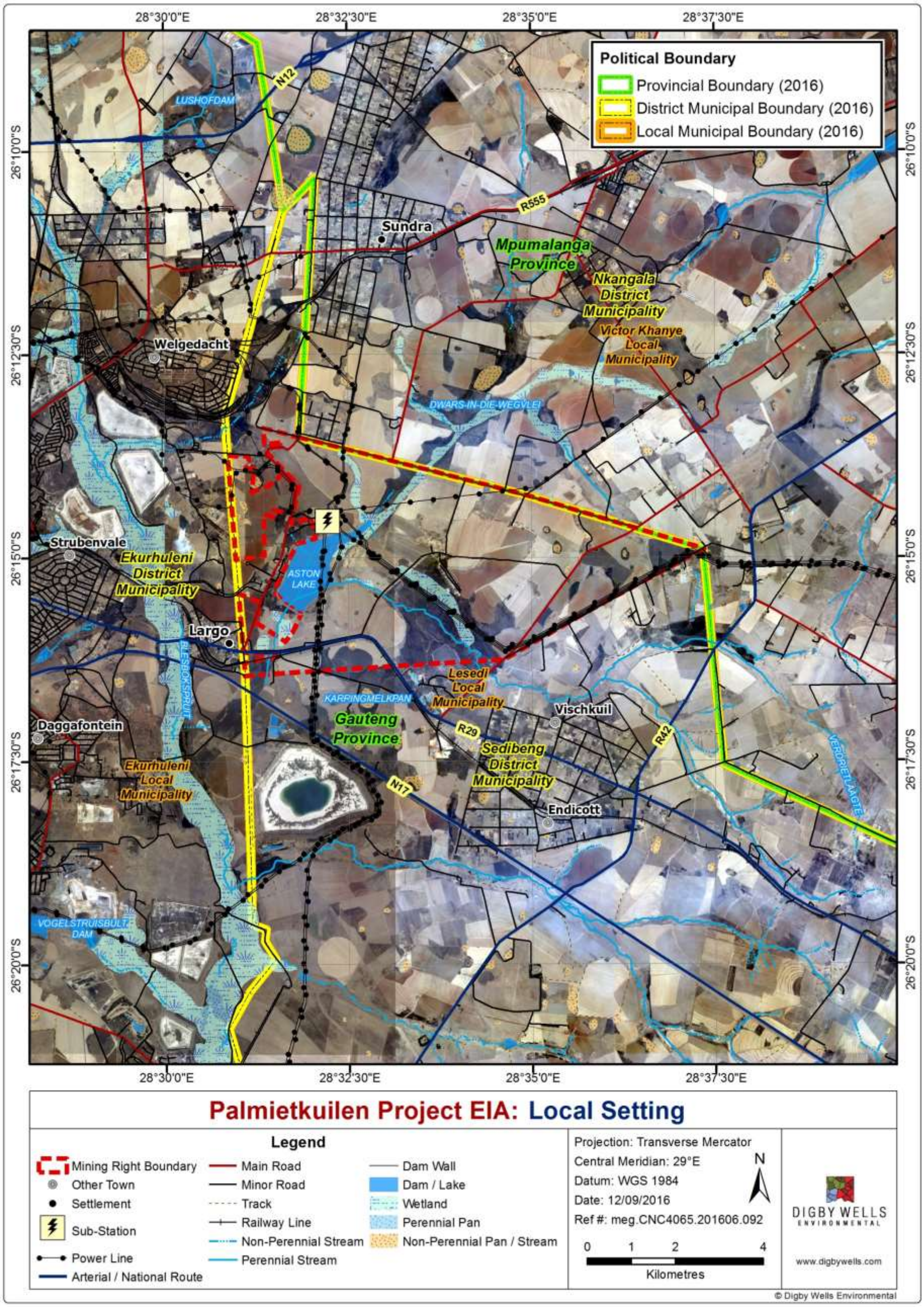

Figure 1-2: Local Setting

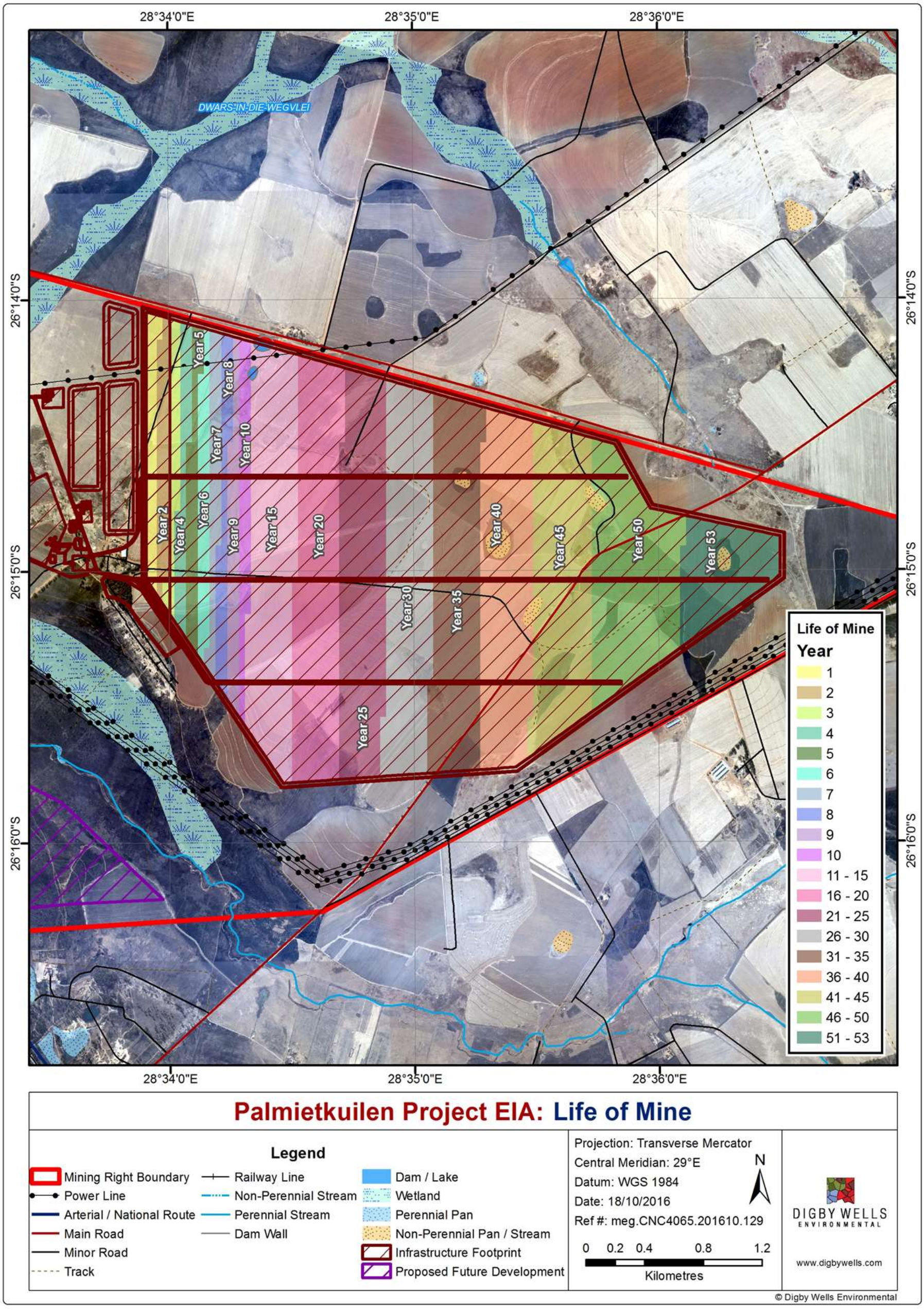

Figure 1-3: Life of Mine Plan

1.1 Mining Method

The coal resource will be mined using open pit methods due to the seemly depth of the coal reserve (between 12 and 60 m below the surface). Bench mining and strip mining techniques are proposed. Bench mining involves the development of an open pit through a series of benches at varying depths while strip mining involves the movement of overburden laterally to an adjacent empty pit where the mineral has already been extracted. The proposed project will include one open pit.

Topsoil and subsoil will be stripped using an excavator and will be stored in separate stockpile areas on the mining area. Drilling and blasting will be employed for the hard overburden or bedrock to expose the coal seams. Once blasted, the hard overburden will be excavated and stockpiled separately for rehabilitation. The mined coal from the open pit will be transported via the haul roads and stored on the Run of Mine (RoM) stockpile area. The coal will be fed into a crushing and washing plant with a conveyor after which the coal product will be temporarily stored at the product stockpile area before being transported to the Welgedacht siding for distribution or directly via truck to the relevant markets. A temporary discard dump containing one year's capacity will be constructed to store discard before being either rewashed or backfilled into mined out areas.

1.1.1 Support Infrastructure

The proposed mine would require additional infrastructure and services to support the proposed mining operation. Figure 1-4 below shows the proposed project infrastructure layout. The supporting infrastructure associated with the proposed Project is discussed in subsections below.

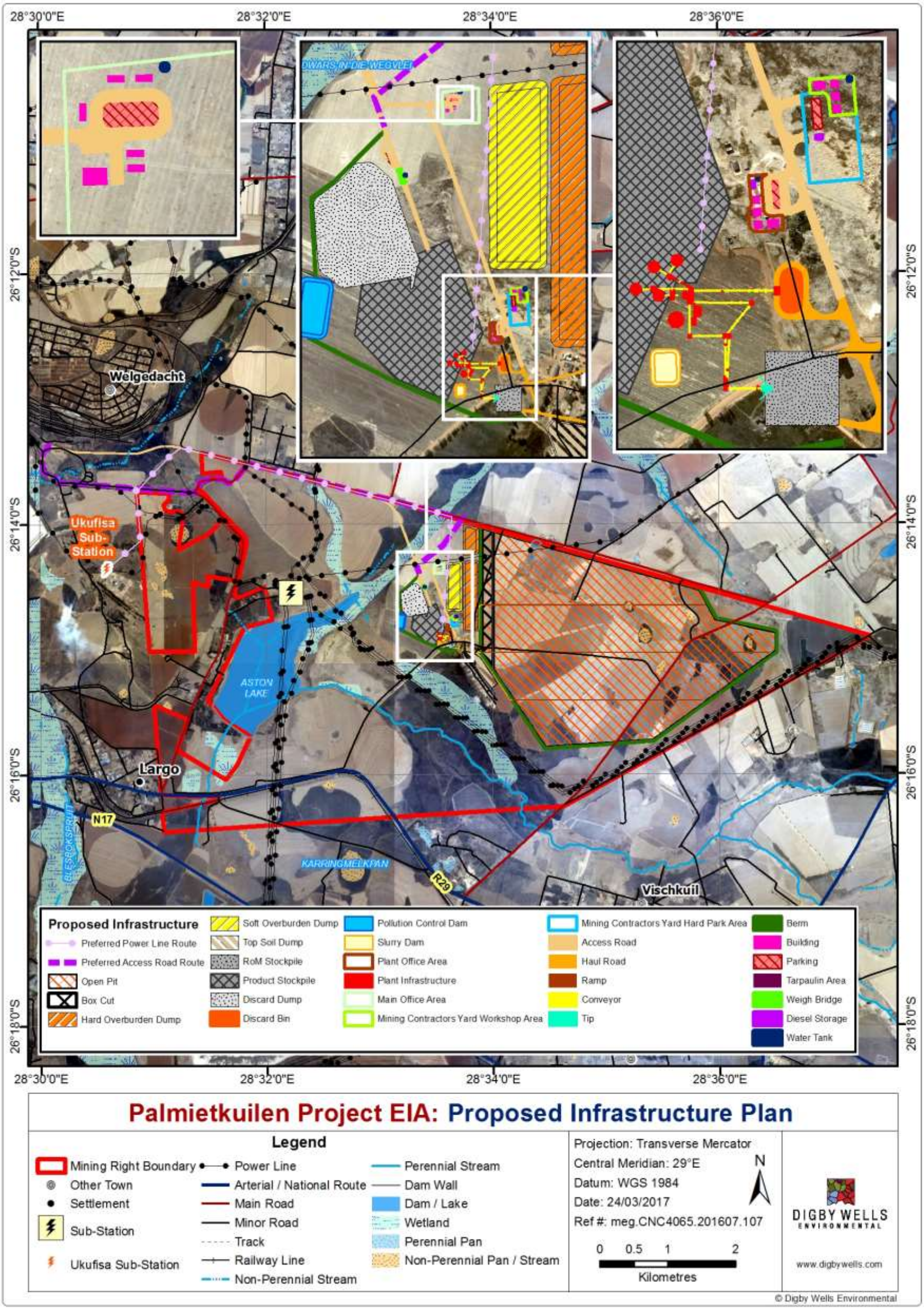

Figure 1-4: Proposed Infrastructure Plan

1.1.2 Stockpile Areas

Topsoil, subsoil and overburden material will be excavated and stored on site for rehabilitation. The mined coal will also need to be temporarily stored on a RoM stockpile and a product stockpile area.

1.1.3 Process Plant

1.1.3.1 Screening and Crushing

The RoM will be fed into the process plant by means of a feeder bin at the RoM pad. The feeding capacity of the plant will be 400 tons/hour. Coal will be manually fed into the bin by means of a Front-End Loader. The first stage of the process plant is to screen the coal into various particle sizes. This is done by the use of a 1.5 x 2.5 m primary vibrating grizzly screen fitted with 80 mm bar spacing. The coal fraction of 250 x 80 mm fraction will be discharged into a primary double roll crusher, which will reduce the oversize fraction to 90 mm in size. The primary crusher product will re-join the grizzly undersize fraction which feeds into a secondary 1.8 x 6.0 m double deck screen fitted with 60 and 50 mm bar spacing. The oversize (+75 mm) fraction will be fed to a secondary double roll crusher, the crushed product will be returned to the primary screen feed conveyor belt, in a closed crushing circuit.

1.1.3.2 Coal Washing and Processing

The eventual crushed and screened undersize fraction (-75mm) will be fed to the cyclone, drum and spiral sections of the wash plant which will then be deposited onto a product stockpile. The washing section will operate during mining hours.

The slurry from the thickener underflow will report to the filter press and make up 12 % to 15 % of the plant feed. The Dense Media Separation (DMS) plant will be capable of a 95 % organic efficiency with a product yield of 60 %. The remaining 25 % to 28 % solid discard will be placed in the opencast voids.

The plant will produce a product suitable for local and export markets.

1.1.3.3 Product Storage

The coal product will be stored on a product stockpile. The product stockpile conveyor belt will be fitted with a level probe to avoid over filling the stockpile and a mass meter for process accounting purposes.

1.1.4 Water Supply and Management

Possible water sources for use in mining operations include the existing Aston Lake, owned by the Schoeman Boerdery as well as available or new boreholes. These water sources are still to be confirmed by undertaking the relevant feasibility studies. Pipes and pumps will be installed to pump water from these resources directly to the process plant. Process water will

be managed and re-used throughout the operations of the project via clean and dirty water separation system, which shall include separate drains that lead into the following dams.

1.1.4.1 Waste Water Dams

Waste water dams will be constructed in the form of a slurry dam and pollution control dam. The purpose of the slurry dam is to collect and separate water from its dissolved constituents. A slurry dam will be constructed adjacent to the processing plant. The purpose of the pollution control dam is to store process water and stormwater for re-use in the plant. The dams will be designed as per requirements of the Department of Water and Sanitation.

1.1.4.2 Power Supply

The project will obtain power from an existing Eskom distribution power lines. Pandospan are proposing to construct a substation on the project site to connect to existing power line to secure power for the operation of the proposed mine. The required power requirements would need to be confirmed with Eskom.

Electricity will also be generated by means of diesel generator sets for lighting and pumping of water. Pandospan is also currently investigating the feasibility of using onsite solar power generation as a backup system. The maximum power requirements for the mine will be 5 MVA.

1.1.5 Waste Management

The proposed mining and related activities will result in the generation of slurry waste, which will be stored in the slurry dam. Furthermore, the solid coal discard will be temporarily stored on a discard dump before being taken back to the open pit for final disposal.

A proposed sewage treatment plant is proposed as part of the project to manage sewage waste. Other wastes including materials and chemicals from maintenance activities and daily operation of the proposed mine will also be generated. All hazardous wastes will be stored and handled appropriately prior to being disposed of by a licensed hazardous waste disposal contractor. General domestic wastes will be managed in accordance with the requirements of the district municipality.

1.1.6 Access and Site Roads

The project site is bordered by an unnamed road to the north that also serves as the boundary between the Gauteng and Mpumalanga Provinces. The R29 serves as a partial southern boundary. There are various farm roads present on the proposed project area that can used to navigate the site.

Access to the site will be from the R29 onto an unnamed farm road heading north. Pandospan intend on using the surrounding road network to haul coal to the existing Welgedacht siding.

1.1.7 Rail Siding

Coal product may be transported via road to the Welgedacht rail siding from where the coal product will be distributed to the intended local and export markets.

1.1.8 Workshop Area

A workshop and office area is proposed which will also include a contractor's yard where machinery and equipment can be maintained and repaired. It is likely that this area will include offices, a laboratory, wash bays and storage facilities. These buildings are proposed to be approximately 3 m in height.

1.1.9 Hazardous Storage

Diesel storage tanks are proposed to be located in close proximity to the workshop area. This facility will be adequately bunded and have the necessary control systems in place to manage the potential risks of fire and /or explosion.

1.1.10 Vehicles and Equipment

The following vehicles and machinery will be used for the construction and operation of the proposed mine:

- Excavators;
- Dozers to move material;
- Load Haul Dump (LHD);
- Front End Loaders;
- 34 ton interlink haul trucks;
- Mine passenger vehicles;
- Graders for road maintenance;
- Water Bowsers for dust suppression;
- Generators for lighting and water pumping: and
- 2 ton Light Duty Vehicles (LDV).

1.1.11 Re-location of Existing Infrastructure

An existing public gravel road transgressing the site in a SW – NE direction would need to be relocated as it currently runs through the proposed open pit area.

2 Activities per Project Phase

The following activities are envisioned for each of the project phases:

- Construction:

- Site establishment;
- Site clearing, including the removal of topsoil and vegetation;
- Construction of mine related infrastructure, including haul roads, pipes, dams;
- Construction of washing plant;
- Relocation of Infrastructure;
- Blasting and development of initial box-cut for mining, including stockpiling from initial box-cut; and
- Temporary storage of hazardous products, including fuel and explosives, as well as waste and sewage.

- Operational:
  - Stripping topsoil and soft overburden;
  - Removal of overburden, including drilling and blasting of hard overburden;
  - Loading, hauling and stockpiling of overburden;
  - Drilling and blasting of coal;
  - Load, haul and stockpiling of RoM coal;
  - Use and maintenance of haul roads for the transportation of coal to the washing plant;
  - Water use and storage on-site; and
  - Storage, handling and treatment of hazardous products (including fuel, explosives and oil) and waste.
- Decommissioning and closure:
  - Demolition and removal of all infrastructure, including transporting materials off site;
  - Rehabilitation, including spreading of soil, re-vegetation and profiling or contouring;
  - Environmental monitoring of decommissioning activities;
  - Storage, handling and treatment of hazardous products (including fuel, explosives and oil) and waste; and
  - Post-closure monitoring and rehabilitation.

3 Project Schedule

The construction phase of the project will take approximately 1 year to complete and will include site establishment and the construction of all infrastructure, including the

development of the box cut. The operations phase of the project will be approximately 53 years.

4 Project Alternatives

In terms of the Environmental Impact Assessment (EIA) Regulations (2014), project alternatives must be considered during the EIA process. In terms of these regulations, “alternatives” are defined as:

In relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to:

- The property on which or location where it is proposed to undertake the activity;
- The type of activity to be undertaken;
- The design or layout of the activity;
- The technology to be used in the activity;
- The operational aspects of the activity; and
- The option of not implementing the activity” (the ‘no-go’ option).

The Scoping Phase aims to identify and screen alternatives to ensure that they are reasonable and feasible and which can be assessed in further detail during the EIA Phase.

The nature of the mineral reserve determines the mining method and the location of the feasible reserve to be mined determines the location of the mining operation. These two factors limit the project alternatives that are available. The following sections highlight the identified alternatives which are all considered to meet the objective of the project.

4.1 Possible Alternatives

As discussed above, the coal product will be transported off-site via a rail siding, which links to the existing rail network. To transfer the coal product from the product stockpile area to the Welgedacht siding, Pandospan has identified several layout and operational activity alternatives, these are described below:

- Logistics : use of a conveyor system;
- Infrastructure: use of Portions 1, 2, 4, 9, 13 and 19 of the Farm Palmietkuilen 241 IR for the placement of infrastructure; and
- Mining: underground mining.

4.1.1 No-Go Alternative

The no-go alternative would entail maintaining the status quo. The current land use is primarily maize farming and small scale cattle farming. The no-mining option will result in the continuation of such land use.

Although economically viable, the continuation of agriculture would not provide the level of medium term economic growth to the area that mining would offer. These economic benefits include an increase in employment at the local level, contribution to the national economy in taxes and royalties and an injection into the local economy through the procurement of goods and services at the regional level. Furthermore, the justification for the project, including the provision of coal product to existing power stations to secure South Africa's power supply, would not be met. In addition, the no-go alternative would also result in lost foreign revenues from the planned export coal product.

The no-go alternative also means that all potential negative impacts associated with the proposed mine and its associated infrastructure would not occur. Hence, the EIA process will determine if the project would result in any environmental or social fatal flaws that may result in the project being a no-go.

4.1.2 Summary of the Preferred Alternative

The preferred alternative at this stage of project planning is as follows:

- Use of opencast mining methods;
- Transportation of the coal via trucks to the Welgedacht Siding; and
- Use of Portion 2 of the Farm Palmietkuilen 241 IR that is found on the eastern side of Aston Lake for the placement of infrastructure.

A comparative assessment of the above-mentioned project alternatives will be undertaken, the assessment will consider environmental, social, economic and technical criteria to determine the most feasible project.

4.2 Limitations

The RCP is based on the following assumptions and limitations:

- Current information available to Digby Wells was used in developing the RCP;
- The information contained within this RCP is based on current layout plans available. If there is a significant change or addition of other infrastructure areas, the RCP will need to be updated to cater for this change;
- Information, mitigation measures and recommendations given are based on the specialist studies that have been conducted in support of the application process;
- The commitments contained within this report currently exclude any comments or issued raised by Stakeholders and/or Interested and Affected Parties. This report will be updated once the public review process is complete taking these comments into account; and
- This report must be considered as a living document and will be updated as additional information becomes available, and as monitoring and rehabilitation progresses; and

- Vegetation monitoring and maintenance will take place for 3 years post-closure and surface water and groundwater for 5 years post-closure.

4.3 Terms of Reference

Section 41 (1) of Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) has been repealed and in terms of Section 24P in the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) as amended which provides that the holder of a mining right must make financial provision for rehabilitation of negative environmental impacts. The financial provision must guarantee the availability of sufficient funds to undertake the-

- Rehabilitation of the adverse environmental impacts of the listed or specified activities;
- Rehabilitation of the impacts of the prospecting, exploration, mining or production activities, including the pumping and treatment of polluted or extraneous water;
- Decommissioning and closure of the operations;
- Remediation of latent or residual environmental impacts which become known in the future;
- Removal of building structures and other objects; and/or
- Remediation of any other negative environmental impacts.

In addition to Section 24(P), the Regulations pertaining to the financial provision for prospecting, exploration, mining or production operations were promulgated on the 20 November 2015 (Government Notice No. 1147 published in GG 39425).

Regulation 6 of the Financial Provision Regulations requires a holder of a Mining Right to determine the quantum of the financial provision through detailed itemisation of all activities and costs, calculated based on the actual costs of implementation of the measures required for:

- Annual rehabilitation, as reflected in Annual Rehabilitation Plans (ARPs);
- Final rehabilitation, decommissioning and closure of the mining operations as per the RCPs which includes the findings of the Environmental Risk Assessment (ERA); and
- Remediation of latent or residual environmental impacts as identified in the ERA.

It must be noted that exemption from compiling an annual rehabilitation plan is being requested as the proposed mine is currently a greenfield site. It is expected that no annual rehabilitation will be undertaken in the initial construction phase which is envisioned to be one year. Final rehabilitation is only expected to occur once mining has ceased and the open pits rehabilitated, whereas annual rehabilitation will take place concurrently, during operation.

5 Details of Author(s)

The following is a list of the Digby Wells' staff who were involved in the update of the Final Rehabilitation, Decommissioning and Mine Closure Plan and compilation of the Financial Provision:

- **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. She is responsible for development of site specific rehabilitation plans working closely with both the botany and soils units in Digby Wells. Her previous experience was gained in the Restoration Ecology Branch at the eThekwini Municipality in Durban.
- **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.
- **Renée van Aardt;** Renée is the Divisional Manager: Closure and Rehabilitation. 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 in both South Africa and Tanzania.

6 Baseline Environmental Setting

6.1 Regional Climate

The MAP (mean annual precipitation) (obtained from the WR2012 manual) for quaternary catchment C21E is 691 mm. Based on the data, the average driest months for quaternary catchment C21E are June, July and August whilst the average wettest months November, December and January.

6.2 Geology

Geological structures are important in establishing hydraulic conductivity between various rock formations, and thereby determining the movement of groundwater.

The project area is underlain primarily by sedimentary strata (quartzite and shale) associated with the Witwatersrand Supergroup, and younger sediments (dolomite, quartzite and shale) associated with the older strata of the Transvaal Supergroup. The region is dominated by a cover of Karoo sandstone, conglomerate, dolerite sills and shale, with minor coal seams.

The project site is located within the Eastern Basin. The Eastern Basin is characterised by northwest-striking folds, with two prominent anticlinal structures namely the Nigel Anticline and Springs Monocline.

6.1 Hydrogeology

Based on the South African Aquifer Classification System (Parsons, 1995), the intergranular and fractured aquifer underlying Palmietkuilen project area is classified as a Minor Aquifer System, with distinct zones that can be classified as Major Aquifer Systems towards northeast and southeast of the project boundary. Although these aquifers seldom produce large quantities of water, they are important both for local supplies and in supplying base flow to rivers.

The groundwater environment comprises a karst aquifer associated with two outliers of the Malmani Subgroup dolomite, and various fractured rock aquifers associated with the Black Reef Formation strata and older basement rocks of the Central Rand and West Rand Groups.

However, this classification is only applicable to the heterogeneous and shallow, weathered and unconfined aquifer system. High yielding boreholes are found on occasion associated with zones of deep weathering or along geological features such as dykes.

The Eastern Basin has always had better water quality than the Western and Central Basins, which seems to be due to the a lower concentration of pyrites in the rock below the water level and the recharge through the alkaline dolomites. This however is expected to change as the water rises into the Kimberley Reef, which typically has higher pyrite content than the Main Reef (Scott 1995).

6.2 Soils, Land Capability and Land Use

6.2.1 Soils

The land type data gathered during the scoping phase suggested that the dominant land types on site were Ba1, Bb3 and Ea15. The field survey confirmed these findings with the dominant soil forms in the area of the open pit and infrastructure. The project area is dominated by the Hutton, Clovelly and Arcadia soil forms with small portions of Mispah, Glencoe, Katspruit, Kroonstad and Westleigh. The project site is dominated by the presence of high agricultural soils such as Hutton and Clovelly which represent 56% of the project site. Forty four percent of the project consists of soils with low agricultural potential and wetland soils (Digby Wells, 2016f).

6.2.2 Land Capability

Land capability is determined by a combination of soil, terrain and climate features. The dominant land capabilities in the project area were Class II (Intensive cultivation, 57%), followed by Class III (Moderate cultivation, 15%) and Class V (Wet zones, 28%) Arable land capability covers 72% of the land while non-arable (grazing) covers 28%. The land capability where the proposed open mining and infrastructure will be constructed will be reduce from highly arable to non-arable (Digby Wells, 2016f).

6.2.3 Land Use

The most dominant land use is cultivation which occupies 63% of the project site followed by grazing which occupies 37 % including wetlands and water bodies. This shows that the area has been developed into agriculture over years. The main impact on land use will be the change from crop production to that of mining. The cumulative impact on land use will be converting into open cast mining and infrastructure areas resulting in loss of agricultural land in that area for the mining life (<50 years) and after mining land can be restored. Surrounding land use can be broadly defined as arable land under cultivation on commercial farms (Digby Wells, 2016f).

6.3 Surface Water

The Project Area is situated within the Vaal Water Management Area (WMA 5), within the C21E quaternary catchment (Figure 6 1) and it falls within the Sedibeng District Municipality and borders of the Mpumalanga Province. The proposed Palmietkuilen Coal Mine is within the Aston Lake catchment, surrounded by wetlands and drained by the the Dwars-in-die-wegvlei and the Verdrietlaagte stream on either sides as depicted. The Aston Lake discharge flows into the Blesbokspruit. The Blesbokspruit is a perennial second-order stream which is a tributary of the Suikerbosrand River, which in turn flows into the Vaal River. The Blesbokspruit originates in the northern part of the catchment with perennial and non-perennial streams contributing to its flow; it is a NFEPA recognised wetland and is also a Ramsar site. Aston Lake is best known as a fishing destination thus giving is a local recreational importance (Surface Water Impact Assessment Report (Digby Wells, 2016f)).

The surface water uses determined for quaternary catchment C21E included industrial use (urban and non-urban), irrigation (irrigation and watering livestock) and mining.

- pH exceeded the SWQG Agriculture: Irrigation limit in all samples, which has high possibility of affecting yield decreasing marketable products for farmers and is within the range for other limits;
- Turbidity exceeded limit of the SANS 241-2015 drinking water quality standards in all samples;
- SW01 has elevated levels of EC, Ca, Mg, Na, Cl, Total Hardness and Turbidity extremely beyond the SWQG: Domestic Use limit. Cl found in this sample also

exceeds SWQG: Agriculture (Irrigation) Limit. The elevated levels of salts could be attributed to the very low flows and the fact that the water sampled was stagnant;

- The water quality at Aston Lake had elevated Al and Fe exceeding SWQG Domestic Use, Turbidity exceeding beyond both SANS 241-2015 drinking water quality standards and SWQG: Domestic Use limit with SS exceeding SWQG: Agriculture (Irrigation) Limit; and
- The water quality at Aston Lake had elevated Al and Fe exceeding SWQG Domestic Use, Turbidity exceeding beyond both SANS 241-2015 drinking water quality standards and SWQG: Domestic Use limit with SS exceeding SWQG: Agriculture (Irrigation) Limit)
- The identified infrastructure areas amount to approximately 10.72 km^2 as measured on the provided infrastructure layout. The Infrastructure is approximately 3.1% of total catchment area for the Aston Lake (344 km^2) and this would imply a loss of only 3.1 % catchment runoff are to the Aston Lake.

The water quality presented does not provide a precise river water quality as there was no flow during the site assessment. Samples were taken on stagnant pools of water along the river and this only provides an indicative baseline water quality which will still need to be updated during high flows.

6.4 Groundwater

6.4.1 Acid-base Testing

Geostratum Groundwater and Geochemistry Consult (2016) state the following from geochemical investigations (acid-base testing) conducted on material expected to be waste rock at the project area:

- Majority of clastic waste rocks (approximately 85% of all waste rock) have very low sulphide content and will not generate acid mine drainage (AMD);
- 10% of the clastic waste rocks have a moderate amount of sulphides and have a moderate potential to generate AMD; and
- 5% of the clastic rocks (some carbonaceous rocks and especially high sulphide containing sandstone adjacent to coal seams) have a significant potential to generate localised AMD and will form localised hot-spots within the backfill.

6.4.2 Contamination Plume

The contamination plume is expected to extend approximately 500 m beyond the project area boundary. The plume extends into the vicinity of Verdrietlaagte wetland/stream and Dwars-in-die-Wegvlei wetland/stream and could potentially have a negative effect on the wetland/stream water quality (Digby Wells, 2016e).

6.4.3 Decant

Decant is predicted after mine closure at a maximum of approximately 5 L/s and could have a negatively effect on the Dwars-in-die-Wegvlei wetland/stream quality if not properly managed.

Model simulations and hydrostatic calculations show that the mine is likely to decant after closure. A summary of the decant includes:

- The decanting will start 35 years after mine closure and is expected to decant at a rate ranging between 3 and 7 L/s, with the average being 5 L/s; and
- Once the decant (which is expected to be poor in quality) reaches the stream, it can migrate at a higher rate compared to groundwater flow and could have a negative impact on the down-gradient riverine ecosystem and land owners (Digby Wells, 2016e).

6.5 Flora and Fauna

6.5.1 Flora

The Fauna and Flora Impact Assessment (Digby Wells, 2016b) states that the site falls primarily within the regional vegetation types: Eastern Highveld Grasslands, Andesite Mountain Bushveld and the Soweto Highveld Grasslands; all of which are listed as threatened ecosystems by the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA).

The majority of the study area was dominated by cultivation (1738 ha) and the dominant natural habitat type was broadly classified as *Eragrostis* dominated Grassland, covering an area of 807 ha. In addition, ephemeral pan habitat (27 ha), alien bushclumps comprised of *Eucalyptus camuldulensis* and *Acacia mearnsii* (10 ha) and Wetland habitat (835 ha) were delineated. A total of 90 plant species were recorded on site of the 102 recorded for the region.

6.5.2 Fauna

The Fauna and Flora Impact Assessment (Digby Wells, 2016b) recorded a total of 13 mammal species on site, two of these species are regarded as species of special concern; Cape Clawless Otter (*Aonyx capensis*) and Serval (*Felis serval*) are protected according to NEMBA TOPS list. A total of 89 bird species were recorded, one SSC was recorded namely, the Secretary Bird (*Sagittarius serpentarius*). Four frog species were recorded on site, namely: *Amietia angolensis* (Common River Frog), *Bufo gutturalis* (Guttural Toad), *Cacosternum boettgeri* (Common Caco) and *Strongylopus fasciatus* (Striped Stream Frog). (Digby Wells, 2016b).

6.6 Aquatic Ecosystems

According to the Aquatic Ecology Impact Assessment (Digby Wells, 2016a).Two river reaches of the C21E quaternary catchment were assessed on a bi-annual basis. Applying standard River Ecosystem Monitoring Programme techniques the Present Ecological Status of the river reaches was determined. The results of the assessment derived an overall Present Ecological Status class of largely/seriously modified (class D/E). This class was derived due to the existing habitat impacts within the catchment area. The central cause of the poor ecological status was found to be associated with various agricultural practices which have resulted in habitat modification of the assessed river reaches (Digby Wells, 2016a).

6.7 Wetlands

The Wetland Assessment Report (Digby Wells, 2016g) states that the project sites are located in the Upper-Vaal catchment management area and the Blesbokspruit water catchment area. The project site is mostly within the quaternary catchment C21E. The project area is dominated by the National Freshwater Ecosystem Areas (NFEPA) rank 1 valley floor floodplain wetland associated with Aston Lake, which drains into the Blesbokspruit River Ramsar wetland and Marievale Nature Reserve. The infield investigation confirmed the wetland boundaries and concluded that the proposed Mining Right Area (MRA) is characterised by multiple wetland systems, totalling approximately 1,550 ha. The remainder of the area is characterised by extensive hillslope seeps that drain into the valley bottom wetlands and pan wetlands at the tops of the hills.

The wetlands have been largely transformed by agricultural activities, compromising the natural ecological functioning and biodiversity maintenance role of these wetlands. However, the wetlands and landscape will play an important ecological role as they are tributaries to the Blesbokspruit Ramsar Wetland of International Importance and the Marievale Bird Sanctuary. Additionally, most of the project area is mapped as Ecological Support Areas according to the provincial conservation plan whilst some wetlands are Critical Biodiversity Areas (Digby Wells, 2016g).

The predicted negative impacts to the local wetlands as a result of the Project and to the catchment area are major. The proposed mine will lead to the permeant loss of 255 ha of wetland from active soil and vegetation removal. In addition, surrounding wetlands will be damaged by the operational drawdown; and potential continuous water quality deterioration is likely to occur due to post-mining Acid Mine Drainage (AMD) generation. There is no mitigation possible for the loss of wetland habitat and these wetlands will need to be offset if the Project is to go ahead. All other residual impacts to surrounding wetlands must be mitigated as far as possible and long-term passive water treatment options will need to be investigated by Canyon Coal to prevent untreated decant water from entering the catchment (Digby Wells, 2016g).

7 Risk Assessment

7.1 Methodology

Risk assessment is the overall process of risk identification, risk analysis and risk evaluation. A baseline hazard identification and risk assessment (HIRA) was completed as part of the financial provision update. The baseline HIRA is based on a qualitative method. The following process steps were taken:

- A general discussion on hazards and "driving forces" was used to determine things that could "go wrong" during the mine closure;
- The boundaries of the project were defined;
- Areas within the mining area were defined;
- For each of the areas in the process:
  - Potential unwanted events were identified;
  - Current controls for each unwanted event were identified and recorded;
  - The most likely severity, should the event occur, and likelihood of the event occurring were then estimated;
  - Based on this, the level of risk was estimated using the risk matrix; and
  - For the Highly and Extremely Intolerable events, additional "controls" were recommended to reduce the level of risk.

The four levels of risks are classified as shown in Table 7-1 below.

Table 7-1: Risk Levels

Colour	Descriptor	Action	Sign-off
	Extremely Intolerable	Immediate Action	General Manager
	Highly Intolerable	Short term action required	Senior Management
	ALARP	Heightened Action	Section Manager
	Maintain	Ensure levels of control	Supervisor

7.2 Risk Analysis Results

Twenty three (23) unwanted events were identified. These unwanted events were ranked for risk based on the maximum reasonable severity should they occur and the likelihood of that specific severity/consequence occurring. This analysis was firstly done assuming that no controls are in place (i.e. the raw risk) and secondly considering current controls were in place and effective (i.e. residual risk). No unwanted events were ranked as extremely

intolerable, six (6) as highly intolerable, fourteen (14) as ALARP and three (3) ranked maintain

For the highest ranked events, additional “controls” should be put in place to reduce the level of risk. Deadlines for ensuring that the additional controls are put in place as well as accountabilities for doing so, should be defined.

The twenty three unwanted events were again assessed taking into consideration the current control measures. Based on the fact that the proposed Palmietkuilen Coal Mine is not yet operational, current control measures are not yet in place except for the potential risk of not having an adequate financial provision to close the mine sustainably once operations cease.

The full ERR can be seen in Appendix A.

8 Stakeholder Participation

No stakeholder issues or comments have informed this Rehabilitation, Decommissioning and Mine Closure Plan at this stage and this will be undertaken during the public participation component of the proposed project. Results from the draft EIA comment period will be incorporated into the finalised report, once comments have been received.

9 Closure Design Principles

9.1 Closure Visons, Objectives and Targets

Closure and rehabilitation is a continuous series of activities that begin with planning prior to the project’s design and construction, and end with achievement of long-term site stability and the establishment of a self-sustaining ecosystem. Not only will the implementation of this concept result in a more satisfactory environmental conclusion, but it will also reduce the financial burden of closure and rehabilitation.

The following points outline the main objectives for rehabilitation and closure:

- Achieve a final land use that is sustainable and meets both legislative requirements and stakeholder needs.
- Maintain and monitor all rehabilitated areas following re-vegetation and, if this monitoring shows that the objectives have been met, make an application for closure;
- Comply with local, district and national regulatory requirements; and
- Follow a comprehensive consultation and communication process with all stakeholders.

Rehabilitation and closure objectives have been tailored to the project at hand. This Rehabilitation, Decommissioning and Mine Closure Plan aims to assist Canyon Coal in carrying out successful rehabilitation for the proposed Palmietkuilen Coal Mine.

9.2 Alternative Closure and Post-Closure Options

It is expected that the current land use for the study area will not be possible during the operational phase and well into the post closure phase as the mining method is open void. Based on the Environmental Risk Report (ERR) (Appendix A), poor water quality emanating (decanting) post closure could be a concern. Therefore, alternatives would need to be considered during the operational LoM with respect to water treatment (both active and passive forms of treatment). In addition to this, there is a risk of damage to the natural environment that could occur during mining and post closure such as spontaneous combustion, and pollution of soil and water resources.

9.2.1 Preferred Closure Action

Based on the type of mining (open void mining) and the associated risk that could occur post closure, the following recommendations have been made as a result of the outcomes of the ERA conducted:

- Capture decanting mine water before it joins the streams; treat it and thereafter, if the quality is acceptable, re-introduce it into the streams. As experienced from other coal mines, the decant quality could be up to 2500 mg/L of sulphate;
- Compact coal discard to ensure a reduction in the possibility of spontaneous combustion;
- Berms should be created around facilities to reduce pollution leaving the site and reduce sedimentation of rivers;
- Clean and dirty water trenches should be constructed appropriately;
- Monitoring of groundwater water levels in the weathered and coal seam aquifer; and
- Update the numerical model and decant rates annually for the first five years with the monitoring data.

9.2.2 Research

It is advised that during the operational phase, that periodic monitoring of both groundwater and surface water quality is undertaken and that this information is utilised to update the Numerical Groundwater Models, allowing trends to be determined. This will enable the mine to determine the best practicable options that could be considered for post closure treatment of water.

10 Proposed Final Post-Mining Land Use

The final Land Use Plan (LUP) is essentially the end land use to which Canyon Coal would like to return the land affected by mining activities. The closure objectives set as part of the mine closure planning process aims to ensure that the final LUP is achieved and that the area is sustainable in the long-term from an environmental and social point of view.

Due to the excellent quality of the soils for agriculture, it would be preferable to aim to rehabilitate to an agricultural land use. However, due to the onerous and costly nature of rehabilitating to agriculture, a land use of grazing is suggested. Soil stripping and stockpiling practices would need to be adhered to to meet this requirement and a minimum of 300mm of topsoil will need to be placed over infrastructure areas. Post-mining land use will also need to be re-assessed closer to the Rehabilitation Phase.

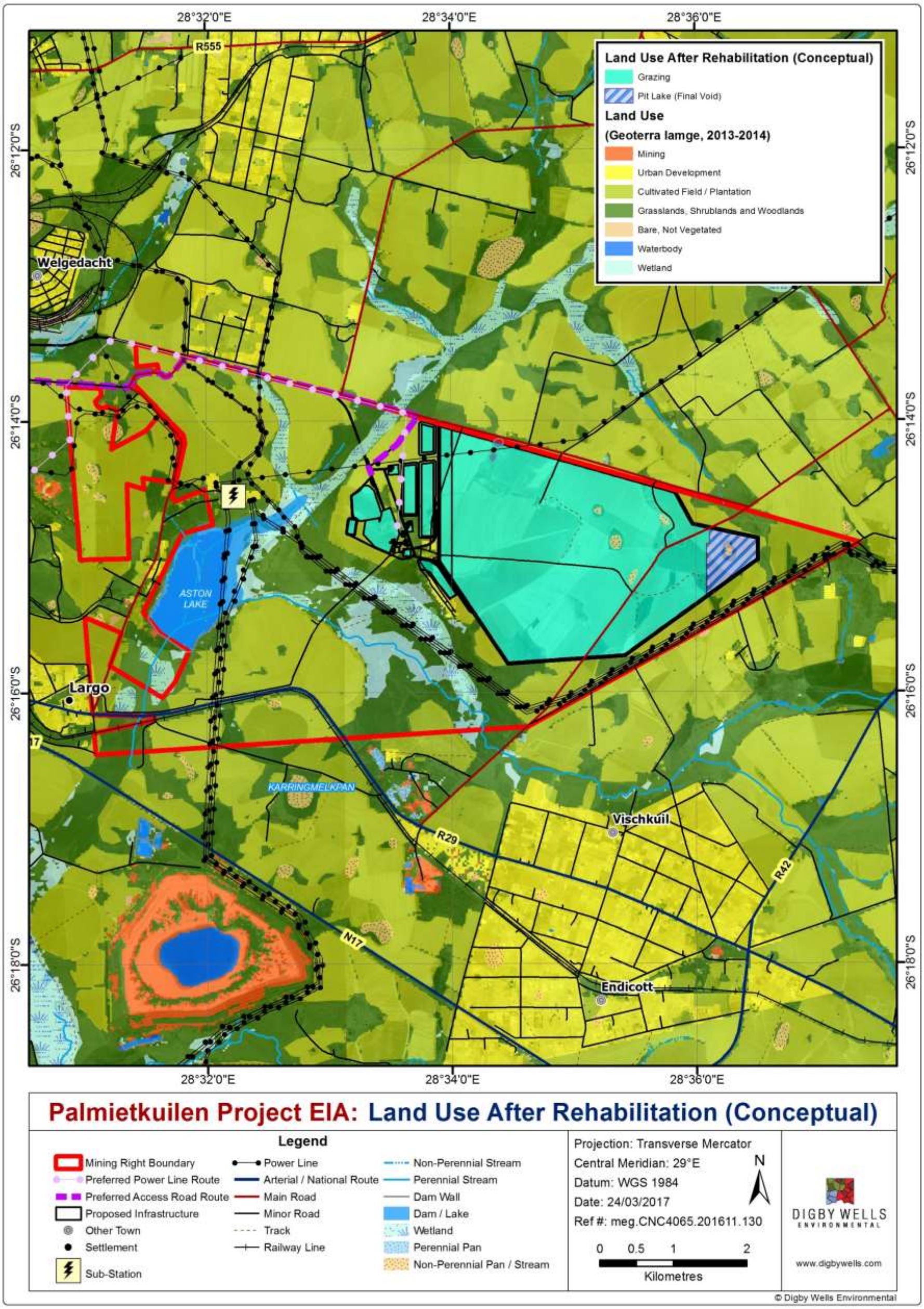

Figure 10-1: Proposed Land Use

10.1 Material Balance Analysis

Post-mining topography is one of the most important factors to be considered in the rehabilitation and closure processes. Generally, contouring of the filled in areas aims to achieve the approximate original contours that existed before mining (SACMA, 2005). To plan or model this process, a materials balance is needed for the full mined out area to determine how much volume is being removed (i.e. coal) and thereafter how much is left to put back and rehabilitate the landscape with. This section describes the materials calculations for the Palmietkuilen operations and gives the recommended post-mining landscape topography plan.

10.1.1 Bulking Factor

A critical factor in the calculations of volumes of material and final landform predictions is the swell or bulking factor of the removed and thereafter replaced materials as the physical act of excavation breaks the rocks up into various sizes, which introduces air pockets and increases the volume of the material. In its simplified format, calculating the bulking factor is done by dividing the loose cubic meters (LCM) by the bank (original) cubic meters (BCM) (Heit, 2011). Soils and other fine materials will result in a negative bulking factor as this handling generally leads to compaction after placement. In reality, the final bulking factor is influenced by many variables including the geological properties of the material and the design of the blasting methods. Although unpublished, an industry norm for the bulking factor of overburden is 30%.

The coal resource will be mined using open pit methods due to the seemly depth of the coal reserve (between 12 and 60 m below the surface). Bench mining and strip mining techniques are proposed. Bench mining involves the development of an open pit through a series of benches at varying depths while strip mining involves the movement of overburden laterally to an adjacent empty pit where the mineral has already been extracted. The proposed project will include one open pit.

Three scenarios have been calculated to see the possible scenarios for a low, average (~30%) and high bulking factor for the materials. The factors used are shown in the Table 10-1 below. This percentage is converted into a factor of above 1 for bulking or less than 1 if compaction. The South and North pit consists of blocks of which detailed information of the thickness of each layers is given. These data were used to calculate the predicted end volumes. With the bulking factors listed, each block volume is calculated for coal removed and thereafter final volume theoretically replaced; and the deficit or surplus of material can therefore be predicted. The tables presented below present two scenarios, one of which discard is not placed back into the void and one where discard is placed back into the voids. The scenarios indicate the predicted volume of material that would be available for backfill for different bulking factors and also indicates if there would be a surplus of deficit of material.

For the purpose of the materials balance calculations the following assumptions have been made:

- Average depth of the pit is assumed to be 60 m;
- Thickness of the coal seams has been averaged for the pit at a thickness of 12 m (taking into account all coal seams that will be mined;
- The depth of the soft overburden has been assumed to be 30 m in thickness on average;
- It is assumed that 25 % to 28% of solid discard will be placed back into the open pit void;
- Depth of interburden/overburden has been assumed to be 18 m thick on average; and
- Two scenarios were calculated. One with discard being placed back into the pit and one without discard being placed back into the pit.

Table 10-1: Bulking factors (%) used for the different layers for three different scenarios

Bulking Factor Scenario	Average Thickness (m)	Low %	Average %	High %
Soft Overburden	30	-10	0	10
Interburden/Overburden	18	20	25	30
Coal Discard	3.43	0	5	10

10.1.2 Material Calculations

Table 10-2 (without discard) and Table 10-3 (with discard) give the results from the material balance calculations done according to the three different bulking scenarios. The total depth that is deficit is given for material that is in deficit over the mining area. The results indicate that for average bulking factors, there will be approximately 7.5m deficit in returning the landscape to original topography without discard being utilised as backfill. If discard is utilised as backfill into the open pit the deficit can be reduced to 3.9 m. It must be noted that the deficit indicated is an average deficit given over the entire pit.

Table 10-2: Results of the material balance calculations for the three different bulking scenarios without discard

Bulking Factor Scenario			
Description	**Low**	**Average**	**High**
Average Block Thickness Deficit	-11.40	-7.50	-3.6

Table 10-3: Results of the material balance calculations for the three different bulking scenarios with discard

Bulking Factor Scenario

Description	Low	Average	High
Average Block Thickness Deficit	-7.97	-3.90	+0.2

In terms of the post mining topography is has been assumed that the open pit would have been rehabilitated concurrently up to year 53, with a bench depth of 10m assuming there will be 6 benches. A final void at year 53 will require infill with a total area of 39.31ha and a depth of five benches (50m) would need to be infilled prior to establishing an inpit lake, allowance was also made for an earth bund on the perimeter of the inpit lake.

Detailed calculations with respect to the final void will need to be done to determine the final size of the void, if concurrent rehabilitation is done to original ground level over the life of mine and it is decided that a final void will remain. The other option is to rehabilitate the entire area to a set height, however it must be noted that there will be an overall change from the post mining topography when compared to the pre-mining topography. Also as a result of the change in topography a free draining environment should be created to ensure that water does not pond.

11 Closure Environmental Management Plan (CEMP)

This CEMP should inform how the mine infrastructure is either handed over legally or removed from site. During the operational phase it is recommended that an assessment be undertaken of the infrastructure to determine if some of the infrastructure can be utilised post closure.

The rehabilitation and closure actions for the particular infrastructure are detailed below and separated into phases. Although concurrent rehabilitation occurs during the operational phase, it has been included in this section as it directly impacts on final rehabilitation and closure. Table 11-1 details actions required during the constructions phase, Table 11-3 the operational phase and Table 11-4 those actions required during the decommissioning and closure phase of the project.

11.1 Construction Phase

Table 11-1: Rehabilitation Actions during the Construction Phase

Construction Phase		
Aspect	**Actions**	**Description**
Construction Activities	Reduce the negative impact on areas	Planning should minimise the area to be occupied by infrastructure. The affected area should be kept as small as practically possible and should be clearly defined and demarcated. Crews must restrict their activities to planned areas. Liners will need to be added to areas such as the discard dump however the type can only be determined once groundwater results have been analysed.
	Vegetation clearance	Prior to construction, the construction footprint must be comprehensively surveyed to identify all important species that may need to be removed and relocated to another suitable site/nursery for the duration of the project life time.
		If rare and protected flora species are found in the mining areas during construction or operational activities, they should be conserved by removing and relocating them to another section of the project area which is suitable. The rare/protected plants can be kept in a nursery; the plants can then be replanted during rehabilitation of the disturbed areas. Permits are required to remove these plants should they fall within the footprint.
		Protected plant species that are removed from the construction footprint must be replaced at a ratio of 1:3 which ultimately means that for every protected plant removed from site, 3 more protected plants must be planted on site after the project has commenced.
		During vegetation removal, the removal of trees should be avoided if possible. If bush

Construction Phase		
Aspect	**Actions**	**Description**
		clearing is required contractors must only clear bushes and trees larger than 1 m. The remaining vegetation must be stripped with the topsoil to conserve as much of the nutrient cycle, organic matter and seed bank as possible. If it is necessary to remove protected trees, permits will be required.
	Soil stripping	The soil must be stripped in line with best practice (see Section 11.1.1 below as well as the Soils, Land Use and Land Capability Assessment Report (Digby Wells, 2016e) for comprehensive information on soil stripping for the different soil types).
	Soil stockpiling	The soil must be stockpiled in line with best practice. This must be done as close as possible to the areas that will be progressively rehabilitated (see Section 0 below as well as the Soils, Land Use and Land Capability Assessment Report (Digby Wells, 2016e) for comprehensive information on soil stockpiling).

11.1.1 Soil Stripping Method

Correct stripping of soils will firstly ensure that enough soils are available for rehabilitation and secondly, that the soils are of adequate quality to support vegetation growth and thus ensure successful rehabilitation. The following requirements should be considered wherever possible (Soils, Land Use and Land Capability Assessment Report (Digby Wells, 2016e)):

- If possible soil material should be stripped when it is in a lightly moist conditions to minimise compaction (i.e. when they are dry);
- Strip red/brown and yellow soils separately;
- Topsoil should be stored separately from subsoil because it contains more nutrients and microbes;
- Soil stripping and stockpiling of the soils should be done in a single action to reduce compaction and to increase the viability of the seed bank contained in the stripped soil surface;
- Demarcate boundaries of different soil types;
- Stripping depths of different soil types. The Hutton and Clovelly soils are deeper and can be stripped between 0.9 to 1.2 m depending on depth;
- Define cut-off horizons in simple terms that the stripping operator can understand;
- Soils should be stripped and replaced using the truck and shovel method as far as possible. This method will limit the compaction of soils and soils must be stripped when dry to minimise compaction;
- Close supervision will ensure that soils are being stripped from the correct area and to the correct depths, and placed on the correct stockpiles to minimise compaction; and
- The handling of the stripped topsoil must be minimized.

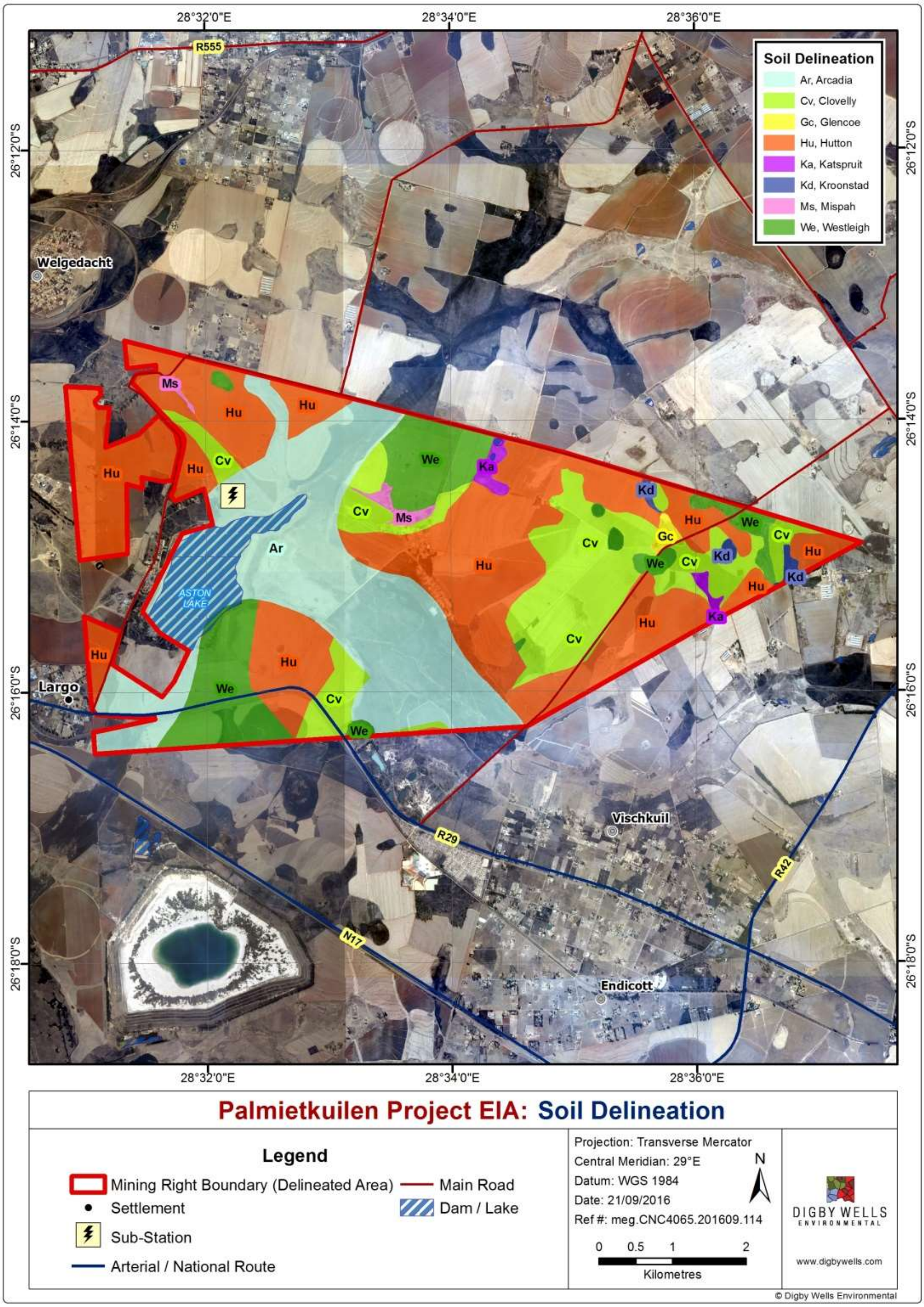

Figure 11-1: Soil Delineation Map for the Palmietkuilen Project EIA

11.1.2 Soil Stripping Volumes

A minimum layer of 0.4 of topsoil and 0.8 of subsoil for Hutton and Clovelly soil forms should be stripped and minimum of 0.25 to 0.4 m of topsoil for Glencoe, Mispah, Kroonstad and Westleigh should be stripped. Topsoil and subsoil should be stockpiled separately. Hutton and Clovelly can be stockpiled and stripped together as they have similar soil properties, while wetland soils Arcadia and Katspruit should not be stripped and together at all. Kroonstad and Westleigh topsails' can be stripped and stockpiled together but not the subsoil as they are different.

Table 11-2: Soil stripping volumes (m^3)

Soil Form	Depth of soil (m)	Area (ha)	Volume of soil to be stripped and stockpiled (m^3)
Hutton	1.2	1382.12	16 585 440
Clovelly	1.2	575.45	6 905 400
Arcadia	0.6	1024.65	6 147 900
Glencoe	0.5	12.25	61 250
Katspruit	0.6	27.70	166 200
Kroonstad	0.6	17.67	106 020
Mispah	0.3	20.31	60 930
Westleigh	0.4	413.25	1 653 000
TOTAL		**3473.07**	**31 686 140**

Although there is a large amount of topsoil available. The current plans only suggest stripping of a small area and stockpiling these on an area of 9.21 ha. The plans state that the topsoil should be stockpiled at a height of 20 m. This amounts to 1 842 000 m^3 of topsoil for rehabilitation. Stockpiling at this height is detrimental to rehabilitation and Digby Wells suggests only stockpiling to a height of 10 m which amounts to a total of 921 000 m^3.

Soil required for 10 years	115.92 ha	300 mm	347 760 m^3

Soil required for LOM	137.32 ha	300 mm	411 960 m^3
Soil available at 20 m stockpile height	9.21 ha	300 mm	1 842 000 m^3
Soil available at 10 m stockpile height	9.21 ha	300 mm	921 000 m^3

Should Canyon Coal adhere to the suggested 10 m stockpile height there will be sufficient topsoil. Generally, 4 m high stockpiles would be suggested, however the lack of space means that this can't be achieved. However, this will have additional cost implications as this would increase soil amelioration costs.

11.1.3 Stockpiling Method

This section provides topsoil stockpile management measures which aim to conserve topsoil in a condition as close as possible to its original state.

- Separate stockpiles for topsoil and subsoil;
- Stockpiles should be at least not greater than 10 m high. If space is limited, stockpiles can be higher, however additional amelioration may be required during the rehabilitation process and compaction of the removed topsoil must be avoided by prohibiting traffic on stockpiles;
- Stockpile the major soil types separately and accurately demarcate the soil stockpiles and the type of soil for use in rehabilitation activities ;
- Stockpiles should be revegetated to minimise loss of soil quality and maintained;
- Stockpiles should be clearly signposted for easy identification and defined as no-go areas;
- Locations should be accurately surveyed and data is recorded relating to the soil type and volume;
- All stockpiles should be located in areas where they will not have to be removed prior to final placement. Materials should thus be placed in their final closure location or as close as practicable to it;
- Stockpile should be located outside proposed mine disturbance areas;
- Stockpiles should be located in areas away from drainage lines or windy areas to minimise the risk of soil erosion;
- Minimise compaction during stockpile creation and revegetate to avoid erosion losses;

- No waste material should be placed on the stockpiles;
- Equipment movement on top of the soil stockpiles should be limited to avoid topsoil compaction and subsequent damage to the soils and seedbank;
- Soil erosion should be controlled on stockpiles by having control measures to reduce erosion risk such as erosion control blankets, soil binders, revegetation, contours, diversion banks and spillways;
- It is assumed that some of stockpiles will be in place for several years (stockpiles that are not utilised during concurrent rehabilitation) and therefore should be vegetated with the species seed mix to reduce the risk of erosion, prevent weed growth and to reinstitute the ecological processes within the soil;
- Once established, stockpiles should be managed to ensure that losses from the piles are minimized and that additional damage to the physical, chemical or biotic component is minimised; and
- Stockpiles should only be used for their designated final purposes.

11.2 Operational Phase

Table 11-3: Rehabilitation Actions during the Operational Phase

Operational Phase		
Aspect	**Actions**	**Description**
Open Pit	Concurrent rehabilitation of open pits	Once mining of an open pit strip is completed, the strip is filled with overburden material and compacted. This is followed by the replacement of stockpiled topsoil for the purpose of re-vegetation. Following the filling of open pit strips and replacement of topsoil, the disturbed area is re-vegetated. This is done on a continuous basis throughout the operational phase.
Pollution Control Dam	Desilt PCD	Desilting of the PCD should be done continuously throughout operations.
Alien Species	Remove alien vegetation	Alien invasive species must be removed.
Pollution Control	Pollution control	Hydrocarbons and hazardous substances must be stored in bunded areas and refuelling should take place in contained areas, when rehabilitation activities are undertaken.
		Ensure that oil traps are well maintained, if oil traps are utilised.
		Vehicles and heavy machinery used should be serviced and checked on a regular basis to prevent leakages and spills.
		Implementation of storm water management system around hazardous materials or waste storage facilities in order to contain spills.
		All hazardous waste should be removed by a suitably qualified service provider and disposed of at

Operational Phase		
Aspect	**Actions**	**Description**
		an approved permitted landfill site. If contamination does occur, soil remediation must take place.
Wetlands	Monitor wetlands and remediate where possible	Wetlands near the pit should be monitored frequently to determine if they are being impacted negatively. Rehabilitation measures should take place as soon as possible in these instances.

11.3 Rehabilitation, Decommissioning and Closure Phase

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

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

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

Table 11-4 describes the activities that will be undertaken during the rehabilitation decommissioning and closure phase.

It should be noted that decant is expected to occur 35 years after closure. Nearer to this time, options to treat this water must be considered; this may include active treatment, or passive treatment options such as constructed wetlands or phytoremediation.

Table 11-4: Rehabilitation Actions during the Rehabilitation, Decommissioning and Closure Phase

Rehabilitation, Decommissioning and Closure Phase		
Aspect	**Actions**	**Description**
Office and Plant Infrastructure	Remove infrastructure	All portable infrastructure will be removed off the site. Structures that require demolishing such as workshops will be demolished to 1m below ground level for areas which cannot be used by a subsequent land user. The rubble will either be buried on site provided it will not have any detrimental impacts on water quality. The conveyor and associated infrastructure will also need to be removed.
	Shape	Once the site has been cleared the exposed underlying materials should be reshaped to create a gently sloping, free-draining topography. Re-instate natural drainage lines to limit erosion and sediment build up within local river courses.
	Replace topsoil	Appropriate topsoil sourced from the topsoil stockpiles should be replaced to a minimum thickness of 300 mm on the rehabilitated areas.
	Reseed/Vegetate	Reseed with grasses listed in Table 11-5 and improve species diversity by planting species listed Table 11-6. Additionally, replant species that were relocated due to mining construction.
	Remove alien vegetation	Remove alien invasive plants (see Section 11.3.4 for more detail).
	Restrict access to rehabilitated areas	Prevent access of people/machinery/vehicles/grazing animals on newly rehabilitated land to allow regeneration of vegetation and reduce erosion.
Open Pit and Boxcut	Backfill final void	Infilling of the pit/strips will occur as mining progresses and subsequent spoils rehabilitation will also take place for the areas which can only be accessed at the end. Ensure that the

Rehabilitation, Decommissioning and Closure Phase		
Aspect	**Actions**	**Description**
		waste rock material that is high in pyrite content and prone to acid generation is deposited at the base of the rehabilitated pit in such a way that it will be completely flooded with groundwater. Where possible, material will be replaced in the reverse order to which it has been removed. An in pit lake may need to be established should there not be sufficient material, as reflected in the materials balance.
	Shape	The areas that have been infilled will be shaped to reduce the likelihood of ponding occurring on surface and to blend in with the surrounding topography.
	Replace topsoil	Once mining of the final open pit strip has been completed, the strip is filled with overburden, levelled and topsoil replaced (300 mm). Based on current planning, for average bulking factors, there will be approximately 7.5m deficit in returning the landscape to original topography without utilising discard. If discard is utilised as backfill the estimated deficit would be 3.9m.
	Reseed/Vegetate	Reseed with grasses listed in Table 11-5 and improve species diversity by planting species listed Table 11-6. Additionally, replant species that were relocated due to mining construction.
	Remove alien vegetation	Remove alien invasive plants (see Section 11.3.4 for more detail).
	Restrict access to rehabilitated areas	Prevent access of people/machinery/vehicles/grazing animals on newly rehabilitated land to allow regeneration of vegetation and reduce erosion.
Discard Dump	Remove contamination	Backfill the coal discard into the pits. Remove coal veneer from affected area.

Rehabilitation, Decommissioning and Closure Phase		
Aspect	**Actions**	**Description**
		Contaminated material will then need to be disposed of at a hazardous waste facility.
	Shape	The area will be shaped to reduce the likelihood of ponding occurring on surface and to blend in with the surrounding topography.
	Rip	The area should be ripped to 500 mm to reduce compaction.
	Replace topsoil	Appropriate topsoil sourced from the topsoil stockpiles should be replaced to a minimum thickness of 300 mm on the rehabilitated areas.
	Reseed/Vegetate	Reseed with grasses listed in Table 11-5 and improve species diversity by planting species listed Table 11-6. Additionally, replant species that were relocated due to mining construction.
	Restrict access to rehabilitated areas	Prevent access of people/machinery/vehicles/grazing animals on newly rehabilitated land to allow regeneration of vegetation and reduce erosion.
Product Stockpiles	Stockpiled material	Removal of all stockpiled coal from the site and remove sacrificial coal layer.
	Rip	The footprints of the stockpiles must be ripped to reduce compaction.
	Replace topsoil	Appropriate topsoil sourced from the topsoil stockpiles should be replaced to a minimum thickness of 300 mm on the rehabilitated areas.
	Reseed/ Vegetate	Reseed with grasses listed in Table 11-5 and improve species diversity by planting species

Rehabilitation, Decommissioning and Closure Phase		
Aspect	**Actions**	**Description**
		listed Table 11-6. Additionally, replant species that were relocated due to mining construction.
	Remove alien vegetation	Remove alien invasive plants (see Section 11.3.4 for more detail).
	Restrict access to rehabilitated areas	Prevent access of people/machinery/vehicles/grazing animals on newly rehabilitated land to allow regeneration of vegetation and reduce erosion.
ROM Stockpile	Remove contaminated material	Remove coal veneer. This must then be disposed of at a hazardous waste facility.
	Shape	Once the site has been cleared the exposed underlying materials should be reshaped to create a gently sloping, free-draining topography. Re-instate natural drainage lines to limit erosion and sediment build up within local river courses.
	Replace topsoil	Appropriate topsoil sourced from the topsoil stockpiles should be replaced to a minimum thickness of 300 mm on the rehabilitated areas.
	Rip	The footprints of the ROM stockpile must be ripped to reduce compaction.
	Reseed/ Vegetate	Reseed with grasses listed in Table 11-5 and improve species diversity by planting species listed Table 11-6. Additionally, replant species that were relocated due to mining construction.
	Remove alien vegetation	Remove alien invasive plants (see Section 11.3.4 for more detail).

Rehabilitation, Decommissioning and Closure Phase		
Aspect	**Actions**	**Description**
	Restrict access to rehabilitated areas	Prevent access of people/machinery/vehicles/grazing animals on newly rehabilitated land to allow regeneration of vegetation and reduce erosion.
Diesel storage	Remove tank	Remove tank and associated infrastructure from site.
	Demolish concrete bund wall and foundation	Demolish the concrete bund wall and foundation. These structures should be demolished to 1000 mm below surface and the demolition rubble removed from the site. Soil should be tested for contamination. If contamination is discovered, this soil should be removed and disposed of in the appropriate waste disposal facility.
	Shape	Once the site has been cleared the exposed underlying materials should be reshaped to create a gently sloping, free-draining topography. Re-instate natural drainage lines to limit erosion and sediment build up within local river courses.
	Replace topsoil	Appropriate topsoil sourced from the topsoil stockpiles should be replaced to a minimum thickness of 300 mm on the rehabilitated areas.
	Reseed/Vegetate	Reseed with grasses listed in Table 11-5 and improve species diversity by planting species listed Table 11-6. Additionally, replant species that were relocated due to mining construction.
	Remove alien vegetation	Remove alien invasive plants (see Section 11.3.4 for more detail).
	Restrict access to rehabilitated areas	Prevent access of people/machinery/vehicles/grazing animals on newly rehabilitated land to allow regeneration of vegetation and reduce erosion.

Rehabilitation, Decommissioning and Closure Phase		
Aspect	**Actions**	**Description**
Dams	Desilt the dams	Desilt the pollution control dams.
	Remove HDPE liner	Remove liners – these should be disposed of at the correct hazardous waste disposal facility.
	Doze the dam walls	Doze the dam walls.
	Dismantle all dam infrastructure	Remove supporting plinths for pipeline as well as foundations and other associated infrastructure. Remaining structures should be demolished to 1 m below surface and the demolition rubble removed and any re-usable items should be removed from the site. Soil should be tested for contamination. If contamination is discovered, this soil should be removed and disposed of in the appropriate waste disposal facility.
	Rip	The footprints of dams must be ripped to 200 mm.
	Replace topsoil	Appropriate topsoil sourced from the topsoil stockpiles should be replaced to a minimum thickness of 300 mm on the rehabilitated areas.
	Reseed/ Vegetate	Reseed with grasses listed in Table 11-5 and improve species diversity by planting species listed Table 11-6. Additionally, replant species that were relocated due to mining construction.
	Remove alien vegetation	Remove alien invasive plants (see Section 11.3.4 for more detail).
	Restrict access to rehabilitated	Prevent access of people/machinery/vehicles/grazing animals on newly rehabilitated land

Rehabilitation, Decommissioning and Closure Phase		
Aspect	**Actions**	**Description**
	areas	to allow regeneration of vegetation and reduce erosion.
Linear infrastructure	Remove linear infrastructure	Linear infrastructure will need to be removed. The re-usable items should be removed from the site. Remaining structures should be demolished to 1 m below surface and the demolition rubble removed. Soil should be tested for contamination. If contamination is discovered, this soil should be removed and disposed of at the appropriate waste disposal facility.
	Shape	Once the site has been cleared of all infrastructure and rubble and no contamination is present, the exposed underlying materials should be reshaped to create a gently sloping, free-draining topography. Natural drainage lines should be reinstated to limit erosion and sediment build up within local river courses.
	Replace topsoil	Appropriate topsoil sourced from the topsoil stockpiles should be replaced to a minimum thickness of 300 mm on the rehabilitated areas.
	Reseed/Vegetate	Reseed with grasses listed in Table 11-5 and improve species diversity by planting species listed Table 11-6. Additionally, replant species that were relocated due to mining construction.
	Remove alien vegetation	Remove alien invasive plants (see Section 11.3.4 for more detail).
	Restrict access to rehabilitated areas	Prevent access of people/machinery/vehicles/grazing animals on newly rehabilitated land to allow regeneration of vegetation and reduce erosion.

Rehabilitation, Decommissioning and Closure Phase		
Aspect	**Actions**	**Description**
Roads and parking areas	Leave some roads in situ	Roads that can and will be used for rehabilitation/monitoring or by other users post-closure should be left in situ provided this is agreed upon by all parties concerned.
	Replace topsoil	Appropriate topsoil should be replaced to a minimum of 300 mm thick in all rehabilitated areas.
	Rip	Topsoil should be ripped to 200 mm to reduce compaction.
	Reseed/Vegetate	Reseed with grasses listed in Table 11-5 and improve species diversity by planting species listed Table 11-6. Additionally, replant species that were relocated due to mining construction.
	Remove alien vegetation	Remove alien invasive plants (see Section 11.3.4 for more detail).
	Restrict access to rehabilitated areas	Prevent access of people/machinery/vehicles/grazing animals on newly rehabilitated land to allow regeneration of vegetation and reduce erosion.

11.3.1 Soil Replacement

All soils should be replaced to a similar depth as was encountered prior to the mining operation. However, soils can be replaced to a depth (0.3 m) that will sustain a grazing land capability. It is recommended that the soils should be replaced as follows:

- Soil horizons (topsoil and subsoil) should be replaced in the same sequence in which they were stripped;
- The usable subsoil material should be replaced on the reshaped spoil, flowed by the topsoil and ensure natural revegetation with the species that were originally in the area;
- Soils should be moved when dry to minimise compaction;
- Compaction should be minimised by use of appropriate equipment and replacing soils;
- Minimise compaction during smoothing of replaced soils by using dozers rather than graders; and
- Following replacement, all soils should be ripped to full rooting depth using dozer rippers.

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 following steps should be taken during the amelioration of soils:

- The soils must be ripped to ensure reduced compaction;
- An acceptable seed bed should be produced by surface tillage;
- Restore soil fertility
  - Soils should be analysed for plant nutrient content;
  - Fertiliser should be applied to raise soil nutrient content to the desired levels; and
  - Fertiliser should be applied annually until the soil fertility cycle is restored at determined rate.
- Incorporate the immobile fertilisers into the plant rooting zone before ripping; and
- Apply maintenance dressing of fertilisers on an annual basis until the soil fertility cycle has been restored.

11.3.2 Revegetation

A revegetation plan is a necessary component of the decommissioning phase. The overall objectives for the re-vegetation of reshaped and top-soiled land are to:

- Prevent erosion;

- Avoid soil loss;
- Restore the land to the agreed land capability;
- Reduce sedimentation into aquatic ecosystems such as rivers and wetlands;
- Re-establish eco-system processes (succession) 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.

In order to have a chance at successful rehabilitation at the proposed project site, it is important to note the vegetation types so that these can be replaced to some extent once mining has been completed. The proposed project area falls predominantly within the Eastern Highveld Grassland as described by Mucina and Rutherford (2006) in the Grassland Biome.

11.3.3 Seeding and Planting

Table 11-5 is the grass seed mix advised for the rehabilitation areas of the proposed project site whilst Table 11-6 lists species characteristic of Eastern Highveld Grassland that can be planted on site to boost species richness. The sensitive Andesite Mountain Bushveld vegetation type present in the project area has been avoided though he repositioning of infrastructure on the landscape.

During rehabilitation the terrestrial areas should be seeded with grasses such as Cynodon dactylon, *Eragrostis tef, Eragrostis chloromelas, Chloris gayana, Digitaria eriantha* and *Panicum maximum* (Table 11-5). As grazing is a possible end land use, species that have high grazing value have been selected. However, some grass species indicated in Table 11-6 must also be included to increase species diversity and ensure that the grass species represent species that would have been found naturally in the area. Additionally, in South Africa, only one in six plant species are grasses, therefore it is imperative that these areas should also be vegetated with herbs, geophytic herbs, succulent herbs and low shrubs. Examples of these species for planting on site are included in Table 11-6.

Importantly, plant species of special concern that were removed prior to mining must now be transplanted back on site during rehabilitation.

Table 11-5: Grasses for Rehabilitation

Species name	Common name	Properties	Grazing potential	Grazing status	Sowing rate (kg/ha)	% mix
Cynodon dactylon	Couch Grass	Mat-forming, stabiliser	High grazing values	Increaser 2	5	20%
Eragrostis tef	Teff	Annual, pioneer	High grazing value		2	8%
Eragrostis chloromelas	Curly Leaf	Perennial	Moderate grazing value	Increaser 2	3	12%
Chloris gayana	Rhodes grass	Short-lived perennial, stabiliser	High grazing value	Decreaser	4	16%
Digitaria eriantha	Finger grass	Perennial	High grazing value	Decreaser	8	32%
Panicum maximum	White Buffalo Grass	Perennial	High grazing value	Decreaser	3	12%
Total					**25 kg/ha**	**100%**

Table 11-6: Common and Characteristic Plant Species of the Eastern Highveld Grassland

Plant form	Species
Graminoids (grasses and sedges)	*Heteropogon contortus, Aristida aequigluims, A. congesta , A. junciformis subsp. Galpini, Brachiaria serrata, Cynodon dactylon, Digitaria monodactyla, D. tricholaenoides, Elionurus muticus, Eragrostis chloromelas, E. curvula, E. plana, E. racemosa, E. sclerantha, Loudetia simplex, Microchloa caffra, Monocymbium cereiiforme, Setaria sphacelata, Sporobolus africanus, S. pectinatus, Themeda triandra, Trachypogon spicatus, Tristachya leucothrix, T. rhmanni, Alloteropsis semialata subsp. eckloniana, Andrpogon appendiculatus, A. schirensi, Bewsia biflora, Ctenuim concinnum, Diheteropogon amplectens, Eragrostis capensis, E. gummiflua, E. patentissima, Harpochloa falx, Panicum natalense, Rendlia altera, Schizachyruim sanguineum, Setaria nigrirostris, Urelytrum agropyroides*
Herbs	*Berkheya setifera, Haplocarpha scaposa, Euryops gifillani, Justicia anagalloides, Acalyha angusta, Cahmaecrista mimosoides, Dicoma anomala, E. transvalensis subsp. setilobus, Helichrysum aureonitens, H. caespititium, H. callicomum, H. oreophilum, H. caespititium, H. oerophilum, H. rugulosum, Ipomoea crassipes, Pentanisia prunelloides subsp. latifolia, Selago densiflora, Senecio coronatus, Hilliardiella oligocephala, Wahlenbergia undulata*
Geophytic herbs	*Gladiolus crassifolius, Haemanthus humilis subsp. hirsutus, Hypoxis rigidulua var. pilosissima, Ledebouria ovatifolia*
Succulent herb	*Aloe ecklonis*
Low shrubs	*Anthospermum rigidum subsp. pumilum*

Hand seeding/ tractor seeding are options for seeding at the project site. Planting is generally most successful when done at or immediately after the first rains and into freshly-prepared fine-tilled seedbeds. To stimulate germination, water retention in the seed zone is essential and can be aided by the use of light vegetation mulches. The rehabilitation seed mixes generally consist of grasses as they rapidly establish and provide excellent protection against surface erosion (Tanner *et al*., 2007).

11.3.4 Alien Invasive Plants

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 which is detrimental to rehabilitation of vegetation. AIPs directly compete with rehabilitating vegetation and could result in increasing costs of revegetation in the long term. In addition, various invasive species are required by law to be removed. 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. One of the most cost-effective and sustainable options is to utilise biocontrol. Biocontrol makes use of a natural enemy of the AIP in its native country to help reduce the population in the country it invades (see the Agricultural Research Council website for more information on Biocontrol). If mechanical and chemical means need to be used, AIPs must be continually removed after rehabilitation has occurred 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.

- There must be no planting of alien plants (e.g. black wattle, eucalyptus, pampas grass) anywhere within the project area;
- 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; 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.*

Due to the nature of the mining method, some rehabilitation actions will take place during the operational phase (backfilling of the open pit) and the balance will take place in the decommissioning phase when all surface infrastructure is removed. However, it is important that actions during the construction phase, specifically soil stripping and stockpiling is done correctly as that lays the foundation for successful rehabilitation.

11.4 Threats Opportunities and Uncertainties

The following has been identified, with respect to threats, opportunities and uncertainties with respect to the compilation of this plan to define any additional work that is needed in order to reduce the level of uncertainty:

- Ongoing surface water and groundwater quality monitoring during the operational LoM in order to determine trends overtime and to monitor changes in water quality overtime to determine if the mine is impacting on water quality resources;
- The sampling results should be utilised to update the Numerical Model, initially undertaken, in order to refine the model and more accurately predict post closure impacts based on actual data obtained during the operational phase;
- Ongoing engagement with communities surrounding the area, with respect to the closure vision of the mine and tacking these issues into account when closure is being considered;
- Skill development training for employees and engagement with employees to ensure that when closure is reached and downscaling and retrenchment of staff occurs that all are aware of the process and that people have the required skills in order to find alternative employment; and
- Adopting closure recommendations as identified in the respective specialist reports, with particular emphasis on social, water and biodiversity related aspects.

11.5 Relinquishment Criteria

Relinquishment requires formal acceptance from the regulatory authority to ensure that all obligations associated with closure are achieved, prior to a closure certificate being issued. To achieve relinquishment, criteria need to be set, measured and met for all parties to understand what needs to be done to obtain a closure certificate. This provides all parties involved in the process a target that needs to be achieved and sets the standards that closure and rehabilitation are measured against. Table 11-7 provides the respective environmental relinquishment criteria.

Table 11-7: Environmental Relinquishment Criteria

Environmental Aspect	Closure Criteria	Monitoring Requirement	Reporting Requirement
Biodiversity	Establishment of vegetation that has a basal cover of 15% and that is self-sustaining and can be measured over a 3-5 year period, indicating that natural succession has occurred.	Vegetation monitoring and rehabilitation monitoring	Monitoring Reports
Groundwater	Groundwater qualities need to comply with the qualities as stipulated in the Water Use Licence Application (WULA) and the appropriate Department of Water Affairs and Sanitation (DWS) and South African National Standards (SANS).	Monthly and Quarterly Reports	Monitoring Reports

Environmental Aspect	Closure Criteria	Monitoring Requirement	Reporting Requirement
Surface Water	Surface water qualities need to comply with the qualities as stipulated in the WULA and the appropriate DWS and SANS Standards	Monthly and Quarterly Reports	Monitoring Reports
Social	Engagement with stakeholders and employees regarding closure related aspect and formulisation of a retrenchment and downscaling policy demonstrating training initiatives and skills development assisting in employees being upskilled, which would help in individuals being able to seek for alternative employment at the time of closure	Engagement, training and skills development policies	Records of correspondence, training matrices and records of training.
Air Quality	Dust, PM_{10} and $PM_{2.5}$ must comply with the minimum standards and limits as set by the NEM:AQA and applicable regulations and guidelines.	Monthly and Quarterly Reports	Monitoring Reports
Soil, Land Capability and Land Use	Post land use mining assessment to determine status of rehabilitated areas with respect to soil quality and that rehabilitated areas have been rehabilitated to an agreed upon land use. In addition to the above, inspections should be undertaken to identify areas of erosion and that erosion measures have been constructed.	Soil chemistry, depth (300 mm) and physical properties analysis to determine soil quality	Results of soil quality report and erosion monitoring report
Safety	Ensure pits have been appropriately filled or fencing and appropriate signage erected.	Visual inspections and sign off report by a registered engineer.	Signed off report by registered engineer.

12 Mine Closure Schedule

The mine closure schedule needs to be linked to the financial provision estimate and forecast that is undertaken for each year of mining. The schedule should take into account areas that become available for rehabilitation and costs should be provided to undertaken such rehabilitation.

The mine closure schedule addresses the timing of rehabilitation and closure activities performed during the decommissioning and post-closure phases for the proposed operation.

Presented below is a high level schedule of closure related aspects that should be undertaken either during the LoM and/or during the decommissioning phase.

- Annual review and update of the Rehabilitation, Decommissioning and Mine Closure Plan;
- Five years prior to closure start with the closure engagement process with stakeholders and employees;
- Decommissioning phases are expected to take one to two years, including rehabilitation which is expected to take six months to complete; and
- Post closure monitoring and maintenance for three years aside from groundwater and surface water which requires five years.

13 Organisational Capacity

13.1 Organisational Structure

The planned labour complement, once the mine is fully operational, is expected to be 320 employees (mine and contractor employees). Only nine employees will be directly employed by Pandospan, of these two will be directors, one mine manager, one engineer, one financial and human resource manager, one accountant, two weighbridge operators and one Safety Health and Environmental officer. Based on the current mining programme the mine workforce will be recruited in mid-2018.

According to the mining programme 320 employees will be appointed by the primary mining contractor approximately 3 months before operations commence. Contractors will be required to honour commitments made in the SLP and also to comply with the Mining Charters requirement in terms of Black Economic Empowerment (BEE). The current business requirement and manpower plan foresee the combined workforce to be employed within several core business areas, these areas are listed in the table below.

Table 13-1: Proposed Workforce

Designation	Number
Top and senior management	10
Weighbridge operators	4
Coal handling and loading	26
Services	26
Railway siding	26
Transport	48

Open Pit Mining	180
Total	**320**

13.2 Training and Capacity Building

According to the Social Impact Assessment Report (Digby Wells, 2016d) Canyon Coal has committed to identifying training needs and ensuring that all personnel whose work may create a significant impact upon the environment receive appropriate training (Canyoncoal, 2015b). Canyon Coal's Environmental Awareness Plan describes the training available and the manner in which environmental training needs will be identified and continually reassessed (Canyoncoal, 2015b). In particular the objective of the Plan is to ensure that:

- Training needs are identified and all personnel whose work may create a significant impact upon the environment have received appropriate training;
- Procedures are established and maintained to make appropriate employees aware of:
  - The importance of conformance with Safety, Health, Environment and Quality policy and procedures and the requirements of the environmental management;
  - The significant environmental impacts, actual or potential, of their work activities and environmental benefits of improved personal performance;
  - Their roles and responsibilities in achieving conformance with environmental policy, procedures and environmental management services; and
  - The potential consequences of departure from specified operating procedures.
- Personnel performing tasks, which can cause significant environmental impacts, are competent in terms of appropriate education, training and/ or experience (Canyoncoal, 2015b).

14 Financial Provision

Digby Wells calculated the financial provision for the proposed Palmietkuilen Coal Mine according to Regulation 6 of the Financial Provision Regulations (2015) which prescribe the minimum content requirements.

14.1 Closure Cost Methodology

Section 41 (1) of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) has been repealed and in terms of Section 24P in the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) as amended, which provides that the holder of a mining right must make financial provision for rehabilitation of

negative environmental impacts. In addition to Section 24(P), the Regulations pertaining to the financial provision for prospecting, exploration, mining or production operations were promulgated on 20 November 2015.

Regulation 6 of the Financial Provision Regulations (GN R1147 in GG 39425 of 20 November 2015) requires that an applicant determines the financial provision based on the actual costs required for:

- Annual rehabilitation as reflected in the Annual Rehabilitation Plan (ARP);
- Final rehabilitation, decommissioning and closure as reflected in the Final Rehabilitation and Closure plan (RCP); and
- The remediation of latent or residual environmental impacts including but not limited to the pumping and treatment of polluted or extraneous water, as reflected in an Environmental Risk Report (ERR).

Digby Wells calculated the financial provision for the Palmietkuilen Mining Project according to Regulation 6 of the Financial Provision Regulations (2015) which prescribe the minimum content requirements for documents used in the compilation of the financial provision estimate.

A closure cost model has been compiled using Microsoft Excel for the Mining area. The closure cost model consists of an input sheet, containing measurements of the infrastructure, a standard rate sheet and a summary sheet, which summarises the financial provision estimate. The closure cost model calculates the cost of demolishing, removing and rehabilitating each component of the mining area infrastructure.

The infrastructure areas and other areas affected by mining activities were measured from plans provided by the client. All measured areas and infrastructure were mapped using GIS software and attached in Appendix C.

14.2 Assumptions

The following assumptions have been made and limitations identified, during the calculation of the financial provision:

- All infrastructure will be removed from the mine at closure;
- All infrastructure will be constructed in year 1, as per the Mine Works Programme (MWP);
- The concrete will only be demolished up to 1000 mm below natural ground level;
- Inert waste will be disposed on site or buried 1 m underground prior to closure;
- All powerlines are Eskom's liability/responsibility;
- All roads have an average width of 6 m;
- All fences will be removed at end of life;

- The pollution control dam will be lined with HDPE and it was assumed that 150mm silt will require removal over 40% of the dam area;
- The dirty water trench will be lined with 150 mm thick concrete;
- No contamination will be present at the tarpaulin area;
- For Year 10 of operation and LoM, the discard dump will be used as backfill material into the open pit, therefore allowance was made to rip the footprint, import 300 mm topsoil and vegetating the footprint area;
- All temporary structures will be removed from site prior to closure;
- All the material on stockpile areas would have been removed prior to closure, and therefore only footprint rehabilitation is allowed for;
- According to the MWP the coal seams will vary between 12 m and 60 m depth, thus it was assumed the pit will have a total depth of 60 m. The pit was divided up in 6 benches with a height of 10 m each;
- General surface rehabilitation must involve the shaping of the surface topography to match the surrounding landscape and 300mm of topsoil, where available, needs to be added to the site. During the process of shaping the landscape, drainage lines must be properly reinstated into the topography. Any heaps of excess material also need to be removed so that effective revegetation can take place;
- For Year 10 of operation, including one year of construction, it is assumed that the open pit will be backfilled and rehabilitated. According to the life of mine (LoM) plan the pit area at Year 9 of mining (effectively Year 10 due to mining only starting in Year 2) will be 17.9 ha with an average pit depth of 36 m;
- At LoM, it is assumed that the open pit would have been rehabilitated concurrently. A final void at Year 53 will require backfill. A total area of 39.31 ha and an average pit depth of 36 m would require backfill material;
- All soft and hard overburden material will be used to rehabilitate the open pit;
- Water monitoring costs have been included for 4 surface points and 17 groundwater points for at least 5 years after mine closure;
- Vegetation monitoring and maintenance on rehabilitated areas is assumed to take place for three years after closure;
- A contingency of 10% on all infrastructure costs has been allowed for. This contingency takes into account possible omissions and price fluctuations with regard to plant hire and fuel;
- A 6% allowance has been included for project management fees. These fees account for the costs required to manage the closure and rehabilitation phase as well as provide personnel to monitor and maintain the rehabilitated areas after closure;

- The financial provision estimate is based on the latest mine plans and information received from the client; and
- The financial provision estimate has been calculated for end of life of mining and at the end of Year 10 of operations.

14.3 Calculation Summary

The financial provision estimate was calculated based on the Financial Provision Regulations (GNR. 1147). The estimated financial provision required for the rehabilitation and closure of the Palmietkuilen Mine is **R 162 441 981** (Year 10) and **R 330 475 001** (LoM) **excl. VAT**. The financial provision estimate associated with the LoM and Year 10 of operations is included in the table below (Table 14-1). Detailed sheets are provided in Appendix B.

Table 14-1: Palmietkuilen Financial Provision Summary

	Digby Wells Environmental	
	Canyon Resources (Pty) Ltd, Palmietkuilen Mine, CNC4065, Revision: 1	
Area and Description	**Year 10 of Operation 2026**	**End of Life 2069**
Infrastructure and Rehabilitation		
Area 1: Mine Office	R297 709	R297 709
Area 2: Plant infrastructure	R2 528 445	R2 792 798
Area 3: Mining and Related areas	R131 113 650	R275 428 583
Area 4: Linear infrastructure	R2 418 734	R2 418 734
Sub-total	**R136 358 539**	**R280 937 825**
Monitoring and Maintenance		
Monitoring Costs (Groundwater and Surface water 5 Years)	R1 595 900	R1 427 600
Monitoring Costs (Vegetation 3 Years)	R67 809	R79 563
Maintenance Costs (Vegetation 3 Years)	R2 602 367	R3 079 962
Sub-total	**R4 266 076**	**R4 587 124**
Project Management (6%)	R8 181 512	R16 856 269
Contingency (10%)	R13 635 854	R28 093 782
GRAND TOTAL (Excl. VAT)	**R162 441 981**	**R330 475 001**

14.4 Recommendations

Digby Wells recommends the following:

- A topsoil balance must be done to ensure enough material is available to rehabilitate all the disturbed areas;
- Calculate accurate pit depths for each Year of mining. This will assist in potentially refining the financial provision estimate; and
- The liability figures need to be updated on an annual basis as a requirement by the NEMA. This will ensure that all costs become more accurate over time and will reflect current market conditions.

15 Monitoring Auditing and Reporting

15.1 Auditing Plan

The auditing requirements have been summarised in Table 15-1 below.

15.2 Reporting Requirements

The reporting requirements have been summarised in Table 15-1 below.

15.3 Monitoring Plan

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 the desired final ecosystem.

Table 15-1: Monitoring Plan

Aspect	Activities	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	Type of Requirement (Monitoring, Auditing and/or Reporting)
Surface Water	All activities	- Water quality	Ensure that monitoring is implemented to cover all mining activity areas. Water quality parameters that need to be analyzed are shown in the Surface Water Report.	Specialist Environmental Quality	Monthly during construction. - Reduce to quarterly on rehabilitated areas. - This can further be reduced to biannually (wet and dry season). -Monitoring needs to carry on after the project has ceased and the results depict a steady state, as is standard practice to detect residual impacts.	Monitoring
		Water quantity	Flow monitoring should be carried out in channels and pipelines and at facilities on site. Monitoring water levels in dams and channels. Records of Pit dewatering.	Specialist Environmental Quality	-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 operational areas, daily records need to be kept	Monitoring
		Physical structures and SWMP performance	Personnel should have a walk around facilities to determine the facilities conditions and pick out any anomalies such as leaks or overflows and system malfunctions. Dams are inspected for silting and blockages of inflows, pipelines for hydraulic integrity; monitor the overall SWMP performance.	Specialist Environmental Quality	Continuous process and yearly formal report	Reporting
		Meteorological data	Measure rainfall	Sampler	Real time system if in place	Monitoring
Soil	All activities	Fertility	Monitoring should always be carried out at the same time of the year. Soils should be sampled and analysed for the following parameters: pH (KCl); Phosphorus (Bray 1); Cations: Calcium, Magnesium, Potassium, Sodium, Zin (mg/kg); Cation exchange capacity (CEC);	Soil scientist	Annually, at the same time of year.	Monitoring

			Soil organic carbon (%); and Soil texture (Clay, Silt and Sand).			
		Erosion	Erosion occurrences	Soil scientist	Annually, at the same time of year.	Monitoring
		Stripped and stockpiled soil	The location of soil types that can be stripped and stockpiled together; Stripping depths of different soil types; and The location, dimensions and volumes of planned stockpiles for different soil types.	Soil scientist	Annually, at the same time of year.	Monitoring
Aquatic Ecology	All activities	Overall PES	Standard River Ecosystem Monitoring Programme (Ecostatus) methods	Aquatic specialist	Bi-annual (dry and wet season)	Monitoring
		Determine if water quality deterioration is occurring.	SASS5 scores should not decrease as and be related to mining activities.	Aquatic specialist	Bi-annual	Monitoring
		Determine if water quality deterioration is occurring.	Standard water quality monitoring, as per the surface water specialist report.	Aquatic specialist	Monthly	Monitoring
		Determine if water/habitat quality deterioration is occurring.	Monitor for presence of fish.	Aquatic specialist	Bi-annual	Monitoring
Fauna and Flora	Fauna and Flora Monitoring	Impacts on vegetation structure and health; and Impacts on faunal populations and numbers; Red Data Listed fauna and flora species (should it be recorded going forward)	Ensuring sustainable populations of both fauna and flora persist till closure	Terrestrial Ecologist.	Annually	Monitoring
	Rehabilitation	Success of rehabilitation	Rehabilitation success	Rehabilitation Specialist and/or botanist.	Quarterly for 2 years after closure	Monitoring
	Soil disturbance	Establishment of alien plant species	Alien plant monitoring	Qualified botanist.	Quarterly monitoring for two years.	Monitoring
Noise	Construction and operational phase	Noise disturbance	Monitoring should be undertaken in accordance with the National Noise Control Regulations in conjunction with the SANS 10103:2008 guidelines; The locations to be monitoring are N1 and N2 as per the baseline assessment as well as additional noise monitoring location at the small holdings	Noise Monitoring should be conducted by an independent specialist.	The client's Environmental Coordinator to implement and manage the recommended monitoring programme; and Independent specialist to carry out the monitoring programme.	Monitoring

			district (Prosperity AH)			
Groundwater	All activities	Groundwater levels	Dip meter should be used to detect any changes or trends in groundwater elevation and flow direction.		Quarterly	Monitoring
		Groundwater quality	Analyses of the following constituents are recommended: Macro analysis i.e. Ca, Mg, Na, K, SO4, NO3, F, Cl; Initial full suite metals and then Al, As, Ba, Cu, Se, Pb, Fe, and other metals identified according to results of the initial analyses; pH and Alkalinity; and TDS and EC.	Samples should be collected by using best practice guidelines and should be analysed by a SANAS accredited laboratory.	Monthly	Monitoring
Wetlands	All activities	General - All impacts and threats to wetlands predicted or not.	Monitoring of the activities through all phases is important to ensure all impacts are remediated as soon as possible; thus preventing and long term residual impacts to the system that compromises the ability of the wetland to function. The valley bottom wetlands of high sensitivity should be monitored on a regular basis to detect if the mining activities are having any residual or unforeseen impact on the functioning of these important systems. The functional aspects of the wetland should be assessed such as floral diversity, water quality, use of wetland by faunal species, erosion and more.	The environmental officer of the mine should monitor the wetlands at all times as part of managing the site and the surrounding area. Independent wetland specialist should carry out monitoring on a regular basis during all phases of the mining project and provide recommended remedial actions where required.	Internal monitoring should be done as often as possible according to the management practices of the mine. External independent wetland specialist monitoring should be done regularly and when needed, i.e. after an incident.	Monitoring
	Site Clearance within wetlands and their buffer areas	Removal of wetland soils and vegetation; loss of wetland habitat.	Monitor for all risks including uncontrolled erosion, hydrocarbon spills etc. and remediate; ensure proper handling and storage of wetland soils; Must ensure that all activities are done according to the detailed design and are implemented with the least possible impacts to the wetlands.	Wetland specialist.	Construction activities should be monitored monthly.	Monitoring

	Open pit mining requiring dewatering.	Perforation of rock and groundwater reserves leading to severe hydrological and geomorphological impacts to wetlands and catchment due to draw down cone.	As mining progresses, wetlands should be monitored for evidence of loss of functionality due to groundwater changes (the draw down cone).	Wetland specialist.	Internal monitoring should be done as often as possible according to the management practices of the mine during operation. External independent wetland specialist monitoring should be done annually and when needed, i.e. after an incident.	Monitoring
	Decommissioning activities within and around remaining wetland habitats, such demolition and removal of all infrastructure, and subsequent final rehabilitation of the final void and area	Similarly to the construction and operational phase, the decommissioning and rehabilitation activities occurring within an ecologically sensitive catchment pose significant potential negative impacts to functioning wetlands and catchment. Furthermore, the rehabilitated area could cause major negative impacts due to spread of alien invasive vegetation, increased soil compaction erosion and subsequent sedimentation into the wetland ecosystems.	Monitor for all risks including uncontrolled erosion, hydrocarbon spills etc. and remediate; ensure proper handling and storage of wetland soils; Must ensure that all activities are done according to the detailed design and are implemented with the least possible impacts to the wetlands.	Wetland specialist.	Rehabilitation activities should be monitored monthly	Monitoring

15.4 Motivation for Amendments

No amendments have been made.

16 Closing Statement

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

Rehabilitation can be divided into two different streams, namely concurrent rehabilitation and final rehabilitation. Concurrent rehabilitation must be carried out along with the operations on the coal mine, and will decrease the final liability that the mine will carry at the time of closure. This concurrent rehabilitation will be carried out within the context of the approved Environmental Management Programme (EMPR). Final rehabilitation will be carried out once the mine goes into its closure phase.

A coal mine will obtain a closure certificate only once it can prove that rehabilitation is satisfactory, and that if any residual pollution effects exist they can be adequately managed. It is recommended that a post-closure monitoring programme is implemented before the mine applies for closure. The institution of this monitoring programme will enable the mine to identify and rectify any residual pollution impacts.

The recommendations, based on the site visit and compilation of the financial provision are as follows:

- The financial provision needs to be updated on an annual basis as a requirement by the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), as amended. This will ensure that all costs become more accurate over time and will reflect current market conditions;
- Concurrent rehabilitation must take place so as to reduce the liability burden when the mine ceases to operate;
- Decant is expected to occur 35 years after closure. Nearer to this time, options to treat this water must be considered before it enters the rivers and streams; this may include active treatment, or passive treatment options such as constructed wetlands or phytoremediation. Groundwater models should be updated on an ongoing basis, as prescribed in the Groundwater Report (Digby Wells, 2016e);
- Long-term inspection, monitoring, and maintenance of the discard structure is recommended; and

- A wetland offset strategy should be investigated.

17 References

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Appendix A: Environmental Risk Report

DIGBY WELLS
ENVIRONMENTAL

Integrated Environmental Impact Assessment for the Proposed Palmietkuilen Mining Project near Springs, Gauteng

Environmental Risk Report

Project Number:

CNC4065

Prepared for:

Canyon Coal (Pty) Ltd

canyoncoal

January 2017

Digby Wells and Associates (South Africa) (Pty) Ltd
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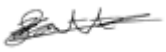
This document has been prepared by Digby Wells Environmental.

Report Type:	**Environmental Risk Report**
Project Name:	**Integrated Environmental Impact Assessment for the Proposed Palmietkuilen Mining Project near Springs, Gauteng**
Project Code:	**CNC4065**

Name	Responsibility	Signature	Date
Leon Ellis	Report Compiler		January 2017
Brett Coutts	Report Review		January 2017

DECLARATION

Digby Wells and Associates (South Africa) (Pty) Ltd

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I, Leon Ellis as duly authorised representative of Digby Wells and Associates (South Africa) (Pty) Ltd., hereby confirm my independence (as well as that of Digby Wells and Associates (South Africa) (Pty) Ltd.) and declare that neither I nor Digby Wells and Associates (South Africa) (Pty) Ltd. have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of Pandospan (Pty) Ltd, other than fair remuneration for work performed, specifically in connection with the Environmental Risk Report for the proposed Palmietkuilen Coal Mine, located near Springs, Gauteng Province.

_____

Name and Surname:	Leon Ellis
Title/ Position:	Unit Manager: Mine Closure
Qualification(s):	BSc. Geography
Experience (Years):	6

EXECUTIVE SUMMARY

Pandospan (Pty) Ltd (Pandospan) concluded a contract with Anglo Operations (Pty) Limited (AOL) in support of the acquisition of a Prospecting Right for coal (DMR Ref. No. GP 30/5/1/1/2 (201/10026) PR). Pandospan forms part of the Canyon Group of Companies for which Canyon Coal functions as the operational division. The enviro-legal applications for the project will be managed by Pandospan on behalf of AOL, the Project applicant.

AOL is planning the development of a new open pit coal mining operation located near Springs within the Gauteng Province to be known as the Palmietkuilen Coal Mining Project. A coal processing plant and associated infrastructure will also be constructed. The Project is a greenfields development planned on Portions 1, 2, 4, 9, 13 and 19 of the Farm Palmietkuilen 241 IR.

Section 41 (1) of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) has been repealed and in terms of Section 24P in the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) as amended, which provides that an applicant for a mining right must make financial provision for rehabilitation of negative environmental impacts.

In addition to Section 24(P), the regulations for the determination of financial provision for mine rehabilitation and closure were promulgated on 20 November 2015 (GN R1147) under the NEMA, as amended.

The objective of the Environmental Risk Report (ERR) is outlined in the Financial Provisioning Regulations, 2015 (GN R1147 promulgated on 20 November 2015). A qualitative Severity and Likelihood Matrix was used during the risk estimation.

Potential unwanted events for and during mine closure were identified and discussed. All unwanted events are listed in Appendix A.

The four levels of risks are classified as shown in Table 1 below.

Table 1: Risk levels

Colour	Descriptor	Action	Sign-off
	Extremely Intolerable	Immediate Action	General Manager
	Highly Intolerable	Short term action required	Senior Management
	ALARP[1]	Heightened Action	Section Manager
	Maintain	Ensure levels of control	Supervisor

Twenty three (23) unwanted events were identified. These unwanted events were ranked for risk based on the maximum reasonable severity should they occur and the likelihood of that specific severity/consequence occurring. This analysis was firstly done assuming that no

[1] As low as reasonably practicable

controls are in place (i.e. the raw risk) and secondly considering current controls were in place and effective (i.e. residual risk).

No unwanted events were ranked as extremely intolerable, six (6) as highly intolerable, fourteen (14) as ALARP and three (3) ranked maintain. A summary of the highest ranked risks are given in Table 2 below.

Table 2: Summary of potential extremely and highly intolerable risks (Raw risk)

Area	Hazard	Discussion	Primary Risk Category	Risk Rank
Open Pit	Possibility of not sufficiently rehabilitating the open pit leading to environmental impacts remaining un-mitigated.	Closure material balance not being sufficient to implement closure actions or to achieve relinquishment requirements.	Natural Environment	Highly Intolerable
Overburden Dumps (Softs and Hards)	Possible sedimentation of streams, rivers and wetlands.	Erosion of discard dump leading to sedimentation of water resources should discard material be left on surface and un-rehabilitated after mine closure.	Natural Environment	Highly Intolerable
Product and RoM Stockpiles	Possible pollution originating from ROM pad areas.	Contamination of soil and groundwater resources should stockpiles not be properly rehabilitated.	Natural Environment	Highly Intolerable
Slurry Dams	Possible SPONCOM of slurry material.	Slurry material left on site might be susceptible to burning.	Natural Environment	Highly Intolerable
General	Possibility of inadequate or no funds to implement closure actions, resulting in	Underestimate of closure quantum, insufficient funds are available to mitigate	Financial	Highly Intolerable

Area	Hazard	Discussion	Primary Risk Category	Risk Rank
	legal obligations not being discharged.	impacts or that funds have not been appropriately provisioned for closure.		
General	Possibility that residual and latent environmental risks will always remain and cannot be adequately provided for.	As a result of the undefined concept of "in perpetuity" and the difficulty of predicting hydro, hydrogeological and land form evolutionary processes far into the future. Identifying management options that provide impact mitigation indefinitely is impractical.	Financial	Highly Intolerable

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1 Introduction

Pandospan (Pty) Ltd (Pandospan) concluded a contract with Anglo Operations (Pty) Limited (AOL) in support of the acquisition of a Prospecting Right for coal (DMR Ref. No. GP 30/5/1/1/2 (201/10026) PR). Pandospan forms part of the Canyon Group of Companies for which Canyon Coal functions as the operational division. The enviro-legal applications for the project will be managed by Pandospan on behalf of AOL, the Project applicant.

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Section 41 (1) of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) has been repealed and in terms of Section 24P in the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) as amended, which provides that the holder of a mining right must make financial provision for rehabilitation of negative environmental impacts.

In addition to Section 24(P), the regulations for the determination of financial provision for mine rehabilitation and closure were promulgated on 20 November 2015 (GN R1147) under the NEMA, as amended.

Regulation 6 of the Financial Provision Regulations (GN R1147) requires an applicant to determine the financial provision based on the actual costs of implementation of the measures required for:

- Annual rehabilitation as reflected in the Annual Rehabilitation Plan (ARP);
- Final rehabilitation, decommissioning and closure as reflected in the Final Rehabilitation and Closure plan (RCP); and
- The remediation of latent or residual environmental impacts including but not limited to the pumping and treatment of polluted or extraneous water, as reflected in an Environmental Risk Report (ERR).

In terms of the new Financial Provision 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 month period.

The ERR complies with the requirements as contemplated in Appendix 5 of the NEMA Financial Provision Regulations.

2 Study Area

The Project covers an area of approximately 3,422 hectares (ha), located entirely within the Sedibeng District Municipality. The northern Project boundary lies on the Mpumalanga and Gauteng provincial boundary, and the western boundary also lies on the boundary between the Ekurhuleni District Municipality and the Sedibeng District Municipality. The site is on the border of Gauteng and Mpumalanga, in the Sedibeng District Municipality and the Lesedi Local Municipality. The proposed mine boundary borders the Ekurhuleni Metropolitan Municipality (Gauteng) and the Nkangala District Municipality and the Victor Khanye Local Municipality (Mpumalanga).

The coordinates of the centre point of the Project area are 26° 15’ 07.073” S and 28° 33’ 39.643” E. Several tributaries of the Blesbokspruit run through the Project area and one of these tributaries includes the Dwars-in-die-wegvlei and Aston Lake. The Project area and surrounds are interspersed with streams, wetlands and pans. The R29 regional road runs through Largo settlement and the south-western part of the Project area. The N12 and N17 national routes are situated approximately 6,8 kilometres (km) north and 260 m south of the Project area respectively. The R42 regional road is situated approximately 1.1 km east, the R51 is situated approximately 6,5 km west and the R555 is situated approximately 3,8 km north of the Project area.

The location of the project area can be seen on Figure 2-1 and Figure 2-2 respectively. The proposed infrastructure layout and wetlands found on site are shown in Figure 2-3.

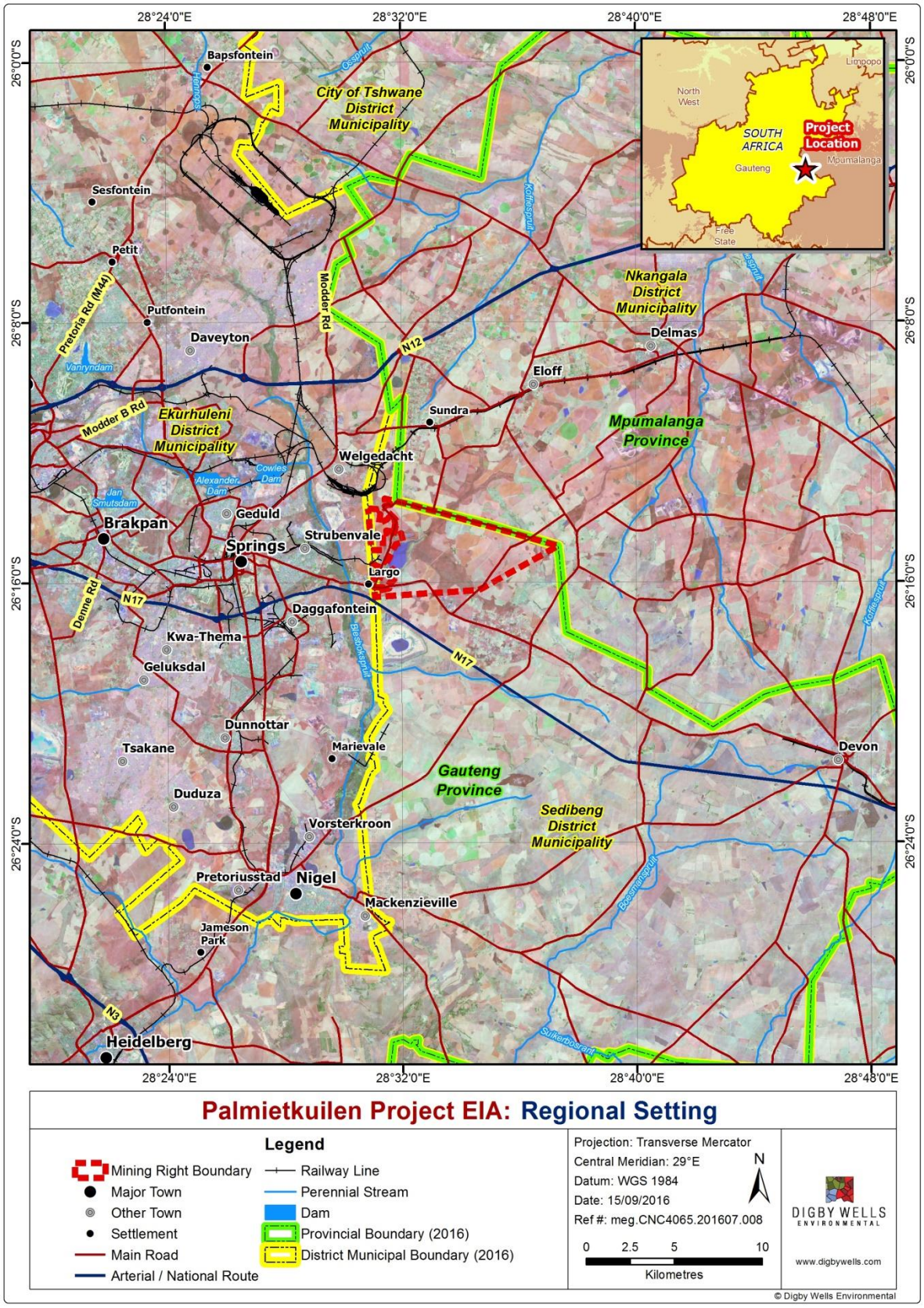


Figure 2-1: Regional Setting

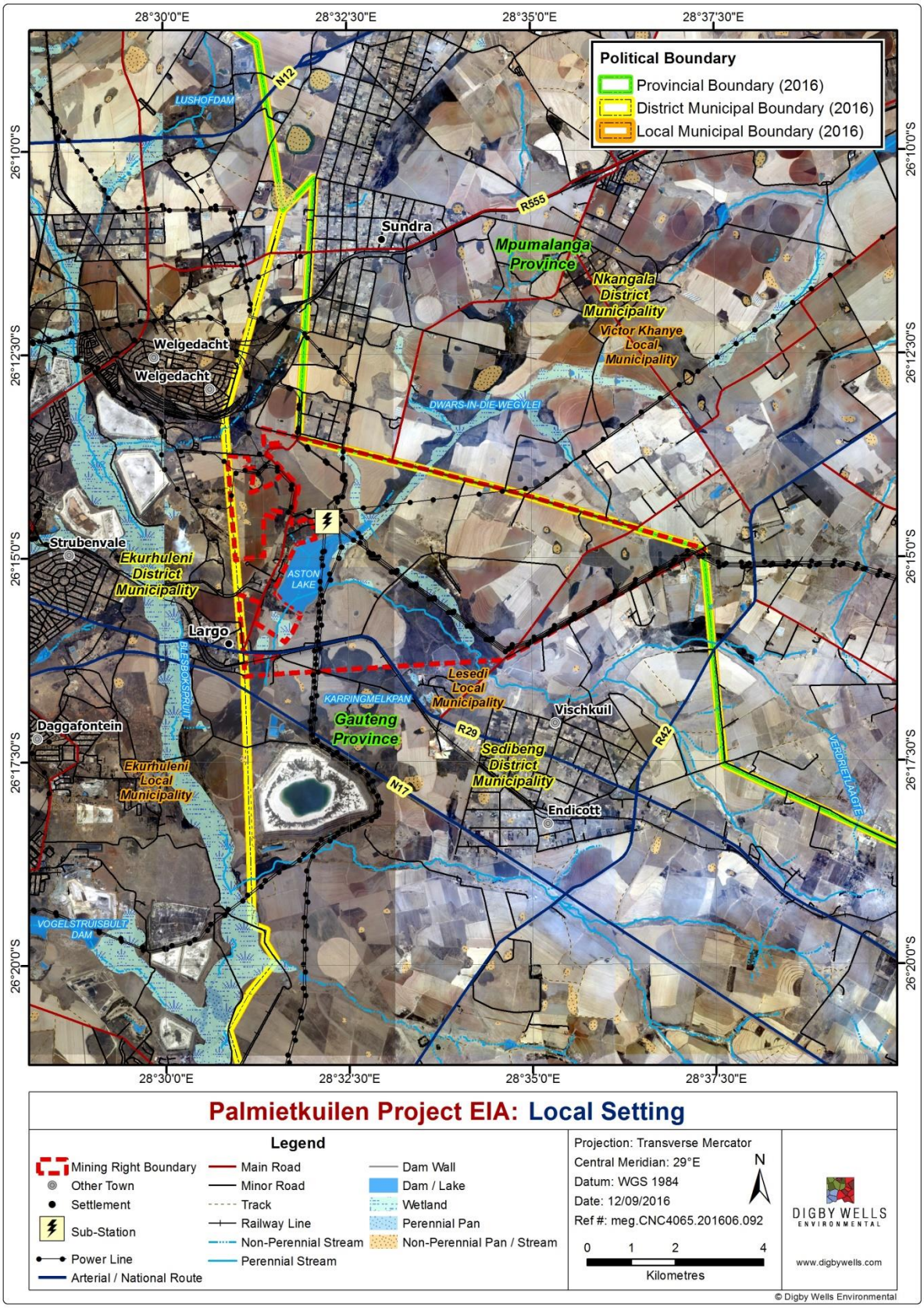


Figure 2-2: Local Setting

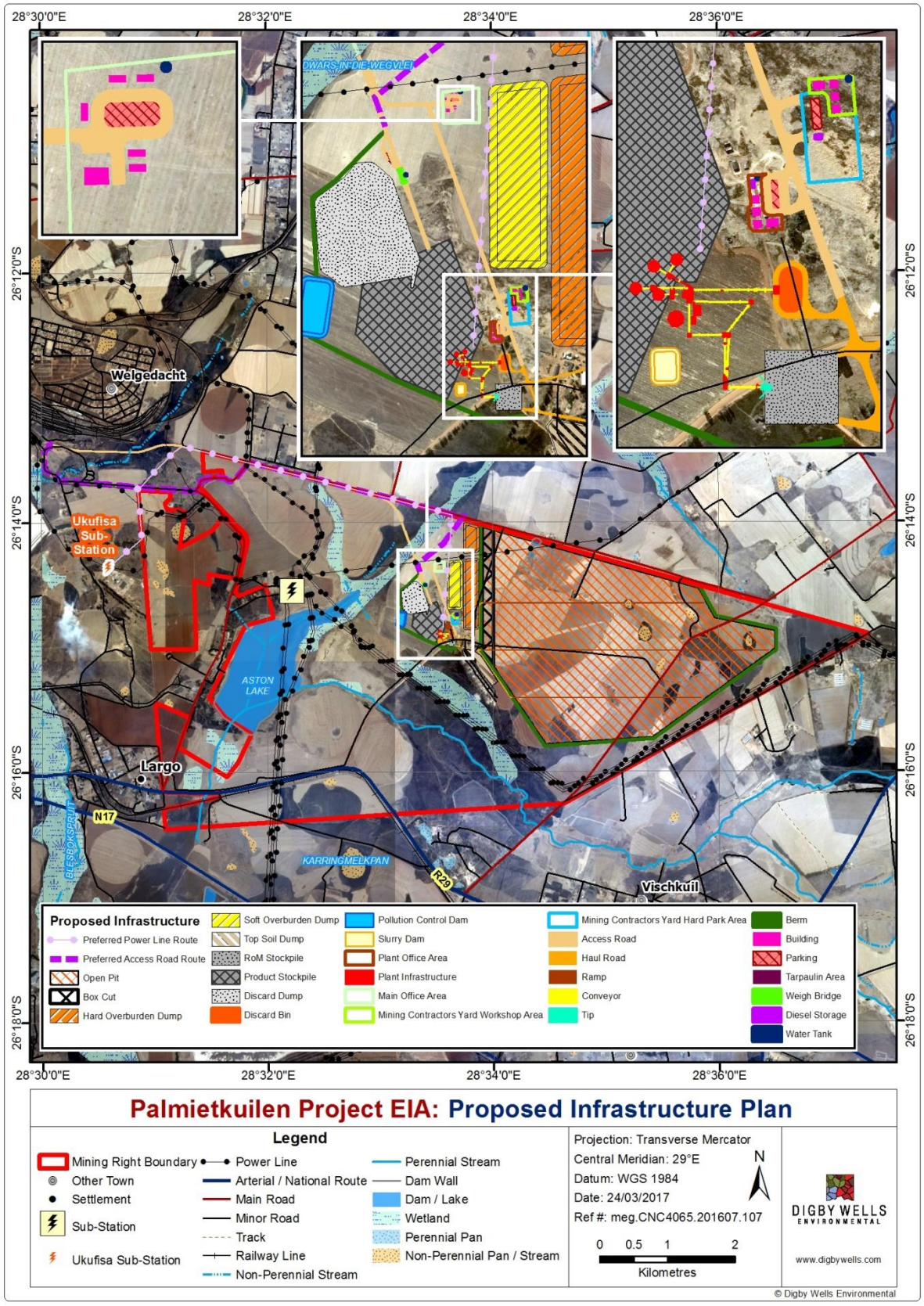


Figure 2-3: Proposed Infrastructure Layout

3 Project Overview

The proposed Palmietkuilen Coal Mining Project is a “greenfields” Project, meaning there is currently no mining activity on the proposed site. AOL proposes to extract the coal through open pit mining and the Project is anticipated to have a Life of Mine of approximately 47 years. It is anticipated that the mine will produce 2 400 000 tonnes of coal per annum to supply to local and international markets.

The proposed infrastructure required on site includes the following:

- Access and haul roads;
- Office blocks;
- Workshops;
- A coal processing plant including a filter press;
- Stockpile areas;
- Pollution control dams;
- Slurry dams;
- A return water dam; and
- Stormwater trenches and berms.

The establishment of the open pit will lead to the establishment of topsoil-, subsoil-, and overburden stockpiles. Once coal is extracted it will initially be stored on a Run of Mine (ROM) stockpile before being fed to a processing plant on site which will crush and screen the coal. From there, slurry will be sent to the dense media separator and the remaining solid discard will be placed back into the void. Coal product will be stockpiled on the product stockpile and thereafter transported by truck to the Welgedacht Siding located approximately 2 kilometres (km) from the proposed Project area. The Welgedacht siding is linked to the major rail networks in the area and coal will be transported from there to the relevant markets. Surface water management infrastructure will also be required, thus a pollution control dam will be constructed for all mine-affected water. A slurry dam is also proposed and the slurry will be fed to a Filter Press Plant to extract coal fines to convert into coal “cakes”, which will also be sold as product.

4 Expertise of Specialist

The specialist involved in compiling the Environmental Risk Report (ERR) associated with the financial provision update was Leon Ellis. His curriculum vita is available on request.

Leon completed his BSc. (Hons) in Geography and Environmental Management at the University of Johannesburg (UJ) in 2009. Leon joined Digby Wells in January 2013 and is currently the Manager of the Mine Closure Unit. He is involved in conducting financial provision assessments, environmental risk assessments and mine closure plans. He also

successfully completed the Environmental Risk Assessment and Management course based on ISO 31000 at the Centre of Environmental Management (North West University) in 2016.

5 Objective of Environmental Risk Assessment

The objective of the ERR is outlined in the Financial Provisioning Regulations, 2015. The objective is to:

- Ensure timeous risk reduction through appropriate interventions;
- Identify and quantify the potential latent environmental risks related to post closure;
- Detail the approach to managing the risks;
- Quantify the potential liabilities associated with the management of the risks; and
- Outline monitoring, auditing and reporting requirements.

6 Risk Assessment Methodology

Risk assessment is the overall process of risk identification, risk analysis and risk evaluation. A baseline hazard identification and risk assessment (HIRA) was completed as part of the financial provision update. The baseline HIRA is based on a qualitative method. The following process steps were taken:

- A general discussion on hazards and “driving forces” was used to determine things that could “go wrong” during the mine closure;
- The boundaries of the project were defined;
- Areas within the mining area were defined;
- For each of the areas in the process:
  - Potential unwanted events were identified;
  - Current controls for each unwanted event were identified and recorded;
  - The most likely severity, should the event occur, and likelihood of the event occurring were then estimated;
  - Based on this, the level of risk was estimated using the risk matrix; and
  - For the Highly and Extremely Intolerable events, additional “controls” were recommended to reduce the level of risk.

The four levels of risks are classified as shown in Table 6-1 below.

Table 6-1: Risk levels

Colour	Descriptor	Action	Sign-off
	Extremely Intolerable	Immediate Action	General Manager
	Highly Intolerable	Short term action required	Senior Management
	ALARP[2]	Heightened Action	Section Manager
	Maintain	Ensure levels of control	Supervisor

The five types of risk have been outlined and included in the risk matrix.[3] These are, in no order of priority:

- Health and Safety Risk;
- Natural Environment Risk;
- Social Risk;
- Legal and Reputational Risk; and
- Financial Risk.

A qualitative Severity and Likelihood Matrix was used during the risk estimation as shown below in Table 6-2.

The severity and likelihood definitions are provided in Table 6-2. Once the severity and likelihood of the unwanted events had been rated, the risk rank was determined using the risk matrix. This matrix is not a simple multiplication tool; risk rank is skewed so that emphasis is placed on high severity events, rather than on high likelihood events. The likelihood and consequence definitions were reviewed by the risk assessment team and accepted as being relevant for this risk assessment.

[2] As low as reasonably practicable

[3] HB 436:2004, Risk Management Guidelines, Companion to AS/NZS 4360:2004

Table 6-2: Risk estimation matrix

	ENVIRONMENTAL RISK MATRIX							Norms and Standards (N)	Effect on Work Image (WI)	Effect on Environment (E1)	Effect on Social and Ecosystem Processes (E2)	Public Reaction (P)	Legal Implications (L)
		ALARP	HIGH RISK (INTOLERABLE)										
SEVERITY	A	Highly Intolerable	Highly Intolerable	Extremely Intolerable	Extremely Intolerable	Extremely Intolerable	Extremely Intolerable	Consistently outside of the norm or standard	Reputation impacted with majority of key stakeholders.	Irreversible changes to abundance/ biomass in affected area. Loss of ecological functioning with little prospect of recovery	**Majo**r, potential for irreversible change to valued flora and fauna, ecosystem processes and structure, including ecosystem services.	Severe national pressure to cease business. Serious public or media outcry (international coverage).	Referral to the National Prosecuting Authority. Potential investigation by authority with prosecution and fines.
	B	ALARP	Highly Intolerable	Highly Intolerable	Extremely Intolerable	Extremely Intolerable	Extremely Intolerable	Largely deviating from the norm or standard	Reputation impacted with significant number of key stakeholders	Substantial reduction of abundance/ biomass in affected area. Eventual recovery of ecological systems possible, but not necessarily to same pre-impact conditions	**Major**, potential for unacceptable, longer term change to valued flora and fauna, ecosystem processes and structure, including ecosystem services.	Severe local and national public or press reaction.	Withdrawal of permit.
	C	ALARP	ALARP	I Highly Intolerable	Highly Intolerable	Extremely Intolerable	Extremely Intolerable	Frequent and significant deviations from the norm or standard	Reputation impacted with some stakeholders	Reduction of abundance/biomass in affected area. Limited impact to local biodiversity without significant loss of pre-impact functioning	**Moderate**, potential for unacceptable, short term change to valued flora and fauna, ecosystem processes and structure, including ecosystem services	Local public or press reaction.	Notification of intent to issue a directive.
	D	Maintain	Maintain	ALARP	ALARP	Highly Intolerable	Highly Intolerable	Occasional and minor deviation from the norm or standard	Reputation impacted with small number of people	Minimal reduction of abundance/biomass in affected area. Limited impact to local biodiversity without significant loss of pre-impact functioning.	**Moderate**, potential for acceptable, longer term change to valued flora and fauna, ecosystem processes and structure, including ecosystem services	Minor local public or media reaction.	Departmental enquiry and correspondence.
	E	Maintain	Maintain	Maintain	ALARP	ALARP	ALARP	Rare and minimal deviation from the norm or standard	No discernible impact on reputation	Reduction of the abundance/biomass of flora and fauna in affected area. No permanent changes to biodiversity or exposed ecological system	**Minor**, potential for acceptable, short term change to valued flora and fauna, ecosystem processes and structure, including ecosystem services..	Little or no reaction Public concern restricted to local complaints.	Complaints from the public and/or regulator.
	F	Maintain	Maintain	Maintain	Maintain	Maintain	Maintain	Consistently within the norm or standard	No discernible impact on reputation	Possible incidental impacts to flora and fauna in locally affected area. No ecological consequences	**Minor,** potential for incidental and/or transient changes to valued flora and fauna, ecosystem processes and structure, including ecosystem services	None.	No legal implications.

	LIKELIHOOD					
	G	***H***	***I***	***J***	***K***	***L***
	Highly unlikely	***Rare***	***Low likelihood/ Unlikely***	***Probable/ Possible***	***Can happen/ Likely***	***Regular/ Almost Certain***
Percentage (%)	***<0.1%***	***0.1 - 0.4%***	***5 - 14%***	***15 - 49%***	***50 - 74%***	***75 - 100%***
Descriptor	Practically impossible, not foreseen to occur	Conceivable under exceptional circumstances	Only remotely possible (has happened somewhere)	Unusual but possible (can happen)	Quite possible	Is the most likely and expected to happen (has and foresee it to happen again)
	Once in more than 10 000 years.	Once in 1 000 years.	Once in 100 years.	Once every 10 years	Once every year	More than once a year

7 Risk Analysis Results

Potential unwanted events for and during mine closure were identified and discussed. All unwanted events are listed in Appendix A.

Twenty three (23) unwanted events were identified. These unwanted events were ranked for risk based on the maximum reasonable severity should they occur and the likelihood of that specific severity/consequence occurring. This analysis was firstly done assuming that no controls are in place (i.e. the raw risk) and secondly considering current controls were in place and effective (i.e. residual risk).

No unwanted events were ranked as extremely intolerable, six (6) as highly intolerable, fourteen (14) as ALARP and three (3) ranked maintain as shown in Table 7-1 below.

Table 7-1: Raw risk ranking

Area number	Description	Number of unwanted events	Extremely Intolerable	Highly Intolerable	ALARP	Maintain
1	Open Pit	**1**	0	1	0	0
2	Overburden Dumps (Softs and Hards)	**3**	0	1	2	0
3	Product and RoM Stockpiles	**1**	0	1	0	0
4	Slurry Dams	**1**	0	1	0	0
5	Pollution Control Dams	**2**	0	0	2	0
6	Infrastructure (Offices, Conveyors, Plant etc.)	**3**	0	0	2	1
7	General	**12**	0	2	8	2
	Total	**23**	**0**	**6**	**14**	**3**

For the highest ranked events, additional “controls” should be put in place to reduce the level of risk. Deadlines for ensuring that the additional controls are put in place as well as accountabilities for doing so, should be defined.

The twenty three unwanted events were again assessed taking into consideration the current control measures. Based on the fact that the proposed Palmietkuilen Coal Mine is not yet operational, current control measures are not yet in place except for the potential risk

of not having an adequate financial provision to close the mine sustainably once operations cease.

The residual risks were ranked assuming the control measures are in place and effective. Table 7-2 below summarises the residual risks after taking the current control measures into consideration. The initial number of risks per risk priority is shown with the number of residual risks included in brackets.

Table 7-2: Residual risk ranking

Area number	Description	Number of unwanted events	Extremely Intolerable	Highly Intolerable	ALARP	Maintain
1	Open Pit	**1**	0	1 (0)	0 (1)	0
2	Overburden Dumps (Softs and Hards)	**3**	0	1 (0)	2 (2)	0 (1)
3	Product and RoM Stockpiles	**1**	0	1 (0)	0	0 (1)
4	Slurry Dams	**1**	0	1 (0)	0	0 (1)
5	Pollution Control Dams	**2**	0	0	2 (0)	0 (2)
6	Infrastructure (Offices, Conveyors, Plant etc.)	**3**	0	0	2 (0)	1 (3)
7	General	**12**	0	2 (0)	8 (6)	2 (6)
	Total	**23**	**0**	**6 (0)**	**14 (9)**	**3 (14)**

Additional controls were recommended for the risks identified and these are listed in Appendix A.

Table 7-3 below gives a summary of the potential extremely and highly intolerable risks identified.

Table 7-3: Summary of potential extremely and highly intolerable risks (Raw risk)

Area	Hazard	Discussion	Primary Risk Category	Risk Rank
Open Pit	Possibility of not sufficiently rehabilitating the open pit leading to environmental impacts remaining un-mitigated.	Closure material balance not being sufficient to implement closure actions or to achieve relinquishment requirements.	Natural Environment	Highly Intolerable
Overburden Dumps (Softs and Hards)	Possible sedimentation of streams, rivers and wetlands.	Erosion of discard dump leading to sedimentation of water resources should discard material be left on surface and un-rehabilitated after mine closure.	Natural Environment	Highly Intolerable
Product and RoM Stockpiles	Possible pollution originating from ROM pad areas.	Contamination of soil and groundwater resources should stockpiles not be properly rehabilitated.	Natural Environment	Highly Intolerable
Slurry Dams	Possible SPONCOM of slurry material.	Slurry material left on site might be susceptible to burning.	Natural Environment	Highly Intolerable
General	Possibility of inadequate or no funds to implement closure actions, resulting in	Underestimate of closure quantum, insufficient funds are available to mitigate	Financial	Highly Intolerable

Area	Hazard	Discussion	Primary Risk Category	Risk Rank
	legal obligations not being discharged.	impacts or that funds have not been appropriately provisioned for closure.		
General	Possibility that residual and latent environmental risks will always remain and cannot be adequately provided for.	As a result of the undefined concept of "in perpetuity" and the difficulty of predicting hydro, hydrogeological and land form evolutionary processes far into the future. Identifying management options that provide impact mitigation indefinitely is impractical.	Financial	Highly Intolerable

8 Conclusion

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

Rehabilitation can be divided into two different streams, namely concurrent rehabilitation and final rehabilitation. Concurrent rehabilitation must be carried out along with the operations on the coal mine, and will decrease the final liability that the mine will carry at the time of closure.

A mine will obtain a closure certificate only once it can prove that rehabilitation is satisfactory, and that if any residual pollution effects exist they can be adequately managed. It is recommended that a post-closure monitoring programme is implemented before the mine applies for closure. The institution of this monitoring programme will enable the mine to identify and rectify any residual pollution impacts.

Appendix A: Unwanted Events

Mine:	Proposed Palmietkuilen Coal Mine	DMR Reference:	GP30/5/1/2/2/10047MR	Evaluation Year:	2016	Evaluators:	Digby Wells Environmental	
Location:	Springs, Gauteng Province			Last Modified:	28/03/2017	Facilitator:	Leon Ellis	

Area ID	Area	Hazard (Unwanted Event)	Consequence(s)	Primary Risk Category	Raw Risk			Current Controls	Residual Risk			Possible New Controls	Accountability	Due Date
					Severity	Likelihood	Risk Rank		Severity	Likelihood	Risk Rank			
1	Open Pit	Possibility of not sufficiently rehabilitating the open pit leading to environmental impacts remaining unmitigated.	Closure material balance not being sufficient to implement closure actions or to achieve relinquishment requirements.	Natural Environment	C	J	Highly Intolerable	Material designated for closure will be protected within the operational footprint.	D	J	ALARP	In the event that insufficient closure material is available, alternative sources will be investigated	Senior Management	
2	Overburden Dumps (Softs and Hards)	Possible sedimentation of streams, rivers and wetlands.	Erosion of discard dump leading to sedimentation of water resources should discard material be left on surface and unrehabilitated after mine closure.	Natural Environment	C	J	Highly Intolerable	Berms will be constructed around perimeter of facilities.	D	I	ALARP	Water quality monitoring should continue as this would serve as an early warning system in the event of the occurrence of adverse impacts.	Senior Management	
3	Product and RoM Stocklipes	Possible pollution originating from ROM pad areas.	Contamination of soil and groundwater resources should stockpiles not be properly rehabilitated.	Natural Environment	C	J	Highly Intolerable	All stockpile areas will be rehabilitated at closure.	D	H	Maintain	Water quality monitoring should continue as this would serve as an early warning system in the event of the occurrence of adverse impacts.	Senior Management	
4	Slurry Dams	Possible SPONCOM of slurry material.	Slurry material left on site might be susceptable to burning.	Natural Environment	C	J	Highly Intolerable	All slurry dams will be rehabilitated at closure.	D	H	Maintain		Senior Management	
7	General	Possibility of inadequate or no funds to implement closure actions, resulting in legal obligations not being discharged.	Underestimate of closure quantum, insufficient funds are available to mitigate impacts or that funds have not been appropriately provisioned for closure.	Financial	C	J	Highly Intolerable	Financial Provision assessment completed based on current layout plans and infrastructure requirements.	D	J	ALARP	Ensure financial provision assessments are updated annually or when significant changes occur in the mining method or approach.	Senior Management	
7	General	Possibility that residual and latent environmental risks will always remain and cannot be adequately provided for.	As a result of the undefined concept of "in perpetuity" and the difficulty of predicting hydro, hydrogeological and land form evolutionary processess far into the future. Iidentifying	Financial	D	K	Highly Intolerable	AOL will remain abreast of technologies for predicting the likelihood of future impacts associated with the latent and residual risks and will apply the appropriate methodology for	D	J	ALARP		Senior Management	
2	Overburden Dumps (Softs and Hards)	Possible pollution originating from overburden dumps.	Contamination of soil and groundwater resources should discard material be left on surface and unrehabilitated after mine closure.	Natural Environment	D	J	ALARP	Overburden material will be used to backfill the open pit.	E	I	Maintain	Water quality monitoring should continue as this would serve as an early warning system in the event of the occurrence of adverse impacts.	Section Manager	
2	Overburden Dumps (Softs and Hards)	Overburden material in dumps could be susceptible to SPONCOM.	May require special H&S precautions and increase handling costs during replacement in open pit.	Financial	D	I	ALARP		D	I	ALARP		Section Manager	
5	Pollution Control Dams	Inadvertent access to PCDs.	Should the PCDs remain after mine closure, people or animals entering this area unknowingly or as a result of no access control (such as fencing), people or animals may drown.	Health & Safety	C	H	ALARP	All PCDs will be rehabilitated at closure and slurry properly disposed of.	D	G	Maintain		Section Manager	
5	Pollution Control Dams	Possible pollution originating from PCDs.	Damage to integrity of dam liners during rehabilitation leading to seepage of water which may remain in the structure.	Natural Environment	D	I	ALARP	All PCDs will be rehabilitated at closure and materials properly disposed of.	D	G	Maintain	Water quality monitoring should continue as this would serve as an early warning system in the event of the occurrence of adverse impacts.	Section Manager	
6	Infrastructure (Offices, Conveyors, Plant etc.)	Possible pollution of soils and water resources.	Potential of contaminated leachate emanating from the plant area.	Natural Environment	C	G	ALARP	Quarterly Water Quality Monitoring.	D	G	Maintain	Water quality monitoring should continue as this would serve as an early warning system in the event of the occurrence of adverse impacts.	Section Manager	
6	Infrastructure (Offices, Conveyors, Plant etc.)	Possible collapse of remnant infrastructure which could lead to human injury or fatality.	The withdrawal of planned maintenance on any structures that are left for 3rd party post closure use, may result in the integrity of the structures deteriorating to the point where they represent a H&S risk to users, if the 3rd party does not implement its own maintenance regime	Health & Safety	C	G	ALARP	All infrastructure will be demolished and removed at closure. The area will be rehabilitated.	D	G	Maintain		Section Manager	
7	General	Possibility of ineffective planning for mine closure.	Unidentified environmental impacts are not mitigated as a result of closure actions that are not planned.	Natural Environment	B	G	ALARP	Closure Plan and Rehabilitation Plan in place and will be enforced.	C	G	ALARP	Update closure and rehabilitation plan regularly as new information becomes available.	Section Manager	
7	General	Potential additional closure liabilities and potentially different closure actions required to rehabilitate and close the mine .	Future mining requirements may include infrastructure that is not currently considered in planning.	Financial	D	J	ALARP	Financial Provision assessment completed based on current layout plans and infrastructure requirements.	D	H	Maintain	Ensure financial provision assessments are updated annually or when significant changes occur in the mining method or approach.	Section Manager	
7	General	Potentially requiring registration of land as contaminated land and requiring remediation.	Operational activities may result in soil being considered contaminated under S8 of Chapter 4 of NEMWA.	Financial	D	J	ALARP	Operational impacts will be remediated as far as practicable during operations.	D	I	ALARP	A contamination assessment should be conducted at the end of Life of Mine and appropriate remedial measures instituted. These should include land farming for hydrocarbon contaminated soils and the removal of soils contaminated with coal particulates around silos and conveyor routes.	Section Manager	
7	General	Possible delaying of closure once LoM reached.	Possible vandalism and interference with infrastructure, which may lead to more costly remedial measures being implemented when closure actions are undertaken.	Financial	E	K	ALARP	Appropriate security measures will be retained to secure infrastructure until the infrastructure can be demolished.	E	I	Maintain	Priority should be given to scheduling the demolition of infrastructure where integrity damage could cause more expensive remedial measures.	Section Manager	
7	General	Drastic changes in legislative requirements.	AOL incurring additional closure and rehabilitation costs.	Financial	D	J	ALARP		D	J	ALARP		Section Manager	
7	General	Might not be able to demonstrate to the authorities that the relinquishment criteria have been achieved.	Possibility that AOL does not achieve mine closure.	Legal & Reputational	E	K	ALARP	The closure actions have been developed to achieve the relinquishment criteria and appropriate monitoring activities have been identified to assist with demonstrating that relinquishment criteria have been achieved.	E	I	Maintain	Relinquishment and monitoring criteria should be evaluated with progressive updates to the plans and should be adapted to meet changing legislative and environmental pressures.	Section Manager	
7	General	Possibility of civil unrest for those that loose employment.	Labour expectations are not achieved. No altrnative livelihood opportunities.	Legal & Reputational	D	I	ALARP	Continual engagement with internal stakeholders will be undertaken as described in the Social and Labour Plan to assist with the transition to the post closure period.	E	I	Maintain		Section Manager	
7	General	Possibility of failing to control alien invasive species on rehabilitated land.	Loss of biodiversity.	Natural Environment	E	J	ALARP		E	J	ALARP	Implement Alien Invasive Management Plan.	Section Manager	
7	General	Potential negative impact on local livelihoods.	Failure to implement the final land use plan.	Natural Environment	E	I	Maintain	Continual engagement with local community will be undertaken as described in the Social and Labour Plan to assist with the transition to the post closure period.	E	I	Maintain		Senior Management	
6	Infrastructure (Offices, Conveyors, Plant etc.)	Possible contamination eminating from the plant and workshop ares.	Possible pollution impacting on soil and water resources.	Natural Environment	D	G	Maintain	All infrastructure will be demolished and removed at closure. The area will be rehabilitated.	D	G	Maintain		Supervisor	
7	General	Possible dust generation during decommissioning and closure of the mine.	Nuisance dust to community.	Health & Safety	E	I	Maintain		E	I	Maintain		Supervisor	

Appendix B: Financial Provision Estimate

DIGBY WELLS ENVIRONMENTAL	Digby Wells Environmental	
	Canyon Resources (Pty) Ltd, Palmietkuilen Mine, CNC4065, Revision: 1	
Area and Description	**Year 10 of Operation 2026**	**End of life 2069**
Infrastructure and Rehabilitation		
Area 1: Mine Office	R297 709	R297 709
Area 2: Plant infrastructure	R2 528 445	R2 792 798
Area 3: Mining and Related areas	R131 113 650	R275 428 583
Area 4: Linear infrastructure	R2 418 734	R2 418 734
Sub-total	**R136 358 539**	**R280 937 825**
Monitoring and Maintenance		
Monitoring Costs (Groundwater and Surface water)	R1 595 900	R1 427 600
Monitoring Costs (Vegetation)	R67 809	R79 563
Maintenance Costs (Vegetation)	R2 602 367	R3 079 962
Sub-total	**R4 266 076**	**R4 587 124**
Project Management (6%)	R8 181 512	R16 856 269
Contingency (10%)	R13 635 854	R28 093 782
GRAND TOTAL	**R162 441 981**	**R330 475 001**

Digby Wells Environmental

Canyon Resources (Pty) Ltd, Palmietkuilen Mine, CNC4065

End of Life and Year 10 of Operation Assessment, Detail breakdown, September 2016

Map Ref.	Aspect Name	Description	Year 10 of Operation 2026						End of life 2069						Cost per year for the first 10 years									
			Class	Quantity	Unit	Rate	Amount	Comments	Class	Quantity	Unit	Rate	Amount	Comments	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
															2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Area 1		**Mine Office**																						
		Demolish infrastructure																						
		Offices:																						
MO1	Mine office 1	Remove single story brick building	101	204.00	m²	R306.55	R62 536.65	Assume Single Brick buildings	101	204.00	m²	R306.55	R62 536.65	Assume Single Brick buildings	R 62 536.65	R62 536.65	R62 536.65	R62 536.65	R62 536.65	R62 536.65	R62 536.65	R62 536.65	R62 536.65	R 62 536.65
MO2	Mine office 2	Remove single story brick building	101	60.00	m²	R306.55	R18 393.13	Assume Single Brick buildings	101	60.00	m²	R306.55	R18 393.13	Assume Single Brick buildings	R 18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R 18 393.13
MO3	Mine office 3	Remove single story brick building	101	60.00	m²	R306.55	R18 393.13	Assume Single Brick buildings	101	60.00	m²	R306.55	R18 393.13	Assume Single Brick buildings	R 18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R 18 393.13
MO4	Mine office 4	Remove single story brick building	101	60.00	m²	R306.55	R18 393.13	Assume Single Brick buildings	101	60.00	m²	R306.55	R18 393.13	Assume Single Brick buildings	R 18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R 18 393.13
MO5	Mine office 5	Remove single story brick building	101	60.00	m²	R306.55	R18 393.13	Assume Single Brick buildings	101	60.00	m²	R306.55	R18 393.13	Assume Single Brick buildings	R 18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R 18 393.13
MO6	Mine office 6	Remove single story brick building	101	60.00	m²	R306.55	R18 393.13	Assume Single Brick buildings	101	60.00	m²	R306.55	R18 393.13	Assume Single Brick buildings	R 18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R 18 393.13
CP1	Car port 1	Remove IBR carports	105	671.86	m²	R91.79	R61 669.43		105	671.86	m²	R91.79	R61 669.43		R 61 669.43	R61 669.43	R61 669.43	R61 669.43	R61 669.43	R61 669.43	R61 669.43	R61 669.43	R61 669.43	R 61 669.43
		Remove tar surface	133	671.86	m²	R13.66	R9 179.44		133	671.86	m²	R13.66	R9 179.44		R 9 179.44	R9 179.44	R9 179.44	R9 179.44	R9 179.44	R9 179.44	R9 179.44	R9 179.44	R9 179.44	R 9 179.44
WT1	Water tank 1	Remove steel water tank	141	1.00	Item	R15 920.37	R15 920.37		141	1.00	Item	R15 920.37	R15 920.37		R 15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R 15 920.37
		Demolition Total					**R 241 271.55**						**R 241 271.55**											
		Rehabilitation																						
		Rip soil	132	0.18	Ha	R7 540.00	R1 393.18		132	0.18	Ha	R7 540.00	R1 393.18		R 1 393.18	R1 393.18	R1 393.18	R1 393.18	R1 393.18	R1 393.18	R1 393.18	R1 393.18	R1 393.18	R 1 393.18
		Grade an area	123	0.00	Ha	R2 306.29	R0.00		123	0.00	Ha	R2 306.29	R0.00		R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
		General clean up	124	0.00	m²	R15.22	R0.00		124	0.00	m²	R15.22	R0.00		R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
		Rubble	125	0.00	m³	R18.62	R0.00		125	0.00	m³	R18.62	R0.00		R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
		Replace soil and spread - 150mm	126	0.00	m²	R13.51	R0.00		126	0.00	m²	R13.51	R0.00		R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
		Replace soil and spread - 300mm	127	1847.72	m²	R26.82	R49 548.87		127	1847.72	m²	R26.82	R49 548.87		R 49 548.87	R49 548.87	R49 548.87	R49 548.87	R49 548.87	R49 548.87	R49 548.87	R49 548.87	R49 548.87	R 49 548.87
		Revegetate areas	128	0.18	Ha	R29 744.13	R5 495.89		128	0.18	Ha	R29 744.13	R5 495.89		R 5 495.89	R5 495.89	R5 495.89	R5 495.89	R5 495.89	R5 495.89	R5 495.89	R5 495.89	R5 495.89	R 5 495.89
		Bulldoze material	130	0.00	m³	R16.79	R0.00		130	0.00	m³	R16.79	R0.00		R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
		Rehabilitation Total					**R 56 437.94**						**R 56 437.94**											
		Area 1 Total					**R 297 709.49**						**R 297 709.49**											
Area 2		**Plant infrastructure**																						
		Demolish infrastructure																						
		Processing Plant:																						
PC	Primary crusher	Remove Primary crusher 1	137	100.79	m²	R357.98	R36 082.11	Assume triple story steel structure	137	100.79	m²	R357.98	R36 082.11	Assume triple story steel structure	R 36 082.11	R36 082.11	R36 082.11	R36 082.11	R36 082.11	R36 082.11	R36 082.11	R36 082.11	R36 082.11	R 36 082.11
		Remove 750mm crusher foundation	110	75.60	m³	R1 276.05	R96 464.52		110	75.60	m³	R1 276.05	R96 464.52		R 96 464.52	R96 464.52	R96 464.52	R96 464.52	R96 464.52	R96 464.52	R96 464.52	R96 464.52	R96 464.52	R 96 464.52
		Remove concrete retaining wall at ROM	109	112.00	m³	R708.24	R79 322.32	Total length of RW is 40m, assumed an average height of 8m x 350mm thick	109	112.00	m³	R708.24	R79 322.32	Total length of RW is 40m, assumed an average height of 8m x 350mm thick	R 79 322.32	R79 322.32	R79 322.32	R79 322.32	R79 322.32	R79 322.32	R79 322.32	R79 322.32	R79 322.32	R 79 322.32
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
SC	Secondary crusher	Remove Secondary crusher	136	75.88	m²	R292.89	R22 223.00	Assume double story steel structure	136	75.88	m²	R292.89	R22 223.00	Assume double story steel structure	R 22 223.00	R22 223.00	R22 223.00	R22 223.00	R22 223.00	R22 223.00	R22 223.00	R22 223.00	R22 223.00	R 22 223.00
		Remove 750mm crusher foundation	110	56.91	m³	R1 276.05	R72 615.37		110	56.91	m³	R1 276.05	R72 615.37		R 72 615.37	R72 615.37	R72 615.37	R72 615.37	R72 615.37	R72 615.37	R72 615.37	R72 615.37	R72 615.37	R 72 615.37
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
TC	Tertiary crusher	Remove Primary crusher 2	137	56.77	m²	R357.98	R20 321.48	Assume triple story steel structure	137	56.77	m²	R357.98	R20 321.48	Assume triple story steel structure	R 20 321.48	R20 321.48	R20 321.48	R20 321.48	R20 321.48	R20 321.48	R20 321.48	R20 321.48	R20 321.48	R 20 321.48
		Remove 750mm crusher foundation	110	42.58	m³	R1 276.05	R54 328.92		110	42.58	m³	R1 276.05	R54 328.92		R 54 328.92	R54 328.92	R54 328.92	R54 328.92	R54 328.92	R54 328.92	R54 328.92	R54 328.92	R54 328.92	R 54 328.92
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
DB	Discard bin	Remove steel structure	137	73.70	m²	R357.98	R26 382.84	Assume triple story steel structure	137	73.70	m²	R357.98	R26 382.84	Assume triple story steel structure	R 26 382.84	R26 382.84	R26 382.84	R26 382.84	R26 382.84	R26 382.84	R26 382.84	R26 382.84	R26 382.84	R 26 382.84
		Remove concrete retaining wall	109	84.00	m³	R708.24	R59 491.74	Total length of RW is 30m, assumed an average height of 8m x 350mm thick	109	84.00	m³	R708.24	R59 491.74	Total length of RW is 30m, assumed an average height of 8m x 350mm thick	R 59 491.74	R59 491.74	R59 491.74	R59 491.74	R59 491.74	R59 491.74	R59 491.74	R59 491.74	R59 491.74	R 59 491.74
		Remove 750mm foundation	110	55.27	m³	R1 276.05	R70 533.80		110	55.27	m³	R1 276.05	R70 533.80		R 70 533.80	R70 533.80	R70 533.80	R70 533.80	R70 533.80	R70 533.80	R70 533.80	R70 533.80	R70 533.80	R 70 533.80
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
SC	Suspended conveyor	Remove conveyor in plant	148	539.98	m	R392.98	R212 201.76		148	539.98	m	R392.98	R212 201.76		R 212 201.76	R212 201.76	R212 201.76	R212 201.76	R212 201.76	R212 201.76	R212 201.76	R212 201.76	R212 201.76	R 212 201.76
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
CS	Change stations	Remove steel change stations	135	134.01	m²	R227.80	R30 527.70	7 off Required assume single story	135	134.01	m²	R227.80	R30 527.70	7 off Required assume single story	R 30 527.70	R30 527.70	R30 527.70	R30 527.70	R30 527.70	R30 527.70	R30 527.70	R30 527.70	R30 527.70	R 30 527.70
		Remove 400mm concrete slab	109	53.60	m³	R708.24	R37 964.01		109	53.60	m³	R708.24	R37 964.01		R 37 964.01	R37 964.01	R37 964.01	R37 964.01	R37 964.01	R37 964.01	R37 964.01	R37 964.01	R37 964.01	R 37 964.01
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
T	Thickener	Remove steel thickener	A	1.00	Item	R264 454.96	R264 454.96		A	1.00	Item	R264 454.96	R264 454.96		R 264 454.96	R264 454.96	R264 454.96	R264 454.96	R264 454.96	R264 454.96	R264 454.96	R264 454.96	R264 454.96	R 264 454.96
		Remove 500mm concrete slab and foundation	109	132.35	m³	R708.24	R93 732.02	Total area of 331m2	109	132.35	m³	R708.24	R93 732.02	Total area of 331m2	R 93 732.02	R93 732.02	R93 732.02	R93 732.02	R93 732.02	R93 732.02	R93 732.02	R93 732.02	R93 732.02	R 93 732.02
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
PS1	Process Structure 1	Remove steel structures	137	53.09	m²	R357.98	R19 004.58		137	53.09	m²	R357.98	R19 004.58		R 19 004.58	R19 004.58	R19 004.58	R19 004.58	R19 004.58	R19 004.58	R19 004.58	R19 004.58	R19 004.58	R 19 004.58
		Remove 400mm concrete slab	109	21.24	m³	R708.24	R15 039.78		109	21.24	m³	R708.24	R15 039.78		R 15 039.78	R15 039.78	R15 039.78	R15 039.78	R15 039.78	R15 039.78	R15 039.78	R15 039.78	R15 039.78	R 15 039.78
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
PS2	Process Structure 2	Remove steel structures	137	18.16	m²	R357.98	R6 499.57		137	18.16	m²	R357.98	R6 499.57		R 6 499.57	R6 499.57	R6 499.57	R6 499.57	R6 499.57	R6 499.57	R6 499.57	R6 499.57	R6 499.57	R 6 499.57
		Remove 400mm concrete slab	109	7.26	m³	R708.24	R5 143.61		109	7.26	m³	R708.24	R5 143.61		R 5 143.61	R5 143.61	R5 143.61	R5 143.61	R5 143.61	R5 143.61	R5 143.61	R5 143.61	R5 143.61	R 5 143.61
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
PS3	Process Structure 3	Remove steel structures	137	89.16	m²	R357.98	R31 917.13		137	89.16	m²	R357.98	R31 917.13		R 31 917.13	R31 917.13	R31 917.13	R31 917.13	R31 917.13	R31 917.13	R31 917.13	R31 917.13	R31 917.13	R 31 917.13
		Remove 400mm concrete slab	109	35.66	m³	R708.24	R25 258.48		109	35.66	m³	R708.24	R25 258.48		R 25 258.48	R25 258.48	R25 258.48	R25 258.48	R25 258.48	R25 258.48	R25 258.48	R25 258.48	R25 258.48	R 25 258.48
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
PS4	Process Structure 4	Remove steel structures	137	204.47	m²	R357.98	R73 196.21		137	204.47	m²	R357.98	R73 196.21		R 73 196.21	R73 196.21	R73 196.21	R73 196.21	R73 196.21	R73 196.21	R73 196.21	R73 196.21	R73 196.21	R 73 196.21
		Remove 400mm concrete slab	109	81.79	m³	R708.24	R57 925.78		109	81.79	m³	R708.24	R57 925.78		R 57 925.78	R57 925.78	R57 925.78	R57 925.78	R57 925.78	R57 925.78	R57 925.78	R57 925.78	R57 925.78	R 57 925.78
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
PS5	Process Structure 5	Remove steel structures	137	65.37	m²	R357.98	R23 400.43		137	65.37	m²	R357.98	R23 400.43		R 23 400.43	R23 400.43	R23 400.43	R23 400.43	R23 400.43	R23 400.43	R23 400.43	R23 400.43	R23 400.43	R 23 400.43
		Remove 400mm concrete slab	109	26.15	m³	R708.24	R18 518.56		109	26.15	m³	R708.24	R18 518.56		R 18 518.56	R18 518.56	R18 518.56	R18 518.56	R18 518.56	R18 518.56	R18 518.56	R18 518.56	R18 518.56	R 18 518.56
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
PS6	Process Structure 6	Remove steel structures	137	5.20	m²	R357.98	R1 861.92		137	5.20	m²	R357.98	R1 861.92		R 1 861.92	R1 861.92	R1 861.92	R1 861.92	R1 861.92	R1 861.92	R1 861.92	R1 861.92	R1 861.92	R 1 861.92
		Remove 400mm concrete slab	109	2.08	m³	R708.24	R1 473.48		109	2.08	m³	R708.24	R1 473.48		R 1 473.48	R1 473.48	R1 473.48	R1 473.48	R1 473.48	R1 473.48	R1 473.48	R1 473.48	R1 473.48	R 1 473.48
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
		Plant Offices:													R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
PO1	Plant office 1	Remove single story brick building	101	60.00	m²	R306.55	R18 393.13		101	60.00	m²	R306.55	R18 393.13		R 18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R18 393.13	R 18 393.13
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
PO2	Plant office 2	Remove steel structures	137	144.00	m²	R357.98	R51 548.57		137	144.00	m²	R357.98	R51 548.57		R 51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R 51 548.57
		Remove 400mm concrete slab	109	57.60	m³	R708.24	R40 794.34		109	57.60	m³	R708.24	R40 794.34		R 40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R 40 794.34
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
PO3	Plant office 3	Remove steel structures	137	144.00	m²	R357.98	R51 548.57		137	144.00	m²	R357.98	R51 548.57		R 51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R 51 548.57
		Remove 400mm concrete slab	109	57.60	m³	R708.24	R40 794.34		109	57.60	m³	R708.24	R40 794.34		R 40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R 40 794.34
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
PO4	Plant office 4	Remove single story brick building	101	144.00	m²	R306.55	R44 143.52		101	144.00	m²	R306.55	R44 143.52		R 44 143.52	R44 143.52	R44 143.52	R44 143.52	R44 143.52	R44 143.52	R44 143.52	R44 143.52	R44 143.52	R 44 143.52
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
PO5	Plant office 5	Remove single story brick building	101	144.00	m²	R306.55	R44 143.52		101	144.00	m²	R306.55	R44 143.52		R 44 143.52	R44 143.52	R44 143.52	R44 143.52	R44 143.52	R44 143.52	R44 143.52	R44 143.52	R44 143.52	R 44 143.52
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
CP2	Car port 2	Remove IBR carport structure	105	496.47	m²	R91.79	R45 570.74		137	496.47	m²	R357.98	R177 725.46		R 45 570.74	R45 570.74	R45 570.74	R45 570.74	R45 570.74	R45 570.74	R45 570.74	R45 570.74	R45 570.74	R 45 570.74
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
DB1	Diesel Bay 1	Remove tank	141	1.00	Item	R15 920.37	R15 920.37		141	1.00	Item	R15 920.37	R15 920.37		R 15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R 15 920.37
		Remove concrete bund wall and slab	101	56.94	m²	R306.55	R17 455.11		101	56.94	m²	R306.55	R17 455.11		R 17 455.11	R17 455.11	R17 455.11	R17 455.11	R17 455.11	R17 455.11	R17 455.11	R17 455.11	R17 455.11	R 17 455.11
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
WT2	Water tank 2	Remove steel water tank	141	1.00	Item	R15 920.37	R15 920.37		141	1.00	Item	R15 920.37	R15 920.37		R 15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R 15 920.37
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
		Mining Contractors yard:													R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
WS1	Workshop 1	Remove steel structures	137	60.00	m²	R357.98	R21 478.57		137	60.00	m²	R357.98	R21 478.57		R 21 478.57	R21 478.57	R21 478.57	R21 478.57	R21 478.57	R21 478.57	R21 478.57	R21 478.57	R21 478.57	R 21 478.57
		Remove 400mm concrete slab	109	24.00	m³	R708.24	R16 997.64		109	24.00	m³	R708.24	R16 997.64		R 16 997.64	R16 997.64	R16 997.64	R16 997.64	R16 997.64	R16 997.64	R16 997.64	R16 997.64	R16 997.64	R 16 997.64
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
WS2	Workshop 2	Remove steel structures	137	144.00	m²	R357.98	R51 548.57		137	144.00	m²	R357.98	R51 548.57		R 51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R 51 548.57
		Remove 400mm concrete slab	109	57.60	m³	R708.24	R40 794.34		109	57.60	m³	R708.24	R40 794.34		R 40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R 40 794.34
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
WS3	Workshop 3	Remove steel structures	137	144.00	m²	R357.98	R51 548.57		137	144.00	m²	R357.98	R51 548.57		R 51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R 51 548.57
		Remove 400mm concrete slab	109	57.60	m³	R708.24	R40 794.34		109	57.60	m³	R708.24	R40 794.34		R 40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R 40 794.34
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
WS4	Workshop 4	Remove steel structures	137	144.00	m²	R357.98	R51 548.57		137	144.00	m²	R357.98	R51 548.57		R 51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R 51 548.57
		Remove 400mm concrete slab	109	57.60	m³	R708.24	R40 794.34		109	57.60	m³	R708.24	R40 794.34		R 40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R 40 794.34
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
WS5	Workshop 5	Remove steel structures	137	144.00	m²	R357.98	R51 548.57		137	144.00	m²	R357.98	R51 548.57		R 51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R51 548.57	R 51 548.57
		Remove 400mm concrete slab	109	57.60	m³	R708.24	R40 794.34		109	57.60	m³	R708.24	R40 794.34		R 40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R40 794.34	R 40 794.34
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
DB2	Diesel Bay 2	Remove tank	141	1.00	Item	R15 920.37	R15 920.37		141	1.00	Item	R15 920.37	R15 920.37		R 15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R 15 920.37
		Remove concrete bund wall and slab	109	56.94	m³	R708.24	R40 326.96		109	56.94	m³	R708.24	R40 326.96		R 40 326.96	R40 326.96	R40 326.96	R40 326.96	R40 326.96	R40 326.96	R40 326.96	R40 326.96	R40 326.96	R 40 326.96
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
CP3	Car port 3	Remove IBR carport structure	105	496.64	m²	R91.79	R45 585.70		137	496.64	m²	R357.98	R177 783.82		R 45 585.70	R45 585.70	R45 585.70	R45 585.70	R45 585.70	R45 585.70	R45 585.70	R45 585.70	R45 585.70	R 45 585.70
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
WT3	Water tank 3	Remove steel water tank	141	1.00	Item	R15 920.37	R15 920.37		141	1.00	Item	R15 920.37	R15 920.37		R 15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R 15 920.37
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
HP	Hard park area	Rip hard park area		0.74				Included under rehabilitation		0.74				Included under rehabilitation	R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
		Demolition Total					**R 2 367 719.86**						**R 2 632 072.70**											
		Rehabilitation																						
		Rip soil	132	1.18	Ha	R7 540.00	R8 866.07		132	1.18	Ha	R7 540.00	R8 866.07		R 8 866.07	R8 866.07	R8 866.07	R8 866.07	R8 866.07	R8 866.07	R8 866.07	R8 866.07	R8 866.07	R 8 866.07
		Grade an area	123	0.00	Ha	R2 306.29	R0.00		123	0.00	Ha	R2 306.29	R0.00		R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
		General clean up	124	0.00	m²	R15.22	R0.00		124	0.00	m²	R15.22	R0.00		R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
		Rubble	125	0.00	m³	R18.62	R0.00		125	0.00	m³	R18.62	R0.00		R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
		Replace soil and spread - 150mm	126	0.00	m²	R13.51	R0.00		126	0.00	m²	R13.51	R0.00		R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
		Replace soil and spread - 300mm	127	4358.71	m²	R26.82	R116 884.03		127	4358.71	m²	R26.82	R116 884.03		R 116 884.03	R116 884.03	R116 884.03	R116 884.03	R116 884.03	R116 884.03	R116 884.03	R116 884.03	R116 884.03	R 116 884.03
		Revegetate areas	128	1.18	Ha	R29 744.13	R34 975.26		128	1.18	Ha	R29 744.13	R34 975.26		R 34 975.26	R34 975.26	R34 975.26	R34 975.26	R34 975.26	R34 975.26	R34 975.26	R34 975.26	R34 975.26	R 34 975.26
		Bulldoze material	130	0.00	m³	R16.79	R0.00		130	0.00	m³	R16.79	R0.00		R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00

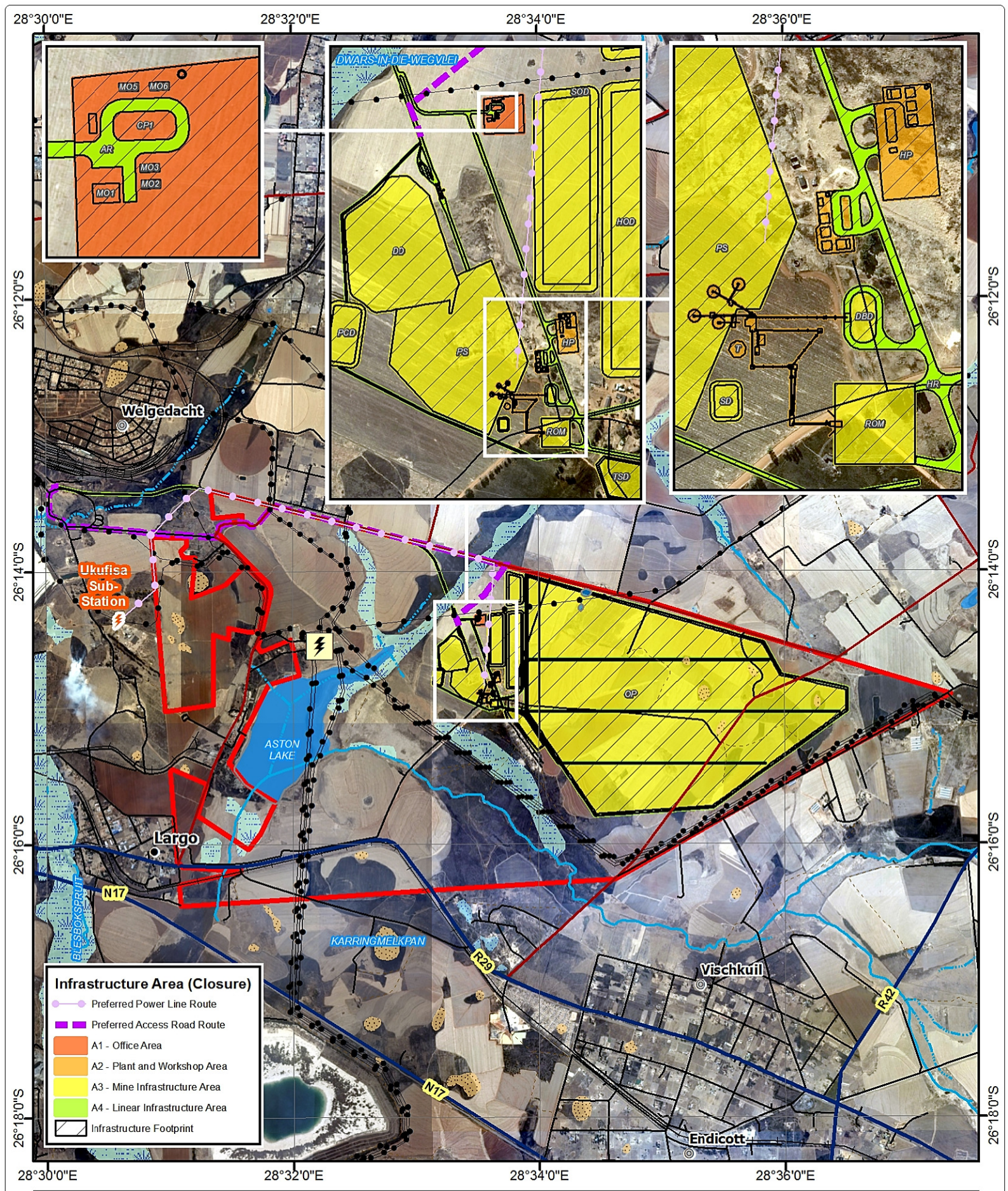
Digby Wells Environmental

Canyon Resources (Pty) Ltd, Palmietkuilen Mine, CNC4065

End of Life and Year 10 of Operation Assessment, Detail breakdown, September 2016

Map Ref.	Aspect Name	Description	Year 10 of Operation 2026						End of life 2069						Cost per year for the first 10 years									
			Class	Quantity	Unit	Rate	Amount	Comments	Class	Quantity	Unit	Rate	Amount	Comments	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
															2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
		Rehabilitation Total					**R 160 725.36**						**R 160 725.36**											
		Area 2 Total					**R 2 528 445.22**						**R 2 792 798.05**											
Area 3		**Mining and Related areas**																						
		Demolish infrastructure																						
WB	Weighbridge	Remove concrete structure	109	184.81	m³	R708.24	R130 888.42	Assume concrete thickness of 400mm	109	184.81	m³	R708.24	R130 888.42	Assume concrete thickness of 400mm	R 130 888.42	R130 888.42	R130 888.42	R130 888.42	R130 888.42	R130 888.42	R130 888.42	R130 888.42	R130 888.42	R 130 888.42
		Remove Security building	101	13.63	m²	R306.55	R4 178.73		101	13.63	m²	R306.55	R4 178.73		R 4 178.73	R4 178.73	R4 178.73	R4 178.73	R4 178.73	R4 178.73	R4 178.73	R4 178.73	R4 178.73	R 4 178.73
		Remove steel water tank	141	1.00	Item	R15 920.37	R15 920.37		141	1.00	Item	R15 920.37	R15 920.37		R 15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R15 920.37	R 15 920.37
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
TA	Tarpaulin Area	Rehabilitate area		0.06				Assume no contamination at this park area. Refer to Rehabilitation for rehab measures		0.06				Assume no contamination at this park area. Refer to Rehabilitation for rehab measures	R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
															R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
SWT	Dirty Water Trench	Remove 150mm concrete lining	107	686.93	m³	R303.53	R208 501.86	Assume trapizoid trench that is 1500mm wide x 150mm thick concrete = 2.13*0.15*2150m Refer to Rehabilitation for rehab measures	107	686.93	m³	R303.53	R208 501.86	Assume trapizoid trench that is 1500mm wide x 150mm thick concrete = 2.13*0.15*2150m Refer to Rehabilitation for rehab measures	R 208 501.86	R208 501.86	R208 501.86	R208 501.86	R208 501.86	R208 501.86	R208 501.86	R208 501.86	R208 501.86	R 208 501.86
		Demolition Total					**R 359 489.38**						**R 359 489.38**											
		Rehabilitation																						
		General rehabilitation																						
		Rip soil	132	0.53	Ha	R7 540.00	R3 990.21	Rip areas where structures have been removed	132	0.53	Ha	R7 540.00	R3 990.21	Rip areas where structures have been removed	R 1 330.07	R 2 660.14	R 3 990.21	R3 990.21	R3 990.21	R3 990.21	R3 990.21	R3 990.21	R3 990.21	R 3 990.21
		Grade an area	123	0.00	Ha	R2 306.29	R0.00		123	0.00	Ha	R2 306.29	R0.00		R 0.00	R 0.00	R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
		General clean up	124	0.00	m²	R15.22	R0.00		124	0.00	m²	R15.22	R0.00		R 0.00	R 0.00	R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
		Rubble	125	0.00	m³	R18.62	R0.00		125	0.00	m³	R18.62	R0.00		R 0.00	R 0.00	R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
		Replace soil and spread - 150mm	126	0.00	m²	R13.51	R0.00		126	0.00	m²	R13.51	R0.00		R 0.00	R 0.00	R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
		Replace soil and spread - 300mm	127	5292.06	m²	R26.82	R141 912.77		127	5292.06	m²	R26.82	R141 912.77		R 47 304.26	R 94 608.52	R 141 912.77	R141 912.77	R141 912.77	R141 912.77	R141 912.77	R141 912.77	R141 912.77	R 141 912.77
		Revegetate areas	128	0.53	Ha	R29 744.13	R15 740.76		128	0.53	Ha	R29 744.13	R15 740.76		R 5 246.92	R 10 493.84	R 15 740.76	R15 740.76	R15 740.76	R15 740.76	R15 740.76	R15 740.76	R15 740.76	R 15 740.76
		Bulldoze material	130	0.00	m³	R16.79	R0.00		130	0.00	m³	R16.79	R0.00		R 0.00	R 0.00	R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
		Specific rehabilitation																						
FV	Open pit	Infill of pit void	125	6444000.00	m³	R18.62	R119 993 794.48	Assume pit area at Yr 9 will be 17.9ha (assuming a 3year construction period) and that up to year 8 the pit area would have been rehabilitated concurrently, with an avg. pit depth of 36m.	125	14151246.25	m³	R18.62	R263 510 511.11	Assume Final void will be 39.31ha with an avg. pit depth of 36m. Assume no inpit lake		R13 332 643.83	R26 665 287.66	R39 997 931.49	R53 330 575.33	R66 663 219.16	R79 995 862.99	R93 328 506.82	R106 661 150.65	R119 993 794.48
		Rip infilled area	132	17.90	Ha	R7 540.00	R134 966.00		132	39.31	Ha	R7 540.00	R296 389.99			R14 996.22	R29 992.44	R44 988.67	R59 984.89	R74 981.11	R89 977.33	R104 973.56	R119 969.78	R134 966.00
		Establish vegetation	128	17.90	Ha	R29 744.13	R532 419.96		128	39.31	Ha	R29 744.13	R1 169 212.59			R59 157.77	R118 315.55	R177 473.32	R236 631.09	R295 788.87	R354 946.64	R414 104.41	R473 262.19	R532 419.96
															R 0.00	R 0.00	R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
SOD	Soft Overburden dump	Rip area	132	16.07	Ha	R7 540.00	R121 167.80	Assume will be used for rehabilitation, therefore only footprint rehab is allowed for	132	16.07	Ha	R7 540.00	R121 167.80	Assume will be used for rehabilitation, therefore only footprint rehab is allowed for		R13 463.09	R26 926.18	R40 389.27	R53 852.36	R67 315.44	R80 778.53	R94 241.62	R107 704.71	R121 167.80
		Establish vegetation	128	16.07	Ha	R29 744.13	R477 988.20		128	16.07	Ha	R29 744.13	R477 988.20			R53 109.80	R106 219.60	R159 329.40	R212 439.20	R265 549.00	R318 658.80	R371 768.60	R424 878.40	R477 988.20
															R 0.00	R 0.00	R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
HOD	Hard Overburden dump	Rip area	132	33.27	Ha	R7 540.00	R250 855.80	Assume will be used for rehabilitation, therefore only footprint rehab is allowed for	132	33.27	Ha	R7 540.00	R250 855.80	Assume will be used for rehabilitation, therefore only footprint rehab is allowed for		R27 872.87	R55 745.73	R83 618.60	R111 491.47	R139 364.33	R167 237.20	R195 110.07	R222 982.93	R250 855.80
		Establish vegetation	128	33.27	Ha	R29 744.13	R989 587.27		128	33.27	Ha	R29 744.13	R989 587.27			R109 954.14	R219 908.28	R329 862.42	R439 816.56	R549 770.70	R659 724.84	R769 678.99	R879 633.13	R989 587.27
															R 0.00	R 0.00	R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
TSD	Topsoil dump	Rip area	132	9.21	Ha	R7 540.00	R69 447.71	Assume will be used for rehabilitation, therefore only footprint rehab is allowed for	132	9.21	Ha	R7 540.00	R69 447.71	Assume will be used for rehabilitation, therefore only footprint rehab is allowed for	R 23 149.24	R 46 298.48	R 69 447.71	R69 447.71	R69 447.71	R69 447.71	R69 447.71	R69 447.71	R69 447.71	R 69 447.71
		Establish vegetation	128	9.21	Ha	R29 744.13	R273 960.47		128	9.21	Ha	R29 744.13	R273 960.47		R 91 320.16	R 182 640.32	R 273 960.47	R273 960.47	R273 960.47	R273 960.47	R273 960.47	R273 960.47	R273 960.47	R 273 960.47
															R 0.00	R 0.00	R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
PS	Product stockpile	Remove veneer	122	29448.46	m³	R20.84	R613 651.44	Assume all product will be removed. Remove 150mm thick veneer	122	29448.46	m³	R20.84	R613 651.44	Assume all product will be removed. Remove 150mm thick veneer	R 204 550.48	R68 183.49	R136 366.99	R204 550.48	R272 733.97	R340 917.47	R409 100.96	R477 284.45	R545 467.95	R613 651.44
		Rip area	132	19.63	Ha	R7 540.00	R148 027.57		132	19.63	Ha	R7 540.00	R148 027.57		R 49 342.52	R16 447.51	R32 895.02	R49 342.52	R65 790.03	R82 237.54	R98 685.05	R115 132.55	R131 580.06	R148 027.57
		Establish vegetation	128	19.63	Ha	R29 744.13	R583 945.82		128	19.63	Ha	R29 744.13	R583 945.82		R 194 648.61	R64 882.87	R129 765.74	R194 648.61	R259 531.48	R324 414.34	R389 297.21	R454 180.08	R519 062.95	R583 945.82
ROM	ROM stockpile	Doze and remove ROM Embankment	130	80800.00	m³	R16.79	R1 356 632.86	Assume ROM height of 8m	130	80800.00	m³	R16.79	R1 356 632.86	Assume ROM height of 8m		R150 736.98	R301 473.97	R452 210.95	R602 947.94	R753 684.92	R904 421.91	R1 055 158.89	R1 205 895.87	R1 356 632.86
		Rip area	132	1.01	Ha	R7 540.00	R7 615.40		132	1.01	Ha	R7 540.00	R7 615.40			R846.16	R1 692.31	R2 538.47	R3 384.62	R4 230.78	R5 076.93	R5 923.09	R6 769.24	R7 615.40
		Establish vegetation	128	1.01	Ha	R29 744.13	R30 041.57		128	1.01	Ha	R29 744.13	R30 041.57			R3 337.95	R6 675.91	R10 013.86	R13 351.81	R16 689.76	R20 027.72	R23 365.67	R26 703.62	R30 041.57
															R 0.00	R 0.00	R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
PCD	Pollution Control Dam	Desilt dam	113	5822.54	m³	R33.86	R197 168.85	Assume silt of 150mm thick over 40% of area	113	5822.54	m³	R33.86	R197 168.85	Assume silt of 150mm thick over 40% of area	R 65 722.95	R 131 445.90	R 197 168.85	R197 168.85	R197 168.85	R197 168.85	R197 168.85	R197 168.85	R197 168.85	R 197 168.85
		Remove HDPE liner	112	29112.69	m²	R6.99	R203 504.77		112	29112.69	m²	R6.99	R203 504.77		R 67 834.92	R 135 669.85	R 203 504.77	R203 504.77	R203 504.77	R203 504.77	R203 504.77	R203 504.77	R203 504.77	R 203 504.77
		Breach dam wall	111	8353.04	m³	R18.70	R156 199.66	Assume dam wall of 12.5m3/m	111	8353.04	m³	R18.70	R156 199.66	Assume dam wall of 12.5m3/m	R 52 066.55	R 104 133.11	R 156 199.66	R156 199.66	R156 199.66	R156 199.66	R156 199.66	R156 199.66	R156 199.66	R 156 199.66
		Rip area	132	0.58	Ha	R7 540.00	R4 390.19		132	0.58	Ha	R7 540.00	R4 390.19		R 1 463.40	R 2 926.80	R 4 390.19	R4 390.19	R4 390.19	R4 390.19	R4 390.19	R4 390.19	R4 390.19	R 4 390.19
		Establish vegetation	128	0.58	Ha	R29 744.13	R17 318.64		128	0.58	Ha	R29 744.13	R17 318.64		R 5 772.88	R 11 545.76	R 17 318.64	R17 318.64	R17 318.64	R17 318.64	R17 318.64	R17 318.64	R17 318.64	R 17 318.64
															R 0.00	R 0.00	R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
SD	Slurry Dam	Desilt dam	113	382.57	m³	R33.86	R12 955.01	Assume silt of 150mm thick over 40% of area	113	382.57	m³	R33.86	R12 955.01	Assume silt of 150mm thick over 40% of area	R 4 318.34	R 8 636.67	R 12 955.01	R12 955.01	R12 955.01	R12 955.01	R12 955.01	R12 955.01	R12 955.01	R 12 955.01
		Breach dam wall	111	1057.98	m³	R18.70	R19 783.99	Assume dam wall of 6.5m3/m	111	1057.98	m³	R18.70	R19 783.99	Assume dam wall of 6.5m3/m	R 6 594.66	R 13 189.33	R 19 783.99	R19 783.99	R19 783.99	R19 783.99	R19 783.99	R19 783.99	R19 783.99	R 19 783.99
		Rip area	132	0.04	Ha	R7 540.00	R288.46		132	0.04	Ha	R7 540.00	R288.46		R 96.15	R 192.31	R 288.46	R288.46	R288.46	R288.46	R288.46	R288.46	R288.46	R 288.46
		Establish vegetation	128	0.04	Ha	R29 744.13	R1 137.92		128	0.04	Ha	R29 744.13	R1 137.92		R 379.31	R 758.62	R 1 137.92	R1 137.92	R1 137.92	R1 137.92	R1 137.92	R1 137.92	R1 137.92	R 1 137.92
															R 0.00	R 0.00	R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
DBD	Discard Bin	Rip area	132	0.18	Ha	R7 540.00	R1 382.19		132	0.18	Ha	R7 540.00	R1 382.19			R153.58	R307.15	R460.73	R614.31	R767.89	R921.46	R1 075.04	R1 228.62	R1 382.19
		Establish vegetation	128	0.18	Ha	R29 744.13	R5 452.54		128	0.18	Ha	R29 744.13	R5 452.54			R605.84	R1 211.68	R1 817.51	R2 423.35	R3 029.19	R3 635.03	R4 240.87	R4 846.70	R5 452.54
															R 0.00	R 0.00	R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
DD	Discard dump	Rip footprint area	132	14.37	Ha	R7 540.00	R108 339.24	Rip footprint area where all discard has been removed	132	14.37	Ha	R7 540.00	R108 339.24	Rip footprint area where all discard has been removed		R12 037.69	R24 075.39	R36 113.08	R48 150.78	R60 188.47	R72 226.16	R84 263.86	R96 301.55	R108 339.24
		Import and place 300mm topsoil on entire dump/footprint	127	143686.00	m²	R26.82	R3 853 111.58	Assume entire discard footprint will be occupied at 10 years of operation, this material will be used for backfilling of the pit. The footprint will be cleared to earth.	127	143686.00	m²	R26.82	R3 853 111.58	Assume all discard would have been used for concurrent rehabilitation, and a footprint will remain at closure that require rehabilitation. The footprint will be cleared to earth.		R428 123.51	R856 247.02	R1 284 370.53	R1 712 494.03	R2 140 617.54	R2 568 741.05	R2 996 864.56	R3 424 988.07	R3 853 111.58
		Establish vegetation	128	14.37	Ha	R29 744.13	R427 381.53		128	14.37	Ha	R29 744.13	R427 381.53			R47 486.84	R94 973.67	R142 460.51	R189 947.35	R237 434.18	R284 921.02	R332 407.86	R379 894.70	R427 381.53
		Rehabilitation Total					**R 130 754 160.68**						**R 275 069 093.94**											
		Area 3 Total					**R 131 113 650.06**						**R 275 428 583.31**											
Area 4		**Linear infrastructure**																						
		Demolish infrastructure																						
	Berm	Dose down site berm	130	89269.89	m³	R16.79	R1 498 842.36	Assume dam wall of 6.5m3/m	130	89269.89	m³	R16.79	R1 498 842.36	Assume dam wall of 6.5m3/m	R 499 614.12	R 999 228.24	R 1 498 842.36	R1 498 842.36	R1 498 842.36	R1 498 842.36	R1 498 842.36	R1 498 842.36	R1 498 842.36	R 1 498 842.36
															R 0.00	R 0.00	R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
	Access Roads	Rehabilitate road	133	8806.79	m²	R13.66	R120 324.59		133	8806.79	m²	R13.66	R120 324.59		R 40 108.20	R 80 216.39	R 120 324.59	R120 324.59	R120 324.59	R120 324.59	R120 324.59	R120 324.59	R120 324.59	R 120 324.59
															R 0.00	R 0.00	R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
	Haul Roads	Rehabilitate road	134	2465.08	m²	R7.22	R17 797.90		134	2465.08	m²	R7.22	R17 797.90		R 5 932.63	R 11 865.27	R 17 797.90	R17 797.90	R17 797.90	R17 797.90	R17 797.90	R17 797.90	R17 797.90	R 17 797.90
															R 0.00	R 0.00	R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
	Fence	Mine office fence	147	536.00	m	R13.02	R6 977.27		147	536.00	m	R13.02	R6 977.27		R 2 325.76	R 4 651.51	R 6 977.27	R6 977.27	R6 977.27	R6 977.27	R6 977.27	R6 977.27	R6 977.27	R 6 977.27
		Workshop fence	147	219.19	m	R13.02	R2 853.25		147	219.19	m	R13.02	R2 853.25		R 951.08	R 1 902.17	R 2 853.25	R2 853.25	R2 853.25	R2 853.25	R2 853.25	R2 853.25	R2 853.25	R 2 853.25
		Hard park fence	147	380.72	m	R13.02	R4 955.95		147	380.72	m	R13.02	R4 955.95		R 1 651.98	R 3 303.97	R 4 955.95	R4 955.95	R4 955.95	R4 955.95	R4 955.95	R4 955.95	R4 955.95	R 4 955.95
		Plant office fence	147	245.31	m	R13.02	R3 193.26		147	245.31	m	R13.02	R3 193.26		R 1 064.42	R 2 128.84	R 3 193.26	R3 193.26	R3 193.26	R3 193.26	R3 193.26	R3 193.26	R3 193.26	R 3 193.26
															R 0.00	R 0.00	R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
		Demolition Total					**R 1 654 944.59**						**R 1 654 944.59**											
		Rehabilitation																						
		Rip soil	132	2.50	Ha	R7 540.00	R18 854.30		132	2.50	Ha	R7 540.00	R18 854.30		R 6 284.77	R 12 569.53	R 18 854.30	R18 854.30	R18 854.30	R18 854.30	R18 854.30	R18 854.30	R18 854.30	R 18 854.30
		Grade an area	123	0.00	Ha	R2 306.29	R0.00		123	0.00	Ha	R2 306.29	R0.00		R 0.00	R 0.00	R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
		General clean up	124	0.00	m²	R15.22	R0.00		124	0.00	m²	R15.22	R0.00		R 0.00	R 0.00	R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
		Rubble	125	0.00	m³	R18.62	R0.00		125	0.00	m³	R18.62	R0.00		R 0.00	R 0.00	R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
		Replace soil and spread - 150mm	126	0.00	m²	R13.51	R0.00		126	0.00	m²	R13.51	R0.00		R 0.00	R 0.00	R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
		Replace soil and spread - 300mm	127	25005.70	m²	R26.82	R670 557.69		127	25005.70	m²	R26.82	R670 557.69		R 223 519.23	R 447 038.46	R 670 557.69	R670 557.69	R670 557.69	R670 557.69	R670 557.69	R670 557.69	R670 557.69	R 670 557.69
		Revegetate areas	128	2.50	Ha	R29 744.13	R74 377.28		128	2.50	Ha	R29 744.13	R74 377.28		R 24 792.43	R 49 584.86	R 74 377.28	R74 377.28	R74 377.28	R74 377.28	R74 377.28	R74 377.28	R74 377.28	R 74 377.28
		Bulldoze material	130	0.00	m³	R16.79	R0.00		130	0.00	m³	R16.79	R0.00		R 0.00	R 0.00	R 0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R 0.00
		Rehabilitation Total					**R 763 789.28**						**R 763 789.28**											
		Area 4 Total					**R 2 418 733.86**						**R 2 418 733.86**											
		GRAND TOTAL (Excl. VAT)					**R 136 358 538.63**						**R 280 937 824.72**		**R 4 813 030**	**R 19 947 373**	**R 35 530 258**	**R 49 934 298**	**R 64 338 338**	**R 78 742 378**	**R 93 146 418**	**R 107 550 458**	**R 121 954 498**	**R 136 358 539**

Appendix C: Layout Plans



Palmietkuilen Project EIA: Proposed Infrastructure Closure Areas

Legend

- Mining Right Boundary
- Other Town
- Settlement
- Sub-Station
- Ukufisa Sub-Station
- Power Line
- Arterial / National Route
- Main Road
- Minor Road
- Track
- Railway Line
- Non-Perennial Stream
- Perennial Stream
- Dam Wall
- Dam / Lake
- Wetland
- Perennial Pan
- Non-Perennial Pan / Stream

Projection: Transverse Mercator
Central Meridian: 29°E
Datum: WGS 1984
Date: 24/03/2017
Ref #: meg.CNC4065.201609.243

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0 0.5 1 2
Kilometres

DIGBY WELLS ENVIRONMENTAL

www.digbywells.com

Appendix D: Staff CV's

Mrs Kathryn Roy

Rehabilitation Specialist

Closure and Rehabilitation

Digby Wells Environmental

1 Education

- 2008-2010: BSc Ecology and Environmental Science (University of Cape Town)
- 2011: BSc Honours in Environmental Management (University of Cape Town)
- 2013- 2015: MSc Restoration Ecology (University of KwaZulu-Natal)

2 Language Skills

- English (fluent); and
- Afrikaans (fair).

3 Employment

- February 2016 – *Present*: Digby Wells Environmental – Rehabilitation Specialist
- February 2012 – February 2015: Environmental Planning and Climate Protection Department, EThekwini Municipality – Research Assistant and Programme Facilitator

4 Experience

Kathryn received a Bachelor of Science in Ecology and Environmental Science and an Honours degree in Environmental Management from the University of Cape Town. She has also received her MSc in Restoration Ecology from the University of KwaZulu-Natal. Kathryn also has completed additional courses in Project Management, Herbarium techniques and Invasive Alien Plant Training (advanced). Kathryn has varied experience both in the local government and consulting environments. This experience includes:

- Compilation of Rehabilitation Plans and assessment of rehabilitation actions throughout South Africa, including:
  - Conceptual Rehabilitation Plans;
  - Detailed Rehabilitation Plans; and
  - Final Rehabilitation, Decommissioning and Mine Closure Plans.
- Facilitation of the University of KwaZulu-Natal – eThekwini Municipality Reforestation Research Partnership:

- Acted on behalf of the eThekwini Municipality, in order to actively drive the objectives of the new research partnership;
- Researched critically important biodiversity and ecosystem assets within the eThekwini Municipality's natural environmental areas;
- Undertook and promoted research on biodiversity, climate change, and socio economic upliftment within the context of local ecosystem restoration and reforestation;
- Transcribed scientific and technical work into popular format for dissemination to stakeholders; and
- Student/staff/researcher liaison.

- Helped to Manage the eThekwini Municipality's Community Reforestation Programme (ecosystem-based adaptation project):
  - Undertook all necessary research, including inputs into experimental design, monitoring, data capture, analyses and verification and contributed to the required proofreading, writing-up, and distribution of research;
  - Showcased the reforestation projects by means of presentations at seminars, field trips, symposiums and conferences locally and internationally;
  - Co-authored a document highlighting the Buffelsdraai Community Reforestation Project;
  - Compiled proposals for funding and awards; and
  - Developed a framework for future monitoring, data capture and evaluation, and ensured relevant databases and reference systems were updated.
- Invasive Alien Plant (IAP) Management:
  - Preparation of tender documents, attendance at tender evaluations, tender briefings, etc.;
  - Project management of the compilation of the Beautiful but Dangerous IAP posters and flash cards, including data and photo collection, collation and liaison with designers; and
  - Project management for the IAP guideline documents, including authoring, data and photo collection, collation and liaison with designers and between authors.

5 Project Experience at Digby Wells

Some of Kathryn's project experience at Digby Wells is listed below:

Year	Client	Project	Responsibility	Location
2016	Copper Sunset Sands (Pty) Ltd	Bankfontein Rehabilitation and Closure Plan	Compilation of Rehabilitation Plan	Free State, South Africa
2016	Naledzi	Geluk Conceptual Rehabilitation and Closure Plan	Compilation of Rehabilitation Plan	Limpopo, South Africa
2016	Eskom	Kilbarchan Rehabilitation and Closure Plan	Compilation of Rehabilitation Plan	KwaZulu-Natal, South Africa
2016	Namane Resources	Namane Generation IPP and Transmission Line Rehabilitation and Closure Plan	Compilation of Rehabilitation Plan	Limpopo, South Africa
2016	Uranex	Nachu Graphite Mine Conceptual Rehabilitation Plan	Compilation of Rehabilitation Plan	Tanzania
2016-present	Sasol Mining	Rehabilitation of the East Overburden Stockpile	Project Manager, Rehabilitation Assessment, and Compilation of Rehabilitation Plan	Free State, South Africa
2016-present	Glencore	Proposed Development of an Underground Coal Mine and Associated Infrastructure near Hendrina, Mpumalanga	Compilation of Rehabilitation Plan	Mpumalanga, South Africa

6 Publications

- Douwes, E., Roy, K.E., Diederichs-Mander, N., Mavundla, K., Roberts, D. 2015. The Buffelsdraai Landfill Site Community Reforestation Project: Leading the way in community ecosystem-based adaptation to climate change. EThekwini Municipality, Durban, South Africa.
- Water Hyacinth Control Guideline Document: Insight into Best Practice, Removal Methods, Training & Equipment. 2013. Environmental Planning and Climate Protection Department. EThekwini Municipality (co-author), p. 58.

- General Invasive Alien Plant Control Guideline Document: Insight into Best Practice, Removal Methods, Training & Equipment. 2013. Environmental Planning and Climate Protection Department. EThekwini Municipality (co-author), p. 78.
- Beautiful but Dangerous posters. 2013. Environmental Planning and Climate Protection Department. EThekwini Municipality, p 5.
- EThekwini State of Biodiversity: Report 2011/2012. Environmental Planning and Climate Protection Department. EThekwini Municipality (acknowledged contributor), p. 27.

Ms Michelle van Niekerk

Mine Closure Consultant

Mine Closure and Rehabilitation

Digby Wells Environmental

1 Education

- Tshwane University of Technology, BTech (Baccalaureus Technologiae): Civil: Environmental Engineering (Cum Laude), December 2014
- Tshwane University of Technology, National Diploma: Civil Engineering, July 2012

2 Language Skills

- English – Reading, writing, speaking (Excellent)
- Afrikaans – Reading, writing, speaking (Excellent)

3 Employment

Company	Position	Period
Digby Wells Environmental	Mine Closure Consultant	March 2016 - Current
Golder Associates Africa	Civil Engineer – CAD group coordinator	December 2015 - February 2016
Golder Associates Africa	Rehabilitation and Closure Costing Consultant	July 2014 - December 2015
Resonant Environmental Technologies	Civil Engineering Technician	June 2011 - June 2014

4 Experience

Michelle has completed her B Tech degree in Civil: Environmental Engineering at Tshwane University of Technology. She joined Digby Wells in March 2016 and is part of the Mine Closure and Rehabilitation Department. Michelle currently holds the position of mine closure consultant with close to 3 year's experience in the Mine Closure sector and 3 year's experience as a Civil Engineering Technician.

5 Project Experience

Year	Client	Project	Responsibility	Location
2017	Ivanplats	Closure Cost Assessment	PM and Closure	South Africa

	Proprietary Limited	Update	Technical Specialist	
2017	Anker Coal And Mineral Holdings Sa (Pty) Ltd	Closure Cost Assessment Elandsfontein Colliery EMP Amendment	Closure Technical Specialist	South Africa
2016	Pembani Coal Carolina	Annual Financial Provision Assessment	PM and Closure Technical Specialist	South Africa
2016	Lanxess Chrome Mining (Pty) Ltd	Annual Financial Provision Assessment	PM and Closure Technical Specialist	South Africa
2016	HCI Coal (Pty) Ltd	Palesa Colliery Financial Provision Assessment Mid-Year Update	Closure Technical Specialist	South Africa
2016	HCI Coal (Pty) Ltd	Mbali Colliery Financial Provision Assessment Midyear Update	Closure Technical Specialist	South Africa
2016	Canyon Resources (Pty) Ltd	Financial Provision for Palmietkuilen Colliery Environmental Impact Assessment	Closure Technical Specialist	South Africa
2016	Universal Coal PLC	Financial Provision Update For Brakfontein Colliery	Closure Technical Specialist	South Africa
2016	Galaxy Gold Mining Limited	Financial Provision for the Agnes Gold Mine Regulatory Permits & Licences	Closure Technical Specialist	South Africa
2016	Sedibelo Platinum Mines Limited	Financial Provision	Closure Technical Specialist	South Africa
2016	Glencore Operations South Africa (Pty) Ltd	Financial Provision for the Hendrina Reserve EIA/EMP and WULA	Closure Technical Specialist	South Africa
2016	Eskom Holdings SOC Ltd	Closure Cost Assessment for Kilbarchan Colliery	Closure Technical	South Africa

		Environmental Authorisations and Closure Study	Specialist	
2016	Ergo Mining Operations (Pty) Ltd.	Closure Cost Assessment for all Ergo Operations	Closure Technical Specialist	South Africa
2016	Arthur D Little	Closure Cost Assessment for Transnet Oil and Gas pipelines	Closure Technical Specialist	South Africa
2016	Sasol Sigma	Compilation of peat wetland fire control sequence of events	Closure Technical Specialist	South Africa
2015	Sasol	Review and update closure costs of Sasol Synfuels and compiling a new closure assessment for Sasol Chemicals	Closure Technical Specialist	South Africa
2015	Sibanye Gold Randfontein	Review and update of closure costs for Cooke, Ezulwini and Rand Uranium Surface operations	Closure Technical Specialist	South Africa
2015	Various	Environmental Liability Assessment for Prospecting areas	Closure Technical Specialist	South Africa
2015	Eskom	Environmental Liability Assessment of several Eskom power stations	Closure Technical Specialist	South Africa
2015	Evraz	Environmental Liability Assessment	Closure Technical Specialist	South Africa
2015	Anglo Heidelberg	Closure cost assessment for South Rand Environmental Impact Assessment	Closure Technical Specialist	South Africa
2014	Total Coal	Review and update closure costs for Dorstfontein East and West, Forzando North and South mine sites as well as the associated railway sidings.	Closure Technical Specialist	South Africa

2014	Sibanye Gold Randfontein	Closure costs for the recently purchased Cooke, Ezulwini and Rand Uranium Surface operations	Closure Technical Specialist	South Africa
2014	First Quantum Mine Kansanshi	Closure cost assessment	Closure Technical Specialist	Zambia
2014	Samancor MFC	Review and update closure cost assessment	Closure Technical Specialist	South Africa
2014	Samancor Ferrometal	Review and update closure cost assessment	Closure Technical Specialist	South Africa
2013 to 2014	Tubatse Samancor Chrome and Sinosteel	Convert and compile layout and detail drawing of Brick buildings, reinforced concrete structures and steel structures for the	Civil Engineering Technician, Project administration and site supervision	South Africa
2013	Xstrata Lydenburg	Detailing of Cyclone reinforced concrete foundations and reinforced concrete slabs	Civil Engineering Technician	South Africa
2013	Assmang Samancor Chrome - Machadodorp	Detailing of reinforced concrete foundations	Civil Engineering Technician	South Africa
2012	Various projects: ■ Tubatse - upgrade of the Off-gas system ■ Chemk Meltshop 9 ■ Assmang Samancor Chrome ■ Ascon ■ SGB Cape	Detailing of steel manufacturing drawings Detailing of concrete structures Detailing of reinforcement Compilation of Bill of Quantities Assisted with slab designs Scaffolding inspection (SABC and Mnet)	Civil Engineering technician, Project assistant and administrator	South Africa

	■ Eskom			
2011	Various projects: ■ Sasol ■ Eskom ■ Xstrata	Detailing of steel structures Detailing of concrete structures Detailing of reinforcement Compilation of Bill of Quantities Surveying of Ash dams Assisted with base designs Scaffolding inspection (SABC and Mnet)	Training Civil Engineering technician	South Africa

6 Professional Affiliations

- South African Institution of Civil Engineering (SAICE), membership no: 2012208
- Engineering Council of South Africa (ECSA), membership no: 201580897

7 Professional Registration

None

8 Publications

None

Mr. Brett Coutts

Unit Manager: Rehabilitation

Mine Closure and Rehabilitation

Digby Wells Environmental

1 Education

- 2006 – 2007: BSc Honours in Ecology, Environment and Conservation - University of the Witwatersrand.
- 2003 – 2006: Undergraduate BSc - University of the Witwatersrand.

2 Language Skills

- English; and
- Afrikaans.

3 Employment

- September 2012 – Present: Digby Wells Environmental – Unit Manager: Rehabilitation.
- October 2008 – August 2012: Terra Pacis Environmental (Pty) Ltd – Environmental Consultant.
- November 2007 – September 2008: Hydromulch (Pty) Ltd – Junior Project Manager.

4 Experience

Brett Coutts is an Ecologist with a BSc Honours in Ecology, Environment and Conservation. Brett gained practical hands on experience as a project manager on environmental rehabilitation projects at Hydromulch and his roles and responsibilities include the compilation of Basic Assessment (BA) reports, Scoping & Environmental Impact Reports, compilation of Environmental Management Plans (EMP), GIS mapping and Biodiversity Action Plans linking to rehabilitation. Brett is currently the Unit Manager for the Rehabilitation Department and his roles involve the compilation of rehabilitation plans, undertaking audits and implementation of rehabilitation projects.

Prior to his appointment, he gained experience as a junior project manager on environmental rehabilitation projects at Hydromulch and then was appointed by Terra Pacis as an Environmental Consultant where his roles and responsibilities included the compilation of

Basic Assessment (BA) reports, Scoping &Environmental Impact Reports, compilation of Environmental Management Plans (EMP), GIS mapping and Biophysical Studies.

5 Project Experience

- Integrated Environmental Authorisations for Blue Sphere Investments and Trading 103 (Pty) Ltd – Consultant.
- The compilation of the Atmospheric Emissions Licences for Samancor Manganese (Pty) Ltd, Metalloys, BHP Billiton – Consultant.
- Scoping and Environmental Impact Reporting for the Refurbishment of West Plant Sludge Dam No.3 and associated Mixing Facility at Samancor Manganese (Pty) Ltd, Metalloys, BHP Billiton – Consultant.
- Scoping and Environmental Impact Reporting for the Upgrade of the existing Pelletising Plant to an Agglomeration Plant at Samancor Manganese (Pty) Ltd, Metalloys, BHP Billiton – Consultant.
- Waste Assessment for Kopanang Mine (Phase 2) - AngloGold Ashanti –Vaal River Operations - Consultant.
- Waste Assessment for Mponeng Mine (Phase 2) - AngloGold Ashanti - West Wits - Consultant.
- Compilation of Operational Procedures for the New North and West Plant Sludge Dams - Samancor Manganese (Pty) Ltd, Metalloys, BHP Billiton - Consultant.
- Biodiversity Assessment at Samancor Manganese (Pty) Ltd, Metalloys, BHP Billiton– Specialist.
- Basic Assessment for a Proposed Residential Development on Portion 378 and Portion 379 of the Farm Driefontein 85 IR,Boksburg - Business Venture Investments No. 1172 (Pty) Ltd – Consultant.
- Vegetation, Invertebrate and Wetland Assessments for the Proposed a Residential Development on Portions 378 and 379, of the Farm Driefontein 85 IR, Boksburg - Business Venture Investments No. 1172 (Pty) Ltd - Specialist.
- Salvage Yard Layout-Review of Design and Stormwater - Samancor Manganese (Pty) Ltd, Metalloys, BHP Billiton – Consultant.
- Dams Risk Assessment - Goedgevonden Colliery, Xtrata Coal South Africa – Consultant.
- Invasive Alien Plant Control Procedure at Samancor Manganese (Pty) Ltd, Metalloys, BHP Billiton - Consultant.
- Environmental Management Plan Update - North Mara Mine Limited, Barrick Gold Corporation – Consultant.

- Waste Assessment for Kopanang Mine(Phase 1) - AngloGold Ashanti –Vaal River Operations - Consultant.
- Waste Assessment for Mponeng Mine (Phase 1) - AngloGold Ashanti - West Wits - Consultant.
- Admox Bagging Plant, Admox Bagging Plant, Admox Pelletising Plant and OBC Fume Extraction Operation Environmental Management Plan - Samancor Manganese (Pty) Ltd, Metalloys, BHP Billiton - Consultant.
- Compilation of Standard Operational Procedures for the Slag and Dust Stockpiles - Samancor Manganese (Pty) Ltd, Metalloys, BHP Billiton - Consultant.
- Internal Water Use License Audit - Goedgevonden Colliery, Xtrata Coal South Africa - Auditor.
- Biophysical Specialist Study Report for the Bravo 3 Power Line Route Alternatives-2008 – Zitholele Consulting – Specialist.
- Voorspoed Mine Closure Plan - De Beers Consolidated Mines – Consultant.
- Co-ordination and Implementation Project for Thabazimbi Iron Ore Mine associated with Aerial Seeding and Re-vegetation Reporting Plan, Anglo Group – Rehabilitation Consultant.
- Exxaro Portfolio, Rehabilitation Specialist for Grootegeluk Coal Mine, Compilation of Rehabilitation Plan, Exxaro Coal (Pty) Ltd – Rehabilitation Specialist.
- Rehabilitation plan compilation for historical mines located in Mpumalanga with associated biophysical studies and monitoring of progress of rehabilitation, Anker Coal– Rehabilitation Specialist.
- Overall management and coordination of projects associated with the mine and co-ordination with mine personnel, Key Account Management – Environmental Consultant.
- Scoping and Environmental Impact Assessment for the Proposed Schoonoord Underground Mine, Exxaro Arnot Coal Mine, Exxaro (Pty) Ltd – Project Manager.
- Scoping and Environmental Impact Assessment for the Proposed Thabametsi Coal Mine, Exxaro (Pty) Ltd – Project Manager.
- Compilation of Biodiversity Management Plans for Tongon Gold Mine, Rand Gold Resources – Technical Specialist and Project Manager.
- Wetland Offset Strategy for the Waterberg Region , Exxaro (Pty) Ltd– Project Manager.
- Rehabilitation Plan for Consbrey and Hawar Projects Msobo Coal– Rehabilitation Specialist.

- Update of Greenside Colliery Closure Plan, Anglo American (Pty) Ltd – Project Manager.
- Compilation of Putu Iron Ore Rehabilitation Plan, Liberia – Rehabilitation Specialist.
- Compilation of Rehabilitation Plan for Balama, Mozambique, Syrah Resources – Rehabilitation Specialist.
- Compilation of Rehabilitation and Closure Plan for Storm Mountain Diamond Mine – Rehabilitation Specialist.
- Overall management and coordination of projects associated with the mine and co-ordination with mine personnel, Bokoni Platinum Mine – Key Account Manager.
- Environmental and Social Impact Assessment for New Liberty Gold Mine, Liberia, Aureus – Project Manager.
- Preliminary Closure Plan for New Liberty Gold Mine, Liberia, Aureus– Rehabilitation Specialist.
- Waste Assessment for Kopanang Mine(Phase 1) - AngloGold Ashanti –Vaal River Operations - Consultant.
- Compilation of GIS Training Manual – Consultant (Internal).
- Rehabilitation Plan for IPP Station, Vedanta Resources – Rehabilitation Specialist.
- Compilation of Biodiversity Management Plans for Morila Gold Mine, Mali, Rand Gold Resources – Technical Specialist and Project Manager.

6 Short Courses

- 2009: IEMA Approved Carbon Footprint Management Course: An Introductory Programme.
- 2010: Exclusive Panel Discussion on: The Copenhagen Climate Change Conference.
- 2011: International Association for Impact Assessments conference at the Wild Coast.
- 2012: Centre for Environmental Management, North-West University: Environmental Law for Environmental Managers.

7 Professional Affiliations

Geographic Information Society of South Africa (GISSA)

8 Professional Registration

- 2009: IAIAsa - International Association for Impact Assessment (South Africa).

- 2012: Registered as a Candidate Natural Scientist with the South African Council for Natural Scientific Professions.

Mr. Leon Ellis

Unit Manager: Mine Closure

Digby Wells Environmental

1 Education

1.1 Tertiary:

Institution:	**University of Johannesburg (Department of Geography, Environmental Management and Energy Studies)**
Degree obtained:	BACHELOR OF SCIENCE HONOURS (Geography)
Period:	2009

Institution:	**University of Johannesburg (Department of Geography, Environmental Management and Energy Studies) (2006-2008)**
Degree obtained:	BACHELOR OF SCIENCE (Geography and Environmental Management)
Period:	2006 - 2008

1.2 Secondary:

Institution:	**Hoërskool Oosterlig**
Highest Grade Passed:	Grade 12 (2005)

2 Additional Training

Institution:	**North West University (Centre of Environmental Management)**
Course:	Environmental Risk Assessment and Management based on ISO 31000 (CEM-05.2)
Period:	2016

3 Language Skills

Afrikaans and English

4 Employment

Company:	Quanto Environmental Solutions CC
Position held:	Environmental Consultant
Duration:	November 2009 to December 2012

Company:	Digby Wells Environmental
Position:	Unit Manager: Mine Closure
Duration:	January 2013 to date

5 Experience

Leon is the manager of the Mine Closure Unit at Digby Wells. He joined Digby Wells in January 2013. When Leon joined Digby Wells, he was part of the Environmental Management Services (EMS) Department and since joined the Mine Closure Unit. He has six years' experience in the environmental services sector with specialised focus on Environmental Liability Assessments, Mine Closure Plans, Performance Assessments and Risk Assessments, locally and internationally. He has been involved in the undertaking of Mine Closure Liability Assessments, Environmental Impact Assessments (EIAs), Environmental Management Programmes (EMPs), Integrated Water Use Licence Applications (IWULA), Basic Assessments, including other environmental authorisations as required by South African legislation for various mining projects. Other responsibilities include the day to day management of the Mine Closure Unit and projects.

6 Project Experience

Company	Project	Year
Sedibelo Platinum Mines	Financial Provision Assessment for Pilanesberg Platinum Mine based on GN R1147	2016
Universal Coal plc	Financial Provision Assessment for Kangala and Brakfontein Collieries based on GN R1147	2016
Ergo Mining Operations (Pty) Ltd.	Financial Provision Assessment for Ergo's operations based on GN R1147	2016
Ergo Mining Operations (Pty) Ltd.	Group Closure Cost Assessment	2016
Eskom Holdings SOC Limited	Closure Plan and Risk Assessment for the Kilbarchan Colliery	2016
Mbuyelo Coal (Pty) Ltd.	Closure Cost Assessment for Rirhandzu and Manungu Collieries	2016

Company	Project	Year
Storm Mountain Diamonds (Pty) Ltd.	Preliminary Closure Plan for Kao Diamond Mine, Lesotho	2016
Harmony Gold Mining Company Limited	Mine Closure Liability Assessments	2016
Arthur D. Little	Decommissioning Cost Calculation for Transnet Oil and Gas Pipeline Network	2016
Rustenburg Platinum Mines (Pty) Ltd.	Closure Applications for two prospecting sites	2016
Exxaro Coal (Pty) Ltd.	Closure Cost Assessment for Arnot Colliery	2015
Petra Diamonds (Pty) Ltd.	Performance Assessment for Finch Diamond Mine	2015
Rustenburg Platinum Mines (Pty) Ltd.	Performance Assessment for Prospecting Sites	2015
Ivanplats (Pty) Ltd.	Annual Closure Cost Assessment for the Platreef Mine	2015
Ergo Mining Operations (Pty) Ltd.	Closure Plan for several reclaimed Tailings Storage Facilities	2015 - 2016
Ixia Coal (Pty) Ltd.	Topography and Visual Impact Assessment for a proposed open pit coal mine near Kriel	2015
Oakleaf Investment Holdings 95 (Pty) Ltd.	Topography and Visual Impact Assessment for a proposed open pit coal mine near Bronkhorstspruit	2015
Pamish Investments No. 39 (Pty) Ltd.	Closure Plan and Liability Assessment for a proposed Magnetite Mine near Mokopane	2015
Universal Coal plc	Environmental Liability Assessment for Kangala Colliery	2015
Anker Coal (Pty) Ltd.	EMPR Performance Assessment for Elandsfontein Colliery	2015
HCI Coal (Pty) Ltd.	Environmental Liability Assessment for Palesa Colliery	2014
HCI Coal (Pty) Ltd.	EMPR Performance Assessment for Palesa Colliery	2014
Exxaro Coal (Pty) Ltd.	Mine Closure EMP including Quantitative Risk Assessment for the Tshikondeni Coal Mine	2014
Richards Bay Coal Terminal (RBCT)	Environmental Liability Assessment for the Coal Terminal at Richards Bay	2014
Newberry Recovery Works	Environmental Liability Assessment for Newberry's	2014

Company	Project	Year
	Operation near Krugersdorp	
Anker Coal (Pty) Ltd.	Environmental Liability Assessment for Elandsfontein Colliery	2014
Continental Coal (Pty) Ltd.	Mine Closure Liability Assessment for the Vlakvarkfontein Operation	2014, 2015 & 2016
Randgold Resources Limited	Environmental and Social Impact Assessment for the proposed Kibali Hydropower Project, Orientale Province, DRC	2014
Copper Sunset Sand (Pty) Ltd.	Mine Closure Assessment	2014
Randgold Resources Limited	Screening Report for the proposed Kibali Hydropower Project, Orientale Province, DRC	2014
Eastern Platinum Limited	Mine Closure Liability Assessments for the Western and Eastern Limb operations	2014
Anglo Operations (Pty) Ltd.	Environmental and Social Impact Assessment for the proposed Dalyshope Coal Mine	2013
Anglo Operations (Pty) Ltd.	Draft State of the Environment Report for the proposed Dalyshope Coal Mine	2013
Anglo Operations (Pty) Ltd.	Draft State of the Environment Report for the proposed Dalyshope Coal Mine	2013
Glencore South Africa (Pty) Ltd.	Mine Closure Liability Assessment for their Tweefontein, Goedgevonden and iMpunzi Complexes	2013
Harmony Gold Mining Company Limited	Mine Closure Liability Assessments	2013, 2014 & 2015
Platinum Group Metals (RSA) (Pty) Ltd.	Environmental Management Plans for six Prospecting Right Applications for the Waterberg Prospecting Venture	2013
Msobo Coal (Pty) Ltd.	Scoping and Environmental Impact Assessment Report for a newly proposed Colliery near Breyten	2013
Platinum Group Metals (RSA) (Pty) Ltd.	Compilation of monthly Surface Water Monitoring Reports for the proposed Platinum Mining and Concentrator Plant project (Maseve Investments 11 (Pty) Ltd. Project 1)	2012
Gemsbok Platinum (Pty) Ltd.	Consultation Report and Environmental Management Plan for a new Prospecting Right Application	2012
Servimark 119 cc	Basic Assessment Report for a proposed Pig Farm near	2012

Company	Project	Year
	Bronkhorstspruit	
Sable Platinum (Pty) Ltd.	Section 48 Application for the G5 Sjambok prospecting right project	2012
Platinum Group Metals (RSA) (Pty) Ltd.	Section 41, Financial Provision Determination for the Waterberg Venture	2012
Platinum Group Metals (RSA) (Pty) Ltd	Section 102 amendment of an existing EMP for the Waterberg Prospecting Venture	2012
Platinum Group Metals (RSA) (Pty) Ltd.	Public Participation Process for a new Prospecting Right Application	2012
Platinum Group Metals (RSA) (Pty) Ltd.	Section 102 amendment of an existing EMP for a Prospecting Right	2012
SAMREC (Pty) Ltd.	Compilation of maps for Closure Quantum updates, AutoCAD Map3D	2012
SAMREC (Pty) Ltd.	Closure Quantum update and review for Rhino mine (Thabazimbi), Krugerspost (Lydenburg), Havercroft and Annesley (Burgersfort), Anref (Groot Marico) and Cape Bentonite (Heidelberg, Western Cape)	2012
ECCA Holdings (Pty) Ltd.	Consultation Report and Environmental Management Plan for a new Prospecting Right Application	2012
Platinum Group Metals (RSA) (Pty) Ltd.	Consultation Report and Environmental Management Plan for a new Prospecting Right Application	2012
Sable Platinum (Pty) Ltd.	Compilation of Scoping Report for a new Vanadium and Platinum mining development	2012
Platinum Group Metals (RSA) (Pty) Ltd.	Consultation Report and Environmental Management Plan for a new Prospecting Right Application	2011
Platinum Group Metals (RSA) (Pty) Ltd.	Traffic Impact Study for the proposed Platinum Mining and Concentrator Plant project (Maseve Investments 11 (Pty) Ltd Project 1)	2011
Platinum Group Metals (RSA) (Pty) Ltd.	Compilation of a Waste License Application for the proposed Platinum Mining and Concentrator Plant project (Maseve Investments 11 (Pty) Ltd Project 1)	2011
Platinum Group Metals (RSA) (Pty) Ltd.	Compilation of Technical Document and Water Use License Application for a proposed Bulk Sample operation (Maseve Investments 11 (Pty) Ltd)	2011

Company	Project	Year
Platinum Group Metals (RSA) (Pty) Ltd.	Assistant Environmental Consultant- compilation of an Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for a proposed Platinum Mining and Concentrator Plant project (Maseve Investments 11 PTY LTD Project 1)	2010
Platinum Group Metals (RSA) (Pty) Ltd.	Junior Environmental Consultant- compilation of an Environmental Management Plan for a Proposed Bulk Sample operation	2010
SAMREC (Pty) Ltd.	Closure Quantum update and review for Rhino mine (Thabazimbi), Krugerspost (Lydenburg), Havercroft and Annesley (Burgersfort), Anref (Groot Marico) and Cape Bentonite (Heidelberg, Western Cape)	2010
Beneficiation Company of Southern Africa (Pty) Ltd.	Assistance with the compilation of Technical Document and Integrated Water and Waste Management Plan (IWWMP) for a proposed Ferrochrome Smelter	2010
ChromTech (Pty) Ltd.	Traffic Impact Study for a proposed Chrome Recovery Plant at Anglo Waterval UG2 Concentrator Plant	2010
Beneficiation Company of Southern Africa (Pty) Ltd.	Traffic Impact Study for a proposed Ferrochrome Smelter	2009
Beneficiation Company of Southern Africa (Pty) Ltd.	Junior Environmental Consultant- assistance to EIA and EMP for a proposed Ferrochrome Smelter	2009

7 Professional Affiliations

Member: Geo-Information Society of South Africa (GISSA).

8 Professional Registration

None

Ms Renée van Aardt

Divisional Manager: Mine Closure and Rehabilitation

Technical Services

Digby Wells Environmental

1 Education

- 2003 BSc (Hons) Ecology, Environment and Conservation
- 2002 BSc Ecology, Environment and Conservation, and Zoology

2 Language Skills

- English – Reading, writing, speaking (Excellent)
- Afrikaans – Reading, writing, speaking (Excellent)

3 Employment

- January 2014 to present: Digby Wells Environmental
- January 2011 to October 2013: African Barrick Gold
- August 2009 to December 2010: Foskor
- February 2008 to July 2009: Fraser Alexander Tailings
- August 2007 to January 2008: WSP Environmental
- March 2006 to April 2007: Nemai Consulting

4 Experience

Renée is the Divisional Manager: Mine Closure and Rehabilitation and has been appointed to assist with the management and co-ordination of all activities relevant to mine closure, rehabilitation and soil assessments. Renée's specialization is compilation of mine closure plans and developing closure liability assessments through 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 in both South Africa and Tanzania.

Prior to her appointment, she was a technical specialist at African Barrick Gold and provided support to exploration and operational sites in Tanzania. In addition to the closure support Renée provided, she was also involved in sustainability reporting, EIA/EMP compilation and biodiversity management.

5 Project Experience

Year	Client	Project	Responsibility	Location
2015	Harmony Gold Mining Company	Annual Environmental Liability Assessment	Project Manager	South Africa
2015	Geo Soil Water	Noise Monitoring Survey	Project Sponsor	South Africa
2015	Sasol Mining (Pty) Ltd	Sigma EPAR and Closure Gap Analysis	Project Manager	South Africa
2015	Sasol Mining (Pty) Ltd	Twistdraai Legal Audit	Project Manager	South Africa
2015	Harmony Gold Mining Company	Kalgold Analysis of PM10 Data	Project Sponsor	South Africa
2015	Ivanplats (Pty) Ltd	Environmental and Blasting Noise Monitoring	Project Sponsor	South Africa
2014	Bokoni Platinum Mines (Pty) Ltd	Financial Provision Technical Review	Project Manager	South Africa
2014	South32 SA Coal Holdings (Pty) Ltd	KPSX: South Environmental Authorisations	Project Manager	South Africa
2014	South32 SA Coal Holdings (Pty) Ltd	KPSX: Weltevreden Environmental Authorisations	Project Manager	South Africa
2014	South32 SA Coal Holdings (Pty) Ltd	KPSX Substation Basic Assessment Report	Project Manager	South Africa
2014	Bokoni Platinum Mines (Pty) Ltd	Financial Provision Technical Review	Project Manager	South Africa
2014	Exxaro Coal (Pty) Ltd	Tshikondeni Closure EMP	Project Manager	South Africa
2014	Venmym Deloitte	Project Eagle	Project Manager	South Africa
2014	Mashala Resources (Pty) Ltd	Ferreira Closure Plan	Project Manager	South Africa
2014	Anglo Coal	Greenside Mine Closure Plan	Project Sponsor	South Africa
2014	Foskor (Pty) Ltd	Stormwater Management Plan	Project Sponsor	South Africa

2014	Metorex (Pty) Ltd	Metorex Group Closure Cost Assessment	Project Manager	DRC, Zambia
2014	Kalgold Goldridge Mining Company Ltd	Kalgold ISO14001 Audit	Project Sponsor	South Africa
2014	KPMG Services (Pty) Ltd	Ncondenzi Closure Cost Assessment	Project Manager	Mozambique
2014	Rangdold Resource (Pty) Ltd	Kibali Closure Costing	Project Manager	DRC
2013	African Barrick Gold	Tuluwaka Mine Closure Plan	Project Manager and Technical Specialist	Tanzania
2011-2013	African Barrick Gold	Conceptual Mine Closure Plans for Bulyanhulu, North Mara and Buzwagi Gold Mines	Project Manager	Tanzania
2011-2012	African Barrick Gold	Mine Closure Liability Assessments	Project Manager and Technical Specialist	Tanzania
2011	African Barrick Gold	Buzwagi BAP	Project Manager and Technical Specialist	Tanzania
2011	African Barrick Gold	Golden Ridge Feasibility Closure Plan and Liability	Technical Specialist	Tanzania
2010	Foskor	Tailings Rehabilitation Implementation	Production Superintendent	South Africa
2009	Royal Bafokeng Holdings	Royal Bafokeng Nation Mined Land Strategic Environmental Assessment (2008/9);	Technical Specialist	South Africa
2008	Lonmin Platinum	Rehabilitation for Western Platinum tailings dams	Project Manager	South Africa
2008	Lonmin Platinum	Lonmin BAP	Project Manager	South Africa
2008	Lonmin Platinum	Biodiversity Monitoring Framework	Project Manager	South Africa
2008	Lonmin Platinum	Rehabilitation Guidelines	Technical Specialist	South Africa
2006-2007	National Department of Minerals and Energy	Rehabilitation of Derelict and Ownerless Asbestos Mines	Project Manager and Technical Specialist	South Africa

6 Professional Affiliations

- Institute of Business Management of Southern Africa, Member no: IBM2012/93510.