DIGBY WELLS
ENVIRONMENTAL

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Proposed Development of an Underground Coal Mine and Associated Infrastructure, near Hendrina, Mpumalanga Province

Rehabilitation, Decommissioning and Mine Closure Plan

Project Number:

XST3791

Prepared for:

Umcebo Mining (Pty) Ltd

September 2016

Digby Wells and Associates (South Africa) (Pty) Ltd
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Project Name:	**Proposed Development of an Underground Coal Mine and Associated Infrastructure, near Hendrina, Mpumalanga Province**
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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 Umcebo Mining (Pty) Ltd, other than fair remuneration for work performed, specifically in connection with the proposed development of an underground coal mine and associated infrastructure, located near Hendrina, Mpumalanga Province.

Full Name:	Kathryn Elizabeth Roy
Title/ Position:	Rehabilitation Specialist
Qualification(s):	MSc Restoration Ecology
Experience (Years):	3.5

EXECUTIVE SUMMARY

Digby Wells Environmental (Digby Wells) has been requested by Umcebo Mining (Pty) Ltd (hereafter Umcebo) to compile a Rehabilitation, Decommissioning and Mine Closure Plan for the proposed development of an underground coal mine and associated infrastructure, near Hendrina, Mpumalanga. 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 Umcebo 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 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 etc. 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	
All areas	Progressive rehabilitation is not possible due to the nature of the mining method. Rehabilitation is required for the surface infrastructure and this is required until the end of life of mine. 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.

Target Area	Main Actions
Rehabilitation, Closure and Decommissioning Phase	
Crushing and Screening Plant	The crushing and screening plant will need to be free from contamination and then decommissioned. 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. 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. Re-instate natural drainage lines and encourage water flow off the facility. Replace topsoil to 300 mm 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.
Office Complex (change house, workshop, offices)	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. 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 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.
Access and Service Roads (with weighbridge)	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 (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.
Overburden and Product Stockpiles	All stockpiled product must be removed. Thereafter, the Class C containment barrier materials should be removed and disposed of in 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.

Target Area	Main Actions
Overland Conveyors	The conveyor belt and its associated infrastructure will need to be removed. 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 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.
Access Points to the Underground Reserve and Ventilation shafts	Infrastructure and conveyors associated with the underground access portals must be removed. Thereafter the underground access portal openings must be sealed with a concrete plug and according to engineering requirements. Stockpiled overburden material and stormwater berm material can then be backfilled into the incline portal. Additionally, all vent shafts related infrastructure must be removed and the shaft must be capped with a concrete seal to engineering specifications. 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.
Pollution Control Dam and water pipelines	Pollution control dams must be desilted if necessary. Thereafter the liners can be removed and disposed of at the correct hazardous waste disposal facility. The dam's walls must be dozed and dam infrastructure demolished and also disposed of at the correct hazardous waste disposal facility. Additionally, supporting plinths for pipelines as well as foundations and other associated infrastructure must be demolished to 1 m below surface and the demolition rubble removed. 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.

Target Area	Main Actions
Aboveground Diesel Storage Tanks	Remove tank and associated infrastructure from site (it is assumed that all contamination is removed during operation). Thereafter, demolish concrete bund wall and dispose of contaminated material at a hazardous waste facility. 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. Replace topsoil to 350 mm 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..
Waste bins and Site fencing	Waste bins and fencing to be removed from site. If any concrete foundations were constructed, these must be removed up to 1m below ground level. Once the site has been cleared of all infrastructure and rubble and no contamination is present, the land should be reshaped, if necessary, to create a gently sloping, free-draining topography. Replace topsoil to 350 mm 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 generator and sub-station	Remove generator and sub-station and associated infrastructure from site (it is assumed that all contamination is removed during operation). Thereafter, demolish concrete bund wall and dispose of contaminated material at a hazardous waste facility. 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. 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.
Topsoil Stockpiles	Replace correct topsoil 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.
Water Treatment Plant	It is assumed that the portable plant will be removed prior to closure. Thereafter the concrete foundation must be removed up to 1 m below ground level. 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. 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
Package Sewage Treatment Plant	Remove Package Sewage Treatment Plant and associated infrastructure from site (it is assumed that all contamination is removed during operation). Thereafter, demolish concrete bund wall and dispose of contaminated material at a hazardous waste facility. 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. 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.

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 cost for rehabilitation and closure of Hendrina that is based on the DMR method of calculation for one year of operation is **R 24 461 018 (incl. VAT)**. The detailed cost estimate sheets are attached in Appendix B.

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LIST OF ACRONYMS AND ABBREVIATIONS

AIP	Alien Invasive Plant
ALARP	As Low As Reasonably Practicable
ARP	Annual Rehabilitation Plan
ARR	Annual Rehabilitation Report
BPA	Best Practice Guidelines
Ca	Calcium
CARA	Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)
CBA	Critical Biodiversity Areas
CSI	Corporate Social Investment
DMR	Department of Mineral Resources
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ERR	Environmental Risk Report
ESA	Ecological Support Areas
ha	Hectares
HDPE	High-density Polyethylene
HSE	Health Safety and Environment
IDP	Integrated Development Plan
IUCN	International Union for Conservation of Nature
K	Potassium
LED	Local Economic Development
LoM	Life of Mine
LOS	Level of Service
LUP	Land Use Plan
m	Metres
MAP	Mean Annual Precipitation
mbgl	Metres below ground level
Mg	Magnesium
mg/L	Milligrams per litre
MLM	Msukaligwa Local Municipality

MPRDA	Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
Na	Sodium
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMAQA	National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)
NEMBA	National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004)
NFEPA	National Freshwater Ecosystem Priority Areas
P	Phosphorus
PES	Present Ecological Status
PCD	Pollution Control Dam
PR	Prospecting Right
RE	Remaining Extent
ROM	Run of Mine
SANBI	South African National Biodiversity Institute
SANS	South African National Standards
SCC	Species of Special Concern
SDF	Spatial Development Framework
SLP	Social and Labour Plan
STLM	Steve Tshwete Local Municipality
TA	Traditional Authorities
VAT	Value Added Tax
WRAC	Workplace Risk Assessment and Control

1 Introduction

Umcebo Mining (Pty) Ltd (Umcebo), a subsidiary of Glencore Operations South Africa (Pty) Ltd (Glencore) is proposing the development and operation of a new underground coal mine and associated infrastructure at three sites, with the closer of the three situated approximately 3 kilometres (km) south east of Hendrina in the Mpumalanga Province of South Africa (the project) (Figure 1-1).

Umcebo currently holds two Prospecting Rights (PRs), namely, MP 1265 PR and MP 1266 PR, located within the Ermelo Coal Field. The total extent of MP 1265 PR (referred to as Mooivley East and Mooivley West) is 3 923 hectares (ha) and comprise the following farms and portions:

- Mooivley 219 IS – Potions 2, 4, 5 and Remaining Extent (RE) of the farm;
- Tweefontein 203 IS – Portions 2, 15, 16, 17 and Portion of Portion 14;
- Uitkyk 220 IS – Portions 2 and 3; and
- Orange Vallei 201 IS – Portions 1 and RE of the farm.

The total extent of MP 1266 PR (referred to as Hendrina South) is 2 787 ha and comprises the following farm and portions:

- Elim 247 IS - RE of the farm;
- Geluksdraai 240 IS – 1 and 2;
- Orpenskraal 238 IS – RE of the farm; and
- Bosmanskrans 217 IS – Potions 1, 3, 4, 6, 8, 9 and RE of the farm.

The project area proposed to be mined (underground) has a combined footprint of 6 714 ha and is located within the Steve Tshwete Local Municipality (STLM) and Msukaligwa Local Municipality (MLM) Figure 1-2.

1.1 Study Area

The project is situated on the N11 national road, with its closest point being approximately 3 km southeast from the outskirts of Hendrina town, stretching approximately 20 km towards Ermelo; located within the Mpumalanga Province (Figure 1-1).

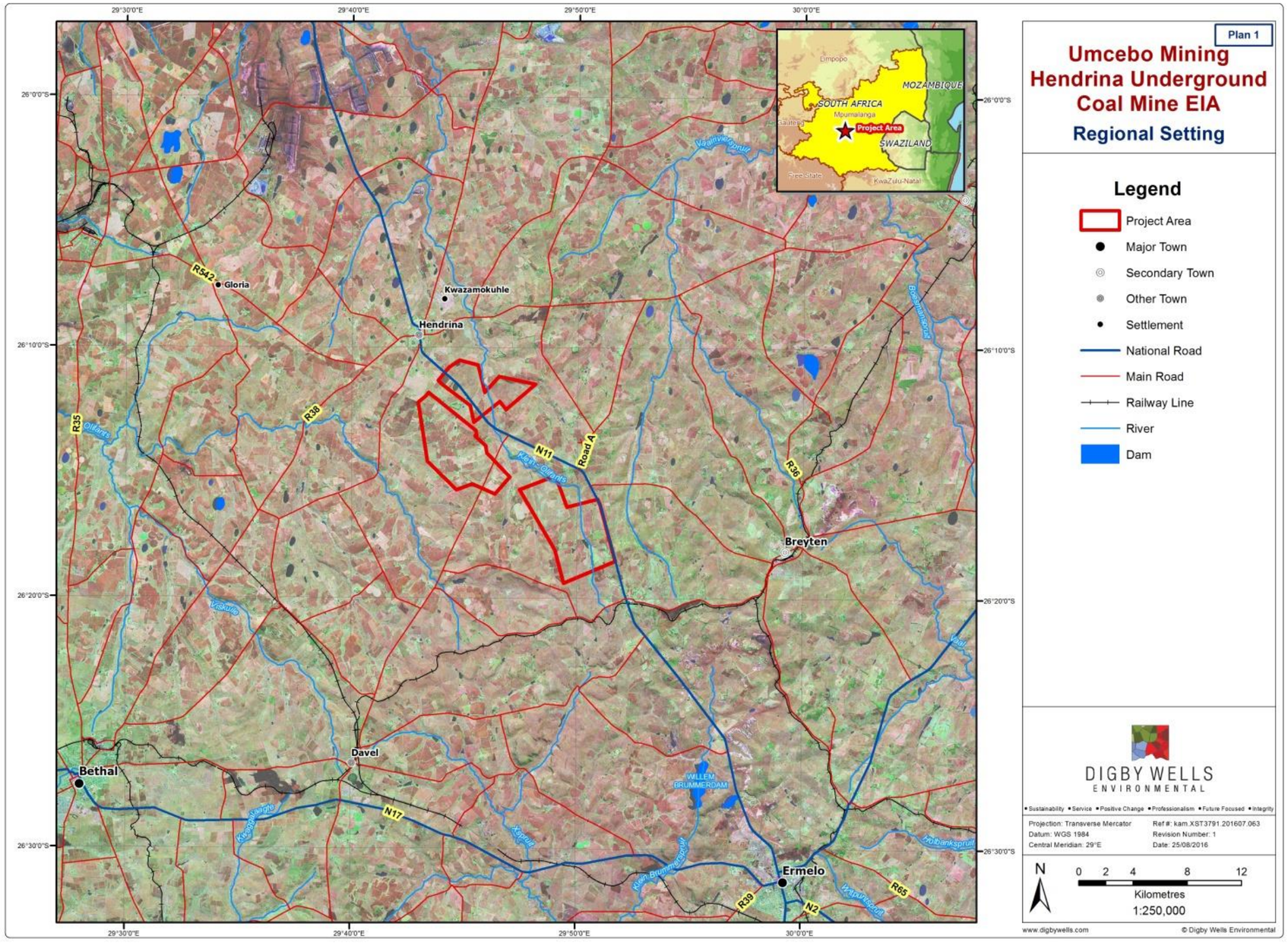

Figure 1-1: Regional Setting

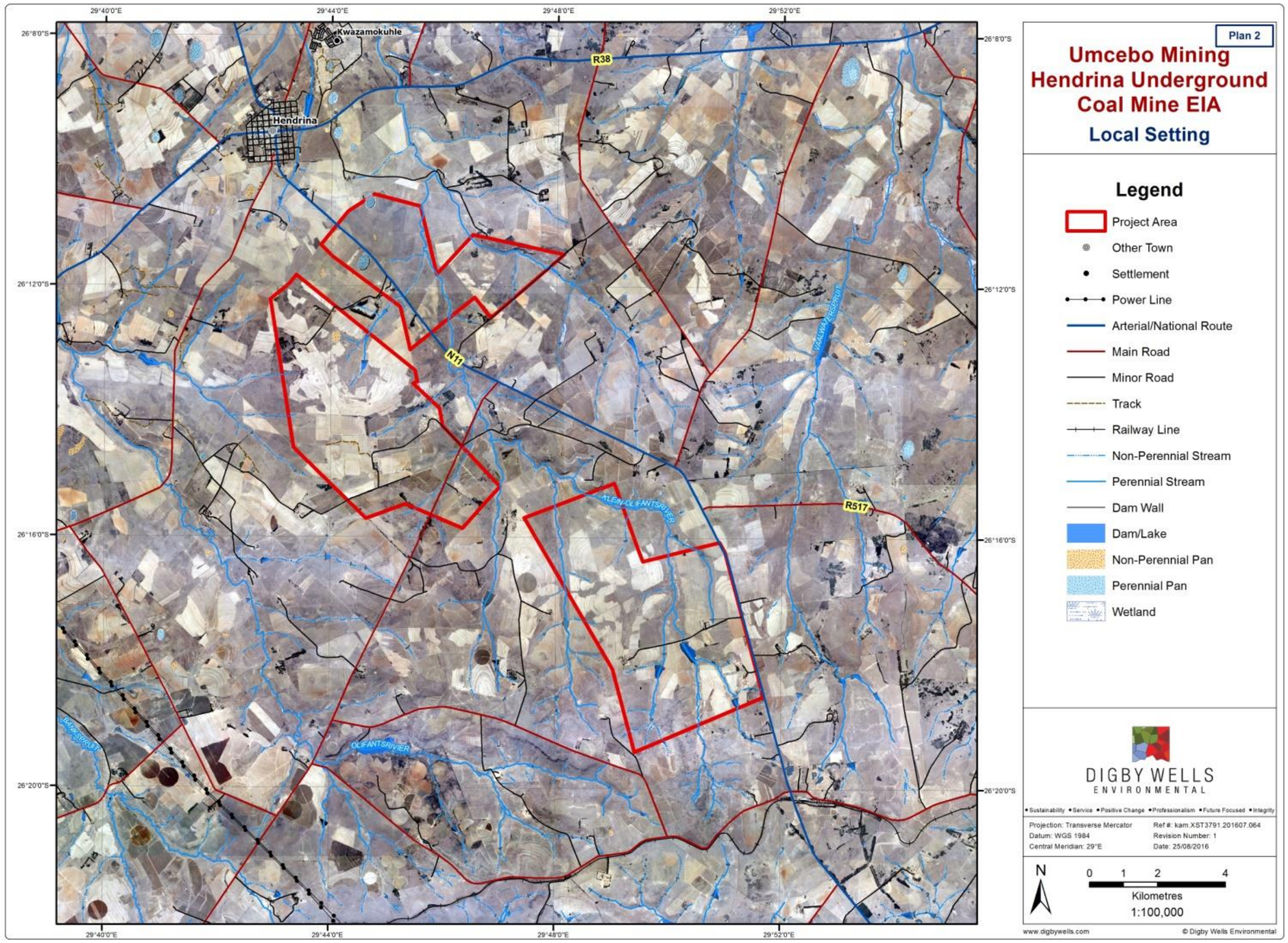

Figure 1-2: Local Setting

The project area comprises three underground reserve blocks namely Mooivley East, Mooivley West and Hendrina South (Figure 1-3). The two Mooivley reserves comprise two shaft areas which will be developed to gain access to the two underground areas whilst the Hendrina South reserve comprises a shaft area. Mooivley West and Hendrina South will be mined at the same time. Once completed, Mooivley East mining activities will commence. The estimated Life of Mine (LoM) will be 30 years[1] for all mining areas (Figure 1-4) with a production rate of 2.4 million tonnes per annum at full capacity, with a total of approximately 78 million tonnes of Run of Mine (ROM). The mine will reach full production within the first four years.

The grade of coal is low and therefore not suitable for export. The coal product will be transported to a nearby Eskom power station (i.e. Kusile, Kendal, Kriel and Grootvlei); via the existing road network.

The project is proposed to commence with construction and development when all required licences and authorisations have been granted.

[1] The MRA will be made for an initial period of 30 years, the maximum allowed in terms of the provisions of Section 23 of the MPRDA. At the end of this period an application for renewal of the mining right will be made for any remaining reserves.

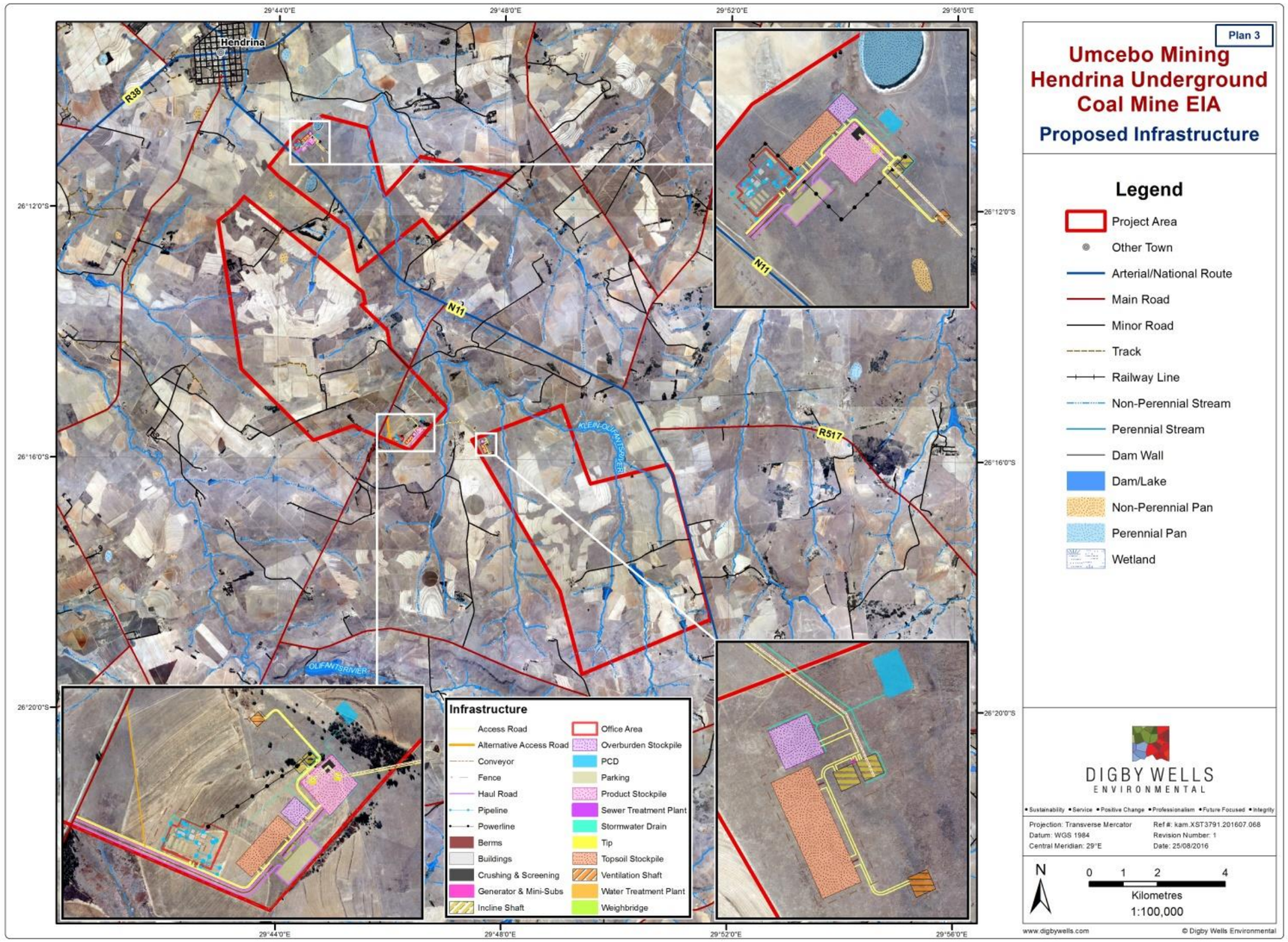

Figure 1-3: Infrastructure Layout

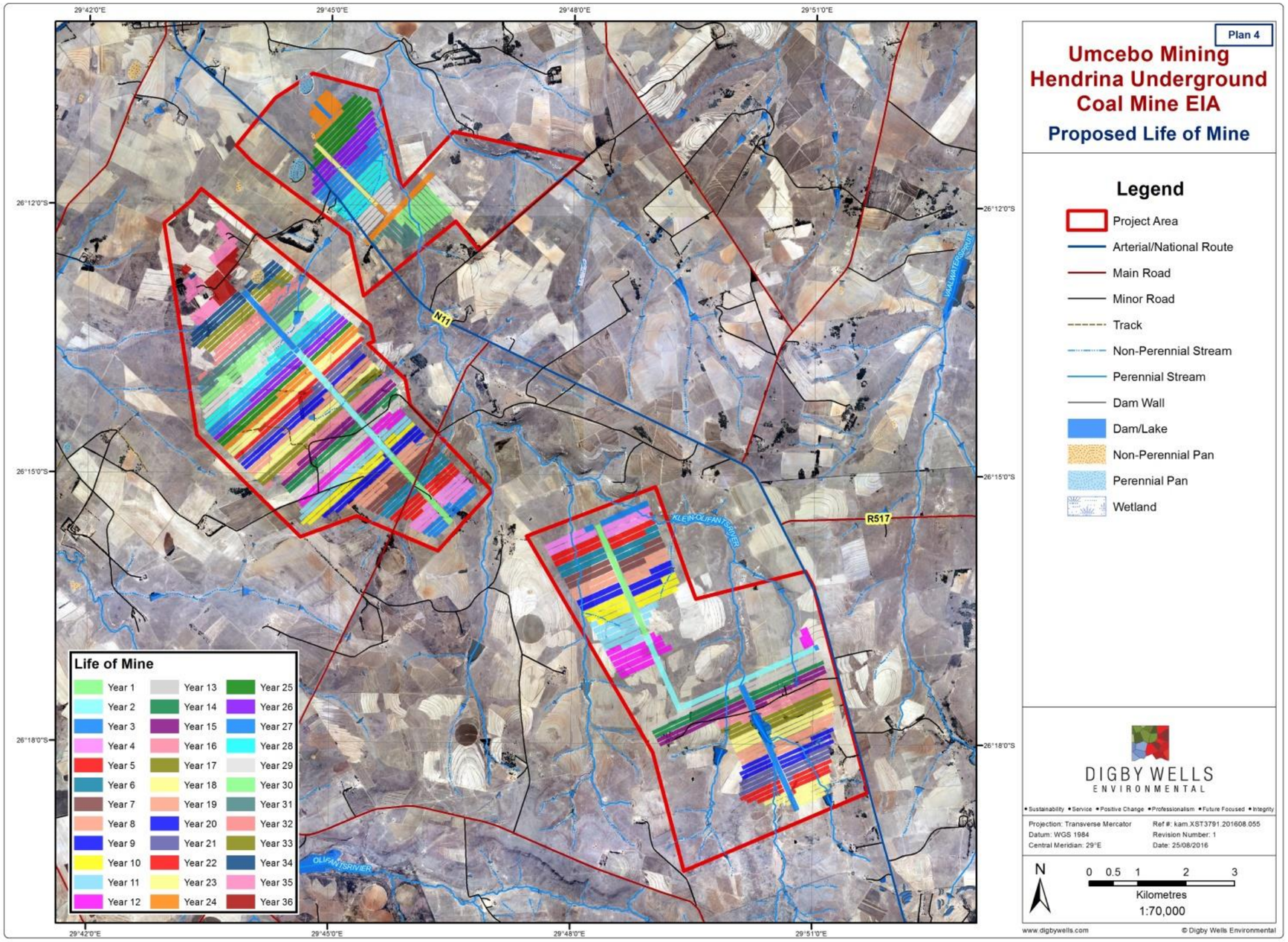

Figure 1-4: Proposed Life of Mine Plan

1.2 Mining Method

Due to the depth of the resource (i.e. between 32 m to 128 m), underground mining will be used to access the ore body. Approximately 75 m deep incline shafts will be constructed to gain access to the underground resource; this will be done through blasting.

The proposed mining method for the extraction of coal will be bord-and-pillar. In mechanised bord-and-pillar mining, extraction is achieved by developing a series of roadways (bords) in the coal seam connected by splits (cut-throughs) to form pillars and is done through the use of machinery referred to as a continuous miner. These pillars are left behind as part of a primary roof support system. In partial pillar extraction, every alternative pillar is left behind to support the overburden or all the pillars are extracted to allow the roof to collapse in a controlled manner. There is no plan to extract any of the pillars for this project. It is expected that there will be dolerite intrusions and a dyke development section will be deployed for the purpose of mining through these and preparing new mining sections.

Any overburden material extracted will be stockpiled and used to rehabilitate the shafts once mining is completed.

1.3 Associated Mine Infrastructure

All proposed mine infrastructure has been reflected Figure 1-3 and includes the following:

- Crushing and Screening Plant;
- Overburden and Product Stockpiles;
- Access and Service Roads (with weighbridge);
- Overland Conveyors;
- Three Access Points to the Underground Reserve;
- Three Ventilation Shafts;
- Office Complex (change house, workshop, offices);
- Three Pollution Control Dams (PCD) and water pipelines;
- Five Aboveground Storage Tanks for the storage of diesel;
- Three Waste Bins per Shaft;
- Site Fencing located around the Conveyer Belt and each Mining Complex;
- Diesel Generator and Sub-station;
- Water Treatment Plant; and
- Package Sewage Treatment Plant.

2 Terms of Reference and Legal Requirements

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. 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; 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). For the purposes of this report, the financial provision estimate and respective reports will be compiled in line with the requirements of the New Financial Provision Regulations. Please refer to Section 15 of this report, indicating the methodology adopted to compile this report that is aligned to the New Financial Provision Regulations, 2015.

Regulation 6 of the Financial Provision Regulations, 2015 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 Rehabilitation, Decommissioning and Mine Closure Plan (RCP) 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 because the site is a greenfields site and that is not currently an operational mine, that the requirements for an Annual Rehabilitation Plan should not be required, as it is expected that no rehabilitation will be undertaken during the first year of operations.

It must be noted that exemption from compiling an Annual Rehabilitation Plan is being requested as it is expected that no annual rehabilitation will be undertaken in the initial construction and operational phases as the mine is an underground mine and final rehabilitation is only expected to occur once mining has ceased and the shaft areas can be closed. The need for an Annual Rehabilitation Plan will be reassessed annually as part of the financial provision update.

Key legislation governing the requirements for legislation for rehabilitation is also contained in the following acts:

- The Constitution of the Republic of South Africa. 1996 (Act No. 108 of 1996) ("The Constitution");
- The National Environmental Management Act, 1998 (Act No. 107 of 1998), (NEMA); and
- The National Water Act, 1998 (Act No. 36 of 1998), NWA).

Other legislation that is applicable to rehabilitation includes:

- The Environment Conservation Act ,1989 (Act No. 73 of 1989, (ECA);
- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004, (NEMBA);
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), (CARA);
- National Forests Act, 1998 (Act No. 84 of 1998), (NFA);
- National Heritage Resources Act, 1999 (Act No. 25 of 1999), (NHRA);
- Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) (OHS);
- Atmospheric Pollution Prevention Act, 1965 (Act No. 45 of 1965);
- Hazardous Substances Act, 1973 (Act No. 15 of 1973);
- National Environmental Management: Air Quality, 2004 (Act No. 39 of 2004), (NEM:AQA);
- National Environmental Management: Waste Management, 2008 (Act No. 50 of 2008), (NEM:WA);
- National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998);
- Promotion of Access to Information Act, 2000 (Act No. 2 of 2000); and
- The Promotion of Administrative Justice Act, 2000 (Act 3 No. of 2000).

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

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

3 Details of Author(s)

The following is a list of the Digby Wells' staff involved in the compilation 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. Kathryn's roles and responsibilities include compiling rehabilitation plans and strategies, costing for financial provision and conducting field work.
- **Brett Coutts:** Rehabilitation Unit Manager; received a Bachelor of Science and Honours degree in Zoology and Environmental Science from the University of Witwatersrand. Brett assists with the management and co-ordination of all relevant studies related to rehabilitation. This includes the compilation of rehabilitation plans and undertaking of rehabilitation assessments. In addition to this, Brett assists within the Biophysical Department with the management of specialist studies that are undertaken by the department and is also responsible for the compilation of the Geographic Information System (GIS) component of Biodiversity Land Management Plans (BLMP) and undertaking ecological assessments. He previously worked for a Hydromulch, a company that specialises in vegetation rehabilitation. Pr.Sci.Nat Membership number: 100010/12
- **Leon Ellis**: Mine Closure Unit Manager; completed his BSc. (Hons) in Geography and Environmental Management at the University of Johannesburg (UJ) in 2009. Leon joined Digby Wells in January 2013. He is involved in conducting financial provision estimates, environmental risk assessments and mine closure plans.

4 Limitations and Assumptions

The compilation of this Final Rehabilitation, Decommissioning and Mine Closure Plan has been based on the following assumptions and limitations:

- The information contained within this Final Rehabilitation, Decommissioning and Mine Closure Plan is based on the current plans provided. If there is a significant change or addition of other infrastructure areas the Plan will need to be updated to cater for this change;
- Information provided in this report and 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
- It must be noted that the proposed project is a greenfields project, thus some of the information contained within this report is based as a conceptual level. As the mine progresses and more information becomes available, this report should be updated, thus this report should be considered as a living document and should be reviewed and updated, if required on an annual basis.

5 Baseline Environmental Setting

5.1 Regional Climate

The climate is warm and temperate and is characterised by summer rainfall, and in December, the area receives an average of 130 mm of rainfall – in July an average of only 5 mm of rain can be expected. The Mean Annual Precipitation (MAP) is 726 mm.

January has an average maximum temperature of 25.4 °C and an average minimum of 13.2°C. June differs substantially with an average maximum of 16.7°C and an average minimum of 0.1°C.

5.2 Soils, Land Capability and Land Use

5.2.1 Soils

The dominant soil forms encountered during the soil site investigation were Hutton, Clovelly, Griffin, Shortlands and shallow Mispah and Glenrosa. Sub dominant forms present were the Shortlands, Valsrivier and Glencoe forms (Soils and Land Capability Assessment Report (Earth Science Solutions, 2016)). There were also a significantly large proportion of wet based soils in the project area as well as materials that classify as “wetlands” in terms of the wetland delineation guidelines.

Other important findings include:

- Significantly large areas of colluvial and alluvial derived soils are associated with the wide open drainage lines;
- Marked differences in soil depths across the study area as well as differences in the texture and structure of the soils;
- A greater proportion of the areas being considered for development returned soils that are of a moderate grazing land potential, with average soil depths, moderate to poor nutrient status and better than average water holding capabilities;
- The percentage of the overall study area associated with wet based soils is significant, with the associated wetland status being of concern to some of the proposed surface development;
- The wet based soils mapped on the midslope have for the most part been impacted by cultivation or livestock grazing;
- The soils are moderately easily worked and stored, albeit that erosion is an issue to be considered and managed; and
- Commercial livestock grazing and agriculture are the dominant commercial activity.

5.2.2 Land Capability

According to the Soils and Land Capability Assessment Report (Earth Science Solutions, 2016), the land capability varies between moderate potential “grazing” and low potential “arable”. There are also significant areas of wet based soils as well as areas with transition zone “wetland” status.

5.2.3 Land Use

The present land includes commercial grazing and cropping, the intensity of these, however, varies from areas where no farming takes place, to areas where there is intensive farming. There is little to no subsistence farming or grazing in the area (Soils and Land Capability Assessment Report (Earth Science Solutions, 2016)).

5.3 Flora, Fauna and Wetlands

5.3.1 Flora

According to the Flora and Fauna Impact Assessment Report (2016) the project area falls within the Eastern Highveld Grassland and Soweto Highveld Grassland as described by Mucina and Rutherford (2006) in the Grassland Biome. These vegetation types occur within Mpumalanga Province at an altitude of 1520-1780 meters above sea level (mamsl). Thirty percent of the biome has been irreversibly transformed and only 1.9 % is formally conserved. The Flora and Fauna Impact Assessment Report (Digby Wells, 2016) highlights that the majority of the study area (3 081 ha and 46 %) had undergone transformation due to

cultivation for maize and soy beans. Livestock were also observed throughout most of the site and evidence of overgrazing was recorded in grassland areas; showing a dominance of Increaser species and some erosion. Despite these impacts, areas that were left intact showed a high diversity of grasses and forbs, particularly members of the Asteraceae family and the *Helichrysum* genus.

A total of 137 plant species were recorded on site (see the Flora and Fauna Impact Assessment Report for a detailed list), of 273 listed in South African National Biodiversity Institute (SANBI's) regional list. Five plant Species of Special Concern (SSC) were recorded on site: *Aloe ecklonis, Crinum bulbispermum, Eucomis autumnalis, Haemanthus humilis* subsp. *hirsutus*, and a *Satyrium* species all of which are provincially protected; including two declining species. A total of 17 Alien Invasive Plant (AIP) species were recorded on site; seven of these have been assigned alien plant categories according to Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA) and NEMBA.

5.3.2 Fauna

With reference to mammals:

- Twenty-one mammals were recorded in the project area during the survey;
- Five of these species are regarded as SCC;
- Two of the SCC, the African clawless Otter (*Aonyx capensis*), and Serval (*Felis serval*) are Red Data species protected under the International Union for Conservation of Nature (IUCN). Furthermore, both species have a Near Threatened status; and
- Four species, African Clawless Otter (*Aonyx capensis*), Steenbuck (*Raphicerus campestris*), Aardwolf (*Proteles cristatus*) and Aardvark (*Orycteropus afer*) are protected according to the Mpumalanga Protected Species (1998).

With reference to avi-fauna:

- During the first field survey a total of 83 species were identified during both the dry season, and the wet season surveys; and
- Nine red data species could potentially occur in the area.

With reference to herpetofauna:

- No protected species were encountered;
- Three amphibians were encountered during the field survey by means of active searching and pitfall traps, Common River Frog (*Afrana angolensis)* Guttural Toad (*Bufo gutturalis*) Common Caco (*Cacosternum boettgeri)* Striped Stream Frog (*Strongylopus fasciatus)* with three species encountered during previous surveys; and

- Two species of reptile, a Rinkhals (*Hemachatus haemachatus*) and Brown House Snake (*Lamprophis fuliginosus*) was identified during the field survey through opportunistic observations (Flora and Fauna Impact Assessment Report, 2016).

With reference to invertebrates:

- Five butterfly species were observed within the Umcebo study area, these included the, Spotted jonker (*Byblia ilythia*), African monarch (*Danaus chrysippus*), Brown-veined White (*Belenois aurota*), Broad bordered grass yellow (*Eurema brigitta*) and the Citrus swallowtail (*Papilio demodocus*);
- No butterfly species observed were considered to be SCC. However according to SANBI, it is possible that the Near Threatened Marsh sylph (*Metisella meninx*) can be located on the site;
- Wasp robber flies (*Philodicus sp*) were located in the mixed grasslands area south of the existing overburden stockpile; and
- Dung beetles (*Scarabeus sp*) were located throughout the property and wherever cattle faeces were evident (Flora and Fauna Impact Assessment Report, 2016).

5.3.3 Wetlands

According to the Wetland Assessment Report (Digby Wells, 2016) the project area is characterised by large areas of wetlands; totalling 2 830.2 ha, which equates to approximately 42 % of the proposed mining right areas. These include three major types of wetlands, being: valley bottom systems, hillslope seeps and pan wetlands, which all function differently and deliver a variety of goods and services. Many of these wetlands are mapped as National Freshwater Ecosystem Priority Areas (NFEPA) and thus are recognised for the role that they play in supporting and provisioning services to the surrounding area and country. These wetlands are also identified as Ecological Support Areas (ESA) according to the Mpumalanga Biodiversity Sector Plan (2013) in the terrestrial and freshwater assessments. Some areas associated with the Klein Olifants River are designated as Critical Biodiversity Areas (CBA). These findings are further highlighted in the Mining and Biodiversity Guideline Report (2013) as these sensitive areas are designated as highest risk to mining and they are of highest biodiversity importance for national biodiversity strategic goals. These findings together with the in-field detailed assessment of the wetlands allowed a sensitivity analysis to be completed (Wetland Assessment Report, 2016) and the table below details these areas.

Table 5-1: Sensitivity Assessment

Sensitivity Rating	Wetland Areas identified
Very High – No Go areas	The Klein Olifants River, the channelled valley bottom systems and the natural pans.
High	All hillslope seep wetlands.

Sensitivity Rating	Wetland Areas identified
Moderate – High	The 100 m buffer of all wetlands.
Moderate – Low	The 500 m buffer (remaining after 100 m) of all wetlands as well as the impacted pans.

The Wetland Assessment Report (Digby Wells, 2016) states that the delineated wetlands constitute 42 % of the three proposed mining right areas and both surface infrastructure and underground mine plan interacts with the wetlands found on site. The current proposed surface infrastructure will directly impact approximately 19 ha of wetland according to the current layout and the underground mine plan currently underlies 897 ha of wetland across all three mining areas, which will range from a depth of 32 m to 128 m.

5.4 Aquatic Ecology

An overall Present Ecological State (PES) class of moderately/largely modified (class C/D) was determined by the Aquatic Ecology surveys. This class was derived due to the exiting land use within the catchment area of the Klein Olifants River. The central cause of the poor ecological status was found to be associated with various agricultural practices which have resulted in the erosion and subsequent sedimentation of the assessed river reaches (Aquatic Ecology Assessment Report (Digby Wells, 2016)).

5.5 Surface Water

The project area is found predominantly within the quaternary catchment B12A, which is characterised by the Klein Olifants River (sub-quaternary reach B12A-01309). In addition, the western portion of the project area expands into the quaternary catchment B11A and the south-eastern edge of the project area stretches partly over the catchment divide between B11A and X11A. The landscape is characterised by an undulating terrain within these catchments. It is in the valley bottom areas where water collects and wetlands are likely to be present. Refer to the Aquatic Ecology Assessment Report (Digby Wells, 2016) as well as the Surface Water Assessment Report (Digby Wells, 2016) for more information regarding the catchment characteristics.

5.6 Groundwater

The Groundwater Assessment Report (Digby Wells, 2016) states that the project area is located within the Ermelo Coalfield where there are five major coal Seams. The D and E Seams are thin to absent over much of the coalfield and only the E seam reaches mineable thicknesses in isolated patches in the northern parts of the coalfield. The B and C seams are most widely developed, and to mineable thicknesses, in the coalfield. The A seam has, over large areas of the northern and central areas of the coalfield, been removed by erosion. Although to a lesser extent, the B and C seams have also been removed by erosion.

Intrusive dykes and sills, predominately doleritic in composition, are common and devolatilisation of the coal adjacent to the intrusives can be significant.

According to the Groundwater Assessment Report (Digby Wells, 2016), a total of 190 boreholes were recorded during the hydrocensus and from the national groundwater archive. Ten of the 13 boreholes sampled are suitable for human consumption. None of the tested parameters exceeded the recommended limits. Noteworthy is the baseline sulphate levels in all of the boreholes. The recommended sulphate limit is 250 mg/L for its aesthetic effect and 500 mg/L for its acute health effect. The sulphate concentrations for the sampled boreholes are currently less than 20.6 mg/L. Since sulphate is expected to be an element of concern in coal mines, the values obtained during this study can be used as a baseline for future contamination comparisons. Three boreholes fell within the unacceptable category water quality range. These are either due to fluoride or manganese, both of which are suspected to be due to natural dissolution from the host rocks, particular from the pre-Karoo intrusive rocks.

The water level ranges between 0.6 m and 50.0 m below ground level (bgl). The relatively large water level variation over a relatively short distance may indicate that some of the boreholes are groundwater abstraction points measured after pumping and with no sufficient time to recover, or possibly from different aquifers. A comparison of the water level elevation with topography shows a good correlation of 97.1 %. This confirms that groundwater elevation mimics the topography and in the project area flows towards the northwest. Refer to the Groundwater Assessment Report for more information (Digby Wells, 2016).

6 Baseline Socio-Economic Setting

The Social Impact Assessment Report (Digby Wells, 2016) provides a baseline for the socio-economic setting of the areas affected by the project.

The table below provides a summary of the baseline profile of the study area; it highlights features and trends within the respective study areas that might have relevance for Umcebo in terms of possible opportunities/ benefits and constraints/ challenges.

Table 6-1: Summary of Socio-Economic Baseline Profile

Socio-economic Attribute	Supporting Data	Relevance to Umcebo
Opportunities and Benefits		
District and Local development plans are in place	Desktop review: Local and district Municipal Integrated Development Plans (IDPs), Local Economic Development (LED) plans, and Spatial Development Frameworks (SDFs) that are readily available online	Opportunity for the Project to align future socio-economic development programmes or future Social and Labour Plans (SLP) with existing municipal development plans; this will increase sustainability and relevance of any initiatives.

Socio-economic Attribute	Supporting Data	Relevance to Umcebo
Large potential labour force	Statistics South Africa (StatsSA), 2013: Those between 15-64 years comprises the largest age cohort; high unemployment rates and mining is a prominent industry	Can increase the prospect of the Project meeting any local recruitment targets for semi-unskilled positions.
Most people have a relatively basic skill level – skill levels tend to be even lower within Msukaligwa Local Municipality (MLM)	StatsSA, 2013: 50 % or more of people in the secondary study area have not completed secondary schooling	Although low skills levels has obvious negative implications for the employment potential of the population, and LED initiatives; it provides ample opportunity for the Project to contribute to community development through skills development programmes during its construction and operational phases.
Commercial farming is a popular land use in the secondary and primary study area	Most rural households within the primary study area are employed on surrounding farms; commercial farming is also prevalent; the IDP for both Steve Tswete Local Municipality (STLM) and MLM identifies agriculture as LED focus area	Opportunity for the Project to pursue a future SLP or Corporate Social Investment (CSI) project, which is focussed on agriculture. This will contribute towards any drive aimed at diversifying the economy. District and Local level economic development plans also identify agriculture as a key development area.
Mining is by far the dominant sector in the Province, as well as in Nkangala District Municipality (NDM) and STLM	StatsSA, 2013: mining is the primary contributor to the STLM and NDM economy, but also contributes to MLM's economy	▪ Procurement could potentially be from suppliers located within the tertiary or secondary study area who are currently servicing mines in the area; and ▪ It is likely that some individuals with mining related skills will reside in the secondary or primary study area, which will assist the Project or contractor in meeting local recruitment targets.
Several large mining operations are situated within the secondary study area	District and Local Municipal SDFs; Field investigations; investigation of available spatial data	Opportunity to synergise any SLP (i.e. LED) and CSI initiatives with existing initiatives of other mines.

Socio-economic Attribute	Supporting Data	Relevance to Umcebo
General backlog of basic service delivery infrastructure (housing, sanitation and water), especially within MLM and rural household within the primary study area	Stats 2013 and STLM and MLM IDPs: ▪ Significant housing shortages throughout the primary study area ▪ A large number of households still rely on the bucket system and has no electrical connections ▪ Clinics within STLM and MLM is not sufficient ▪ A large number of rural households are not connected to the electricity grid	Provides opportunities to continue contribution to infrastructure development as part of drive towards LED (but may also hinder the productivity of the local workforce).
Gender disparity in employment rates – financial vulnerability among females	StatsSA, 2013 - Unemployment amongst females is significantly higher than males. Furthermore, when women do generate income, it is likely to be less or through the informal sector and of a survivalist nature	The Project could contribute to gender equity by implementing higher female employment targets for contractors – this requirement, if feasible, could be formalised by incorporating it into the contractor's conditions of contract.
High dependency ratio, poverty and food insecurity, especially within MLM	StatsSA, 2013: High unemployment rate combined with low levels of income in the secondary study area, but especially within the wards in MLM. Poverty is recognised as a major problem in the IDPs of both STLM and MLM.	Local procurement and job creation will have a major positive effect on any local businesses their employees and dependants, as well as on successful job-applicants and their dependants.
Constraints or Challenges		
Although most of the secondary study area is administrated by government, several portions are governed by Traditional Authorities (TA)	Desktop review: Active TAs within MLM include the Mahlangu chieftaincy (Ubukhosi bakaMahlangu)	Depending on the TAs area of jurisdiction this could result in tensions between local municipalities and traditional leaders, especially during implementation of LED plans.

Socio-economic Attribute	Supporting Data	Relevance to Umcebo
High levels of Population migration	StatsSA, 2013, Municipal IDPs	Project-induced population influx will add to existing influx, especially in areas such as Hendrina and Breyten, placing increased pressure on available local resources, services and facilities.
Substantial housing shortage in urban areas	Stats, 2013; Municipal IDPs	▪ Any project-induced influx to urban centres may place additional pressure on limited housing ▪ Project should preferably not rely on existing housing for staff accommodation
Spatial development planning indicates that existing towns should be prioritised for further development and investment areas	DM and LM SDFs	This should be considered when deciding on construction site of any staff accommodation
This District's economy is very dependent on mining, this dependency is even higher within STLM	Mining contributes to 31% STLM's Gross Development Product	▪ The Project will likely contribute to increasing dependency on mining among local communities; and ▪ LED activities should preferably be aimed at establishing economic development outside the mining sector.
Existing mining trucks are contributing to road deterioration in the local study area	Field investigations and Municipal IDPs	Local perceptions on mining impacts should be expected and a proactive approach be implemented to address such concerns.
The land area which will be consumed by the Project facilitates residential , grazing, and commercial agricultural activities	Field investigations; spatial data	Umcebo should consider the potential physical and economic displacement impact of the Project, which could have substantial time and cost implications for the Project. However, this will be dependent on the degree of subsidence related impacts.
Commercial farming is the most common land use	IDPs for Local and District Municipalities; Field investigations	Agricultural activities may potentially be directly affected by the proposed Project, if subsidence significantly decreases borehole yields or quality of water this would likely result in stakeholder issues.

7 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.

8 Closure Design Principles

8.1 Closure Vision, 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:

- Make all areas safe for both humans and animals;
- Make all areas stable and sustainable;
- Follow a process of closure that is progressive and integrated into the short and long term plans, and that will assess the closure impacts proactively at regular intervals throughout project life;
- 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 Umcebo in carrying out successful rehabilitation for the project.

8.2 Alternative Closure and Post-Closure Options

It is expected that the current land use for the study area will continue during the operational phase and well into the post closure phase as the mining method is underground which allows farmers to utilise the surface during the LoM. 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 always a risk of surface subsidence and damage to the natural environment

that could occur post closure. Annual monitoring for subsidence and sinkholes followed by rehabilitation will be required and remedial action taken.

8.2.1 Preferred Closure Action

Based on the type of mining (underground 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;
- Monitoring of groundwater water levels in the weathered and coal seam aquifers;
- If sinkholes from subsidence are formed after closure, they should be rehabilitated as soon as possible to minimise water and oxygen inflow from the atmosphere; and
- Update the numerical model and decant rates annually for the first five years with the monitoring data.

The following mitigation measures are proposed to minimise the risk of the contamination plume negatively impacting the natural environment:

- Groundwater will flow away from the mine footprint if the hydraulic head within the mine is higher than the surrounding elevation. Ensure (through dewatering or decant management) that the hydraulic head in the mine void is always lower than that of the river or the regional head;
- Monitoring of groundwater water levels and mine inflow rates; and
- Update numerical model and decant rates annually as information becomes available.

8.2.2 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. In addition to this surface subsistence monitoring should be undertaken during the operational phase and predicative modelling should be undertaken to determine the risk of surface subsistence.

9 Risk Assessment

The information presented below has been summarised from the ERR, please see Appendix A.

Potential unwanted events during mine closure were identified and discussed. The three mining areas (i.e. Mooivley West, Hendrina South and Mooivley East) essentially have the same infrastructure and mining method, thus these areas were grouped together in the risk assessment as to not duplicate information.

The four levels of risks are classified as shown in Table 9-1 below.

Table 9-1: Risk Levels

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

Twelve 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).

Three of the unwanted events were ranked as extremely intolerable, four were ranked as highly intolerable and five were ranked as low as reasonably practicable (ALARP).

The 12 unwanted events were then re-assessed taking into consideration the current control measures. The residual risks were ranked assuming the control measures are in place and effective. Table 9-2 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 9-2: Residual Risk Ranking

Area number	Description	Number of unwanted events	Extremely Intolerable	Highly Intolerable	ALARP	Maintain
1	Mooivley West, Hendrina South & Mooivley East	10	2 (2)	3 (3)	5 (5)	0 (0)
2	General	2	1 (0)	1 (0)	0 (1)	0 (1)
Total		**12**	**3 (2)**	**4 (3)**	**5 (6)**	**0 (1)**

[2] As low as reasonably practicable

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

The potential extremely and highly intolerable risks identified are the following:

- Poor groundwater quality – Decanting;
- Legal censure from the decanting of mine affected water;
- Inadequate funds for mine closure;
- Physical surface disturbance (i.e. on-site watercourses and wetlands);
- Poor surface water management of runoff leading to infiltration;
- Soil erosion – Rehabilitated areas; and
- Failure to implement the final Land Use Plan (LUP) (Figure 10-1).

The latent risks associated with the proposed project relates to the possible decant of mine affected water and the possibility of surface subsidence once operations cease and the mine is closed. This could have a negative impact on surface water resources and sensitive environments such as wetlands in the area. The Klein Olifants River and the associated wetlands are within an important catchment and impacts to this area will have a regional level significance (Wetland Assessment, 2016).

Once the mine is closed and dewatering ceases, groundwater will start to recover to its pre-mining level. Following full recovery (expected to be around 30 years after closure) the contaminants will start to migrate away from the mine site. The contamination plume will be transported with the groundwater but due to the limited hydraulic permeability of the region, the plume is expected to remain in the vicinity of the mine zones. The plume is not expected to reach and contaminate rivers during mine operation or after closure.

The Shaft 3 Area (located in Mooivley East) could potentially decant after closure at a 7 m^3/d and could alter the river water quality as well as negatively impacting on wetlands if not properly managed.

Please see Appendix A for the complete ERR.

10 Proposed Final Post-Mining Land Use

The final LUP is essentially the end land use to which Umcebo 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.

It is expected that areas where infrastructure is located, will be areas that the current land use will be impacted upon. For these areas it is recommended that the mine rehabilitate the areas back to the pre-mining land use (Figure 10-1), as these footprints are expected to be small in size. As a result of the mine being an underground operation, the surface land use should not be impacted upon; however subsidence could impact on land use if there is a

collapse. It is recommended that ongoing monitoring is undertaken on the surface and modelling is undertaken to predict if subsidence would occur and the risk associated with such. In the event that subsidence does occur, rehabilitation of these areas needs to be undertaken. The level of rehabilitation would be dependent on the risk of collapse and the degree of subsidence. If subsidence is a high risk and occurs on site resulting in a drastic change in topography, these areas may need to be designated as no-go areas and these areas should be fenced off and appropriate signage erected.

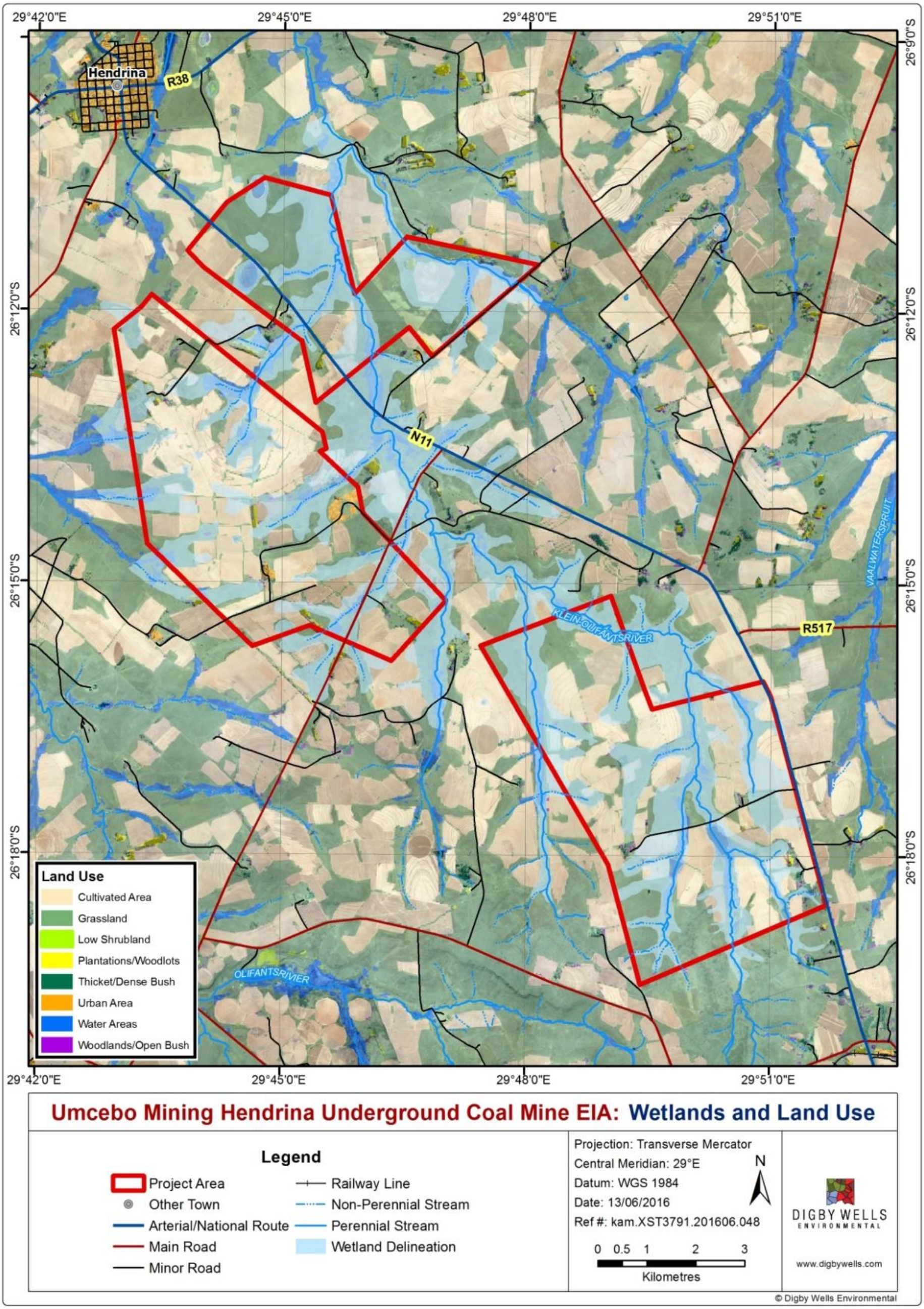

Figure 10-1: Current and Final Land Use

11 Closure Environmental Management Plan

The main aim in developing the Final Rehabilitation, Decommissioning and Mine Closure Plan is to minimise and mitigate the impacts caused by mining and industrial activities and to restore land back to a satisfactory standard. It is best practice to develop the Plan as early as possible so as to ensure the optimal management of rehabilitation and closure issues that may arise. It is critical that a mine's Final Rehabilitation, Decommissioning and Mine Closure Plan is defined and understood from before mining progresses and is complimentary to the objectives and goals set. Rehabilitation and closure objectives need to be tailored to the project at hand and be aligned with the Environmental Management Plan (EMP).

The Final Rehabilitation, Decommissioning and Mine Closure Plan aims to inform on the actions required to rehabilitate the project to ensure that the area is socially and environmentally safely and sustainably closed. Importantly, the Rehabilitation Plan consists of direct activities associated with rehabilitation of various infrastructure components.

11.1 Rehabilitation Actions and Management Plans

The activities involved in the Rehabilitation Action Plan are discussed according to the different needs of the infrastructure areas and these areas are shown Figure 1-3. Table 11-6 summarises these actions.

This report 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.

Limited surface infrastructure will be established to support the mining activities for the project and this infrastructure footprint will need to be rehabilitated. The primary structures proposed include:

- Crushing and Screening Plant;
- Overburden and Product Stockpiles;
- Access and Service Roads (with weighbridge);
- Overland Conveyors;
- Three Access Points to the Underground Reserve;
- Three Ventilation Shafts;
- Office Complex (change house, workshop, offices);
- Three PCDs and water pipelines;
- Five Aboveground Storage Tanks for the storage of diesel;
- Three Waste Bins per Shaft;

- Site Fencing located around the Conveyer Belt and each Mining Complex;
- Diesel Generator and Sub-station;
- Water Treatment Plant; and
- Package Sewage Treatment Plant.

The rehabilitation actions for the particular infrastructure are detailed below and separated into phases.

11.1.1 Construction Phase

The land preparation for the intended infrastructure will require similar actions and these are described below:

- 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;
- Care should be taken around sensitive landscapes e.g. wetlands/pans/riverine areas to ensure that impacts to them are none to minimal;
- Construction crews should restrict their activities to planned areas. Clear instructions and control systems should be in place and compliance to the instructions should be policed;
- 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 (such as *Eucomis autumnalis, Haemanthus humilis* subsp. *hirsutus Satyrium* sp. that were identified on site), 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 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; and
- If it is necessary to remove protected trees, permits will be required.

- The soil must be stripped (see Section 11.1.1.1.4 below as well as the Soil and Land Capability Assessment Report (Earth Science Solutions, 2016) for comprehensive information on soil stripping for the different soil types);
- The soil must be stockpiled. This must be done as close as possible to the areas that will be progressively rehabilitated (see Section 11.1.1.1.4 below as well as the Soil and Land Capability Assessment Report (Earth Science Solutions, 2016) for comprehensive information on soil stockpiling);
- Pollution must be controlled at the proposed project area through the following guidelines:
  - 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; and
  - All hazardous waste should be removed by a suitably qualified service provider and disposed of to an approved permitted landfill site.
- Alien invasive species must be removed (for more information, see Section 11.1.3.13.2).

Note: According to the Groundwater Assessment Report (Digby Wells, 2016) and the Engineering Design Criteria Report (Revision B, Umcebo Mining), the facilities would be designed in accordance with the specifications for a Class C landfill site (Old GLB+ landfill facilities). During construction, the correct liners/barriers must be utilised and the legally required material and methods adhered to.

11.1.1.1 Soil Guidelines

The Guidelines for the Rehabilitation of Mined Land (as provided by the South African Chamber of Mines) states that soil management during construction is the key process in determining rehabilitation effectiveness and that soil stripping guidelines should be developed for the construction teams which clearly defines the soil horizons to be removed and where and how to store them.

11.1.1.1.1 Soil types

According to the Soils and Land Capability Assessment Report (Earth Science Solutions, 2016) the project area is dominated by Hutton, Clovelly, Griffin, Shortlands and shallow Mispah and Glenrosa, with sub dominant forms that include the Shortlands, Valsrivier and

Glencoe forms. Hydromorphic soils are extremely prevalent and range from extremes of deep Avalon, Bainsvlei, Bloomsdale, Glencoe and Pinedene forms on the transition zone slopes, and shallow Avalon, Westleigh, Kroonstad and Sepane Forms associated with the lower slopes and midslope seeps, to highly structured prismacutanic and gleycutanic form soils (Katspruit, Rensburg etc.) associated with the alluvial floodplains. The Soils and Land Capability Assessment Report (Earth Science Solutions, 2016) identified erosion and compaction as the limiting factors to rehabilitation of soils.

The soils were categorised and mapped into groups with each group comprising soils of similar characteristics (soil structure, texture, depth, wetness) that can be handled and managed in a similar way. The dominant groups in the area (Table 11-1) that will be impacted on by **surface infrastructure** include:

- Moderately deep sandy loam;
- Shallow sandy loam;
- Deep wet based sandy loam; and
- Shallow wet based clay loam.

These dominant groups will need to be managed according to their limitations, for example, all are susceptible to erosion and compaction, which will have rehabilitation implications.

Table 11-1: Dominant Soil Groups Found Where Surface Infrastructure will Impact

Dominant soil group	Soil types	Nutrients	Water Holding capacity	Limitations	Location on site
Moderately deep sandy loam (2)	Hutton, Clovelly and deeper Glenrosa forms soils	The inclusion of hard rock will reduce the soils viability (dilutes the nutrient pool).	Low water holding capacity	Compaction and erosion	Mooivley East, Hendrina South
Shallow sandy loam (3)	Glenrosa and Mispah	Low nutrient availability	Low water holding capacity	Sub-surface hindrance, compaction and erosion	Mooivley West
Deep wet based sandy loam (5)	Glencoe, Bainsvlei, Bloemdal, Pinedene and Avalon.	Rich in iron and magnesium	Moderate to low water holding capabilities	Impeded drainage, compaction and erosion	Mooivley West
Shallow wet based clay loam (6)					Mooivley East, Hendrina South

11.1.1.1.2 Land Capability

As indicated in the Soils and Land Capability Assessment Report (Earth Science Solutions, 2016) and illustrated in Table 11-1, the dominant groups were moderately deep sandy loam (Hutton, Clovelly), shallow, sandy loam (Glenrosa and Mispah), deep wet based sandy loam and shallow wet based clay loam (Glencoe, Bainsvlei, Bloemdal, Pinedene and Avalon).

The moderately deep sandy loam and shallow, sandy loam groups have grazing potential, while the deep wet based sandy loam and shallow wet based clay loam groups have low agricultural potential due to impeded drainage, compaction in the wet state, and erosion.

Table 11-2: Dominant Soil Groups and Land Capabilities within the Surface Infrastructure Area

Surface Infrastructure Area	Dominating soil groups	Land Capability
Mooivley West	Shallow, sandy loam	Grazing
	Deep wet based sandy loam	Wet-based
Mooivley East	Moderately deep sandy loam	Grazing
	shallow wet based clay loam	Wet-based
Hendrina South	Moderately deep sandy loam	Grazing
	shallow wet based clay loam	Wet-based

11.1.1.1.3 Soil Erosion and Compaction

The Soils and Land Capability Assessment Report (Earth Science Solutions, 2016) states that the average “Erosion Indices” for the dominant soil forms on the study site can be classified as having a moderate erodibility index. This is largely ascribed to the generally low organic carbon content and the sensitivity of the soils to solution weathering. These factors are offset by the generally gentle to flat topography and the moderate clay contents. The vulnerability of the “B” horizon to erosion once/if the topsoil is removed must not be under estimated.

According to the Soils and Land Capability Assessment Report (Earth Science Solutions, 2016), the wet and structured soils are susceptible to compaction due to the swelling clays that are common in the majority of the materials classified. These soils will need to be managed extremely well, both, during the stripping operation, as well as during the stockpiling/storage and rehabilitation stages.

The following management actions should be followed to prevent/reduce soil erosion and compaction at the project site:

- Reduce the project footprint as much as possible;

- Effective soil stripping should take place during the dryer and less windy months when the soils are less susceptible to erosion and compaction. This will assist the stockpiling and vegetative cover to propagate before the following wet season;
- Soil replacement and the preparation of a seed bed should take place to facilitate the re-vegetation program and to limit potential erodibility during the rehabilitation process;
- Ensure proper storm water management designs are in place;
- If erosion occurs, corrective actions (erosion berms) must be taken to minimise any further erosion from taking place;
- If erosion has occurred, usable soil should be sourced and replaced and shaped to reduce the recurrence of erosion;
- Use stoloniferous grasses such as *Cynodon dactylon*; and
- Keep grazers out of the rehabilitation areas, if possible for one to two growing seasons, until a suitable vegetation cover has established.

11.1.1.1.4 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 and Land Capability Assessment Report (Earth Science Solutions, 2016)):

- Over areas of deep excavation strip all usable soil as defined (700 mm). Stockpile alluvial/colluvial (transported wet based) soils separately from the in-situ materials, which in turn should be stored separately from the underlying overburden. Store the soils in berms or stockpile dumps of no more than 1.5m high if space allows;
- At rehabilitation replace soil to appropriate soil depths in the correct order, and cover areas to achieve an appropriate topographic aspect and attitude so as to achieve a free draining landscape that is as close as possible the pre-mining land capability rating;
- Over area of structures (offices, workshops, haul roads) and soft overburden stockpiles strip the top 300 mm of usable soil over all affected areas including terraces and strip remaining usable soil where founding conditions require further soil removal. Store the soil in stockpiles of not more than 3 m around infrastructure area for closure rehabilitation purposes. Stockpile hydromorphic soils separately from the dry materials;
- Over area of construction of storage facilities and hard overburden stockpiles strip usable soil to a depth of 700 mm in areas of arable soils and between 300 mm and 500 mm in areas of soils with grazing land capability. Stockpile hydromorphic soils separately from the dry and friable materials;

- Over area of access roads, lay-down pads and conveyor servitudes strip the top 150 mm of usable soil over all affected areas and stockpile in longitudinal stockpile within the mining lease area;
- The lower portions of the subsoil's (>500 mm) and the soft overburden material (where removed) can be stored as separate stockpiles close to the areas where they will be required for backfilling and final rehabilitation;
- It is proposed that prior to soil stripping, an appropriate (to be determined by local experts) fertilizer (super phosphate) should be added to the sandy loams and silty clay loams at a rate of about 200 kg/ha if they have not previously been fertilized. This will help to enhance the seed pool and encourage growth within the stored materials;
- 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.

11.1.1.1.5 Stockpiling Method

The following tasks should be considered when stockpiling:

- Stockpile the major soil types separately and accurately demarcate the soil stockpiles and the type of soil for use in rehabilitation activities;
- Soil stockpiles are to be kept to a maximum height of 3 m where possible; (if space is limited that 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;
- 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;
- All stockpiles should be clearly and permanently demarcated and located in defined no-go areas, re-vegetated and monitored on an annual basis;
- 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.

11.1.2 Operational Phase

During the operational phase:

- Ensure crews restrict their activities to planned areas to reduce soil compaction and erosion must be reduced;
- Pollution must be controlled at the proposed project site through the following mitigations:
  - 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 an approved permitted landfill site;
  - If contamination does occur, soil remediation must take place.
- Monitor the conveyor and all facilities for any spillages/leaks or accidental discharges; and
- Alien invasive species must be removed (for more information, see Section 11.1.3.13.2).

11.1.3 Decommissioning Phase

Closure actions are provided for the each of the infrastructure areas:

11.1.3.1 Crushing and Screening Plant

The crushing and screening plant will need to be free from contamination and then decommissioned. Infrastructure that can be re-used or sold should be removed to defray costs. The following actions should be followed:

- Infrastructure, including foundations, steel etc. should 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; and
  - Soil should be tested for contamination. If contamination is discovered, this soil should be removed and disposed of in the appropriate waste disposal facility.

- 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;
- Appropriate topsoil should be replaced to a minimum of 300 mm thick in all rehabilitated areas. If borrow pits are utilised, the borrow pits from where the topsoil originates should be rehabilitated and revegetated to create sustainable cover that prevents erosion and enhances natural succession. This must be included in the monitoring programme;
- Topsoil should be fertilised and ripped to 200 mm to reduce compaction. The fertiliser requirements can only be determined once a fertility assessment is carried out at the proposed project;
- Reseed with grasses listed in Table 11-3 and improve species diversity by planting species listed Table 11-4. Additionally, replant species that were relocated due to mining construction;
- Remove alien invasive plants (see Section 11.1.3.13.2 for more detail);
- Prevent access of people/machinery/vehicles/grazing animals on newly rehabilitated land to allow regeneration of vegetation and reduce erosion; and
- Ensure that robust care and maintenance plans are in place.

11.1.3.2 Overburden and Product Stockpiles

Note: The facilities should be designed in accordance with the specifications for a Class C landfill site (Old GLB+ landfill facilities). These will require liners/barriers as mentioned in Section 11.1.1.

- Remove all stockpiled product and utilise overburden material as backfill to fill the shaft areas, prior to sealing of the shafts;
- The liner should be removed and disposed of in a hazardous waste facility;
- Soil should be tested for contamination. If contamination is discovered, this soil should be removed and disposed of in the appropriate waste disposal facility.
- Once the site has been cleared of contamination, 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;

- Appropriate topsoil should be replaced in all rehabilitated areas (all usable topsoil stripped from these areas should be placed back in these areas). This must be included in the monitoring programme;
- Topsoil should be fertilised and ripped to 200 mm to reduce compaction. The fertiliser requirements can only be determined once a fertility assessment is carried out at the proposed project area;
- Reseed with grasses listed in Table 11-3 and improve species diversity by planting species listed Table 11-4. Additionally, replant species that were relocated due to mining construction;
- Remove alien invasive plants (see Section 11.1.3.13.2 for more detail);
- Prevent access of people/machinery/vehicles/grazing animals on newly rehabilitated land to allow regeneration of vegetation and reduce erosion; and

11.1.3.3 Ensure that robust care and maintenance plans are in place.

11.1.3.4 Access and Service Roads (with weighbridge)

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, they will require the following actions:

- Demolish weighbridge. Soil should be tested for contamination. If contamination is discovered, this soil should be removed and disposed of at the appropriate waste disposal facility;
- Appropriate topsoil should be replaced to a minimum of 300 mm thick in all rehabilitated areas. This must be included in the monitoring programme;
- Topsoil should be fertilised and ripped to 200 mm to reduce compaction. The fertiliser requirements can only be determined once a fertility assessment is carried out at the proposed project area;
- Reseed with grasses listed in Table 11-3 and improve species diversity by planting species listed Table 11-4. Additionally, replant species that were relocated due to mining construction;
- Remove alien invasive plants (see Section 11.1.3.13.2 for more detail);
- Prevent access of people/machinery/vehicles/grazing animals on newly rehabilitated land to allow regeneration of vegetation and reduce erosion; and
- Ensure that robust care and maintenance plans are in place.

11.1.3.5 Overland Conveyors

The conveyor belt and its associated infrastructure will need to be removed. The following actions will be required

- Infrastructure, including foundations, belts, etc. should 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.
- 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;
- Appropriate topsoil should be replaced (all usable topsoil stripped from these areas should be placed back in these areas) in all rehabilitated areas. This must be included in the monitoring programme;
- Topsoil should be fertilised and ripped to 200 mm to reduce compaction. The fertiliser requirements can only be determined once a fertility assessment is carried out at the proposed project site;
- Reseed with grasses listed in Table 11-3 and improve species diversity by planting species listed Table 11-4. Additionally, replant species that were relocated due to mining construction;
- Remove alien invasive plants (see Section 11.1.3.13.2 for more detail);
- Prevent access of people/machinery/vehicles/grazing animals on newly rehabilitated land to allow regeneration of vegetation and reduce erosion; and
- Ensure that robust care and maintenance plans are in place.

11.1.3.6 Access Points to the Underground Reserve and ventilation shafts

Any overburden material extracted during operation that was stockpiled will be used to rehabilitate the incline shafts once mining is complete. The following rehabilitation actions should be followed:

11.1.3.6.1 Underground Access Portals

- Remove infrastructure and conveyors associated with the underground access portals;

- Seal all underground access portal openings with a concrete plug and according to engineering requirements;
- Backfill stockpiled overburden material and stormwater berm material into the incline portal;
- Shape the area to create a gently sloping, free-draining topography. Re-instate natural drainage lines to limit erosion and sediment build up within local river courses;
- Appropriate topsoil should be replaced (all usable topsoil stripped from these areas should be placed back in these areas) in all rehabilitated areas. This must be included in the monitoring programme;
- Topsoil should be fertilised and ripped to 200 mm to reduce compaction. The fertiliser requirements can only be determined once a fertility assessment is carried out at the proposed project site;
- Reseed with grasses listed in Table 11-3 and improve species diversity by planting species listed Table 11-4. Additionally, replant species that were relocated due to mining construction;
- Remove alien invasive plants (see Section 11.1.3.13.2 for more detail);
- Prevent access of people/machinery/vehicles/grazing animals on newly rehabilitated land to allow regeneration of vegetation and reduce erosion; and
- Ensure that robust care and maintenance plans are in place.

11.1.3.6.2 Ventilation Shafts

- Remove all vent shaft related infrastructure;
- Cap shaft with engineering requirement seal (6.1 m diameter)
- Appropriate topsoil should be replaced to a minimum of 300 mm thick in all rehabilitated areas. This must be included in the monitoring programme;
- Topsoil should be fertilised and ripped to 200 mm to reduce compaction. The fertiliser requirements can only be determined once a fertility assessment is carried out at the proposed project area;
- Reseed with grasses listed in Table 11-3 and improve species diversity by planting species listed Table 11-4. Additionally, replant species that were relocated due to mining construction;
- Remove alien invasive plants (see Section 11.1.3.13.2 for more detail);
- Prevent access of people/machinery/vehicles/grazing animals on newly rehabilitated land to allow regeneration of vegetation and reduce erosion; and
- Ensure that robust care and maintenance plans are in place.

11.1.3.7 Office Complex (change house, workshop, offices)

Infrastructure such as the offices, administration buildings and workshops will require the following actions during the Closure, Decommissioning and Rehabilitation Phase:

- Infrastructure, including foundations, access roads to the buildings etc. should be removed, unless the liability is taken over by another party. If complete infrastructure removal is chosen, the following steps should be followed:
  - 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 in the appropriate waste disposal facility;
- 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. Re-instate natural drainage lines to limit erosion and sediment build up within local river courses;
- Appropriate topsoil should be replaced (all usable topsoil stripped from these areas should be placed back in these areas) in all rehabilitated areas. This must be included in the monitoring programme;
- Topsoil should be fertilised and ripped to 200 mm to reduce compaction. The fertiliser requirements can only be determined once a fertility assessment is carried out at the proposed project area;
- Reseed with grasses listed in Table 11-3 and improve species diversity by planting species listed Table 11-4. Additionally, replant species that were relocated due to mining construction;
- Remove alien invasive plants (see Section 11.1.3.13.2 for more detail);
- Prevent access of people/machinery/vehicles/grazing animals on newly rehabilitated land to allow regeneration of vegetation and reduce erosion; and
- Ensure that robust care and maintenance plans are in place.

11.1.3.8 Three Pollution Control Dams and Associated Water Pipelines

- Desilt the pollution control dams;
- Remove liners – these should be disposed of at the correct hazardous waste disposal facility;
- Doze the dam walls;

- Dismantle dam infrastructure - these should be disposed of at the correct hazardous waste disposal facility;
- Remove supporting plinths for pipeline as well as foundations and other associated infrastructure:
  - The re-usable items should be removed from the site;
  - Remaining structures should be demolished to 1000 mm below surface and the demolition rubble removed; and
  - Soil should be tested for contamination. If contamination is discovered, this soil should be removed and disposed of in the appropriate waste disposal facility.
- 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. Re-instate natural drainage lines to limit erosion and sediment build up within local river courses;
- Appropriate topsoil should be replaced (all usable topsoil stripped from these areas should be placed back in these areas) in all rehabilitated areas. This must be included in the monitoring programme;
- Topsoil should be fertilised and ripped to 200 mm to reduce compaction. The fertiliser requirements can only be determined once a fertility assessment is carried out at the proposed project site;
- Reseed with grasses listed in Table 11-3 and improve species diversity by planting species listed Table 11-4. Additionally, replant species that were relocated due to mining construction;
- Remove alien invasive plants (see Section 11.1.3.13.2 for more detail);
- Prevent access of people/machinery/vehicles/grazing animals on newly rehabilitated land to allow regeneration of vegetation and reduce erosion; and
- Ensure that robust care and maintenance plans are in place.

11.1.3.9 Aboveground Diesel Storage Tanks, Diesel Generator and Sub-station

- It is assumed that all contamination is removed during operation;
- Remove tank and associated infrastructure from site;
- Demolish concrete bund wall and dispose of contaminated material at a hazardous waste facility;
- 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. Re-instate natural drainage lines to limit erosion and sediment build up within local river courses;

- Appropriate topsoil should be replaced (all usable topsoil stripped from these areas should be placed back in these areas) in all rehabilitated areas. This must be included in the monitoring programme;
- Topsoil should be fertilised and ripped to 200 mm to reduce compaction. The fertiliser requirements can only be determined once a fertility assessment is carried out at the proposed project site;
- Reseed with grasses listed in Table 11-3 and improve species diversity by planting species listed Table 11-4. Additionally, replant species that were relocated due to mining construction;
- Remove alien invasive plants (see Section 11.1.3.13.2 for more detail);
- Prevent access of people/machinery/vehicles/grazing animals on newly rehabilitated land to allow regeneration of vegetation and reduce erosion; and
- Ensure that robust care and maintenance plans are in place.

11.1.3.10 Waste Bins and Site Fencing

- It is assumed these will be removed prior to closure; and
- The footprint area will be ripped and revegetated.

11.1.3.11 Water Treatment Plant and Package Sewage Treatment Plant

- It is assumed that this portable plant will be removed prior to closure;
- Remove the concrete foundation to up to 1 m bgl;
- 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. Re-instate natural drainage lines to limit erosion and sediment build up within local river courses;
- Appropriate topsoil should be replaced (all usable topsoil stripped from these areas should be placed back in these areas) in all rehabilitated areas. This must be included in the monitoring programme;
- Topsoil should be fertilised and ripped to 200 mm to reduce compaction. The fertiliser requirements can only be determined once a fertility assessment is carried out at the proposed project site ;
- Reseed with grasses listed in Table 11-3 and improve species diversity by planting species listed Table 11-4. Additionally, replant species that were relocated due to mining construction;
- Remove alien invasive plants (see Section 11.1.3.13.2 for more detail);

- Prevent access of people/machinery/vehicles/grazing animals on newly rehabilitated land to allow regeneration of vegetation and reduce erosion; and
- Ensure that robust care and maintenance plans are in place.

11.1.3.12 Topsoil Stockpiles

- Once all usable stockpiled topsoil has been replaced onto the rehabilitated areas the topsoil stockpile needs to be rehabilitated. The correct topsoil should be replaced to a minimum of 350 mm thick in all rehabilitated areas (300 mm is required for an end land use of grazing and the additional 50 mm allows for some compaction – if an agricultural land use is expected, then additional topsoil will need to be replaced). This must be included in the monitoring programme;
- Topsoil should be fertilised and ripped to 200 mm to reduce compaction. The fertiliser requirements can only be determined once a fertility assessment is carried out at the proposed project site;
- Reseed with grasses in Table 11-3, replant species that were stored in the nursery as well as species that were grown in the nursery;
- Remove alien invasive species;
- Prevent access to allow regeneration of vegetation; and
- Ensure that robust care and maintenance plans are in place.

11.1.3.13 Revegetation of All Areas in Decommissioning Phase

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 within the Eastern Highveld Grassland and Soweto Highland Grassland vegetation types as described by Mucina and Rutherford (2006) in the Grassland Biome. Proposed surface infrastructure on Mooivley East and Hendrina South would be situated on land that is considered to be of moderate

ecological sensitivity, whereas infrastructure on Mooivley West is considered to be predominantly of low ecological sensitivity with small portions of moderately ecologically sensitive land. All 3 sets of infrastructure border closely on highly ecologically sensitive land so it is imperative that the infrastructure footprint is kept to a minimum and impacts are reduced as much as possible so as to have a minimal impact on surrounding vegetation.

11.1.3.13.1 Seeding and Planting

Due to the sensitivity of the site, it is recommended that a higher diversity of species be planted and that effort is made to source the recommended indigenous species. Table 11-3 is the grass seed mix advised for the rehabilitation areas of the proposed project site whilst Table 11-4 lists species characteristic of Eastern Highveld Grassland that can be planted on site to boost species richness.

All sites associated with the surface infrastructure are delineated as Eastern Highveld Grassland. More specifically, *Eragrostis*-dominated Grassland was the most encountered vegetation type. 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 11-3). However, some grass species indicated in Table 11-4 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 11-4. A nursery is recommended to propagate these plants.

Importantly, species such as *Aloe ecklonis, Crinum bulbispermum, Eucomis autumnalis,* and other plant species of special concern (

Table 11-5) that should be removed prior to mining must now be transplanted back on site during rehabilitation.

Table 11-3: 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	Fingergrass	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 11-4: 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, Seriphium plumosa*

Table 11-5: Plant Species of Special Concern

Species	SA Red List	Provincial List	CITES	Recorded on site
Aloe ecklonis	LC	x	II	x
Aspidoglossum xanthosphaerum	VU	-		
Crinum bulbispermum	Declining	x		x
Gladiolus crassifolius	LC	x	-	
Gladiolus robertsoniae	NT	x	-	

Species	SA Red List	Provincial List	CITES	Recorded on site
Eucomis autumnalis	Declining	x		x
Haemanthus humilis subsp. hirsutus	-	x	-	x
Hypoxis hemerocallidea	Declining	-		
Pachycarpus suaveolens	VU	-		
Satyrium sp.		x		x
Nerine gracilis	VU	-		
Zantedeschia pentlandii	VU	-		

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).

11.1.3.13.2 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 (underground), the majority of actions 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. Table 11-6 provides a summary of actions required per area in all the phases.

Table 11-6: Summary of Rehabilitation Actions per Area per Phase

Target Area	Main Actions
Construction Phase	
Overburden and Product Stockpiles	Prepare area as a Class C landfill with correct liner etc. 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	
All areas	Progressive rehabilitation is not possible due to the nature of the mining method. Rehabilitation is required for the surface infrastructure and this is required until the end of life of mine. 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.

Target Area	Main Actions
Rehabilitation, Closure and Decommissioning Phase	
Crushing and Screening Plant	The crushing and screening plant will need to be free from contamination and then decommissioned. 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. 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. Re-instate natural drainage lines and encourage water flow off the facility. Replace topsoil to 300 mm 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.
Office Complex (change house, workshop, offices)	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. 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 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.
Access and Service Roads (with weighbridge)	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 (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.
Overburden and Product Stockpiles	All stockpiled product must be removed. Thereafter, the Class C containment barrier materials should be removed and disposed of in 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.

Target Area	Main Actions
Overland Conveyors	The conveyor belt and its associated infrastructure will need to be removed. 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 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..
Access Points to the Underground Reserve and Ventilation shafts	Infrastructure and conveyors associated with the underground access portals must be removed. Thereafter the underground access portal openings must be sealed with a concrete plug and according to engineering requirements. Stockpiled overburden material and stormwater berm material can then be backfilled into the incline portal. Additionally, all vent shafts related infrastructure must be removed and the shaft must be capped with a concrete seal to engineering specifications. 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.
Pollution Control Dam and water pipelines	Pollution control dams must be desilted if necessary. Thereafter the liners can be removed and disposed of at the correct hazardous waste disposal facility. The dam's walls must be dozed and dam infrastructure demolished and also disposed of at the correct hazardous waste disposal facility. Additionally, supporting plinths for pipeline as well as foundations and other associated infrastructure must be demolished to 1 m below surface and the demolition rubble removed. 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.
Aboveground Diesel Storage Tanks	Remove tank and associated infrastructure from site (it is assumed that all contamination is removed during operation). Thereafter, demolish concrete bund wall and dispose of contaminated material at a hazardous waste facility. 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. Replace topsoil to 350 mm 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
Waste bins and Site fencing	Waste bins and fencing to be removed from site. If any concrete foundations were constructed, these must be removed up to 1m below ground level. Once the site has been cleared of all infrastructure and rubble and no contamination is present, the land should be reshaped, if necessary, to create a gently sloping, free-draining topography. Replace topsoil to 350 mm 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 generator and sub-station	Remove generator and sub-station and associated infrastructure from site (it is assumed that all contamination is removed during operation). Thereafter, demolish concrete bund wall and dispose of contaminated material at a hazardous waste facility. 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. 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.
Topsoil Stockpiles	Replace correct topsoil 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.
Water Treatment Plant	It is assumed that this portable plant will be removed prior to closure. Thereafter the concrete foundation must be removed up to 1m below ground level. 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. 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.
Package Sewage Treatment Plant	Remove Package Sewage Treatment Plan and associated infrastructure from site (it is assumed that all contamination is removed during operation). Thereafter, demolish concrete bund wall and dispose of contaminated material at a hazardous waste facility. 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. 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.

11.2 Threats, Opportunities and Uncertainties

The information that was utilised to formulate this report was based on desktop information, baseline information gathered by specialists and predictive modelling. Based on the current level of information available the following additional work should be undertaken:

- Ongoing surface water and groundwater quality monitoring during the operational phase to determine trends and to monitor changes in water quality over time. This will aid in determining 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;
- Assessment of water treatment options during the operational phase of the mine, including an assessment on both active and passive forms of treatment;
- 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;
- Subsidence monitoring and predictive modelling to determine if subsidence will occur and to what extent and then adopt the required mitigation measures in order to reduce the potential level of the impact that could occur; and
- Adopting closure recommendations as identified in the respective specialist reports, with particular emphasis on social, water and biodiversity related aspects.

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 undertake such rehabilitation.

The mine closure schedule addresses the timing of rehabilitation and closure activities performed during the decommissioning and post-closure phases for a particular operation. As a result of the type of mining that is undertaken (underground mining), it is anticipated that rehabilitation and closure will only be undertaken at the end of mining (end of the LoM).

Based on this assumption and the type of mining it is unlikely that any rehabilitation (annual) will be undertaken during the LoM. Areas may be available during the construction phase that may require rehabilitation, such as construction laydown areas and these could be

rehabilitated after the construction phase. 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

Refer to contents contained within the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the Proposed Hendrina Underground Coal Mine, Mpumalanga (Digby Wells, 2016). In summary refer Figure 13-1 which indicates the Organisational Structure related to the Health Safety and Environment (HSE) Division.

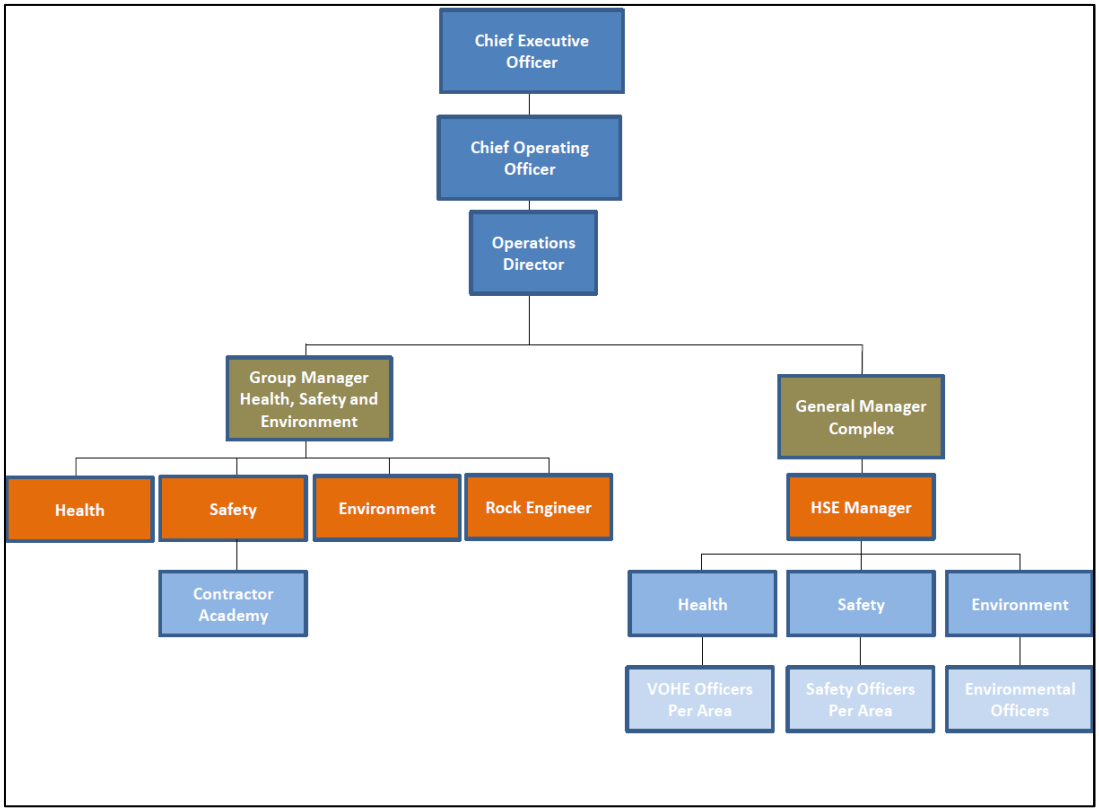

Figure 13-1: HSE Organisational Strucutre

13.2 Responsibilities

HSE is the responsibility of management, at both the corporate and complex/operations levels, and all personnel on site, including contractors. Specific roles and accountabilities for HSE and the elements are contained within the HSE Policy and specific roles are included in job descriptions. Performance against HSE roles and responsibilities and specific performance indications are assessed as part of annual performance appraisals of employees.

13.3 Training and Capacity Building

Training is done in a centralised manner and all training is done through the Group Training Centre (GTC) where each line manager is responsible for the development of their own employees. The GTC is responsible for the co-ordinating and maintaining records of all training undertaken by employees and contractors.

Umcebo will provide the necessary tools and training for its employees and contractors to enable the effective implementation and maintenance of the HSE Management System. Training forms an integral part of any management system and is required at both the Group and Site Levels. It is the means by which personnel are informed of the components of the system and how it is to be implemented and their responsibilities with regards to the management of the HSE.

HSE awareness training will be conducted as part of the individual development plan and induction done by the GTC and will incorporate the following:

- Corporate policies;
- Regional policies;
- Relevant legislation and other requirements;
- HSE management system;
- Objectives and targets;
- Responsibilities; and
- Other topics as required.

At site level, specific training on specific roles and responsibilities will be determined to address matters such as major legislation changes or if other significant issues arise and the training will be done at the GTC.

Training will be competency based, with programmes revised regularly to ensure they continue to meet the requirements of the HSE Management System. All business units shall have a programme to ensure that all personnel and contractors working on the site are

adequately trained with regards to HSE awareness. This shall be facilitated through general induction, visitor's induction and other HSE awareness training as required.

A process for assessing the competence of all personnel with regard to HSE awareness and roles and responsibilities shall be developed and implemented. This will include planned task observations for the assessment of competence.

Individual development and training programmes hall be developed through the HSE Development Committee and progress tracked against the training matric of each employee.

14 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 14-1 provides the respective environmental relinquishment criteria.

Table 14-1: 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 and physical properties analysis to determine soil quality	Results of soil quality report and erosion monitoring report

Environmental Aspect	Closure criteria	Monitoring Requirement	Reporting Requirement
Safety	Ensure shafts have been appropriately sealed and capped and appropriate signage erected.	Visual inspections and sign off report by a registered engineer.	Signed off report by registered engineer.

15 Financial Provision

As part of the EIA, Digby Wells calculated the financial provision for Hendrina on the new financial provision regulations. During the EIA process Glencore requested that the financial provision should be calculated in line with the methodology applied to other Glencore operations as previously approved by DMR and which follows the DMR methodology.

The financial provision is done in accordance with the requirements of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) as amended[3] and associated regulations.[4] These Regulations provide that the holder of a mining right must make full financial provision for rehabilitation of negative environmental impacts. The methodology used was based on the Department of Mineral Resources (DMR) *"Guideline Document for the Evaluation of the Quantum of Closure- related Financial Provision provided by a Mine"* (DME, 2005), as per the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA).

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. This assessment of the financial provision did not address any of the requirements of these promulgated regulations.

In terms of the new Financial Provision Regulations, a holder will have 39 months to assess, review and adjust the sum of the financial provision in accordance with Regulation 9 and 11. Failure to do so will mean that the existing approved financial provision will lapse after 45 calendar days after the lapsing of the 39 month period. Thus the implementation date is extended to February 2019.

[3] Previously, closure methodology was prescribed in Section 41 (1) of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) and its Regulations, but these provisions have been repealed. Section 24P in NEMA as amended provides that the holder of a mining right must make financial provision for rehabilitation of negative environmental impacts arising from mining activities

[4] Environmental Impact Assessment Regulations, 2014, GN R982 in Government Gazette 38282 of 4 December 2014

15.1 Methodology

Glencore requested that the financial provision be calculated in line with the methodology applied to other Glencore operations as previously approved by DMR and which follows the DMR methodology.

For the Hendrina financial provision assessment to be completed, a number of tasks had to be completed.

15.1.1 Cost Methodology

The DMR Guideline format makes use of a set template for which defined rates and multiplication factors are used. The multiplication and weighting factors which ultimately define the rate to be used are determined by amongst others the topography, the classification of the mine according to mineral mined, the risk class of the mine and its proximity to built-up or urban areas.

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

15.1.2 Rates

The 2005 DMR Master Rates published by the DMR are no longer accurate. The 2005 rates have therefore been escalated with CPI% that was provided by Glencore. Table 15-1 displays the escalation percentages used and Table 15-2 display the rates that were supplied by Glencore and reviewed by Digby Wells.

Table 15-1: Glencore Annual Escalation Percentage

Year	Dec 2005	Dec 2006	Dec 2007	Dec 2008	Dec 2009	Dec 2010	Dec 2011	Dec 2012	Dec 2013	Dec 2014	Dec 2015	Predicted Dec 2016
CPI (%)	3.6	5.8	9.0	9.5	6.3	3.5	6.1	5.7	5.8	6.3	5.0	7.5

Table 15-2: Glencore Annual Escalated Rates

Glencore Rates		2016
1	Dismantling of processing plant & related structures (incl. overland conveyors & Power lines)	R 14
2 (A)	Demolition of steel buildings & Structures	R 195
2 (B)	Demolition of reinforced concrete buildings & structures	R 287
3	Rehabilitation of access roads	R 35
4(A)	Demolition & rehabilitation of electrified railway lines	R 338
4(B)	Demolition & rehabilitation of non-electrified railway lines	R 184
5	Demolition of housing &/or administration facilities	R 389
6	Opencast rehabilitation including final voids & ramps	R 198 149
7	Sealing of shafts, adits & inclines	R 105
8(A)	Rehabilitation of overburden & spoils	R 136 061
8(B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	R 169 462
8(C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	R 492 197
9	Rehabilitation of subsidised areas	R 113 931
10	General surface rehabilitation	R 107 783
11	River diversions	R 107 783
12	Fencing	R 123
13	Water management	R 40 982
14	2 to 3 years of maintenance & aftercare	R 13 561

15.1.3 DMR Classification

The DMR Guideline Document classifies a mine according to a number of factors which allows one to determine the appropriate weighting factors to be used during the quantum calculation. The following factors are considered:

- The mineral mined;
- The risk class of the mine;
- Environmental sensitivity of the mining area;
- Type of mining operation; and
- Geographic location.

Once the risk class (Class A, B or C) and the sensitivity of the area where the mine is located (Low, Medium or High) had been determined using the appropriate tables (in the DMR guideline) the unit rates for the applicable closure components were identified

The classification of Hendrina has been summarised in Table 15-3.

It must be noted, however, that of the 18 closure components that exist only 3 are influenced by the risk class and sensitivity, the remaining 15 have a standard multiplication factor, irrespective of the class or sensitivity.

Table 15-3: Classification

Mine	Type of Mineral Mined	Risk Class	Sensitivity	Terrain	Proximity to Urban Area
Hendrina Mooivley West	Coal	A	High	Flat [1]	Peri-Urban [1.05]

15.1.4 DMR Components

Activities associated with Hendrina as per the DMR guidelines are summarized in Table 15-4.

Table 15-4: Activities Associated with Hendrina as per DMR Guidelines

Component	Description	Applicable
1	Dismantling of processing plant & related structures (incl. overland conveyors & Power lines)	Crushing and screening plant; Conveyer
2 (A)	Demolition of steel buildings & structures	Workshop, car ports and tanks
2 (B)	Demolition of reinforced concrete buildings & structures	Concrete slabs for the temporary structures; Water treatment plant; Diesel generator set; Storage of fuel, Lubricants and Explosives
3	Rehabilitation of access roads	Access and haul roads
4(A)	Demolition & rehabilitation of electrified railway lines	Not applicable
4(B)	Demolition & rehabilitation of non-electrified railway lines	Not applicable
5	Demolition of housing &/or administration facilities	Brick walls
6	Opencast rehabilitation including final voids & ramps	Incline portals
7	Sealing of shafts, adits & inclines	2 x Incline shafts and 1 x Ventilation shaft
8(A)	Rehabilitation of overburden & spoils	Topsoil; Overburden Stockpile; Product stockpile
8(B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	Not applicable
8(C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	Pollution control dam
9	Rehabilitation of subsided areas	Not applicable
10	General surface rehabilitation	Plant area, buildings and roads
11	River diversions	Not applicable
12	Fencing	Fences
13	Water management	Components 6, 8(A) and 8(C)
14	2 to 3 years of maintenance & aftercare	All disturbed areas

15.1.5 Assumptions

The assumptions made as part of the Hendrina financial provision assessment are as follows:

- All infrastructure measurements and survey data (footprints, volumes, etc.) provided by Glencore is correct;
- The DMR rates received from Glencore is correct;
- All buildings will be mobile park home type with concrete slabs;
- The closure cost estimate was only calculated for Year 1 of operation. This is only related to Mooivley West;
- The infrastructure and mining areas of Hendrina South and Mooivley East will commence after year 1 of the operation hence not included in the Year 1 closure cost estimate;
- Assume that there will be no subsidence potential at year 1, as no mining would have taken place;
- No due diligence was undertaken to determine whether Glencore is responsible for any other areas not specified in this report;
- The calculations do not account for any value recovered from the sale of plant, steel or other material;
- A 12% allowance has been included for preliminary and general fees. These fees account for the costs required to manage the closure and rehabilitation process as well as provide personnel to monitor and maintain the rehabilitated areas after closure;
- A 10% contingency has been included as there is always the possibility that areas have been left out of the financial provision assessment or that areas may have been overlooked; and
- Maintenance and aftercare costs of rehabilitation have been included.

The cost for rehabilitation and closure of Hendrina that is based on the DMR method of calculation for 1 year of operation is **R 24 461 018** (incl. VAT), see summary in Table 15-5 below.

Table 15-5: Hendrina financial provision summary as per the DMR methodology

DIGBY WELLS ENVIRONMENTAL	Digby Wells Environmental	
	Umcebo Mining (Pty) Ltd, Hendrina, XST3791	
	DMR Closure Cost Assessment, 2016, Rev 1	
	Calculation of the First year Quantum	
Component	**Description**	**Listed and Specified Activities**	**Total**
1	Dismantling of processing plant & related structures (incl. overland conveyors & Power lines)	Crushing and screening plant 0.2ha x 10m height (Activity 21, GNR 984); Conveyer - 2.5km in length and assumed height of 2m and width of 1m totalling 5000 m3 [Activity 17, 7&8, GNR984 and GNR985]	R 1 161 592
2 (A)	Demolition of steel buildings & Structures		R 484 475
2 (B)	Demolition of reinforced concrete buildings & structures	Concrete slabs for the following temporary structures: Office area - 4.9ha; Sewage treatment plant - 22m2 (Activity 25, GNR 983); Water treatment plant - 22m2; Diesel generator set - 32m2 (Activity 2, GNR 983); Storage of fuel, Lubricants and Explosives - 366m2 (Activity 4, GNR 984)	R 4 409 678
3	Rehabilitation of access roads	Access road combined length of 7.2km and an average width of 13m (Activity 24, GNR 983)	R 3 325 853
4(A)	Demolition & rehabilitation of electrified railway lines		R 0
4(B)	Demolition & rehabilitation of non-electrified railway lines		R 0
5	Demolition of housing &/or administration facilities		R 1 016 971
6	Open pit rehabilitation including final voids & ramps	Incline portals 0.5ha (Activity 17, GNR984)	R 148 612
7	Sealing of shafts, adits & inclines	2 x Incline shafts - 0.5ha each (Activity17, GNR 984); 1 x Ventilation shaft - 0.25ha (Activity 12, GNR 985)	R 296 972
8(A)	Rehabilitation of overburden & spoils	Topsoil - 3ha; Overburden Stockpile - 1ha; Product stockpile - 3.66ha (Activity 6 and 17, GNR 984)	R 1 042 106

DIGBY WELLS ENVIRONMENTAL		Digby Wells Environmental	
		Umcebo Mining (Pty) Ltd, Hendrina, XST3791	
		DMR Closure Cost Assessment, 2016, Rev 1	
		Calculation of the First year Quantum	
Component	**Description**	**Listed and Specified Activities**	**Total**
8(B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)		R 0
8(C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	PCD - 0.6ha (Activity 6, GNR 984)	R 295 318
9	Rehabilitation of subsided areas		R 0
10	General surface rehabilitation		R 3 161 816
11	River diversions		R 0
12	Fencing		R 747 579
13	Water management		R 369 211
14	2 to 3 years of maintenance & aftercare		R 290 037
Total cost + Weighting Factor 2			**R 17 587 732**
12% Preliminary and General			R 2 110 528
10% Contingency			R 1 758 773
Total (Excl. VAT)			**R 21 457 033**
VAT (14%)			R 3 003 985
Grand Total (Incl. VAT)			**R 24 461 018**

15.2 Recommendations

Digby Wells recommends the following:

- A material balance should be completed to determine whether sufficient rehabilitation material (i.e. topsoil) is available; and
- The financial provision figures need to be updated on an annual basis as per the requirement of the NEMA. This will ensure that costs become more accurate over time and will reflect current market conditions.

16 Monitoring, Auditing and Reporting

16.1 Auditing Plan

The auditing requirements have been summarised in Table 16-1 below.

16.2 Reporting Requirements

The reporting requirements have been summarised in Table 16-1 below.

16.3 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.

The following items should be monitored continuously:

- Topography
  - Alignment of actual final topography to agreed planned landform.
- Soils
  - Depth of topsoil stripped and placed;
  - Chemical, physical and biological status of replaced soil; and
  - Erosion status.
- Water
  - Surface drainage systems and surface water quality; and
  - Groundwater quality at agreed locations.
- Vegetation
  - Vegetation basal cover;

- Species diversity; and
- Alien Invasive species.

- Other:
  - Faunal re-colonisation (Sherman and pitfall trapping); and
  - Proportion of land that has been fully rehabilitated.

16.3.1 Final Topography

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

16.3.2 Soils

16.3.2.1 Depth of Topsoil Stripped and Replaced

The recovery and effective use of the usable topsoil available is very important. It is also important to undertake regular reconciliation of the volumes stripped, stockpiled and returned to the rehabilitated areas. A topsoil balance can be used to keep track of soil resources. The sensitivity of the soils on site makes this section vital for successful rehabilitation.

16.3.2.2 Chemical, physical and biological status of replaced soil

A final rehabilitation performance assessment should be done and information should be adequate for closure applications that involve:

- Assessment of rehabilitated soil thickness and soil characteristics by means of auger observations using a detailed grid;
- Erosion occurrences;
- Soil acidity and salt pollution analyses (pH, electrical conductivity and sulphate) at 0-250 mm soil depth every 10 ha; and
- Fertility analysis (exchangeable cations K, Ca, Mg and Na and phosphorus) every 16 ha (400 x 400 m).

16.3.2.3 Erosion

Erosion monitoring of rehabilitated areas should be undertaken and zones with excessive erosion should be identified. Erosion can either be quantified or the occurrence there-of simply recorded for the particular location.

16.3.3 Water

16.3.3.1 Surface Drainage Systems

The functionality of the surface water drainage systems should be assessed on an annual basis. This should preferably be done after the first major rains of the season and then after any major storm. An assessment of these structures will ensure that the drainage on the recreated profile matches the Rehabilitation, Decommissioning and Mine Closure Plan as well as to detect early on when any drainage structures are not functioning efficiently. These can then be repaired or replaced before it causes significant erosion damage.

16.3.3.2 Ground water

The groundwater levels and quality should be measured and monitored in a similar way to the surface water to determine the impact of the mining activities on the groundwater resources. A hydrogeologist, together with the relevant authorities, should determine the locations of the monitoring boreholes. The monitoring frequency will be approved by the regulator.

16.3.4 Vegetation

16.3.4.1 Basal Cover

Basal cover refers to the proportion of ground at root level which is covered by vegetation and by the rooting portion of the cover plants. The line-transect (or the quadrat bridge) method can be used to establish sampling positions. A target of at least 15 % basal cover should be set for fully established vegetation. It is important to note the difference between basal cover and canopy cover, shown in Figure 16-1.

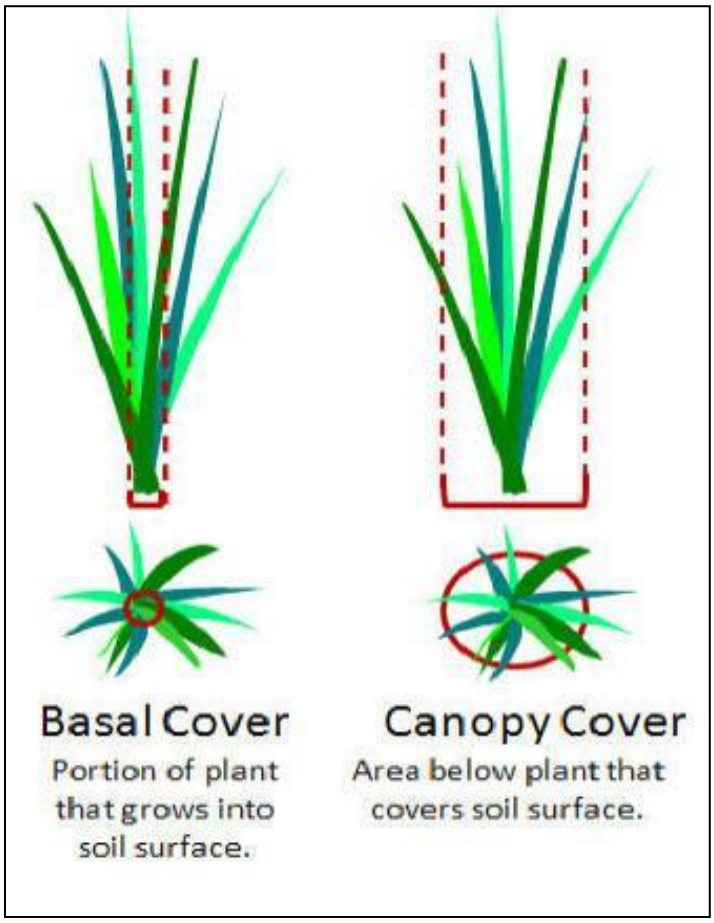

Figure 16-1: Diagram Comparing Basal Cover and Canopy Cover

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

16.3.4.2 Species

Biodiversity assessments and surveys should be undertaken by external experts to establish the full range of plants that have become established. Summer and winter samplings should be done during these assessments. These rehabilitated areas are to remain as “No Go” areas initially to allow recolonization of the vegetation and all livestock animals must be kept out. Ensure continual monitoring and maintenance. Basal cover should be 10-15 %. Assessments should be carried out after each growing season. Bare areas of >4 m^2 need to be reseeded with the grass species in Table 11-3.

16.3.4.3 Alien Invasive Plant Monitoring

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

- Annual surveys, aimed at updating the alien plant list and establishing and updating the invasive status of each of the alien species, should be carried out (can be done by Hendrina staff); and
- Follow-up control of alien plant seedlings, saplings and coppice regrowth is essential to maintain the progress made with initial control work, and to prevent suppression of planted or colonizing grasses. Before starting new control operations on new infestations, all required follow-up control and rehabilitation work must be completed in areas that are originally prioritized for clearing and rehabilitation.

Table 16-1: Monitoring Plan and Audit Requirements

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)
Flora	Soil disturbance	Establishment of alien plant species	Alien plant monitoring	Qualified botanist	Quarterly monitoring for two years	Monitoring
Dust	Operation and decommissioning	Blasting, drilling, hauling, plant operation, demolition	Dust monitoring using the ASTM Method. Monitoring must meet the South African National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) Dust Control Regulations (2013).	A designated air quality officer to collect data/analyse and reporting to regulatory authorities on compliance.	Monthly at existing locations where baseline dust deposition data were collected (2016)	Monitoring
			Continuous PM_{10} monitoring. Monitoring must meet the South African National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) Dust Control Regulations (2013).	A designated air quality officer to collect data/analyse and reporting to regulatory authorities on compliance.	At a sensitive receptor location (i.e. Hendrina Community)	Monitoring
			Passive sampling of gases: SO_2 and NO_2. Monitoring must meet the South African National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) Dust Control Regulations (2013).	A designated air quality officer to collect data/analyse and reporting to regulatory authorities on compliance.	Existing dust monitoring locations where baseline data were collected	Monitoring and Reporting
Groundwater	All activities	Groundwater quality	▪ Macro Analysis i.e. Ca, Mg, Na, K, SO4, NO_3, F, Cl; ▪ Initial full suite metals and then Al, Fe, Mn and other metals identified according to results of the initial analyses; ▪ pH and Alkalinity; and TDS and EC.	Samples should be collected by an independent groundwater consultant, using best practice guidelines and should be analysed by a SANAS accredited laboratory.	It is suggested that quarterly samples be collected, extending up to five years post closure and based on the results. Post closure monitoring should continue until a sustainable situation is reached and after it has been signed off by the authorities.	Monitoring and Reporting
	All activities	Groundwater levels	Groundwater levels must be recorded using an electrical contact tape or pressure transducer, to detect any changes or trends in groundwater elevation and flow direction.	Samples should be collected by an independent groundwater consultant, using best practice guidelines and should be analysed by a SANAS accredited laboratory.	It is suggested that quarterly samples be collected, extending up to five years post closure and based on the results. Post closure monitoring should continue until a sustainable situation is reached and after it has been signed off by the authorities.	Monitoring and Reporting

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)
Aquatics	All activities	Degradation of aquatic resources	The monitoring of river reaches associated with the various mining right areas should be completed. Important areas to consider are the reaches downstream of the mining rights. The monitoring of these reaches can provide information on whether the proposed project is having an impact on water resources.	The environmental officer is responsible for the monitoring of aquatic ecology. The responsible person conducting the monitoring needs to be professionally registered, SASS5 accredited and hold relevant qualification in biological or water sciences.	Bi-annual (twice a year)	Monitoring
Soils	Post-closure	Erosion, loss of soil fertility, compaction	The rehabilitated area must be assessed for compaction, fertility, and erosion and must meet the Chamber of Mines Guidelines	The soils must be assessed by a soil specialist yearly (during the dry season so that recommendations can be implemented before the start of the wet season) so as to correct any nutrient deficiencies.	The rehabilitated area must be assessed once a year for compaction, fertility, and erosion during the dry season	Monitoring
Nosie	Construction and operation	Noise disturbance	▪ Sampled in accordance with the National Noise Control Regulations in conjunction with the SANS 10103:2008 guidelines; ▪ Noise measurements should be taken for a period not less than 10 min at each location	Environmental Coordinator	Monitoring to be conducted on a quarterly basis. Noise levels propagating from the project should not measure above 45 dBA during the daytime and 35 dBA during the night time at any of the monitoring locations. A report must be compiled after the monitoring has been carried out then submitted to management to ascertain compliance with the required regulations and standards.	Monitoring and Reporting
Visual	Construction and operation	Dust	Dust monitoring and management as per the Air Quality Monitoring Plan (reducing the dust on site will reduce the visual impact of dust).	Environmental Coordinator	Monthly. Grievances from visual receptors must be monitored and addressed through a Grievance Mechanism.	Monitoring and Reporting

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)
Wetlands	All activities	General - All impacts and threats to wetlands predicted or not.	Wetlands should be monitored through all phases of the project. The wetlands should be demarcated in the field that are at particular risk of impacts and these area must be monitored regularly. The natural wetlands of high and very 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 natural pans and the Klein Olifants channelled valley bottom wetland are the most important here. The functional aspects of the wetland should be assessed such as floral diversity, water quality, use of wetland by faunal species (notably Flamingos), erosion and more. Monitoring for all risks at highlighted in Wetland Assessment Report including uncontrolled erosion, hydrocarbon spills etc. must be done and remediated where needed.	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
	Removal of infrastructure and surface rehabilitation.	Similarly to the construction phase, the removal of the infrastructure will lead to potential negative impacts on the integrity of the natural wetland systems.	Wetland monitoring should: Ensure that the wetlands are demarcated in the field and that no impact is extended beyond the infrastructure area; monitor for all risks at highlighted in Wetland Assessment Report including uncontrolled erosion, hydrocarbon spills etc. and remediate; ensure proper handling and storage of wetland soils.		Rehabilitation activities should be monitored monthly by a wetland specialist.	Monitoring

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)
	Hauling, Conveying and Stockpiling of Coal	The movement of coal over the channelled valley bottom that is highlighted as an NFEPA wetland and is a tributary to the Klein Olifants has a significant threat to water quality and coal fines that will be transported from the conveyor into the surrounding environment.	Monitoring of the operation of the conveyor over a sensitive wetland 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 conveyor must be monitored internally with the maintenance regime. Specialist monitoring can be undertaken annually to ensure no residual impact is being experienced.	Monitoring
	Underground Blasting and Mining	Undermining of wetlands leading to hydrological and geomorphic changes to the functioning of the ecosystem; particularly related to groundwater impacts.	As mining progresses, wetlands should be monitored for evidence of loss of functionality due to groundwater changes. Monitoring for all risks at highlighted in Section Wetland Assessment Report including uncontrolled erosion, hydrocarbon spills etc. must be done and remediated where needed.		Undermined wetlands should be monitored annually	Monitoring
	Site Clearance within wetlands and their buffer areas	Removal of wetland soils and vegetation; totalling 18.7 ha.	Wetland monitoring should: Ensure that the wetlands are demarcated in the field and that no impact is extended beyond the infrastructure area; monitor for all risks at highlighted in Wetland Assessment Report including uncontrolled erosion, hydrocarbon spills etc. and remediate; ensure proper handling and storage of wetland soils.		Construction activities should be monitored monthly by a wetland specialist.	Monitoring
	Construction of general infrastructure within wetlands and their buffer areas	Industrial activity within a natural ecosystem is a negative impact to habitat integrity.				Monitoring
	Construction of Overland Conveyor across and NFEPA channelled valley bottom wetland	Heavy machinery working with wetland channel and surrounds impacting upon soil, vegetation disturbing fauna.	Monitoring of the construction over this channelled valley bottom must ensure that all activities are done according to the detailed design and are implemented with the least possible impacts to the wetlands. Monitoring for all risks at highlighted in Wetland Assessment Report including uncontrolled erosion, hydrocarbon spills etc. and remediate; ensure proper handling and storage of wetland soils.			Monitoring

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)
Audit Reports	Auditing against the conditions outlined within the approved EMP and EA (EMP Performance Assessment)	EMP Conditions	To determine compliance to EMP conditions	Environmental Officer/Independent Third Party	Annual Performance Assessment	Audit Report
	Annual update of financial provision	Financial Provision Update.	To ensure that the mine is compliant with the financial provision regulations and that there is sufficient funding provided by the mine for closure and rehabilitation cost and meets the requirements as stipulated in Regulation 11 (1) of the New Financial Provision Regulations.	Environmental Officer/Independent Third Party	Annually and must be audited by an independent auditor.	Financial Provision Report submitted to the DMR

16.3.5 Motivation for Amendments

No motivation for amendments to the final Rehabilitation, Decommissioning and Mine Closure Plan have been made as a result of the previous auditing period as this is a greenfield site and no construction has taken place as yet.

17 Closing Statement

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 Umcebo in carrying out successful rehabilitation.

It is recommended that the following actions be taken prior to the update of the Rehabilitation, Decommissioning and Mine Closure Plan:

- Care must be taken when stripping and stockpiling soil due to the sensitive nature of the soils on site;
- Soil stockpile locations need to be determined and sited away from sensitive landscapes, such as pans/wetlands;
- Implement the measures as outlined in the specialist studies to minimise the risk to surface/groundwater contamination from the operations during rehabilitation and closure;
- Further trials should be conducted during the operational phase to determine other rehabilitation options that could be considered for the closure and rehabilitation of the disturbed site;
- There should be a constant interaction and communication with local stakeholders, so that their requirements can be taken into consideration in the rehabilitation process;
- Regular audits should be undertaken by a soil scientist during the soil stripping process. This will guarantee that soils are stripped and stockpiled correctly;
- Regular monitoring of the groundwater should take place in order to determine if there is a potential for mine affected water to occur;
- Regular update of the ERA as more information becomes available;
- Invasive alien plants should be removed on an ongoing basis; and
- Monitoring and maintenance of the rehabilitated areas should take place on an annual basis for at least three years after closure.

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Appendix A: Risk Assessment Report

DIGBY WELLS
ENVIRONMENTAL

DMR Reference Number:

MP30/5/1/2/2/10129MR

Proposed Development of an Underground Coal Mine and Associated Infrastructure, near Hendrina, Mpumalanga Province

Environmental Risk Report

Project Number:

XST3791

Prepared for:

Umcebo Mining (Pty) Ltd

September 2016

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This document has been prepared by Digby Wells Environmental.

Report Type:	**Environmental Risk Report**
Project Name:	**Proposed Development of an Underground Coal Mine and Associated Infrastructure, near Hendrina, Mpumalanga Province**
Project Code:	**XST3791**

Name	Responsibility	Signature	Date
Leon Ellis	Report Compiler		August 2016
Renée van Aardt	Report Review		August 2016

DECLARATION OF INDEPENDENCE

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 Umcebo Mining (Pty) Ltd, other than fair remuneration for work performed, specifically in connection with the proposed development of an underground coal mine and associated infrastructure, located near Hendrina, Mpumalanga Province.

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

EXECUTIVE SUMMARY

Umcebo Mining (Pty) Ltd (Umcebo), a subsidiary of Glencore Operations South Africa (Pty) Ltd (Glencore) is proposing the development and operation of a new underground coal mine with the associated infrastructure at a site situated approximately 22 kilometres (km) south east of Hendrina in the Mpumalanga Province of South Africa (the project).

The project area comprises three underground reserve blocks namely Mooivley East, Mooivley West and Hendrina South. The two Mooivley reserves comprise two shaft areas which will be developed to gain access to the two underground areas whilst the Hendrina South reserve comprises one shaft area.

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 during mine closure were identified and discussed. All unwanted events are listed in Appendix A. The three mining areas (i.e. Mooivley West, Hendrina South and Mooivley East) essentially have the same infrastructure and mining method, thus these areas were grouped together in the risk assessment so as to not duplicate information.

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	CEO
	Highly Intolerable	Short term action required	Senior Management
	ALARP[1]	Heightened Action	Section Manager
	Maintain	Ensure levels of control	Supervisor

Twelve 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).

Three of the unwanted events were ranked as extremely intolerable, four were ranked as highly intolerable and five were ranked as As Low As Reasonably Possible (ALARP) as shown in Table 6-1.

[1] As low as reasonably practicable

The 12 unwanted events were again assessed taking into consideration the current control measures. The residual risks were ranked assuming the control measures are in place and effective. Table 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 2: Residual risk ranking

Area number	Description	Number of unwanted events	Extremely Intolerable	Highly Intolerable	ALARP	Maintain
1	Mooivley West, Hendrina South & Mooivley East	10	2 (2)	3 (3)	5 (5)	0 (0)
2	General	2	1 (0)	1 (0)	0 (1)	0 (1)
Total		**12**	**3 (2)**	**4 (3)**	**5 (6)**	**0 (1)**

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

The potential extremely and highly intolerable risks identified are the following (Table 6-3 in the report provides a full summary):

- Poor groundwater quality – Decanting;
- Legal censure from the decanting of mine affected water;
- Inadequate funds for mine closure;
- Physical surface disturbance/ subsidence (i.e. on-site watercourses and wetlands);
- Poor surface water management of runoff leading to infiltration;
- Soil erosion – rehabilitated areas; and
- Failure to implement the final Land Use Plan (LUP).

The latent risks associated with the proposed project relates to the possible decant of mine affected water and possibility of surface subsidence once operations cease and the mine is closed. This could have a negative impact on surface water resources and sensitive environments in the area.

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1 Introduction

Umcebo Mining (Pty) Ltd (Umcebo), a subsidiary of Glencore Operations South Africa (Pty) Ltd (Glencore) is proposing the development and operation of a new underground coal mine and associated infrastructure at a site situated approximately 22 kilometres (km) south east of Hendrina in the Mpumalanga Province of South Africa (the project). The regional and local setting of the project area is shown in Figure 2-1 and Figure 2-2 respectively.

Umcebo currently holds two Prospecting Rights (PRs), namely, MP 1265 PR and MP 1266 PR, located within the Ermelo Coal Field. The total extent of MP 1265 PR (referred to as Mooivley East and Mooivley West) is 3 923 hectares (Ha) and comprise the following farms and portions:

- Mooivley 219 IS – Potions 2, 4, 5 and Remaining Extent (RE) of the farm;
- Tweefontein 203 IS – Portions 2, 15, 16, 17 and Portion of Portion 14;
- Uitkyk 220 IS – Portions 2 and 3; and
- Orange Vallei 201 IS – Portions 1 and RE of the farm.

The total extent of MP 1266 PR (referred to as Hendrina South) is 2 787 Ha and comprises the following farm and portions:

- Elim 247 IS - RE of the farm;
- Geluksdraai 240 IS – 1 and 2;
- Orpenskraal 238 IS – RE of the farm; and
- Bosmanskrans 217 IS – Potions 1, 3, 4, 6, 8, 9 and RE of the farm.

The project area proposed to be mined (underground) has a combined footprint of 6 714 Ha and is located within the Steve Tshwete Local Municipality (STLM) and Msukaligwa Local Municipality (MLM).

2 Project Description and Background

The project area comprises three underground reserve blocks namely Mooivley East, Mooivley West and Hendrina South. The two Mooivley reserves comprise two shaft areas which will be developed to gain access to the two underground areas whilst the Hendrina South reserve comprises one shaft area. Mooivley West and Hendrina South will be mined at the same time. Once completed, Mooivley East mining activities will commence.

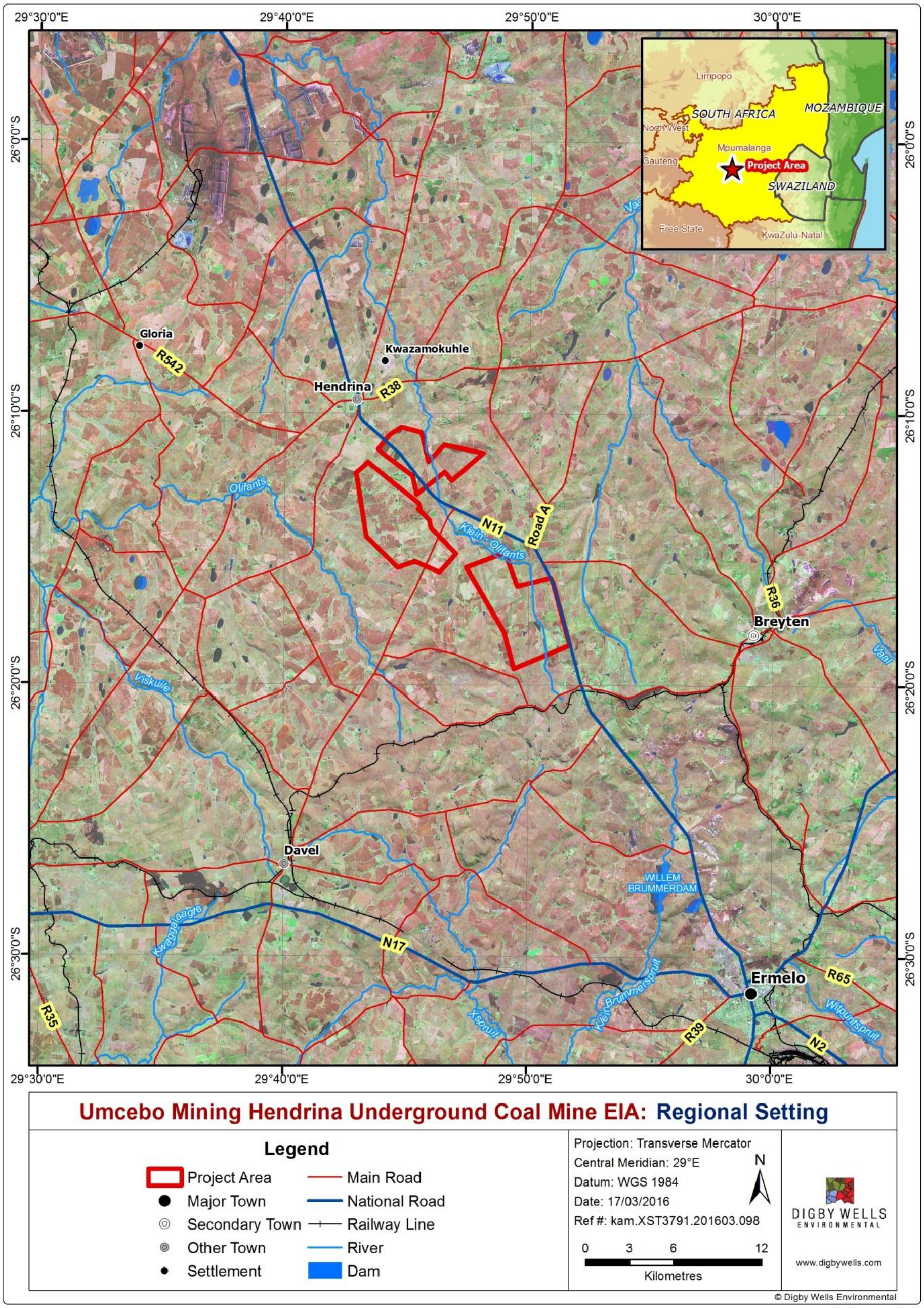


Figure 2-1: Regional Setting

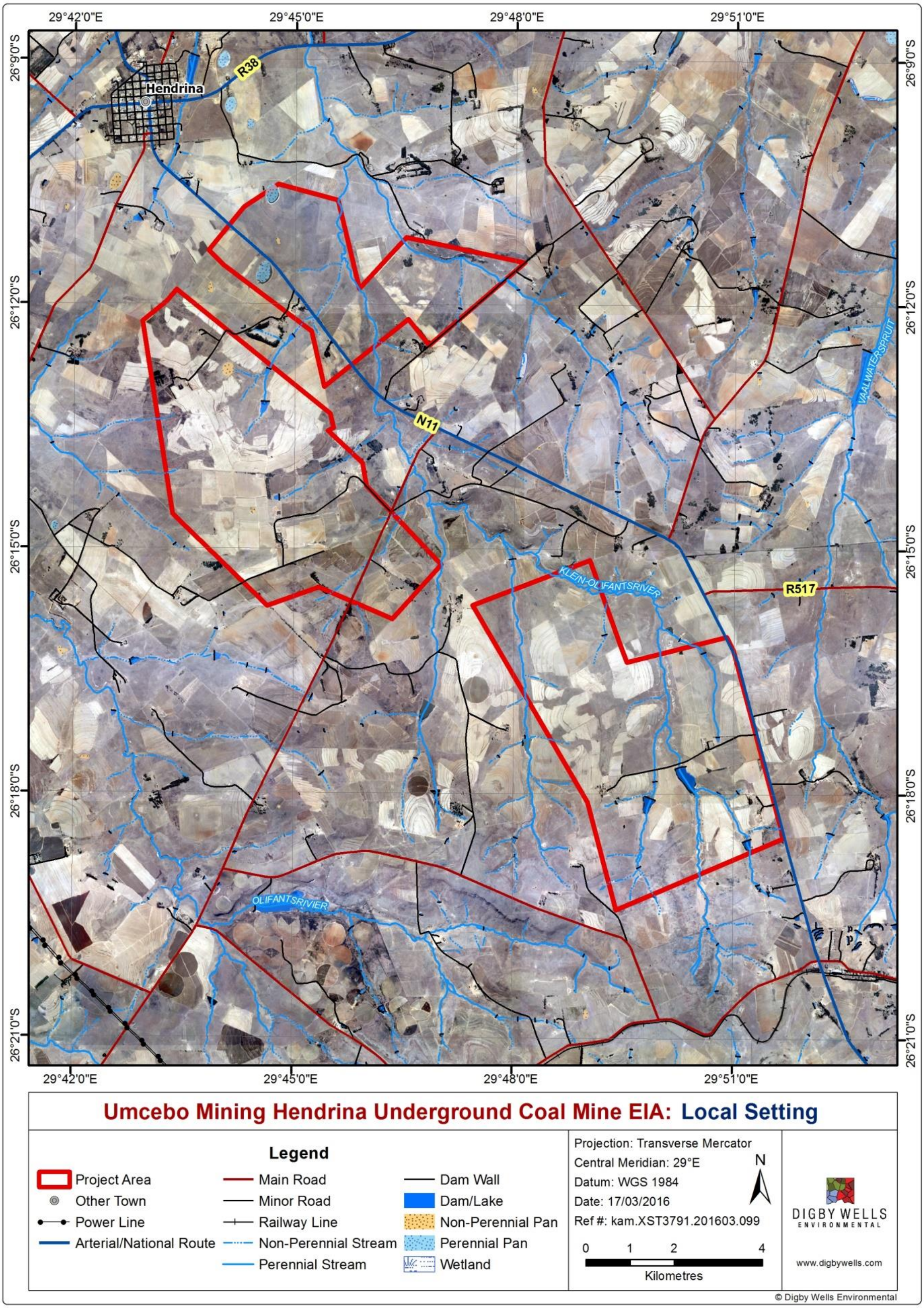


Figure 2-2: Local Setting

2.1 Mineral Resource

The estimated Life of Mine (LoM) will be 30 years[2] for all mining areas with a production rate of 2.4 million tonnes per annum at full capacity, with a total of approximately 78 million tonnes of Run of Mine (ROM). The mine will reach full production within the first four years. The coal deposit is situated within the Karoo Sequence and varies between 32 to 128 metres (m) below ground level (mbgl). The project area is underlain by Ecca Group, sandstone, shale and coal seams of the Vryheid formation which may be intruded by dolerite sills and dykes.

2.2 Mining Method

Due to the depth of the resource (i.e. 32 m to 128 m), underground mining will be used to access the ore body. Approximately 75 m deep incline shafts (total of three incline shafts for the project) will be constructed to gain access to the underground resource; this will be done through blasting. Holes will be drilled with a mobile drill rig, and holes charged with either packaged explosives or boosters and Ammonium Nitrate Fuel Oil (ANFO).

The proposed mining method for the extraction of coal will be bord and pillar. In mechanised bord and pillar mining, extraction is achieved by developing a series of roadways (bords) in the coal seam connected by splits (cut-throughs) to form pillars and is done through the use of machinery referred to as a continuous miner. These pillars are left behind as part of a primary roof support system. In partial pillar extraction, every alternative pillar is left behind to support the overburden or all the pillars are extracted to allow the roof to collapse in a controlled manner. There is no plan to extract any of the pillars for this project. It is expected that there will be dolerite intrusions and a dyke development section will be deployed for the purpose of mining through these and preparing new mining sections.

Any overburden material extracted will be stockpiled and used to rehabilitate the incline shafts once mining is completed.

2.3 Mine Infrastructure

The proposed mine infrastructure includes the following:

- Crushing and Screening Plant;
- Overburden and Product Stockpiles;
- Access and Service Roads (with weighbridge);
- Overland Conveyors;
- Three Access Points to the Underground Reserve;

[2] The MRA will be made for an initial period of 30 years, the maximum allowed in terms of the provisions of Section 23 of the MPRDA. At the end of this period an application for renewal of the mining right will be made for any remaining reserves.

- Three Ventilation Shafts;
- Office Complex (change house, workshop, offices);
- Three Pollution Control Dams (PCDs) and water pipelines;
- Five Aboveground Storage Tanks for the storage of diesel;
- Three Waste Bins per Shaft;
- Site Fencing located around the Conveyer Belt and each Mining Complex;
- Diesel Generator and Sub-station;
- Water Treatment Plant; and
- Package Sewage Treatment Plant.

3 Expertise of Specialist

The specialist involved in compiling the Environmental Risk Report (ERR) for the proposed project was Leon Ellis.

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 environmental liability assessments, environmental risk assessments and mine closure plans.

4 Objective of Environmental Risk Assessment

The objective of the ERR is outlined in the Financial Provisioning Regulations, 2015 (GN R1147 promulgated on 20 November 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.

5 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 project. 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 5-1 below.

Table 5-1: Risk levels

Colour	Descriptor	Action	Sign-off
	Extremely Intolerable	Immediate Action	CEO
	Highly Intolerable	Short term action required	Senior Management
	ALARP[3]	Heightened Action	Section Manager
	Maintain	Ensure levels of control	Supervisor

The six types of risk have been outlined and included in the risk matrix.[4] These are, in no order of priority:

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

A qualitative Severity and Likelihood Matrix was used during the risk estimation as shown below in Table 5-2.

[3] As low as reasonably practicable

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

The severity and likelihood definitions are provided in Table 5-2. 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.

Table 5-2: 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**	Intolerable	Intolerable	Intolerable	Intolerable	Intolerable	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	Intolerable	Intolerable	Intolerable	Intolerable	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	Intolerable	Intolerable	Intolerable	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	Intolerable	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

6 Risk Analysis Results

Potential unwanted events during mine closure were identified and discussed. All unwanted events are listed in Appendix A. The three mining areas (i.e. Mooivley West, Hendrina South and Mooivley East) essentially have the same infrastructure and mining method, thus these areas were grouped together in the risk assessment so as to not duplicate information.

Twelve 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).

Three of the unwanted events were ranked as extremely intolerable, four were ranked as highly intolerable and five were ranked as ALARP as shown in Table 6-1 below.

Table 6-1: Raw risk ranking

Area number	Description	Number of unwanted events	Extremely Intolerable	Highly Intolerable	ALARP	Maintain
1	Mooivley West, Hendrina South & Mooivley East	10	2	3	5	0
2	General	2	1	1	0	0
Total		**12**	**3**	**4**	**5**	**0**

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 12 unwanted events were again assessed taking into consideration the current control measures. The residual risks were ranked assuming the control measures are in place and effective. Table 6-2 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 6-2: Residual risk ranking

Area number	Description	Number of unwanted events	Extremely Intolerable	Highly Intolerable	ALARP	Maintain
1	Mooivley West, Hendrina South & Mooivley East	10	2 (2)	3 (3)	5 (5)	0 (0)
2	General	2	1 (0)	1 (0)	0 (1)	0 (1)
Total		**12**	**3 (2)**	**4 (3)**	**5 (6)**	**0 (1)**

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

Table 6-3 below gives a summary of the potential extremely and highly intolerable risks identified.

Table 6-3: Summary of Potential Extremely and Highly Intolerable Risks (Raw Risk)

Area	Hazard	Discussion	Primary Risk Category	Risk Rank
Mooivley West, Hendrina South & Mooivley East	Poor groundwater quality – Decanting.	Poor quality groundwater decanting from mining areas impacting on surface water resources and wetlands. Precipitation of salts. Shaft 3 at Mooivley East could potentially decant after closure at a 7 m^3/d and could alter the river quality negatively if not properly managed.	Natural Environment	Extremely Intolerable
Mooivley West, Hendrina South & Mooivley East	Legal censure from the decanting of mine affected water.	Poor quality groundwater decanting from mining affected areas impacting on surface water resources. Fines or civil action.	Legal and Reputational	Extremely Intolerable
General	Inadequate funds for mine closure.	Possible inadequate funds allocated for the mine closure trust fund to meet closure needs.	Financial	Extremely Intolerable

Area	Hazard	Discussion	Primary Risk Category	Risk Rank
Mooivley West, Hendrina South & Mooivley East	Physical surface disturbance (i.e. on-site watercourses and wetlands).	As a result of goafing of underground areas, possibility exists of physical surface disturbance which could lead to surface subsidence and damage to natural environment.	Natural Environment	Highly Intolerable
Mooivley West, Hendrina South & Mooivley East	Poor surface water management of runoff leading to infiltration.	Seepage and leaching contaminants due to ineffective surface water runoff management. Possible poor water quality entering the natural environment.	Natural Environment	Highly Intolerable
Mooivley West, Hendrina South & Mooivley East	Soil erosion – rehabilitated areas.	Erosion of rehabilitated areas such as infrastructure and shaft areas.	Natural Environment	Highly Intolerable
General	Failure to implement the final Land Use Plan (LUP).	Failure to implement the agreed final LUP leading to loss of biodiversity, deterioration of rehabilitated areas, soil pollution and social mobilisation by communities.	Natural Environment	Highly Intolerable

7 Latent Environmental Risks

The latent risks associated with the proposed project relates to the possible decant of mine affected water and the possibility of surface subsidence once operations cease and the mine is closed. This could have a negative impact on surface water resources and sensitive environments such as wetlands in the area. The Klein Olifants River and the associated wetlands are within an important catchment and impacts to this area will have a regional level significance (Wetland Assessment, 2016).

7.1 Groundwater

The information presented here is sourced from the Groundwater Assessment Report (dated August 2016) compiled by Digby Wells as part of the Environmental Impact Assessment (EIA) for the proposed project.

Mining is likely to alter the natural geochemistry by exposing the sulphides for oxygenation. This could result in sulphate contamination as observed in the coal mines in the region where the concentration could reach up to 2500 mg/L.

Contaminant plumes predominantly migrate as a result of advection (i.e. with the flow of the groundwater).

Once the mine is closed and dewatering ceases, groundwater will start to recover to its pre-mining level. Following full recovery (expected to be around 30 years after closure) the contaminants will start to migrate away from the mine site. The contamination plume will be transported with the groundwater but due to the limited hydraulic permeability of the region, the plume is expected to remain in the vicinity of the mine zones. The plume is not expected to reach and contaminate rivers during mine operation or after closure.

Model simulations and hydrostatic calculations show that the mine is likely to decant after closure. The decanting is expected to occur through the proposed Shaft 3 at Mooivley East. None of the other shaft areas are foreseen to decant.

- The decanting will start after 30 years since mine closure at a rate of 7 m^3/d as shown in Figure 7-1; and
- Once the contamination plume 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.

It should be noted that the possibility of subsidence and sinkhole formation has not being considered in the decant simulation. Should sinkholes form at elevations lower than the hydraulic head, decanting is likely to occur at those points as well. Any unsealed exploration boreholes or geological fractures enhanced by mine blasting could also be decant zones if their topographic elevation is lower than the hydraulic head. It is impossible to inform at this moment if and when such structures will be formed. Annual monitoring for subsidence and sinkholes followed by rehabilitation will be required.

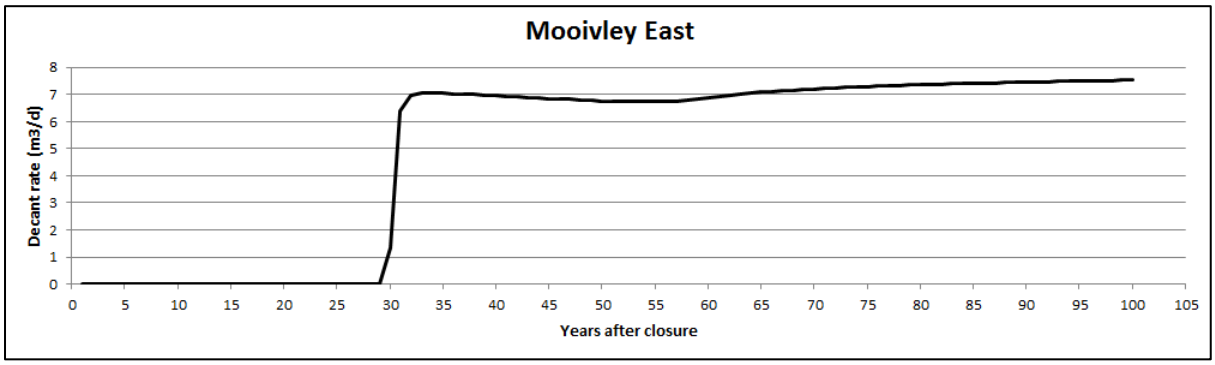


Figure 7-1: Predicted decanting period and rate after mine closure

The following are management objectives for the decommissioning and post-closure phase:

- To minimise or avoid the potential impact by decant on the rivers; and
- To minimise or avoid the groundwater contamination plume migration, as well as potential stream impacts as a result of groundwater base flow.

7.1.1 Management Activities

The following mitigation measures are proposed to minimise the risk of mine decant water negatively impacting the natural environment:

- Capture decanting mine water before joining the streams; treat it and re-introduce it into the streams. As experienced from other coal mines, the decant quality could be up to 2500 mg/L of sulphate;
- Compensation of farmers or communities with impacted rivers;
- Monitoring of groundwater water levels in the weathered and coal seam aquifers;
- If sinkholes from subsidence are formed after closure, they should be rehabilitated as soon as possible to minimise water and oxygen inflow from the atmosphere; and
- Update the numerical model and decant rates annually for the first five years with the monitoring data.

The following mitigation measures are proposed to minimise the risk of the contamination plume negatively impacting the natural environment:

- Groundwater will flow away from the mine footprint if the hydraulic head within the mine is higher than the surrounding elevation. Ensure (through dewatering or decant management) that the hydraulic head in the mine void is always lower than that of the river or the regional head;
- Compensation of farmers with impacted groundwater or mine purchase land;
- Monitoring of groundwater water levels and mine inflow rates; and

- Update numerical model and decant rates annually as aquifer information becomes available.

7.2 Surface Subsidence

This risk relates to the potential for disturbance of the surface as a result of failure underground propagating to surface and impacting on surface topography and the wetlands present on surface. The delineated wetlands constitute 42 % of the three proposed mining right areas and both surface infrastructure and underground mine plan interacts with the wetlands found on site. The current proposed surface infrastructure will directly impact approximately 19 ha of wetland according to the current layout and the underground mine plan currently underlies 897 ha of wetland across all three mining areas, which will range from a depth of 32 m to 128 m (Wetland Assessment, 2016).

This risk exists within the context that Umcebo will apply the duty of care and good engineering practices in the design of the mine layout, section placement and development and the configuration and layout of the longwall sections, the bords and pillars sections and the development of the roof support strategy, with these configuration leading to an appropriate safety factor for the underground workings.

Furthermore, operational controls, including monitoring, to ensure that pillar design is adhered to, will be implemented during the life of the project. Finally, geotechnical assessments will be periodically updated as operational data becomes available to assess whether the safety factor is adhered to and whether the risk profile relating subsidence potential changes.

The remediation of these latent risks cannot be fully addressed at closure as backfilling the underground mining areas is not a viable alternative given the potential health and safety risks incurred during backfilling operations, the fact that some areas would have filled up with water during operations once mining ceased, and most significantly the costs associated with obtaining backfill, trucking it to site and placing it underground would change the economics of the project, making it not feasible to develop the mine.

Once the mine is closed and dewatering ceases, groundwater will start to recover to its pre-mining level. Full recovery is expected to be around 30 years after closure. As a result of groundwater recovery the risk of subsidence does not remain indefinitely. Two effects that reduce the likelihood of failure come into effect. The first is that the water exerts hydrostatic pressure on the roof of the bords as these become buoyant adding support and reducing the probability of failure. Secondly, the water largely displaces the oxygen that is responsible for the oxidisation of the coal in the pillars leading to pillar failure as pillars sprawl.

As the latent risk cannot be mitigated at closure and is an inherent risk, the risk remains as a latent risk after closure, until underground filling occurs.

The risk has been assessed as highly intolerable which is based on the risk assessor assessing the severity/consequence on the natural environment should the risk manifest as being quite severe and the likelihood of that severity occurring as being low.

7.2.1 Management Activities

During the operational, closure and post closure phases, Umcebo should undertake annual Lidar surveys across the mining areas to determine changes in topography which may be associated with subsidence propagating to surface. This will be associated with annual surveys of the wetlands to determine operational impacts.

Should subsidence be detected, those areas should be rehabilitated as soon as is possible to reduce the impact on the natural environment. The detection of subsidence might also require a change in mine design for future mining activities.

8 Cost Estimate

It is recommended that groundwater and wetlands are monitored post-closure for potential impacts as a result of potential decant and subsidence. Long-term water treatment options will need to be investigated by Umcebo to prevent polluted decant water from entering the catchment. At this stage a cost for water treatment has not been considered as it can only be defined once operational monitoring data becomes available.

A cost to monitor groundwater levels and quality has been included. This has been calculated to take place quarterly for five years after mine closure.

The project will have significant negative impacts on the natural wetlands and has the potential to alter the functioning of these systems and compromise their ecosystem services provided.

Given that the geotechnical design is not yet complete, the assumption is that the design will be undertaken to maximise the probability of Stability, which has been assumed to be 95 % as a minimum. This implies that there is a 5 % probability of failure of underground mining areas leading to subsidence on surface.

To assess the potential liability that may arise as a result of underground failure, the total surface area affected by underground mining is 3 016 ha. Of this area, 30 % (897 ha) is occupied by different types of wetlands. Based on the 5 % Probability of Failure, there is the potential 44.85 ha of wetlands which may be affected by underground failure propagating to surface.

The cost of rehabilitating wetland areas is assessed against the Department of Mineral Resources (DMR) Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provisions Provided by a Mine (2005) for subsidence rehabilitation.

The vegetation maintenance and aftercare costs are based on a post implementation period of three years.

A provision has also been included to undertake a Lidar survey of the undermined area every 10 years for the 30 year period until the workings have flooded and the probability of the risks of subsidence is negligible. The objective will be to determine whether there has been any change in surveyed surface topography over the intervening 10 years, which could be attributed to subsidence.

8.1 Summary of Costs

The financial provision estimate in Table 8-1 below is associated with post-closure costs linked to the remediation and management of potential latent environmental impacts associated with the proposed Hendrina Mine. The financial provision estimate is **R 7 972 202 (Excl. VAT).**

Table 8-1: Financial provision for latent environmental impacts

	Digby Wells Environmental
	Umcebo Mining (Pty) Ltd, Hendrina, XST3791 Revision: 0
Area and Description	**End of life 2047**
Monitoring and Maintenance	
Monitoring Costs (Groundwater and Surface water 5 Years, Quarterly)	R 1,461,200
Monitoring Costs (Vegetation 3 Years)	R 29,922
Maintenance Costs (Vegetation 3 Years)	R 1,057,261
Subsidence Maintenance (5% of wetland areas covered by underground mining)	R 4,673,819
Lidar Assessments (every 10yrs for 30yrs after closure)	R 750,000
Total	**R 7,972,202**

9 References

Digby Wells, 2016: Wetland Assessment Report for the Proposed Development of an Underground Coal Mine and Associated Infrastructure, near Hendrina, Mpumalanga Province.

Digby Wells, 2016: Groundwater Assessment Report for the Proposed Development of an Underground Coal Mine and Associated Infrastructure, near Hendrina, Mpumalanga Province.

Appendix A: Unwanted Events

Mine:		Proposed Hendrina Coal Mine	**Project Code:**	XST2791				**Evaluation Year:**	2016			**Evaluators:**	Digby Wells Environmental
Location:		Hendrina, Mpumalanga Province						**Last Modified:**	22/08/2016			**Facilitator:**	Leon Ellis
Area ID	**Area**	**Hazard (Unwanted Event)**	**Discussion of Hazard / Consequence**	**Primary Risk Category**	**Raw Risk**			**Current Controls**	**Residual Risk**			**Possible New Controls**	**Accountability**
					Severity	**Likelihood**	**Risk Rank**		**Severity**	**Likelihood**	**Risk Rank**		
1	Mooivley West, Hendrina South & Mooivley East	Poor groundwater quality – Decanting.	Poor quality groundwater decanting from mining areas impacting on surface water resources and wetlands. Precipitation of salts. Shaft 3 at Mooivley East could potentially decant after closure at a 7 m^3/d and could alter the river quality negatively if not properly managed.	Natural Environment	A	J	Extremely Intolerable	Identify areas of possible decant.	A	J	Extremely Intolerable	Investigate the need to continue pumping water from underground workings and the necessity for a water treatment plant. Monitoring of rebound water in the mining area. Sealing of potential decant pathways. Sealing of surface cracks to reduce infiltration into mining areas. Treatment or containment of decant water.	CEO
1	Mooivley West, Hendrina South & Mooivley East	Legal censure from the decanting of mine affected water.	Poor quality groundwater decanting from mining affected areas impacting on surface water resources. Fines or civil action.	Legal and Reputational	B	J	Extremely Intolerable		B	J	Extremely Intolerable		CEO
2	General	Inadequate funds for mine closure.	Possible inadequate funds allocated for the mine closure trust fund to meet closure needs.	Financial	B	J	Extremely Intolerable	Calculation of financial provision quantum as part of application.	B	I	Highly Intolerable	Conduct annual rehabilitation where possible and annually update the financial provision quantum.	CEO
1	Mooivley West, Hendrina South & Mooivley East	Physical surface disturbance (i.e. on-site watercourses and wetlands).	As a result of goafing of underground areas, possibility exists of physical surface disturbance which could lead to surface subsidence and damage to natural environment.	Natural Environment	B	I	Highly Intolerable	Identify areas of possible surface subsidence.	B	H	ALARP	Ensure underground mining is undertaken to the required safety factors. Monitor natural ground levels once underground mining has commenced (Lidar surveys). Divert water flows if needed. Continuous filling of surface cracks if they appear.	Senior Management
1	Mooivley West, Hendrina South & Mooivley East	Poor surface water management of runoff leading to infiltration.	Seepage and leaching contaminants due to ineffective surface water runoff management. Possible poor water quality entering the natural environment.	Natural Environment	C	J	Highly Intolerable		C	J	Highly Intolerable	Ensure rehabilitated areas are properly sloped and no depressions exist to minimize pooling of surface water runoff.	Senior Management

Mine:		Proposed Hendrina Coal Mine	**Project Code:**	XST2791				**Evaluation Year:**	2016			**Evaluators:**	Digby Wells Environmental
Location:		Hendrina, Mpumalanga Province						**Last Modified:**	22/08/2016			**Facilitator:**	Leon Ellis
Area ID	**Area**	**Hazard (Unwanted Event)**	**Discussion of Hazard / Consequence**	**Primary Risk Category**	**Raw Risk**			**Current Controls**	**Residual Risk**			**Possible New Controls**	**Accountability**
					Severity	**Likelihood**	**Risk Rank**		**Severity**	**Likelihood**	**Risk Rank**		
1	Mooivley West, Hendrina South & Mooivley East	Soil erosion – rehabilitated areas.	Erosion of rehabilitated areas such as infrastructure and shaft areas.	Natural Environment	C	J	Highly Intolerable		C	J	Highly Intolerable	Conduct a scientific proofed design. Ensure strict monitoring of the rehabilitation process. Implement erosion guidelines. Include the rehabilitation specifications in the rehabilitation contractor's contract.	Senior Management
2	General	Failure to implement the final Land Use Plan (LUP).	Failure to implement the agreed final LUP leading to loss of biodiversity, deterioration of rehabilitated areas, soil pollution and social mobilisation by communities.	Natural Environment	C	J	Highly Intolerable	Continuous engagement with the DMR. Develop a sustainable LUP.	C	H	ALARP	Continuously monitor the implementation of the plan. Source the correct expertise to assist with the implementation of the LUP.	Senior Management
1	Mooivley West, Hendrina South & Mooivley East	Inadvertent access by humans to underground workings after mine closure.	Physical injury to humans.	Health & Safety	C	H	ALARP		C	H	ALARP	Ensure incline and ventilation shafts are properly sealed with concrete capping. Shape side walls of portals to a safe angle and fill portals with overburden material.	Section Manager
1	Mooivley West, Hendrina South & Mooivley East	Physical collapse of surface infrastructure.	Physical injury to humans and/or animals.	Health & Safety	C	H	ALARP		C	H	ALARP	Ensure all surface infrastructure is removed or properly maintained after mine closure (i.e. legally handed over to a third party).	Section Manager
1	Mooivley West, Hendrina South & Mooivley East	Hydrocarbon contamination.	Excretion of harmful substances into the soil.	Natural Environment	E	J	ALARP		E	J	ALARP	Identify and map historic hydrocarbon contaminated areas. Bioremediation techniques (e.g. Soil farming). Use of drip trays, bentonite mats for designated areas. Ensure overburden liner is properly removed and disposed of.	Section Manager

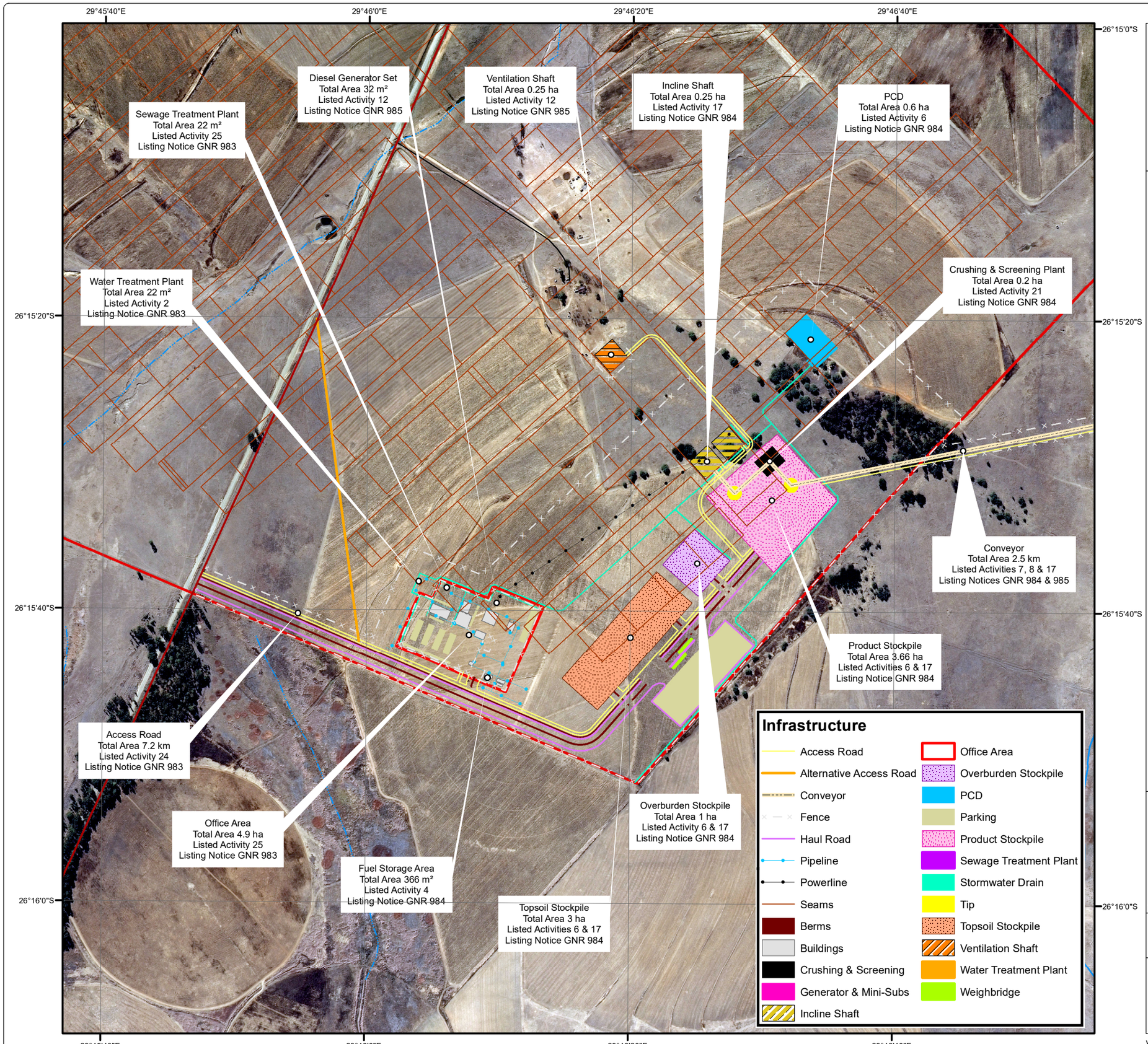
Mine:		Proposed Hendrina Coal Mine	**Project Code:**	XST2791				**Evaluation Year:**	2016			**Evaluators:**	Digby Wells Environmental
Location:		Hendrina, Mpumalanga Province						**Last Modified:**	22/08/2016			**Facilitator:**	Leon Ellis
Area ID	**Area**	**Hazard (Unwanted Event)**	**Discussion of Hazard / Consequence**	**Primary Risk Category**	**Raw Risk**			**Current Controls**	**Residual Risk**			**Possible New Controls**	**Accountability**
					Severity	**Likelihood**	**Risk Rank**		**Severity**	**Likelihood**	**Risk Rank**		
1	Mooivley West, Hendrina South & Mooivley East	Poor groundwater quality – Plumes.	Poor quality groundwater migrating from contamination sources (i.e. underground workings, plant and workshop areas etc.)	Natural Environment	D	J	ALARP		D	J	ALARP	Cut-off trenching. Hydraulic control of plume migration with surface water infiltration galleries. Hydraulic control with trees.	Section Manager
1	Mooivley West, Hendrina South & Mooivley East	Uncontrollable alien invasive species.	Alien invasive species manifesting on rehabilitated areas.	Natural Environment	E	K	ALARP	Develop and implement the alien vegetation plan.	F	K	Maintain	Continue to implement alien vegetation plan after mine closure until alien vegetation has been eradicated.	Supervisor

Appendix B: Financial Provision Estimate and Plans

Plan 1

Umcebo Mining Hendrina Underground Coal Mine EIA

Mooivley West



Legend

- Project Area
- Main Road
- Minor Road
- Non-Perennial Stream
- Perennial Stream

Infrastructure

Access Road	Office Area
Alternative Access Road	Overburden Stockpile
Conveyor	PCD
Fence	Parking
Haul Road	Product Stockpile
Pipeline	Sewage Treatment Plant
Powerline	Stormwater Drain
Seams	Tip
Berms	Topsoil Stockpile
Buildings	Ventilation Shaft
Crushing & Screening	Water Treatment Plant
Generator & Mini-Subs	Weighbridge
Incline Shaft	

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Projection: Transverse Mercator
Datum: WGS 1984
Central Meridian: 29°E

Ref #: kam.XST3791.201611.104
Revision Number: 1
Date: 18/11/2016

N

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Metres

1:8,000

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ENVIRONMENTAL

Calculation of the First year Quantum

Component	Description	Total Cost
1	Dismantling of processing plant & related structures (incl. overland conveyors & Power lines)	R 1 161 592
2 (A)	Demolition of steel buildings & Structures	R 484 475
2 (B)		R 4 409 678
3	Rehabilitation of access roads	R 3 325 853
4(A)	Demolition & rehabilitation of electrified railway lines	R 0
4(B)	Demolition & rehabilitation of non-electrified railway lines	R 0
5	Demolition of housing &/or administration facilities	R 1 016 971
6	Open pit rehabilitation including final voids & ramps	R 148 612
7	Sealing of shafts, adits & inclines	R 296 972
8(A)	Rehabilitation of overburden & spoils	R 1 042 106
8(B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	R 0
8(C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	R 295 318
9	Rehabilitation of subsided areas	R 0
10	General surface rehabilitation	R 3 161 816
11	River diversions	R 0
12	Fencing	R 747 579
13	Water management	R 369 211
14	2 to 3 years of maintenance & aftercare	R 290 037
	Total cost + Weighting Factor 2	**R 17 587 732**
	Preliminary and General	R 2 110 528
	Contingency	R 1 758 773
	Total (Excl. VAT)	**R 21 457 033**
	VAT (14%)	R 3 003 985
	Grand Total (Incl. VAT)	**R 24 461 018**

Digby Wells Environmental

Umcebo Mining (Pty) Ltd, Hendrina - Mooivley West, XST3791

DMR Closure Cost Assessment, 2016, Rev 1

Calculation of the First year Quantum, 2017

Class A (High Risk)			Unit:	A	B	C	D	E=A*B*C*D
Component	Description:	Listed and Specified Activities		Quantity	Master rate	Multiplication factor	Weighting factor 1	Amount (Rands)
				Step 4.5	Step 4.3	Step 4.3	Step 4.4	
1	Dismantling of processing plant & related structures (incl. overland conveyors & Power lines)	Crushing and screening plant 0.2ha x 10m height (Activity 21, GNR 984); Conveyer - 2.5km in length and assumed height of 2m and width of 1m totalling 5000 m3 [Activity 17, 7&8, GNR984 and GNR985]	m^3	82 970.87	R 14.00	1.00	1.00	R 1 161 592
2 (A)	Demolition of steel buildings & Structures		m^2	2 484.49	R 195.00	1.00	1.00	R 484 475
2 (B)	Demolition of reinforced concrete buildings & structures	Concrete slabs for the following temporary structures: Office area - 4.9ha; Sewage treatment plant - 22m2 (Activity 25, GNR 983); Water treatment plant - 22m2; Diesel generator set - 32m2 (Activity 2, GNR 983); Storage of fuel, Lubricants and Explosives - 366m2 (Activity 4, GNR 984)	m^2	15 364.73	R 287.00	1.00	1.00	R 4 409 678
3	Rehabilitation of access roads	Access road combined length of 7.2km and an average width of 13m (Activity 24, GNR 983)	m^2	95 024.38	R 35.00	1.00	1.00	R 3 325 853
4(A)	Demolition & rehabilitation of electrified railway lines		m	-	R 338.00	1.00	1.00	R 0
4(B)	Demolition & rehabilitation of non-electrified railway lines		m	-	R 184.00	1.00	1.00	R 0
5	Demolition of housing &/or administration facilities		m^2	2 614.32	R 389.00	1.00	1.00	R 1 016 971
6	Opencast rehabilitation including final voids & ramps	Incline portals 0.5ha (Activity 17, GNR984)	ha	0.75	R 198 149.00	**1.00**	1.00	R 148 612
7	Sealing of shafts, adits & inclines	2 x Incline shafts - 0.5ha each (Activity17, GNR 984); 1 x Ventilation shaft - 0.25ha (Activity 12, GNR 985)	m^3	2 828.30	R 105.00	1.00	1.00	R 296 972
8(A)	Rehabilitation of overburden & spoils	Topsoil - 3ha; Overburden Stockpile - 1ha; Product stockpile - 3.66ha (Activity 6 and 17, GNR 984)	ha	7.66	R 136 061.00	1.00	1.00	R 1 042 106
8(B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)		ha	-	R 169 462.00	1.00	1.00	R 0
8(C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	PCD - 0.6ha (Activity 6, GNR 984)	ha	0.60	R 492 197.00	**1.00**	1.00	R 295 318
9	Rehabilitation of subsided areas		ha	-	R 113 931.00	1.00	1.00	R 0
10	General surface rehabilitation		ha	29.34	R 107 783.00	1.00	1.00	R 3 161 816
11	River diversions		ha	-	R 107 783.00	1.00	1.00	R 0
12	Fencing		m	6 077.88	R 123.00	1.00	1.00	R 747 579
13	Water management		ha	9.01	R 40 982.00	**1.00**	1.00	R 369 211
14	2 to 3 years of maintenance & aftercare		ha	21.39	R 13 561.00	1.00	1.00	R 290 037
								R 16 750 221
		Weighting Factor 2 (step 4.4)			**1.05**		**Sub Total 1**	**R 17 587 732**
						Preliminary and General	12% of Sub Total 1	**R2 110 527.86**
						Contingency	10% of Sub Total 1	**R1 758 773.22**
							Sub Total 2	**R 21 457 033**
							VAT (14%)	**R 3 003 985**
							GRAND TOTAL	**R 24 461 018**