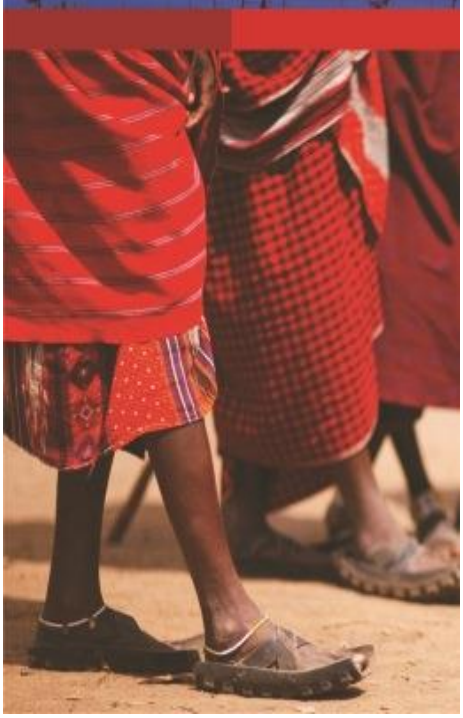

DIGBY WELLS
ENVIRONMENTAL

Dagsoom Twyfelaar Coal Mining Project near Ermelo, Mpumalanga

Rehabilitation and Closure Plan

Project Number:

DAG5603

Prepared for:

Dagsoom Coal Mining (Pty) Ltd

September 2019

Digby Wells and Associates (South Africa) (Pty) Ltd
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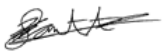
Report Type:	**Rehabilitation and Closure Plan**
Project Name:	**Dagsoom Twyfelaar Coal Mining Project near Ermelo, Mpumalanga**
Project Code:	**DAG5603**

Name	Responsibility	Signature	Date
Brett Coutts	Report Writer		30 September 2019

EXECUTIVE SUMMARY

Background

Dagsoom Coal Mining (Pty) Ltd (hereafter referred to as Dagsoom) is the holder of a Prospecting Right, Department of Mineral Resources (DMR) Ref: MP 30/5/1/1/2/12846 PR over the remaining extent of the farm Klipfontein 283 IT and Portions 1, 2, 5, 7, 8, 9 and remaining extent of the farm Twyfelaar 298 IT, situated in the magisterial district of Ermelo, Mpumalanga Province. Dagsoom has submitted an application for a Mining Right in terms of the Minerals and Petroleum Resources Development Act, 2002 (Act 28 of 2002) (MPRDA). The proposed Twyfelaar Coal Mining Project is herein referred to as "the Project".

The Project, situated on the eastern escarpment of the Mpumalanga Highveld coalfield, is a "greenfields" project with no mining infrastructure or mining activity currently taking place on the proposed site. Current land use activities within the proposed Mining Right boundary, which encompasses the remaining extent of the farm Klipfontein 283 IT and Portions 1, 2, 5, 7, 8, 9 and remaining extent of the farm Twyfelaar 298 IT, are residential and agricultural land uses (subsistence and commercial farming and livestock keeping).

Dagsoom proposes to extract coal through underground mining accessed through an adit. Bord and pillar mining with continuous miners is the preferred mining option for this operation. The Run of Mine (RoM) coal will be conveyed from the mine adit to the processing plant.

The mine will consist of one underground section with associated infrastructure around the mine access area on the northern side of the Project Area on Twyefelaar North (referred to as Block A).

Legal Requirements and Objectives

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 24(P) in the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) as amended which provides that the holder of a mining right must make financial provision for rehabilitation of negative environmental impacts

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

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 establishing 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. This Rehabilitation, Decommissioning and Mine Closure Plan aims to assist Dagsoom in carrying out successful rehabilitation for the Project. The specific closure objectives identified for Twyfelaar are contained within this report.

Risk Assessment

There were 20 unwanted events identified. The assessor ranked these unwanted events for risk based on the likelihood and severity of the particular risk to determine the overall consequence or significance of the risk. The assessor assumed no controls are in place (i.e. the raw risk) and considered current controls are in place and effective (i.e. residual risk).

Fifteen (15) of the unwanted events were ranked as highly intolerable and five as ALARP.

For the highest ranked events (red and pink), additional controls must be put in place to reduce the level of risk.

The assessor ranked the residual risks assuming the control measures are in place and effective.

Only three of the 20 unwanted events remained as Highly Intolerable with controls in place and could have a negative impact on the natural environment.

The following actions are recommended to lower the risks identified during the assessment:

- Ensure rehabilitation is conducted using a clear plan for the mined area's end land use, taking the post-mining landscape designs into consideration. In addition, Dagsoom needs to ensure that the rehabilitation contractor is aware of rehabilitation requirements and include them in contracts;
- Conduct a visual inspection for invasive species on a regular basis, focussing on areas where invasive species have been previously eradicated, and on rehabilitated areas and eradicate them when identified;
- Undertake subsidence modelling to determine the risk and maintain pillar safety factors;
- Conduct a scientifically proofed landform design closer to the time of closure, ensuring strict monitoring of the rehabilitation and implementation of erosion guidelines. In addition, Dagsoom must include the rehabilitation specifications in the rehabilitation contractor’s contract;
- Improve hydrocarbon management during operations to minimise long-term contamination of surface water, groundwater, wetlands and soils that would require costly remediation at closure;
- Ensure shaft is adequately sealed using engineering designed plugs and that the designs are up to date; and
- Intercepted water to be controlled at an appropriately sited evaporation dam, for as long as required.

Action Plan

The activities involved in the Rehabilitation Action Plan are discussed according to the different needs of the infrastructure areas.

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 remain in situ and 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 rehabilitation actions for infrastructure are detailed further within the report and separated into phases (construction, operational and decommissioning and post closure).

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, 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 and integrating the cost of water treatment into the financial provision if required;
- Ongoing engagement with communities surrounding the area, with respect to the closure vision of the mine and taking these issues into account when closure is being considered;
- Skills 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 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 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.

Financial Provision

The financial provision estimate was calculated based on a third-party model (Digby Wells Model). The estimated financial provision required for the rehabilitation and closure of the Proposed Twyfelaar Mine is **R 11,901,761.67** (excl. VAT). The financial provision estimate associated with the proposed operations is included in Table 1-1 below.

Table 1-1: Dagsoom Twyfelaar Financial Provision Estimate

Digby Wells Environmental	
	Dagsoom Coal Mining, Twyfelaar, DAG5603
Area and Description	**Life of Mine**
Infrastructure and Rehabilitation	
Area 1: Eastern Underground Access	R0.00
Area 2: Northern Underground Access	R5,662,955.10
Area 3: Western Underground Access	R0.00
Area 4: Discard Dumps	R2,379,051.64
Sub-total	**R8,042,006.74**
Monitoring and Maintenance	
Monitoring Costs (Groundwater and Surface water)	R1,579,661.00
Monitoring Costs (Vegetation)	R74,858.02
Maintenance Costs (Vegetation)	R435,994.43
Sub-total	**R2,090,513.45**
Project Management (12%)	R965,040.81
Contingency (10%)	R804,200.67
GRAND TOTAL	**R11,901,761.67**

Conclusion and Recommendations

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 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;
- 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 groundwater should take place to determine if there is a potential for mine affected water to occur as identified within the Groundwater Report (Digby Wells, 2019;
- Regular update of the ERA as more information becomes available;
- AIPs 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 five years after closure.

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1 Introduction

1.1 Project Background

Dagsoom Coal Mining (Pty) Ltd (hereafter referred to as Dagsoom) is the holder of a Prospecting Right, Department of Mineral Resources (DMR) Ref: MP 30/5/1/1/2/12846 PR over the remaining extent of the farm Klipfontein 283 IT and Portions 1, 2, 5, 7, 8, 9 and remaining extent of the farm Twyfelaar 298 IT, situated in the magisterial district of Ermelo, Mpumalanga Province. Dagsoom has submitted an application for a Mining Right in terms of the Minerals and Petroleum Resources Development Act, 2002 (Act 28 of 2002) (MPRDA). The proposed Twyfelaar Coal Mining Project is herein referred to as “the Project”.

It is expected that the mining right will be granted towards the end of 2020. During this time, Dagsoom will continue with the environmental authorisation process; which includes the Environmental Impact Assessment and Environmental Management Plan (EIA/EMP), and a Water Use Licence (WUL). As soon as the Mining Right, Environmental Authorisation and WUL have been granted, Dagsoom will secure financing and commence with construction (expected to start in Q1 2021). Production ramp up is expected to start in Q1 2022 with full production on Twyfelaar North to last from 2023 to 2026.Future mining areas include Twyfelaar South and Klipfontein sections, and although the socio-economic baseline considers these two extension areas, these areas do not form part of this application process.

1.2 Project Description

The Project, situated on the eastern escarpment of the Mpumalanga Highveld coalfield, is a “greenfields” project with no mining infrastructure or mining activity currently taking place on the proposed site. Current land use activities within the proposed Mining Right boundary, which encompasses the remaining extent of the farm Klipfontein 283 IT and Portions 1, 2, 5, 7, 8, 9 and remaining extent of the farm Twyfelaar 298 IT, are residential and agricultural land uses (subsistence and commercial farming and livestock keeping).

Dagsoom proposes to extract coal through underground mining accessed through an adit. Bord and pillar mining with continuous miners is the preferred mining option for this operation. The Run of Mine (RoM) coal will be conveyed from the mine adit to the processing plant.

The mine will consist of one underground section with associated infrastructure around the mine access area on the northern side of the Project Area on Twyefelaar North (referred to as Block A).

1.2.1 Project Location

The proposed mine is located on the Farm Twyfelaar 298IT, approximately 30 km southeast of Ermelo in the Msukaligwa Local Municipality, Gert Sibande District Municipality, Mpumalanga Province. The closest town is the settlement of Sheepmoor, approximately 4

km to the east of the Mining Right boundary. The site is accessed from the N2 between Ermelo and Mkhondo (Piet Retief). Table 1-1 below indicates the Project location details.

Table 1-1: Project Location Details

Province	Mpumalanga Province
District Municipality (ies)	Gert Sibande District Municipality
Local Municipality (ies)	Msukaligwa Local Municipality
Ward(s)	Ward 11
Primary Town	Sheepmoor Town / Ermelo
Primary Access Routes	N2
Coordinates of approximate centre of the Project Area	26°41'16.78"S
	30°14'0.95"E

1.2.2 Infrastructure and Activities

The proposed Project activities per project phase are indicated in Table 1-2 below. At the time of writing, the location of the power line was not known.

Table 1-2: Project Activities per Project Phase

Project Phase	Project Activity
Construction Phase	▪ Site / vegetation clearance; ▪ Access and haul road construction; ▪ Infrastructure construction; ▪ Development of a box cut; ▪ Power line construction; ▪ Diesel storage and explosives magazine; and ▪ Topsoil stockpiling.
Operational Phase	▪ Removal of rock (blasting); ▪ Stockpile (rock dumps, soils, ROM, discard dump) establishment and operation; ▪ Diesel storage and explosives magazine; ▪ Operation of the underground workings; ▪ Operating processing plant;

Project Phase	Project Activity
	▪ Operating sewage treatment plant; ▪ Water use and storage on-site – during the operation water will be required for various domestic and industrial uses. Dams will be constructed that capture water from the mining area which will be stored and used accordingly; ▪ Storage, handling and treatment of hazardous products (including fuel, explosives and oil) and waste; and ▪ Maintenance activities – through the operations maintenance will need to be undertaken to ensure that all infrastructure in operating optimally and does not pose a threat to human or environmental health. Maintenance will include haul roads, pipelines, processing plant, machinery, water and stormwater management infrastructure, stockpile areas.
Decommissioning Phase	▪ Demolition and removal of infrastructure – once mining activities have been concluded infrastructure will be demolished in preparation of the final land rehabilitation; ▪ Rehabilitation – rehabilitation mainly consists of spreading of the preserved subsoil and topsoil, profiling of the land and re-vegetation; and ▪ Post-closure monitoring and rehabilitation.

1.3 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 24(P) 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.

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.

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; and
- Best Practice Guidelines (BPGs) series developed by the Department of Water Affairs (DWA).

1.4 Expertise of Authors

Table 1-3 presents a summary of the expertise of the specialists involved in the compilation of this report. The full CVs of these specialists can be provided on request.

Table 1-3: Expertise of the Specialists

Team Member	Bio Sketch
Brett Coutts Principal Consultant	Brett Coutts is an Ecologist with a BSc Honours in Ecology, Environment and Conservation. Brett gained practical hands on experience as a project manager on environmental rehabilitation projects at Hydromulch and his roles and responsibilities include the compilation of Basic Assessment (BA) reports, Scoping & Environmental Impact Reports, compilation of Environmental Management Plans (EMP), GIS mapping and Biodiversity Action Plans linking to rehabilitation. Brett is currently a Principal Consultant and provides technical experience to the ecology and closure and rehabilitation units. Prior to his appointment, he gained experience as a junior project manager on environmental rehabilitation projects at Hydromulch and then was appointed by Terra Pacis as an Environmental Consultant where his roles and responsibilities included the compilation of Basic Assessment (BA) reports, Scoping &Environmental Impact Reports, compilation of Environmental Management Plans (EMP), GIS mapping and Biophysical Studies.

2 Constraints and Limitations

The constraints and limitations to the impact assessment are presented in Table 2-1:

Table 2-1: Applicable Constraints and Limitations and Their Consequences

Constraint or Limitation	Consequence
Information in Report	The information contained within this 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 and is also based on the findings of the ERA conducted
Public Participation	The commitments contained within this report

Constraint or Limitation	Consequence
	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.
Risk of Subsidence	There is a risk that underground mining could result in subsidence as result of mining related activities, however a detailed assessment associated with the risk of subsidence occurring has not yet been taken into consideration, thus this report makes note of the risk and provides certain recommendations with respect to understanding the potential risk.

3 Baseline Environment

3.1 Flora and Fauna

According to Mucina and Rutherford (2012), the proposed Twyfelaar Coal Mine is located in areas classified as Eastern Highveld Grassland (Gm 12) and Wakkerstroom Montane Grassland (Gm 14).

According to the National List of Threatened Terrestrial Ecosystems, the vulnerable Eastern Highveld Grassland covers the largest extent of the study area.

A total of seven plant species of conservation concern listed under the national red list and protected under the Mpumalanga Nature Conservation Act 10 of 1998, could potentially occur in the project area. These include *Aloe kniphofioides* (Vulnerable), *Eucomis autumnalis* (Vulnerable), *Gladiolus malvinus* (Vulnerable), *Hypoxis hemerocallidea* (Near Threatened), *Kniphofia typhoides* (Rare), *Nerine gracilis* (Endangered) and *Ocotea bulata (Burch.) Baill* (Vulnerable).

Thirteen plant species listed by the NEMBA as Alien Invasive Plant Species may occur in the project areas and have the potential to spread due to site disturbance associated with project activities. These include Eucalyptus sp. (Gum tree), Pinus sp. (Pine tree), *Verbena bonariensis* (Tall verbena), *Cirsium vulgare* (Spear thistle), *Pennisetum clandestinum* (Kikuyi grass), *Datura stramonium* (stinkweed), *Solanum mauritianum* (Bugweed), *Tribulus terrestris* and *Arundo donax* (Spanish reed). Refer to the Digby Wells Fauna and Flora report for further details with respect to the specific categories of Alien Invasive Plant species.

The site has been classified into six primary land management units, namely: Agricultural Areas, Alien Bushclumps, Secondary Grassland, Primary Grassland, Rocky Outcrops, and Riparian Areas. The Agricultural Areas are associated with the dominant land use (livestock and Cultivation) in the area did not account for any natural vegetation. Vegetation cover is

sparse and includes alien plant species such as: *Cirsium vulgare* (Scotch Thistle) and *Solanum sisymbriifolium* (Dense-thorned Bitter Apple).

Floral diversity in the Grasslands within the study area were regarded as expected in comparison with the expected species for this regional vegetation type. Alien invasive tree species were found to dominate many landscapes, including riparian, wetlands and primary and secondary grassland.

A total of two flora Species of Special Concern (SSC) were recorded for the site more species are expected, but was not recorded due to seasonal limitations. The two faunal SSC was recorded, namely: Vulnerable species, *Sagittarius serpentarius* (Secretary Bird) and Southern Bald Ibis (*Geronticus calvus)*. The avifaunal assessment yielded a total of 51 bird species within the Twyfelaar project area. Herpetofauna findings included, three reptile species, and no amphibian species. Faunal diversity was lower than expected, given the undisturbed nature of large parts of the project area.

3.2 Soils

The land type data indicated that the dominant land types were Fa162 (Shallow soils, no lime); Bb35 (Yellow, highly weathered structureless soils with plinthic subsoils) and Ba51 (red, highly weathered structureless soils with plinthic subsoils).

The land capability consists of predominantly Class II (Intensive cultivation) and Classes VII and VIII, which can only sustain wildlife.

The fertility status of the soils is generally moderate with some requirement for lime (to counteract acidity) to achieve full cropping potential. Exchangeable base cations (potassium, calcium and magnesium) are present in sufficient levels and there is neither a sodium nor salinity hazard identified in the analysed soils. Texture is variable, with the occurrence of sandy clay loam, sandy loam and silty loam occurring within the site. The most dominant soil texture within the site is the sandy loam.

3.3 Surface Water

The site is located within the W53A quaternary catchment of the Inkomati-Usuthu Water Management Area (WMA 3). The site is characterised by a temperate climate with dry winters and warm summers, while it generally receives moderate to high rainfall during the rainy season. The Mean Annual Precipitation (MAP) and Mean Annual Evaporation (MAE) of this region is 825 mm and 1400 mm respectively. The Mean Annual Runoff (MAR) depth for the area was calculated to be 91.25 mm. This runoff accounts for approximately 11% of the MAP for the area.

Five samples were taken on site to test water quality (refer to Figure 3-1). Generally, the water quality as compared to the Department of Water and Sanitation (DWS) irrigational and domestic standards did not show any significant contamination. All major cations and Anions were within the set standards, except for Iron which exceeded the domestic use standards at monitoring point SW3, SW4 and SW5 while Lead so exceeded the domestic use standard at

SW1 monitoring point. All other trace analysed elements were within the set DWS water quality standards.

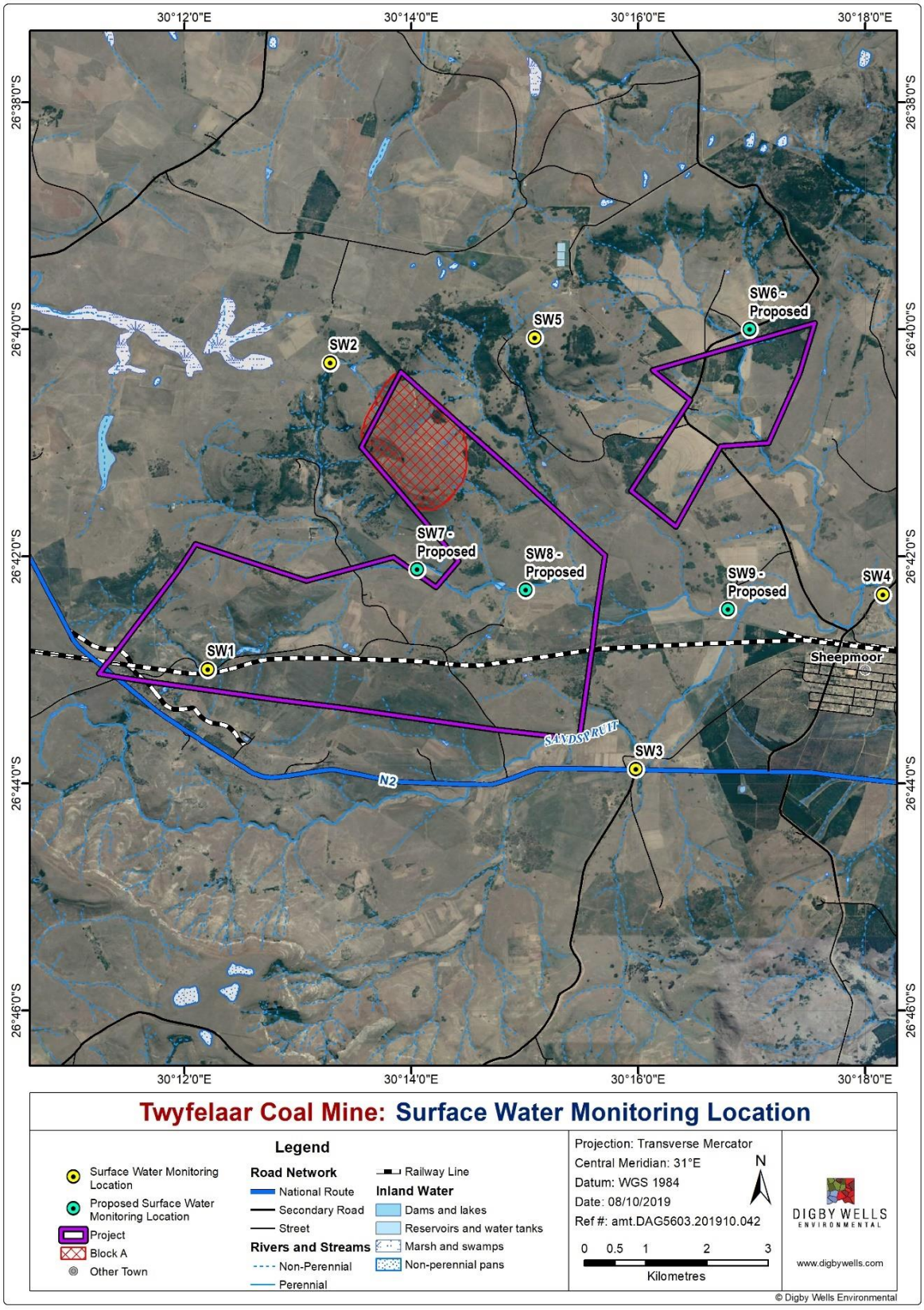

Figure 3-1: Surface Water Sampling Localities at the Proposed Twyfelaar Coal Mine

3.4 Groundwater

Three principal aquifers were identified for the site: the weathered and fractured Karoo aquifers (Vryheid Formtion) and dolerite sills. The aquifers that occur in the area are classified as minor aquifers (low yielding), but of high importance and are understood to have a low to medium development potential, mostly used for small scale domestic purposes or occasionally for large scale irrigation.

The main source of water supply in and around the proposed mining area is groundwater which is abstracted by use of community hand pumps supplemented by a number of springs. Water is mainly used for domestic use and livestock watering.

The groundwater types found were a mixture of mainly Ca-HCO3, Mg-HCO3, Na-HCO3 with one sample showing a Mg-SO4 type groundwater. These water types are typical for the Vryheid formation. The groundwater is generally of good quality and only iron, manganese and aluminium exceedances over the South African National Standards (SANS) drinking water guideline values were observed, likely related to natural background concentrations within the Karoo aquifers.

The potential cone of drawdown is largest at the end of life of mine and water levels are expected to be lowered over a relatively small area (a maximum radius of ~200 m is expected) around the underground void.

Based on the simulations no third-party sources, wellfields or other groundwater abstractions are present within the zone of influence. Therefore, it is unlikely there will be an impact on third party abstraction sources by lowering of water levels as a result of the projected Twyfelaar mining activities.

However, due to the low recharge influx it will take a long time before groundwater levels will return to pre-mining conditions. The numerical model was used to simulate groundwater rebound and indicates the rebound will indeed be slow and groundwater levels in the vicinity of the site will take approximately 30 years to recover.

The maximum extent of the contaminant plume was calculated to be ~275 m from the void moving in a general east to southeast direction. Based on the contaminant transport simulations for the underground mine it is very unlikely that privately owned boreholes located in the vicinity of the proposed development will be impacted upon.

The potential sulphate plume from the discard dump will mainly flow towards the southeast and extend to a maximum distance of ~520 m from the discard dump, reaching a non-perennial stream east of the discard dump. This impact can be mitigated by dump rehabilitation post-closure and application of a Class C liner or mitigations with a similar effectiveness.

For underground mining the decant point can be established as paths, that create a connection between the underground mine and topography i.e. a shaft, decline, adit, vent shaft etc. When the active dewatering of the underground voids has ceased groundwater levels will rebound. As the underground voids flood, decant can occur when the groundwater

level recovers to above the surface elevation of any of the access paths. This can occur long after the end of life of mine and is referred to as the time-to-decant.

Based on the proposed mine layout and site topography the potential decant point have been determined to be the adit into the underground mine at the southern end of the mine.

However, the adit is situated at a topographical elevation of 1 619 metres above mean sea level (mamsl). Based on the groundwater levels measured in third-party and monitoring boreholes, the modelled steady-state water levels indicate a groundwater level of ~1 571 mamsl in the vicinity of the adit at ~48 mbgl. Therefore, it is very unlikely that decant will occur from the proposed underground mine.

3.5 Wetlands

The wetland assessment carried out in September 2019, revealed the presence of twelve wetland systems within the project area and its 500 m zone of regulation, with varied HGM units associated with each.

The HGM unit types observed within the project area included: bench, hillslope seep, channeled valley bottom and unchanneled valley bottom systems. These HGM units were categorized largely on topography and their respective locations within the landscape.

The health and integrity of each of the HGM units present varied considerably, with anthropogenic disturbances being the most significant driver of change to date. These disturbances were related largely to agropastoral activities and linear infrastructures traversing the project area.

The bench wetlands and the hillslope seep wetlands associated with the ‘koppie’ and other hillslopes situated on and directly below the ridges of most of the higher lying areas were found to be in pristine or near-pristine condition due to the reduced suitability of these areas (steep slopes and limited access) for agropastoral activities and other anthropogenic disturbances.

In the foothills and the valleys of the project area, the wetland systems were used extensively for crops and pastures, and impacts relating to these activities, such as the proliferation of alien and invasive species (with special mention of *A. mearnsii*) and an increased potential for erosion, were observed. Disturbance of soils, linear infrastructures (roads, fences, railways), and various small holdings throughout the project area and its associated zone of regulation, had resulted in additional impacts throughout the project area.

The hydrological driver of the wetlands within the project area appear to be two-fold. It is suspected that the benches and hillslope seeps situated on the ‘koppie” are driven to a large extent by the underlying geologies, as further elaborated within the Wetlands Report (Digby Wells, 2019). It is suspected that a shallow aquifer is present in the ‘koppie’, which is comprised of sandstone and shale, with an overlaying sill of dolerite, where daylighting moisture and the origin of many of the hillslope seeps associated with WET3, WET4, WET5, WET6, WET7 and WET8 were observed.

Similarly, WET10, WET11 and WET12 appear to be associated with sills of dolerite overlaying sandstone and shale geologies.

In the foothills, the dominant underlying geologies of WET8 is dolerite, sandstone and alluvium, WET9 is dolerite, while that of WET1 and WET2 is sandstone and shale.

The portions of WET8 in the foothills, with specific reference to the large channelled valley bottom wetland (CVB4), may be regarded as hydrologically connected to the hillslope seeps on the “koppie” and the other high lying areas, however, it is likely that a deeper aquifer supplies water to CVB4 and dewatering of this aquifer for the proposed underground mining has the potential to impact negatively on both WET8 as well as WET9 due to the loss of groundwater supply (Digby Wells, 2019 – Groundwater Report).

In terms of buffers, the buffer calculator was applied to provide suitable buffer zones applicable to wetlands for the proposed surface infrastructures, however, the buffer tool is very limited in its application and is not regarded as suitable for either opencast/pit/highwall mining, or underground mining.

Because it is suspected the HGM units situated on the ‘koppie’ are reliant on a shallow aquifer that is unlikely to be affected by the proposed mining activities. A buffer of 100 m, in line with the 100 m zone of regulation triggered by GN 704 is required as sufficient for these HGM units,

In terms of surface infrastructure and activities, the buffers supplied through the application of the buffer tool are regarded as suitable, however, it must be stressed that buffers are unlikely to mitigate the potential impacts associated with the dewatering of the deeper aquifer and some loss in wetland health and integrity is deemed likely.

4 Stakeholder Participation

Comments pertaining to the Closure and Rehabilitation assessment, received during the Scoping Phase public comment period which have been considered in this report are recorded in Table 4-1.

Table 4-1: Stakeholder Comments Received to Date

Comment	Response	Considered in this report
Storing tailings from a coal washing plant above ground creates a huge dust problem. In winter, the wind direction is mostly from west directly to the east. This will mean the community of Sheepmoor will be directly in the path of the dust cloud from the tailings heap. Being only 6 km away from the proposed tailings heap, the community will suffer the full effect of the coal dust generated during winter. This will have severe effects on people's health and their quality of life. No washing will ever be white again in the path of such a dust cloud. Dust in people's eyes, homes and the like will be a complete irritation.	This location and spread of coal dust will be considered in the Air Quality Impact Assessment during the EIA Phase. Exposed stockpiles and dumps will be subject to dust control through appropriate measures (ie, suppressants and wetting) and this mitigation measure will be included in the EIA Report. Tailings remaining at the end of the Life of Mine will be considered in the Mine Closure and Rehabilitation Report which will also be appended to the EIA Report.	Consideration and recommendations with respect to the rehabilitation of the discard facility have been provided within this report. Refer to Section 10.1.3.2 for further detail.
Once mining operations have been terminated, seepage of acid water will still continue. As a standard, a trust must be created to pay for land rehabilitation and pollution control once the mining operation has stopped. The names of trustees to this trust must be published and the trustees must	As per the requirement of the Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations (Government Notice No 1147), published on 20 November 2015, under the NEMA, Dagsoom must secure the calculated	The current financial provision has excluded costs associated with post treatment of water, however this is should be considered during the operational Life of Mine and if the risk does occur, provision should be provided for such. There is a risk that acid water could impact on water resources and

Comment	Response	Considered in this report
comprise of knowledgeable and competent people to carry out this responsibility on behalf of the next generation.	amount for closure and rehabilitation activities. This amount will be calculated and provided in the EIA Report. A rehabilitation plan, including post-closure monitoring and maintenance, will also be developed for the proposed project and presented in the EIA Report.	downstream users, which has been taken into consideration as a risk. Refer to the Digby Wells Groundwater and Waste Classification Reports for further detail. Post Closure monitoring and maintenance costs have been calculated. Refer to Section 14 for further detail.

5 Closure Design Principles

5.1 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 establishing 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 Dagsoom in carrying out successful rehabilitation for the Project. The specific closure objectives identified for Twyfelaar further within this report.

5.2 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. Approximately 51% of the area has a high arable potential with the remaining areas having a limited potential.

Since the mining method is underground mining, it is expected that there would be very little change in the operational land use when compared to the post closure options that could be considered for the mine. In saying this, areas where mine infrastructure is located, such as the operational plant, roads etc, these areas are rehabilitated to match the surrounding land use and that the land capability post closure is returned to the pre-mining land capability were possible.

Sites such as the discard facility will have altered the potential post mining land capability of the area and there is potential that these facilities will remain post closure, thus management

measures need to be specifically tailored to manage these types of facilities post closure to not impact on the surrounding environment even further after closure.

Water management post closure will be one of the key aspects that need to be managed post closure to ensure that downstream uses are not impacted negatively.

In addition to this, health and safety mitigation measures post closure would be critical for the mine as access to the underground workings is a huge concern and the potential for injury and death is a high risk, which will need to be managed both during the operational and post closure phases.

5.2.1 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:

- Adit/Portal needs to be sealed and the seals need to be engineered to ensure that access to these areas by illegal miners and other people is restricted were possible. Engagement with adjacent landowners and land occupiers must be undertaken to explain the associated risk of entering underground workings;
- Annual update the financial provision to ensure that provision is adequate for closure;
- Undertake subsidence modelling to determine the significance of the risk, if the risk is significant mitigation measures will need to be implemented. It is recommended that this assessment be done within the first three years of mining;
- Rehabilitation of the discard facility is critical to ensure that impacts to both groundwater and surface water resources, such as streams, is minimised as far as possible;
- Monitoring of groundwater and surface water post closure, as per the EMP, to ensure impacts can be minimised as far as possible and to ensure that if interventions are required to be adopted that they can be put into place based on the monitoring results; and
- Update the numerical groundwater model with a specific emphasis on the post closure environment to refine the anticipated impacts post closure and then adopt additional mitigation measures as required.

5.2.2 Research

It is advised that during the operational phase, that monitoring data of both groundwater and surface water quality, as stipulated in the EMP, 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, if water quality is of a poor nature.

6 Risk Assessment

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

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

The objective of the 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.

6.1 Terms of Reference

Dagsoom appointed Digby Wells to conduct an ERR in support of the EA application applicable to the Project and in compliance with the NEMA, as amended, and associated Financial Provisioning Regulations, 2015 (Government Notice No. 1147 published in GG 39425 on 20 November 2015) (GN R1147) **Invalid source specified.**.

Dagsoom appointed Digby Wells to complete the necessary Scope of Work (SoW) to comply with the requirements encapsulated in the national South African regulatory framework, specifically the Financial Provision Regulations**Invalid source specified.**.

The ERR must contain information that is necessary to determine the potential financial provision associated with the management of latent or residual environmental risks post closure. The ERR must address the following key aspects:

- A description of the risk including possible triggers;
- An assessment of recommendations;
- Costing indicating the quantum of the liability; and
- Monitoring, auditing and reporting requirements.

The ERR complies with the requirements as contemplated in Appendix 5 of the NEMA Financial Provision Regulations as of 2015.

6.1.1 Assessment of Environmental Risk Objectives

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 establishing a self-sustaining ecosystem at the point of closure and beyond. The Financial

Provision Regulations**Invalid source specified.** encapsulate the objectives of an ERR that support the aims of sustainable closure. These include *inter alia*:

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

6.2 Assumptions and Limitations

Digby Wells made the following assumptions and noted these limitations as part of the ERR:

- Digby Wells compiled the ERR considering information provided by Dagsoom;
- The ERR is based on information from Digby Wells specialist studies compiled during the mining right application process; and
- The ERR must be a living document and updated regularly to accommodate any significant changes throughout the decommissioning and closure process.

6.3 Methodology

6.1 Risk Assessment Methodology

The baseline Hazard Identification and Risk Assessment (HIRA) is based on a qualitative method to determine the risks. The following 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 and categories specific for the risk assessment to assess the significance of the risk.;
- For each of the areas in the process:
  - Potential unwanted events were identified;
  - Current controls for each unwanted event were identified and recorded;
  - The severity and the likelihood was then assessed to determine the significance of the associated risk;
  - Based on this, the level of risk was estimated using the risk matrix; and
  - For the Highly and Extremely Intolerable events, additional controls were recommended to reduce the level of risk.

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

Table 6-1: Risk Levels

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

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

- Norms and Standards;
- Effect on Work Image (Reputation);
- Effect on Environment;
- Effect on Social and Ecosystem Processes;
- Public Reaction; and
- Legal Implications.

A qualitative Severity and Likelihood Matrix was used during the risk estimation as shown below in Table 6-2. The severity and likelihood definitions are provided in Table 6-2. Once the severity and likelihood of the unwanted events had been rated, the risk rank was determined using the risk matrix. This matrix is not a simple multiplication tool; risk rank is skewed so that emphasis is placed on high severity events, rather than on high likelihood events.

[1] As low as reasonably practicable

Table 6-2: Risk Estimation Matrix

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

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

7 Risk Analysis Results

Potential high residual risks for and during mine closure were identified and discussed in this Section.

There were 20 unwanted events identified. The assessor ranked these unwanted events for risk based on the likelihood and severity of the particular risk to determine the overall consequence or significance of the risk. The assessor assumed no controls are in place (i.e. the raw risk) and considered current controls are in place and effective (i.e. residual risk).

Fifteen (15) of the unwanted events were ranked as highly intolerable and five as ALARP, as shown in Table 7-1 below.

Table 7-1: Raw Risk Ranking

Number of unwanted events	Extremely Intolerable	Highly Intolerable	ALARP	Maintain
20	**0**	**15**	5	**0**

For the highest ranked events (red and pink), additional controls must be put in place to reduce the level of risk.

The assessor ranked the residual risks assuming the control measures are in place and effective. Table 7-2 below summarises the residual risks after taking the current control measures (during operation) into consideration.

Table 7-2: Residual Risk Ranking

Number of unwanted events	Extremely Intolerable	Highly Intolerable	ALARP	Maintain
20	**0(0)**	**3(15)**	**14(5)**	**3(0)**

Table 7-3 below provides the risk rankings prior and post controls and the risk identified.

Table 7-3: Summary of Risk Assessment

Area	Hazard (Unwanted Event)	Consequence(s)	Primary Risk Category	Raw Risk			Current Controls	Residual Risk			Possible New Controls
				Severity	Likelihood	Risk Rank		Severity	Likelihood	Risk Rank	
General Mining Areas	Possibility of not implementing the final Land Use Plan for the disturbed areas.	Land not having a functional use. Could potentially impact wetlands, water resources, biodiversity and health and safety.	Natural Environment	C	I	Highly Intolerable	Ensure rehabilitation is conducted using a clear plan and is aligned to the end land use. Consider post-mining landscape designs. Ensure rehabilitation contractor is aware of rehabilitation requirements (include in contract).	C	H	ALARP	Monitoring of end land use when rehabilitation is undertaken.
General Mining Areas	Accumulation of stormwater on top of backfilled and rehabilitated areas due to insufficient drainage.	Ponding of stormwater and prohibiting stormwater from naturally leaving the site.	Natural Environment	C	I	Highly Intolerable	Shaping of rehabilitated areas to free-draining in order to control stormwater runoff.	C	H	ALARP	If ponding does occur fill these areas and profile to make them free draining.
General Mining Areas	PCD, RoM and Discard stockpiles eroding into water resources	Seepage to underground water and surface water can lead to water pollution and potential impacts on downstream water resources.	Natural Environment	B	I	Highly Intolerable	Ensure all contaminated areas are cleared and removed from site.	B	H	Highly Intolerable	Monitoring of surface and groundwater. Based on monitoring results investigate the need and requirement for water treatment.
General Mining Areas	Collapse of underground mine workings.	Subsidence which could result in water ponding on surface; injury or death to humans or animals; damage to structures on surface etc.; impacts on wetlands, water resources and biodiversity.	Natural Environment	C	J	Highly Intolerable	Evaluate the risk if subsidence and maintain pillar safety factors.	C	H	ALARP	Third party agreements for infrastructure that is handed over must be in place.
General Mining Areas	Closure Plan not approved by DMR	Closure certificate not issued by the DMR	Financial	C	I	Highly Intolerable	Ensure mitigation measures are adopted to reduce the significance of the residual risks.	C	H	ALARP	On-going engagement with DMR
General Mining Areas	Possible human access to remnant infrastructure and underground workings.	Collapse of remnant infrastructure and underground areas which could lead to human injury or fatality.	Financial	D	J	ALARP	Ensure all underground access areas are sealed using engineered plugs.	D	H	Maintain	Investigate potential users for usable infrastructure post closure and then ensure transfers are legally

Area	Hazard (Unwanted Event)	Consequence(s)	Primary Risk Category	Raw Risk			Current Controls	Residual Risk			Possible New Controls
				Severity	Likelihood	Risk Rank		Severity	Likelihood	Risk Rank	
											completed prior to application for closure.
General Mining Areas	Insufficient control of alien invasive species.	Spread of invasive will reduce biodiversity and ecosystem functioning.	Natural Environment	D	I	ALARP	Conduct a visual inspection for invasive species on a regular basis, focusing on areas where invasive species have been previously eradicated, and on rehabilitated areas. Eradicate alien invasive species when identified. An alien plant species management plan should be implemented for two years after rehabilitation is completed. All emergent alien plant species should be removed before they reach a seed-bearing or flowering maturity. At least five species should be used for rehabilitation and only species that are native to the area and stipulated in the Rehabilitation and Closure Plan (Digby Wells, 2019) should be utilized.	D	H	Maintain	Conduct a visual inspection for invasive species on a regular basis, focusing on areas where invasive species have been previously eradicated, and on rehabilitated areas. Eradicate alien invasive species when identified. An alien plant species management plan should be implemented for two years after rehabilitation is completed. All emergent alien plant species should be removed before they reach a seed-bearing or flowering maturity.
General Mining Areas	Potential negative impact on biodiversity and ecosystem functionality.	Failure to establish sustainable vegetation on rehabilitated areas. Loss of biodiversity, increased soil erosion, increased siltation of rivers etc.	Natural Environment	C	J	Highly Intolerable	Adapt operational monitoring programmes at closure to ensure they are appropriate post-closure.	C	H	ALARP	Monitoring post closure and revegetation of areas.
General Mining Areas	Areas not being vegetated according to rehabilitation plan.	Excessive dust generation (nuisance dust) from unvegetated areas.	Social	E	K	ALARP	Consider final capping and vegetation of the Discard Dump. Re-seed bare patches and apply fertilizer if required in order for vegetation to establish to stabilize the area.	E	I	Maintain	Consider final capping and vegetation of the Discard Dump. Re-seed bare patches and apply fertilizer if required in order for vegetation to establish to stabilize the area.

Area	Hazard (Unwanted Event)	Consequence(s)	Primary Risk Category	Raw Risk			Current Controls	Residual Risk			Possible New Controls
				Severity	Likelihood	Risk Rank		Severity	Likelihood	Risk Rank	
General Mining Areas	Possibility of closure material balance not being sufficient for soil to be placed back on areas that require rehabilitation.	Could impact on the implementation of closure actions and the achievement of relinquishment requirements, leading to environmental impacts remaining un-mitigated.	Natural Environment	D	K	Highly Intolerable	To ensure that there is enough material strip all available soil from these footprints that could be utilized as cover material for the discard facility and other areas. Implement erosion guidelines. Keep updated soil balance.	D	I	ALARP	Conduct a scientific proofed landform design closer to the time of closure. Ensure strict monitoring of the rehabilitation. Implement erosion guidelines. Include the rehabilitation specifications in the rehabilitation contractor's contract.
General Mining Areas	Potential inadequate budget for the rehabilitation of the mine.	Failure to rehabilitate and close the mine sustainably.	Financial	C	J	Highly Intolerable	Ensure mine rehabilitation and closure funds are available and updated on a regular basis.	C	J	Highly Intolerable	Ensure mine rehabilitation and closure funds are available and sufficient by conducting annual updates.
General Mining Areas	Possible hydrocarbon contamination.	Contamination of soil and groundwater resources.	Natural Environment	D	I	ALARP	Procedures should be put in place to clean-up spillages in the event that they should occur. Spill kits need to be obtained and should be available on site to clean up any leaks or spills. Spillages of magnitude should also be reported to the authorities within 24 hours and an internal incident reporting system implemented. Undertake a site wide contaminated land assessment at closure to determine extent of contamination.	D	I	ALARP	Procedures should be put in place to clean-up spillages in the event that they should occur. Spill kits need to be obtained and should be available on site to clean up any leaks or spills. Spillages of magnitude should also be reported to the authorities within 24 hours and an internal incident reporting system implemented. Undertake a site wide contaminated land assessment at closure to determine extent of contamination.

Area	Hazard (Unwanted Event)	Consequence(s)	Primary Risk Category	Raw Risk			Current Controls	Residual Risk			Possible New Controls
				Severity	Likelihood	Risk Rank		Severity	Likelihood	Risk Rank	
General Mining Areas	Hazardous waste is not appropriately disposed of.	Hazardous contamination of groundwater and soil resources leading to costly remediation actions.	Natural Environment	C	J	Highly Intolerable	Proper management of hazardous materials during operations to minimize long-term contamination of groundwater and soils, which would require costly remediation at closure.	C	H	ALARP	Proper management of hazardous materials during operations to minimize long-term contamination of groundwater and soils, which would require costly remediation at closure.
Dams and Impoundments	Contaminated spillage from Silt Traps, PCD's and SWD's.	Contamination of soils, surface and groundwater.	Natural Environment	C	I	Highly Intolerable	Ensure that adequate freeboard is available at all times and that dams are desilted regularly operationally. The dam and silt traps should be demolished and concrete from trenches and drains removed, levelled and infilled.	C	H	ALARP	Remove all unnecessary dams at closure to eliminate the risk of spillage.
Discard Dump	Possible sedimentation of streams, rivers and wetlands.	Erosion of Discard Dumps leading to sedimentation of water resources should overburden material be left on surface of mine closure.	Natural Environment	B	I	Highly Intolerable	Establish vegetation and passive clean/dirty water separation systems.	B	G	ALARP	Ensure materials balance and areas requiring rehabilitation is kept up to date as new material generated during mining operation.
Discard Dump	Run off from the discard facility (coal) could impact on downstream water users	Contamination of surface water resources as a result of unacceptable impacts.	Natural Environment	C	I	Highly Intolerable	Catchment of contaminated surface water runoff into appropriate dirty water trenches during the operational phase. Rehabilitation of the facility	C	H	ALARP	Design of an appropriate capping system, to include erosion control and catchment facilities for dirty water.
Discard Dump	Groundwater pollution plume potentially impacting upon groundwater resources.	Contamination of groundwater resources as a result of a migrating plume.	Natural Environment	C	H	ALARP	Rehabilitation of the discard dump to reduce infiltration of rainwater into the dump to reduce seepage generation. Lining of the discard dump will reduce seepage into the underlying aquifer. Groundwater quality should be frequently sampled to establish if a contaminant plume will migrate.	C	H	ALARP	Ensure sufficient provision is made for the capping and rehabilitation of the discard facility.

Area	Hazard (Unwanted Event)	Consequence(s)	Primary Risk Category	Raw Risk			Current Controls	Residual Risk			Possible New Controls
				Severity	Likelihood	Risk Rank		Severity	Likelihood	Risk Rank	
Water Sources	Seepage of contaminated water into natural water resources in the surrounding environment.	Contaminated water in unlined dams can seep into the ground causing surface and groundwater pollution. Legal implications from DWS resulting in refusal of closure and fines. High impact on reputation and possible irreversible changes to affected area.	Natural Environment	C	I	Highly Intolerable	Based on the contaminant transport simulations for the underground mine it is very unlikely that privately owned boreholes located in the vicinity of the proposed development will be impacted upon. The refinement of the post-closure water management plans. Ensure sedimentation is removed during mining operations prior to closure. Removal of PCDs.	C	G	ALARP	Ensure the whole are is cleaned up before closure.
Water Sources	Soil erosion.	Increased sedimentation and reduced water quality of the wetlands.	Natural Environment	C	I	Highly Intolerable	Rehabilitation of the wetlands should be undertaken to improve their conditions and try to meet the recommended ecological categories for the systems during operations and decommissioning if wetland are impacted on. Rehabilitation and/or management of water resources is strongly advised to limit the impact on them to ensure that they continue to meet the recommended ecological categories' set. Establish vegetation and passive clean/dirty water separation systems.	C	H	ALARP	A wetland rehabilitation management plan must be compiled during operations and implemented to try and remediate the impacts from the mine post-closure if impacted on.
Water Sources	Mining under wetlands.	Possible destruction of irreplaceable habitats as a result of potential subsidence and/or draining of wetlands as a result of mining activities	Natural Environment	B	I	Highly Intolerable	The mining impact on the wetlands should be monitored to ascertain whether the wetlands are showing degradation or improvement during the operational phase. Wetland rehabilitation measures will be needed at closure to ensure preservation of these irreplaceable habitats if impacted on	B	H	Highly Intolerable	Continual updating of the numerical groundwater model to determine the extent of underground mining activities could impact on all wetlands. Consideration to provide water to impacted wetlands if this impact does occur through the implementation of scavenger boreholes

Area	Hazard (Unwanted Event)	Consequence(s)	Primary Risk Category	Raw Risk			Current Controls	Residual Risk			Possible New Controls
				Severity	Likelihood	Risk Rank		Severity	Likelihood	Risk Rank	
							during and after the operational phase.				etc.

8 Proposed Control Measures

The following control measures or management actions are proposed for the potential Extremely and Highly Intolerable residual risks:

Hazard	Consequence(s)	Possible New Control Measure(s)
Possibility of not implementing the final Land Use Plan for the disturbed areas.	Land not having a functional use. Could potentially impact wetlands, water resources, biodiversity and health and safety.	Monitoring of final end land use when rehabilitation is undertaken.
Accumulation of stormwater on top of backfilled and rehabilitated areas due to insufficient drainage.	Ponding of stormwater and prohibiting stormwater from naturally leaving the site.	If ponding does occur, fill these areas and profile to make them free draining.
Pollution Control Dam (PCD), RoM and Discard stockpiles eroding into water resources	Seepage to underground water and surface water can lead to water pollution and potential impacts on drinking water.	Monitoring of surface and groundwater. Based on monitoring results investigate the need and requirement for water treatment.
Collapse of underground mine workings.	Subsidence which could result in water ponding on surface; injury or death to humans or animals; damage to structures on surface etc.; impacts on wetlands, water resources and biodiversity.	Third party agreements for infrastructure that is handed over must be in place and rehabilitate subsided areas.
Closure Plan not approved by DMR	Closure certificate not issued by the DMR	On-going engagement with DMR
Possible human access to remnant infrastructure and underground workings.	Collapse of remnant infrastructure and underground areas which could lead to human injury or fatality.	Investigate potential users for usable infrastructure post closure and then ensure transfers are legally completed prior to application for closure.

Hazard	Consequence(s)	Possible New Control Measure(s)
Insufficient control of alien invasive species.	Spread of invasive will reduce biodiversity and ecosystem functioning.	Conduct a visual inspection for invasive species on a regular basis, focussing on areas where invasive species have been previously eradicated, and on rehabilitated areas. Eradicate alien invasive species when identified. An alien plant species management plan should be implemented for two years after rehabilitation is completed. All emergent alien plant species should be removed before they reach a seed-bearing or flowering maturity.
Potential negative impact on biodiversity and ecosystem functionality.	Failure to establish sustainable vegetation on rehabilitated areas. Loss of biodiversity, increased soil erosion, increased siltation of rivers etc.	Monitoring post closure and revegetation of areas.
Areas not being vegetated according to rehabilitation plan.	Excessive dust generation (nuisance dust) from unvegetated areas.	▪ Consider final capping and vegetation of the Discard Dump (WRD). ▪ Re-seed bare patches and apply fertiliser if required in order for vegetation to establish to stabilise the area.

Hazard	Consequence(s)	Possible New Control Measure(s)
Possibility of closure material balance not being sufficient for soil to be placed back on areas that require rehabilitation.	Could impact on the implementation of closure actions and the achievement of relinquishment requirements, leading to environmental impacts remaining un-mitigated.	▪ Conduct a scientific proofed landform design closer to the time of closure. ▪ Ensure strict monitoring of the rehabilitation. Implement erosion guidelines. ▪ Include the rehabilitation specifications in the rehabilitation contractor's contract.
Potential inadequate budget for the rehabilitation of the mine.	Failure to rehabilitate and close the mine sustainably.	Ensure mine rehabilitation and closure funds are available and sufficient by conducting annual updates.
Possible hydrocarbon contamination.	Contamination of soil and groundwater resources.	▪ Procedures should be put in place to clean-up spillages in the event that they should occur. ▪ Spill kits need to be obtained and should be available on site to clean up any leaks or spills. ▪ Spillages of magnitude should also be reported to the authorities within 24 hours and an internal incident reporting system implemented. ▪ Undertake a site wide contaminated land assessment at closure to determine extent of contamination.
Hazardous waste is not appropriately disposed of.	Hazardous contamination of groundwater and soil resources leading to costly remediation actions.	Proper management of hazardous materials during operations to minimize long-term contamination of groundwater and soils, which would require costly remediation at closure.

Hazard	Consequence(s)	Possible New Control Measure(s)
Contaminated spillage from Silt Traps, PCD's and SWD's.	Contamination of soils, surface and groundwater.	Remove all unnecessary dams at closure to eliminate the risk of spillage.
Possible sedimentation of streams, rivers and wetlands.	Erosion of Discard Dumps leading to sedimentation of water resources should overburden material be left on surface of mine closure.	Ensure materials balance and areas requiring rehabilitation is kept up to date as new material generated during mining operation.
Run off from the discard facility (coal) could impact on downstream water users	Contamination of surface water resources as a result of unacceptable impacts.	Design of an appropriate capping system, to include erosion control and catchment facilities for dirty water.
Groundwater pollution plume potentially impacting upon groundwater resources.	Contamination of groundwater resources as a result of a migrating plume.	Ensure sufficient provision is made for the capping and rehabilitation of the discard facility.
Seepage of contaminated water into natural water resources in the surrounding environment.	Contaminated water in unlined dams can seep into the ground causing surface and groundwater pollution. Legal implications from DWS resulting in refusal of closure and fines. High impact on reputation and possible irreversible changes to affected area.	Ensure the whole are is cleaned up before closure.
Soil erosion.	Increased sedimentation and reduced water quality of the wetlands.	A wetland rehabilitation management plan must be compiled during operations and implemented to try and remediate the impacts from the mine post-closure if impacted on.

Hazard	Consequence(s)	Possible New Control Measure(s)
Mining under wetlands.	Possible destruction of irreplaceable habitats.	▪ Continual updating of the numerical groundwater model to determine the extent of underground mining activities could impact on all wetlands. ▪ Consideration to provide water to impacted wetlands if this impact does occur through the implementation of scavenger boreholes etc.

8.1 Recommendations

Only three of the 20 unwanted events remained as Highly Intolerable with controls in place and could have a negative impact on the natural environment.

The following actions are recommended to lower the risks identified during the assessment:

- Ensure rehabilitation is conducted using a clear plan for the mined area's end land use, taking the post-mining landscape designs into consideration. In addition, Dagsoom needs to ensure that the rehabilitation contractor is aware of rehabilitation requirements and include them in contracts;
- Conduct a visual inspection for invasive species on a regular basis, focussing on areas where invasive species have been previously eradicated, and on rehabilitated areas and eradicate them when identified;
- Undertake subsidence modelling to determine the risk and maintain pillar safety factors;
- Conduct a scientifically proofed landform design closer to the time of closure, ensuring strict monitoring of the rehabilitation and implementation of erosion guidelines. In addition, Dagsoom must include the rehabilitation specifications in the rehabilitation contractor's contract;
- Improve hydrocarbon management during operations to minimise long-term contamination of surface water, groundwater, wetlands and soils that would require costly remediation at closure;
- Ensure shaft is adequately sealed using engineering designed plugs and that the designs are up to date; and
- Intercepted water to be controlled at an appropriately sited evaporation dam, for as long as required.

9 Proposed Final Post-Mining Land Use

The final Land Use Plan (LUP) is essentially the end land use to which Dagsoom 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 (Plant areas, roads etc). For these areas, it is recommended that the mine rehabilitate the affected areas back to the pre-mining land use, 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 to a significant degree, however access to the underground working need to

be controlled to prevent illegal mining operations impacting further on the surrounding environment.

There is a risk that subsidence could occur, and it is recommended that modelling be undertaken to determine the significance of this risk and what appropriate mitigation measures will be required.

10 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 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 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 closed in a socially an environmentally safe and sustainable manner. Importantly, the Rehabilitation Plan consists of direct activities associated with rehabilitation of various infrastructure components.

10.1 Rehabilitation Actions and Management Plans

The activities involved in the Rehabilitation Action Plan are discussed according to the different needs of the infrastructure areas.

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 remain in situ and 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 are noted in Table 1-2.

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

10.1.1 Construction Phase

Land preparation during the construction phase for the intended infrastructure is discussed 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 demarcated areas. Clear instructions and control systems should be in place and compliance to the instructions should be monitored;
- Prior to construction, the construction footprint must be comprehensively surveyed to identify all important species (such as Red Data Plants and Species of Special Concern). If rare and protected flora species are found in the mining areas during construction or operational activities they should be conserved by removing and relocating them to another section of the project area which is suitable, if relocation is possible. 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;
- During vegetation removal, the removal of trees should be avoided where 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;
- If it is necessary to remove protected trees, permits will be required.
- The soil must be stripped (see Section 10.1.1.1 below) 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 eventually rehabilitated, such as the discard facility (see Section 10.1.1.1 below 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 10.1.3.5.2).

10.1.1.1 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. As this mine is an underground mine, it is anticipated that minimal soil stripping will be undertaken, however it is advised that wherever infrastructure is placed (such as the footprint of the discard facility) usable soil within these footprints is stripped, according to the method provided below. This material can then be utilised as cover material during final capping of the facility.

10.1.1.1.1 Soil types

10.1.1.1.2 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:

- 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 1.5 m 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 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) 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 areas for construction of storage facilities and stockpiles of discard facilities, 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;
- Where access roads, lay-down pads and conveyor servitudes are proposed, 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 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.

10.1.1.1.3 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 than 3 m, 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) 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, thus should not be utilised for any other purposed than rehabilitation.

10.1.2 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;
    - Implement a storm water management system around hazardous materials or waste storage facilities to contain spills;
    - All hazardous waste should be removed by a suitably qualified service provider and disposed of at an approved permitted landfill site; and
    - 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 10.1.3.5.2.

10.1.3 Decommissioning Phase

It has been assumed that infrastructure with a beneficial use will be transferred to a suitable third party and will not be decommissioned and is thus excluded from the decommissioning phase, however it is recommended that an assessment be conducted for such and that if infrastructure is handed over, that third-party agreements are put into place.

10.1.3.1 Processing Plant

The Processing 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 disposed of onsite; 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 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 200-300 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 10-1;
- Remove alien invasive plants (see Section 10.1.3.5.2 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.

10.1.3.2 Discard Facilities

It is recommended that the following actions be undertaken for the rehabilitation of the Discard Facility:

- To limit the ingress of precipitated water into the discard and prevent seepage from the discard into the surrounding environment as well as to surface and groundwater;
- Consider a whale back design for the facility to limit water ponding;
- Provide a suitable growth medium for vegetation and to store and release water to the vegetation and into the environment through evapo-transpiration;

- Buffer any contamination from the discard material and eliminate fugitive dust that could otherwise originate from the discard;
- Profiled outer slopes should be rehabilitated as soon as possible, if the design is terrace based. This will ensure that rehabilitation takes place prior to final closure and should any corrective action be required then this can be implemented whilst the facility still is in operational;
- Topsoil that is stripped at the facility footprint to be utilised as cover material during the rehabilitation of the discard facility and it is crucial that the soil is stockpiled separately;
- When rehabilitating the top surface of the facility care must be taken to avoid the formation of a bowl.
- The objectives for the vegetation of the sides and tops of the discard facility are to:
    - Prevent erosion;
    - Introduce a vegetation layer to evapo-transpirate rainwater falling on the discard facility;
    - Re-establish eco-system processes to ensure that a sustainable land use can be established without requiring fertilizer additions; and
    - Restore the biodiversity of the area as far as possible.

10.1.3.3 Access Points to the Underground Reserve

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

- Remove infrastructure and conveyors associated with the underground access point;
- Backfill stockpiled overburden material into the incline portal;
- Seal all underground access openings with a concrete plug and according to engineering requirements;
- 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 200-300 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 10-1;

- Remove alien invasive plants (see Section 10.1.3.5.2 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.

10.1.3.4 Storm Water Dam and Pollution Control Dam

- Desilt the dams;
- Remove liners where applicable – these should be disposed of at a registered hazardous waste disposal facility;
- Doze the dam walls;
- Dismantle dam infrastructure - these should be disposed of at a registered hazardous waste disposal facility;
- Remove supporting plinths for pipelines 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 200-300 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 10-1;
- Remove alien invasive plants (see Section 10.1.3.5.2 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.

10.1.3.5 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.

The sections below provide further details on the establishment of vegetation at the Project site.

10.1.3.5.1 Seeding and Planting

Table 10-1 is the grass seed mix advised for the rehabilitation areas of the proposed project site.

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 10-1). In addition to this it is recommended that grasses that are representative of the surrounding veld also be utilised in the seed mixture in order to increase overall biodiversity. 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. A nursery is recommended to propagate these plants.

Table 10-1: 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	Rhodes	Short-lived	High	Decreaser	4	16%

Species name	Common name	Properties	Grazing potential	Grazing status	Sowing rate (kg/ha)	% mix
gayana	grass	perennial, stabiliser	grazing value			
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%**

Hand seeding or 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 adding 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).

10.1.3.5.2 Alien Invasive Plants

Alien Invasive Plant (AIP) species tend to out-compete the indigenous vegetation; this is due to the fact that aliens 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 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 or historically cultivated areas). 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.

Due to the nature of underground mining method, 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.

10.2 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, 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 and integrating the cost of water treatment into the financial provision if required;
- Ongoing engagement with communities surrounding the area, with respect to the closure vision of the mine and taking these issues into account when closure is being considered;
- Skills 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 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 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.

11 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 five years and groundwater and surface water which requires five years.

12 Organisational Capacity

12.1 Organisational Structure

In summary refer Figure 12-1 which indicates the proposed Organisational Structure related to the Health Safety and Environment (HSE) Division that should be adopted.

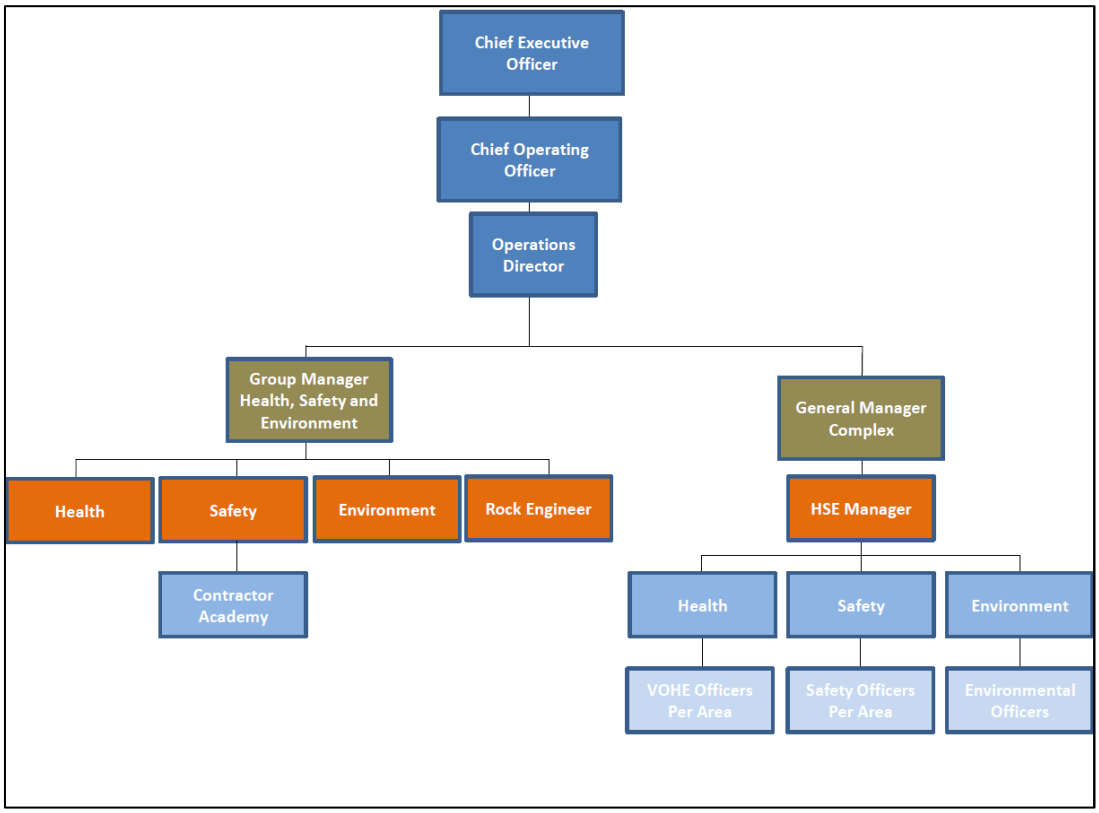

Figure 12-1: HSE Organisational Strucutre

12.2 Training and Capacity Building

The purpose of the general environmental awareness programme is to promote on-going environmental awareness amongst the workforce and even amongst the community. It must focus on addressing particular environmental issues which have been identified as problematic through the Environmental Management Programme as well as current topical or relevant issues. It is advised that this be put into place prior to construction activities taking place and those environmental topics are discussed on a monthly basis and placed on respective notice boards around the mine.

Monthly environmental topics can be discussed or illustrated in a poster format around the site or in the surrounding communities. These topics can include water resource conservation (i.e. How to Save Water), waste management (i.e. Reuse, Reduce, Recycle) and the biodiversity around the area. This may also form part of a community development or education programme for the Mine.

Involving the community also includes giving neighbouring locals the opportunity to report non-compliances or to have a contact forum where grievances can be lodged or enquiries can be directed. It is recommended that a grievance register particularly be implemented during any construction phase.

Training on Environmental Awareness should include all employees and be job specific where possible. Training should include the identification of environmental risks and potential impacts that may result from the specific work undertaken in specific areas on the site. By training in specific sectors of the mine, specific corrective actions can be taught for particular non-compliances that may occur. This training should be undertaken when the workforce is hired and implemented through the induction process.

Inductions should be compulsory for contractors, service providers or visitors on the mine and must be appropriate for short term work. This is a legal commitment for Twyfelaar and should be integrated in with the Health & Safety inductions on the mine. This can be in the form of a presentation to simply highlight the sensitivities of the area, the potential environmental risks and the responsibilities of the people involved.

13 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 (the mine, surrounding stakeholders, communities and respective authorities) to understand what needs to be done to obtain a closure certificate. This provides all parties (as noted above) involved in the process a target that needs to be achieved and sets the standards that closure and rehabilitation are measured against. Table 13-1 provides the respective environmental relinquishment criteria.

Table 13-1: 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

Environmental Aspect	Closure criteria	Monitoring Requirement	Reporting Requirement
Groundwater	Groundwater qualities need to comply with the qualities as stipulated in the Water Use Licence (WUL), the appropriate Department of Water Affairs and Sanitation (DWS) and South African National Standards (SANS) and Catchment Yield Qualities.	Monthly and Quarterly Reports	Monitoring Reports
Surface Water	Surface water qualities need to comply with the qualities as stipulated in the WUL 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 seek 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

Environmental Aspect	Closure criteria	Monitoring Requirement	Reporting Requirement
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
Safety	Ensure access to underground workings has been appropriately sealed and capped and appropriate signage erected to indicate the potential dangers of entering the site.	Visual inspections and sign off report by a registered engineer.	Signed off report by registered engineer.

14 Financial Provision Methodology

To complete the Financial Provision Assessment there are a number of tasks which were undertaken. These tasks are explained separately below.

14.1 Financial Provision Calculations

A financial provision model was compiled using Microsoft Excel. The financial provision model calculates the cost of demolishing, removing and rehabilitating each component of the Project's infrastructure which may include (but is not limited to):

- Demolition of all surface infrastructure including steel, wood, brick and concrete structures;
- Rehabilitation of yards and roads;
- Removal and rehabilitation of process solution facilities (e.g. pads, evaporation ponds etc), in the case of an operational;
- Generalised rehabilitation and vegetation management strategies; and
- Long term maintenance and monitoring costs.

14.2 Calculations

The financial provision estimate was calculated based on a third-party model (Digby Wells Model). The estimated financial provision required for the rehabilitation and closure of the Proposed Twyfelaar Mine is **R 11,901,761.67** (excl. VAT). The financial provision estimate associated with the proposed operations is included in Table 14-1 below.

Table 14-1: Dagsoom Twyfelaar Financial Provision Estimate

Digby Wells Environmental	
	Dagsoom Coal Mining, Twyfelaar, DAG5603
Area and Description	**Life of Mine**
Infrastructure and Rehabilitation	
Area 1: Eastern Underground Access	R0.00
Area 2: Northern Underground Access	R5,662,955.10
Area 3: Western Underground Access	R0.00
Area 4: Discard Dumps	R2,379,051.64
Sub-total	**R8,042,006.74**
Monitoring and Maintenance	
Monitoring Costs (Groundwater and Surface water)	R1,579,661.00
Monitoring Costs (Vegetation)	R74,858.02
Maintenance Costs (Vegetation)	R435,994.43
Sub-total	**R2,090,513.45**
Project Management (12%)	R965,040.81
Contingency (10%)	R804,200.67
GRAND TOTAL	**R11,901,761.67**

14.3 Assumptions

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

- All infrastructure will be removed from the mine;
- The concrete will only be demolished up to 1000mm below natural ground level;
- All waste will be disposed on site or buried 1m underground prior to closure;
- All powerlines are Eskom's liability/responsibility;

- All roads have an average width of 8.5m;
- All fences will be removed at end of LoM;
- The PCDs are HDPE lined and it was assumed that 300mm silt will require removal over the dam area;
- Costing to infill the dams has been incuded in the costing;
- All temporary structures will be removed from site prior to closure;
- General surface rehabilitation must involve the shaping of the surface topography to match the surrounding landscape and 600 mm of topsoil, where available, needs to be added to the site. During the process of shaping the landscape, drainage lines must be properly reinstated into the topography. Any heaps of excess material also need to be removed so that effective revegetation can take place;
- At this stage, no engineering design has been completed for the rehabilitation of the discard facility. Thus, is it is assumed that a cover design will need to be completed. For costing purposes 600 mm of soil has been provided for cover material of the discard facility;
- It has been assumed that 40-50% of some of the infrastructure footprints will require rehabilitation, such as the workshops, plant area, wash-bays, etc;
- Costs to correct subsidence and water treatment costs have been excluded at this stage and will need to be included once more information becomes available;
- Allowance has been made to transport rubble material to the adit as fill material;
- Monitoring costs have been included;
- A 12% allowance has been included for project management fees and a 10% contingency. These fees account for the costs required to manage the closure and rehabilitation phase as well as provide personnel to monitor and maintain the rehabilitated areas after closure;
- The financial provision estimate is based on the latest mine plans and information received; and
- The financial provision estimate has been calculated for LoM and excludes 15% VAT.

14.4 Recommendations

The following recommendations are applicable:

- Conduct concurrent rehabilitation of disturbed mining areas where practical during the life of the operation. This will reduce the financial liability at the end of LoM, such areas could be the rehabilitation of the discard facility;

- Assess the possibility of handing over certain infrastructure to third parties and getting in place some form of agreement or memorandum of understanding with these parties; and
- A topsoil balance must be completed to ensure enough material is available to rehabilitate all the disturbed areas and these areas are to be demarcated off as no go areas.

15 Monitoring, Auditing and Reporting

15.1 Auditing Plan

The auditing requirements (frequency, methodology, responsible person, environmental aspect and reporting) have been summarised in Table 15-1 below.

15.2 Reporting Requirements

The reporting requirements (frequency, methodology, responsible person, environmental aspect and reporting) have been summarised in Table 15-1 below.

15.3 Monitoring Plan

The purpose of monitoring is to ensure that the objectives of rehabilitation are met and that the rehabilitation process is followed. The physical aspects of rehabilitation should be carefully monitored during the operational phase as well as during the progress of establishment of the desired final ecosystem.

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.

15.3.1 Final Topography

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

15.3.2 Soils

15.3.2.1 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.

15.3.2.2 Chemical, physical and biological status of replaced soil

A final rehabilitation performance assessment must be undertaken, once rehabilitation has been undertaken and the required relinquishment criteria have been achieved. This 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; and
- Fertility analysis (exchangeable cations K, Ca, Mg and Na and phosphorus).

15.3.2.3 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 thereof simply recorded for the particular location.

15.3.3 Water

15.3.3.1 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.

15.3.3.2 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, which would include some of the operational boreholes that would have been utilised for monitoring, however additional boreholes may be required based on the updated that would be done to the numerical groundwater model during the operational Life of Mine, which then would determine the locations of the post closure monitoring required and which will need to be approved by the regulator.

15.3.4 Vegetation

15.3.4.1 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 15-1.

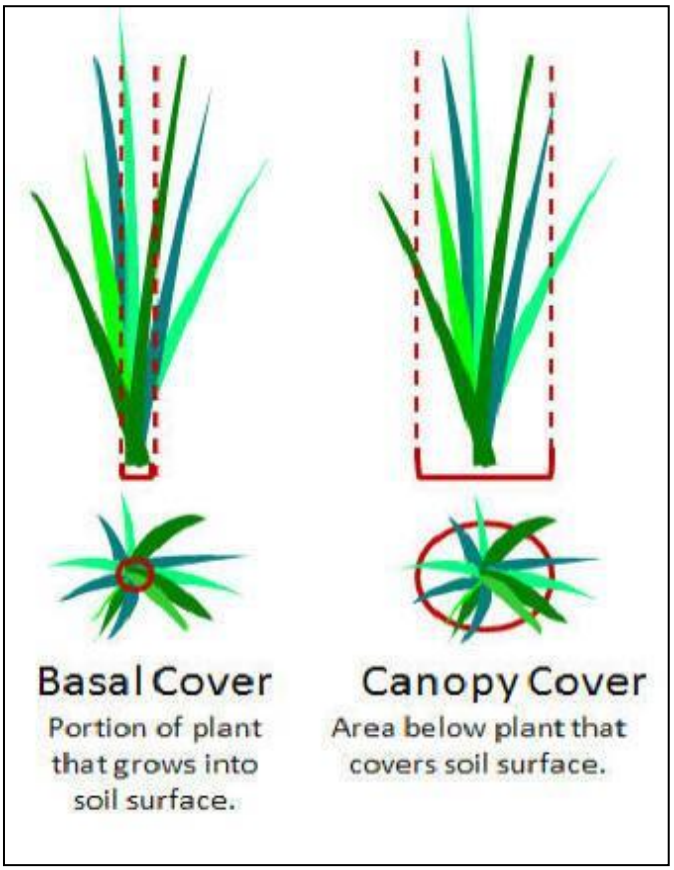

Figure 15-1: Diagram Comparing Basal Cover and Canopy Cover

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

15.3.4.2 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 10-1.

15.3.4.3 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 the mine 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 15-1: 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. 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	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 and seasonal reporting (bi-annual)
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)
Audit Reports	Auditing against the conditions outlined within the approved EMP and Environmental Authorisation (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

15.3.5 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.

16 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 Dagsoom 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 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;
- 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 groundwater should take place to determine if there is a potential for mine affected water to occur as identified within the Groundwater Report (Digby Wells, 2019;
- Regular update of the ERA as more information becomes available;
- AIPs 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 five years after closure.

17 References

Digby Wells, 2019. Groundwater Assessment Report. Environmental Impact Assessment for the Twyfelaar Mine.

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