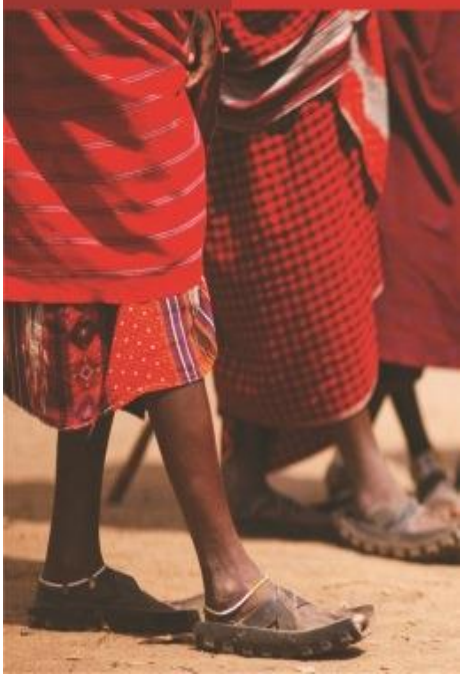

DIGBY WELLS
ENVIRONMENTAL

Environmental Authorisation and Integrated Water Use Licence Applications for the Proposed Active Water Treatment Plant at the Klipspruit Colliery, Mpumalanga Province

Rehabilitation and Closure Plan

Project Number:

SOU5014

Prepared for:

South32 SA Coal Holdings (Pty) Ltd

August 2018

Digby Wells and Associates (South Africa) (Pty) Ltd
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Report Type:	**Rehabilitation and Closure Plan**
Project Name:	**Environmental Authorisation and Integrated Water Use Licence Applications for the Proposed Active Water Treatment Plant at the Klipspruit Colliery, Mpumalanga Province**
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I, Sibongile Chabalala as duly authorised representative of Digby Wells and Associates (South Africa) (Pty) Ltd., hereby confirm my independence (as well as that of Digby Wells and Associates (South Africa) (Pty) Ltd.) and declare that neither I nor Digby Wells and Associates (South Africa) (Pty) Ltd. have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of South32 SA Coal Holdings (Pty) Ltd, other than fair remuneration for work performed, specifically in connection with the integrated environmental regulatory application process for authorisations required to install the proposed Water Treatment Plant (WTP).

Name and Surname:	Sibongile Chabalala
Title/ Position:	Assistant Mine Closure Consultant
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Experience (Years):	1

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1 Introduction

South32 SA Coal Holdings (Pty) Limited (hereafter South32) owns the Klipspruit Colliery (KPS), near Ogies in the Mpumalanga Province (refer to Figure 1-1 for the locality plan). Contaminated water that is being generated at KPS by mining activities exceeds the re-use capacity within the operations, whilst the storage capacity in mined out areas has reached its limits. The result of this is the risk of spillages or discharges to the natural environment. Effective management of this risk is essential to continued operations at KPS ensuring access to coal resources as well as securing and maintaining the requisite environmental licences and authorisations to operate and expand. Water treatment is thus required and South32 proposes to construct a modular Water Treatment Plant (WTP) and ancillary infrastructure to treat mine-affected water (the Project). South32 has appointed Digby Wells Environmental (Digby Wells) as the independent Environmental Assessment Practitioner to undertake the environmental-legal application processes and Specialist studies relevant to this proposed project.

The WTP is to be established within the operational area of the mine in the south-eastern corner of the Mining Right boundary, adjacent to KPS project offices. The proposed WTP will be modular in design and constructed in three phases, starting at a capacity of 2Ml/day, upgradeable to 303Ml/day and then increments of 3.3Ml/day to 10Ml/day. Contaminated water will be abstracted from the Balancing Dam at KPS and pumped to the WTP. After treatment, clean water that complies with the Resource Water Quality Objectives (RWQO) for the Wilge River catchment is proposed to be discharged into the Saalklapspruit at the northern boundary of the KPS operation adjacent to the N12 national highway.

The treatment process will be based on the use of membrane desalination with brine softening and will consist of the following steps:

- Pre-treatment of the feed water using pH adjustment and disinfection to remove organics from the system that can cause fouling and scaling of the membranes;
- Removal of the dissolved metals by chemical oxidation followed by the removal of precipitates and suspended solids using flocculation and coagulation unit processes;
- Ultrafiltration (UF) will be used to remove fine particles from the feed water to the Reverse Osmosis (RO) unit processes. This is necessary to prevent fouling and scaling of the RO membranes; and
- Product water conditioning is required to ensure the pH meets the discharge requirements.

This process will produce gypsum sludge and brine. The gypsum sludge will be dewatered at the WTP and then loaded onto trucks for off-site disposal at a licenced waste management facility designed for this type of material. The brine will be recycled back into the treatment process until the salinity requires that a portion be depleted from the system. This small volume of brine will be stored in tanks within the proposed WTP footprint from

where it will be pumped into road tankers and transported to a third-party waste management site licenced to receive this waste.

The infrastructure layout of the project is depicted in Figure 1-2 and the key infrastructure components of the project scope are as follows:

- A Feed Water Line comprising of a pump station and 1.5km High Density Poly Ethylene (HDPE) pipeline from the Balancing Dam to the WTP site capable of pumping 10Ml/day;
- A return water system from the WTP to the Balancing Dam along the same route as the Feed Water Line for the management of treated water that does not comply with the requirements for release to the catchment;
- A WTP Area with a footprint of approximately 1.5ha for the establishment and operation of a modular WTP with a maximum throughput of 10Ml/day. This includes the development and use of facilities for the storage and handling of hazardous chemicals used in the treatment process;
- A Discharge Line comprising of a 4km HDPE pipeline along the eastern boundary of KPS to transfer the treated water for discharge to the Saalklapspruit. Two pipeline routes are required to accommodate advancing mining and rehabilitation activities along the proposed pipeline servitude, and will be implemented at different stages of the project; and
- A dissipation structure at the proposed discharge point, alongside the N12 National Highway.

Supporting services such as the new powerline and change houses and ablution facilities (connected to KPS's existing sewage line) are also included in the project.

1.1 Study Area

KPS Colliery lies on farm Klipspruit 3 IS. The study area is situated south-west of Emalahleni, north-east of the town Ogies, with the Phola settlement bordering on the western boundary. Most of the surrounding properties are privately owned agricultural farms.

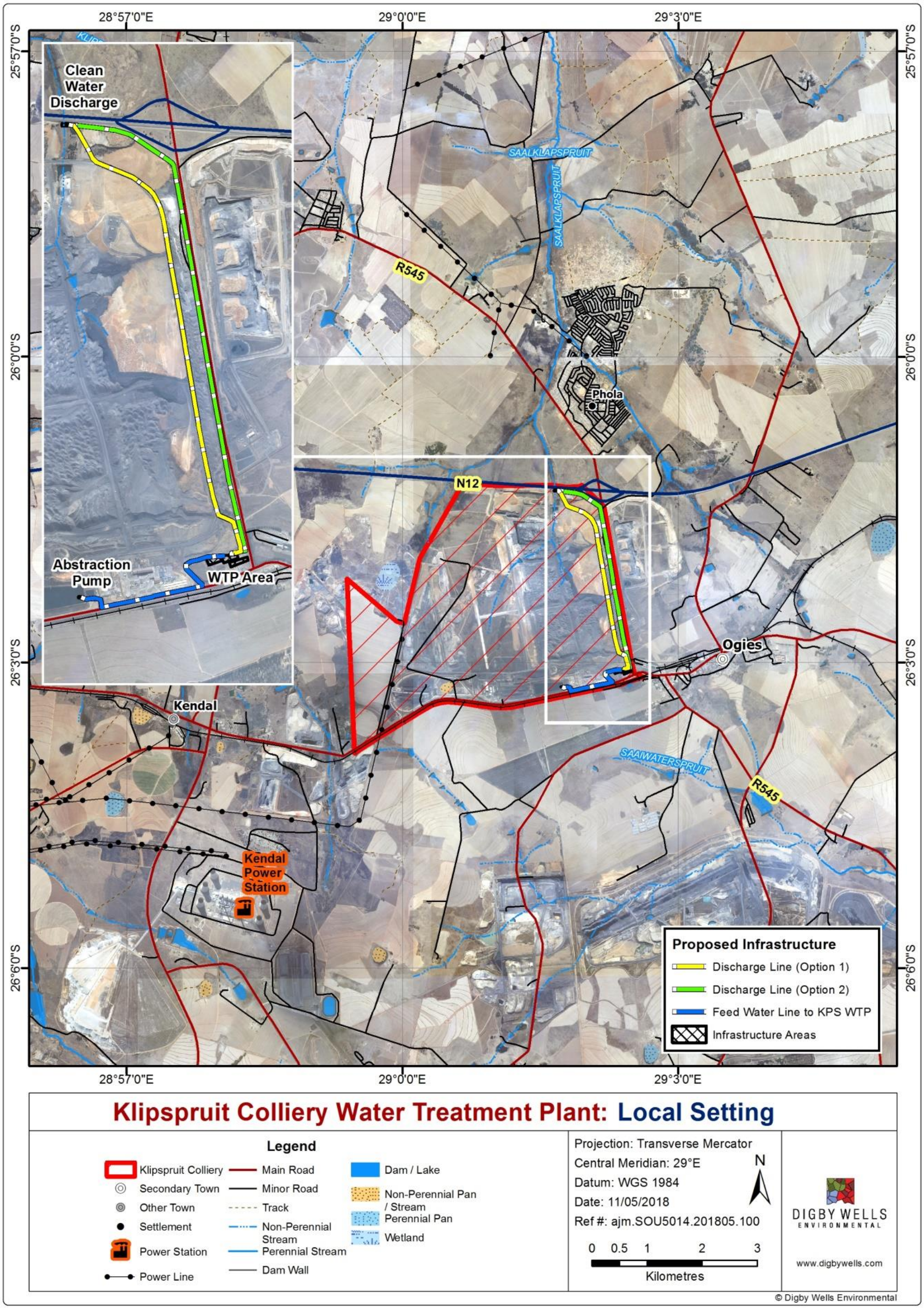

Figure 1-1: Local Setting

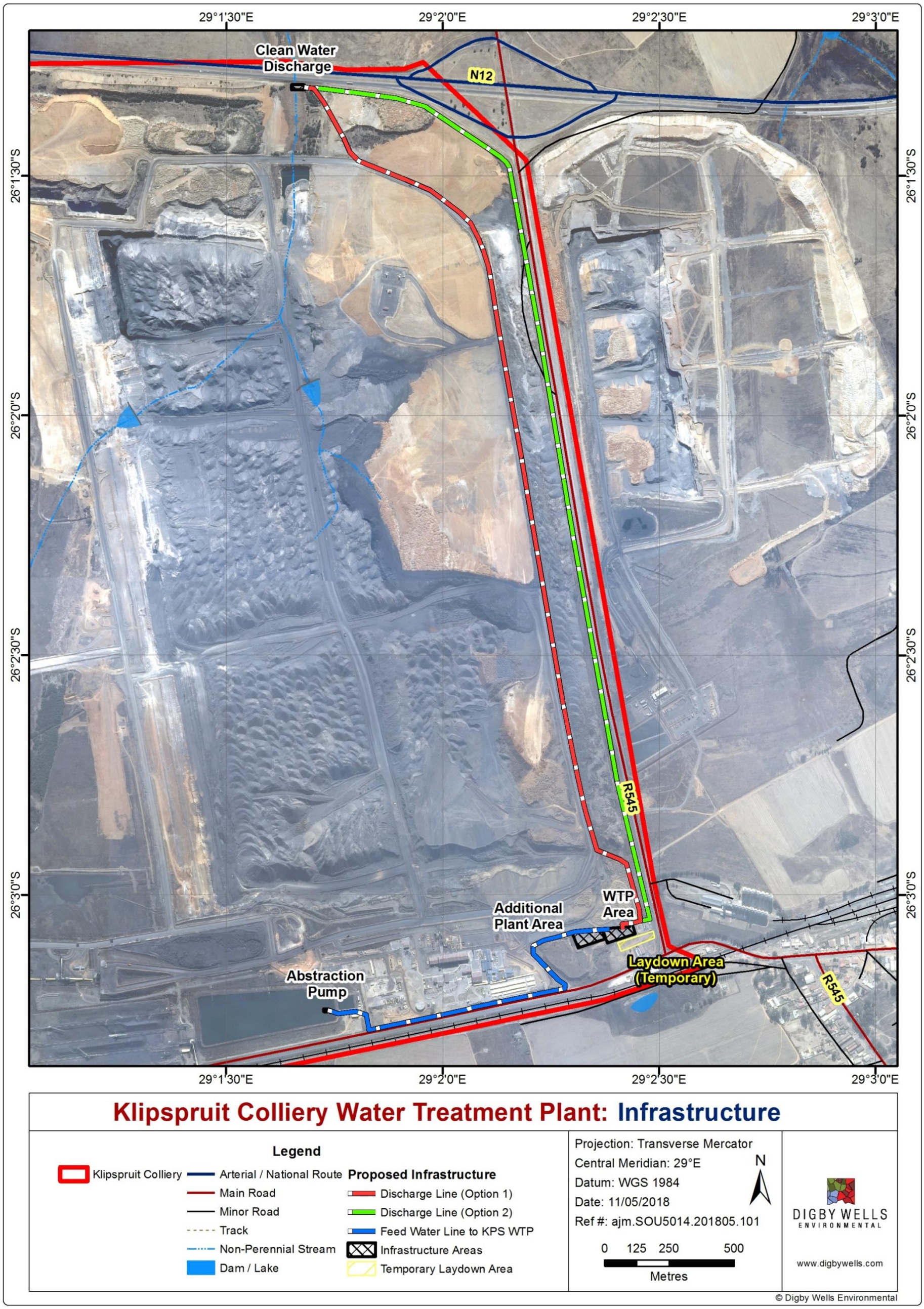

Figure 1-2: KPS WTP Infrastructure

1.2 Limitations and Assumption

The compilation of this RCP is based on the following assumptions and limitations:

- The information contained within this RCP is based on the proposed plans provided by South32. If there is a significant change or addition of other WTP infrastructure area the RCP will need to be updated to cater for this change; and
- This RCP only focusses on the newly proposed infrastructure associated with the WTP.

2 Details of Authors

Below is a list of the Digby Wells staff who were involved in the compilation of the RCP for the WTP at the KPS Colliery:

Sibongile Chabalala is an Assistant Mine Closure Consultant at Digby Wells. She completed her BSc. (Hons) in Animal, Plant and Environmental Sciences at the University of the Witwatersrand (Wits) in 2014. She joined Digby Wells in November 2017. She has been involved in conducting financial provision assessments and mine closure plans. Sibongile also completed an Environmental Law course based on National Environmental Management Act and associated legislation with E.O.H legal services in 2017. Her previous experience was gained in the field of GIS and Remote Sensing at the South African National Space Agency for a period of two years.

Michelle van Niekerk is the Manager of the Mine Closure Unit at Digby Wells. She obtained her B Tech: Civil Environmental Engineering in 2014 from Tshwane University of Technology. She has four years' experience in closure costing and has compiled assessments for Sibanye, Sasol, Total Coal and First Quantum. Michelle is a registered Environmental Engineering Technologist.

Leon Ellis is the Divisional Manager: Closure and Rehabilitation Services at Digby Wells. He has been appointed to assist with the management and co-ordination of all activities relevant to mine closure, rehabilitation and soil assessments. Leon completed his BSc. (Hons) in Geography and Environmental Management at the University of Johannesburg (UJ) in 2009. He joined Digby Wells in January 2013. He has eight years' experience in the environmental services sector with specialised focus on Environmental Liability Assessments, Mine Closure Plans, Performance Assessments and Risk Assessments, locally and internationally. He has also been involved in the undertaking of Environmental Impact Assessments (EIAs) and EMPs. Leon also completed the Environmental Risk Assessment and Management course based on ISO 31000 at the Centre of Environmental Management (North West University) in 2016.

3 Legal Requirements

Relevant legislation governing mine rehabilitation, closure cost assessment (closure provision) and closure planning is described in the Mineral and Petroleum Resources Development Act (Act No. 28 of 2002) (MRPDA) and the NEMA Regulations. The definition for environmental management plan as stated in the MPRDA is '*means a plan to manage and rehabilitate the environmental impact as a result of prospecting, reconnaissance, exploration or mining operations conducted under the authority of a reconnaissance permission, prospecting right, reconnaissance permit, exploration right or mining permit, as the case may be*.'

Specific sections include the following:

- Section 38 on 'Integrated environmental management and responsibility to remedy';
- Section 39 on 'Environmental management programme and environmental management plan';
- Supporting MPRDA Regulations include sections 53 – 57 and 60 – 62; and
- Financial Provision with respect to NEMA as included in GN R1147.

For rehabilitation purposes, these regulations stipulate what information will be required for the final rehabilitation plan. The RCP will form a component of the environmental management programme and will be subjected the same requirements of the environmental management programme with regards to opportunities

4 Terms of Reference

4.1 Rehabilitation and Closure Plan

The intent of the RCP is to ensure that it meets the minimum requirements stipulated by the relevant regulations. In general, the RCP should contain amongst other information the following:

- Providing vision, objectives, targets and criteria for final rehabilitation;
- Legal and governance framework;
- Assessment of post closure options that are practical and within the socio-economic and environmental opportunities;
- Proposed final land use and mapping;
- Ongoing research on closure and rehabilitation options;
- Detailed description of assumptions made;
- Detail on closure actions to mitigate/manage identified risks and describe the nature of residual risks that will need to be managed and monitored post closure;

- Scheduling, budget, roles and responsibilities to be assigned for final rehabilitation;
- Detail of full financial provision for the life of the project;
- Information on the organisational capacity to implement the rehabilitation plan;
- Auditable action plan for audits and update of the annual rehabilitation plan; and
- Outline of monitoring, auditing and reporting requirements.

5 Land Use Plan

The final Land Use Plan (LUP) is essentially the end land use to which South32 would like to return the land affected by WTP 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.

The current land use for the KPS mine is open-pit mining. The final end land use is currently set at grazing and all rehabilitation efforts adopted should rehabilitate the site to a grazing land capability.

The eMalahleni Local Municipality Integrated Development Plan (IDP) (2011) identified a possible expansion of Phola to the east and south east. The expansion of Phola could be utilised as an alternative land use within the proposed Project site, however, this expansion will prevent mining activities, as well as cease current agricultural activities from taking place.

6 Closure Design Principles

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

Rehabilitation can be divided into two different streams, namely concurrent rehabilitation and final rehabilitation. Concurrent rehabilitation must continue to be carried out along with mining. Concurrent rehabilitation activities should decrease the final closure liability that the mine will carry at the time of closure. This concurrent rehabilitation must be carried out within the context of the approved Environmental Management Plan Repot (EMPR) as well as the RCP. Final rehabilitation will be carried out once the mine goes into its decommissioning and closure phase. In the case of the proposed WTP, concurrent rehabilitation is not practicable.

The primary concerns for decommissioning and rehabilitation are to ensure public safety and health, and environmentally stable conditions compatible with the surrounding environment,

and consequently minimize the environmental impacts caused by mining. The overall objective is to have socially, economically, and environmentally sustainable development. The objectives of mine closure as set out in the Department of Minerals (DMR) policies are:

- Safety and health of animals and humans must be safeguarded;
- Environmental damage and residual impacts must be minimized to a level acceptable to all parties, i.e. avoidance of future pollution;
- Land must be rehabilitated to as close to natural state as possible, i.e. creation of a stable land surface;
- Physical and chemical stability of remaining structures must be such that they are not affected by natural elements;
- Mines are closed effectively and cost efficiently; and
- Mines are not abandoned but closed in terms of policy.

7 Risk Assessment

7.1 Methodology

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

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

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

Table 7-1: Risk Levels

Colour	Descriptor	Action	Sign-off
	Extremely Intolerable	Immediate Action	General Manager
	Highly Intolerable	Short term action required	Senior Management
	ALARP[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 7-2.

The severity and likelihood definitions are provided in Table 7-2. 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 7-2: 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

7.2 Risk Analysis Results

Potential unwanted events for and during closure, specifically related to the WTP, were identified and discussed. All unwanted events are listed in Appendix A.

Six (6) unwanted events were identified. These unwanted events were ranked for risk based on the maximum reasonable severity should they occur and the likelihood of that specific severity/consequence occurring. This analysis was firstly done assuming that no controls are in place (i.e. the raw risk) and secondly considering current controls were in place and effective (i.e. residual risk).

Three (3) of the unwanted events were ranked as ALARP, and three (3) as maintain, as shown in Table 7-3 below.

Table 7-3: Raw Risk Ranking

Area number	Description	Number of unwanted events	Extremely Intolerable	Highly Intolerable	ALARP	Maintain
1	WTP and related infrastructure	6	0	0	3	3
Total		**6**	**0**	**0**	**3**	**3**

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

The residual risks were ranked assuming the control measures are in place and effective. Table 7-4 below summarises the residual risks after taking the current control measures into consideration. The initial number of risks (raw risk) per risk priority is shown with the number of residual risks included in brackets.

Table 7-4: Residual Risk Ranking

Area number	Description	Number of unwanted events	Extremely Intolerable	Highly Intolerable	ALARP	Maintain
1	WTP and related infrastructure	6	0(0)	0(0)	3(0)	3(6)
Total		**6**	**0(0)**	**0(0)**	**3(0)**	**3(6)**

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

7.3 Potential Residual Environmental Risks

Some of the potential residual environmental risks identified are the following:

- Failure to establish sustainable vegetation on rehabilitated areas which could lead to a loss of biodiversity, increased soil erosion, increased siltation of rivers etc.;
- Contamination of streams, wetlands and water courses in the surrounding area. Contamination of soil and groundwater resources; and
- General scouring from sedimentation, as well as degraded habitat due to water quality deterioration which will affect entire watercourse and river reaches.

7.4 Proposed Control Measures

The following control measures or management actions are proposed for the potential unwanted residual risks:

Hazard	Consequence(s)	Possible New Control Measure(s)
Not all infrastructure being removed during decommissioning	Collapse of remnant infrastructure which could lead to human injury or fatality.	Ensure infrastructure is removed from site during the decommissioning phase.
Possible sedimentation at the wetland area adjacent to the proposed project area.	General scouring from sedimentation, as well as degraded habitat due to water quality deterioration could affect entire watercourse and river reaches	No material may be dumped or stockpiled within any wetland areas (or the buffers) in the vicinity of the proposed decommissioning footprint.
Possibility of not completely emptying the Brine Holding Tanks and spilling it in the surrounding environment.	Contamination of streams, wetlands and water courses in the surrounding area. Contamination of soil and groundwater resources.	Wetlands and their associated zones of regulation are to be clearly demarcated and avoided wherever possible.

8 Closure Objectives

Closure and rehabilitation are 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 outcome, but it will also reduce the financial burden of closure and rehabilitation. The following points outline the main objectives for rehabilitation and closure of the KPS WTP:

- Return impacted land, to a sustainable land use in agreement with the current landowner or end land user;

- Remove infrastructure that cannot be used by a subsequent land owner or a third party. Where infrastructure can be used by a third party, agreements must be put in place to ensure their long-term sustainable use;
- To manage the impact of physical effects and chemical contaminants on the environment such that the environmental quality is not adversely affected after closure;
- 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;
- Leave a safe and stable environment for both humans and animals and make their condition sustainable;
- To prevent soil, surface water and groundwater contamination by managing water on site;
- Ensure monitoring and maintenance of vegetation on all rehabilitated areas; and
- Comply with national closure and rehabilitation regulatory requirements.

9 Closure Environmental Management Plan

The main aim in developing the RCP 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 RCP as early as possible so as to ensure the optimal management of rehabilitation and closure issues that may arise. It is critical that a mine's RCP is defined and understood from before mining progresses and is complimentary to the objectives and goals set. Table 9-1 below sets out the rehabilitation and closure actions required for the KPS WTP.

Table 9-1: Summary of Rehabilitation and Closure Actions

Target Area	Main Actions
Water Treatment Plant Infrastructure	▪ All Infrastructure should be removed, unless legally transferred or sold to another party; ▪ All infrastructure should be demolished to 1m below surface and the demolition rubble removed and taken to the nearest waste facility; ▪ After all infrastructure has been removed, a soil assessment should be done. If soil contamination is discovered around the WTP infrastructure areas, this soil should be removed and disposed of in the appropriate waste disposal facility; ▪ Areas that have been disturbed or where infrastructure has been removed will have to be shaped and ripped to alleviate compaction; ▪ When shaping of the area is undertaken, reshaping must be free draining and should resemble the surrounding topography; ▪ Appropriate topsoil sourced from the topsoil stockpiles should be replaced on the rehabilitated areas; ▪ Reseed with grasses and improve species diversity by planting different species; ▪ Monitor and maintain vegetation establishment; and ▪ Remove alien invasive vegetation.
Brine and Slurry	▪ The brine will be drained from the WTP into the Brine Holding Tanks; which will be collected by trucks to be managed offsite at a licenced facility. ▪ The slurry after final drying will be collected from the storage pads to be managed offsite at a licenced facility.

Target Area	Main Actions
Roads	▪ Mine roads that are not needed for closure and post-closure uses at the site (e.g. security and monitoring) will be closed; ▪ Removal of all signage, fencing, shade structures, traffic barriers, etc.; ▪ All 'hard top' surfaces to be ripped and concrete removed along with any culverts and concrete structures; ▪ All potentially contaminated soils are to be identified 'and demarcated for later remediation; ▪ Appropriate topsoil sourced from the topsoil stockpiles should be replaced on the rehabilitated areas; ▪ Reseed with grasses and improve species diversity by planting species; ▪ Monitor and maintain vegetation establishment; and ▪ Remove alien invasive vegetation.
Water Pipelines	▪ Remove supporting plinths for pipeline as well as foundations and other associated pipeline infrastructure; ▪ Remaining structures should be demolished to 1 m below surface and the demolition rubble removed and any re-usable items should be removed from the site; ▪ Soil should be tested for contamination. If contamination is discovered, this soil should be removed and disposed of in the appropriate waste disposal facility; ▪ Appropriate topsoil sourced from the topsoil stockpiles should be replaced on the rehabilitated areas; ▪ Reseed with grasses and improve species diversity by planting different species; ▪ Monitor and maintain vegetation establishment; and ▪ Remove alien invasive vegetation.
Laydown Area	▪ The fence should be removed; ▪ The footprint area should be ripped to alleviate compaction and to assist with vegetation establishment; ▪ Appropriate topsoil sourced from the topsoil stockpiles should be replaced on the rehabilitated areas; ▪ Reseed with grasses and improve species diversity by planting different species. ▪ Monitor and maintain vegetation establishment; and ▪ Remove alien invasive vegetation.

9.1 Rehabilitation Strategy

9.1.1 Waste Management

As per the report *Process Description Klipspruit Colliery Mine Water Treatment Plant* prepared by Prentec, in June 2018, the WTP will produce two waste streams:

- Gypsum/Calcium carbonate waste slurry from stage 2 Reactor; and
- Brine streams from RO-02.

The gypsum/calcium carbonate slurry streams will be dewatered prior to loading on trucks for off-site disposal. The brine waste stream will be returned to the Stage 2 Reactor. If the salinity within the treatment process continues to increase, brine will be bled from the system into one of two brine holding tanks, which will then be periodically collected by trucks to be managed offsite.

9.1.2 Soil Management

Soil management measures typically include the following:

- The rehabilitated area should be profiled to replicate the natural landform;
- When there is insufficient soil material for use, select suitable sub surface materials (i.e. those that are neither saline nor sodic) to use as a substitute for soil when covering rehabilitated areas; and
- Ensuring organic content is enough to sustain microbial activity, encourage infiltration, limit runoff and improve soil stability. Despite not being practical, mulch with grass clippings (cut when seed content is at its highest) as an attempt to provide a seed bank.

9.1.3 Shaping and Levelling

Disturbed areas should be shaped and levelled back to original pre-construction ground level and should be free draining.

9.1.4 Soil Compaction Alleviation

To alleviate or reduce soil compaction the following should take place:

- Rip all disturbed footprints and heavily compacted areas (hard pans, access roads);
- Soil should be ripped when moist to allow for maximum alleviation of compaction; and
- Soils should be moved and/or replaced when they are dry to minimise compaction.

9.1.5 Soil Amelioration

Soil amelioration should be done as follows:

- Following de-compaction, an acceptable seed-bed should be produced through surface tillage;
- Soil should be sampled and analysed once placed on rehabilitated areas; and
- Fertiliser should be applied to raise the soil nutrient content to the desired levels and maintenance should continue.

9.1.6 Erosion Control

The following should be done as part of erosion control on rehabilitated land:

- Unnecessary disturbance and vegetation removal should be avoided and prevented;
- Pre-development drainage patterns should be reinstated as far possible; and
- Rehabilitated areas should be monitored for erosion.

9.1.1 Vegetation Establishment

The establishment of natural vegetation is a necessary component of the decommissioning and rehabilitation phase. The overall objectives for the establishment of natural vegetation of reshaped areas are to:

- Prevent erosion;
- Avoid soil loss;
- Restore the land to the agreed land capability;
- Reduce sedimentation into aquatic ecosystems such as rivers and streams;
- Re-establish eco-system processes (succession) to ensure that a sustainable land use can be established without requiring excessive fertiliser additions; and
- Restore the biodiversity of the area as far as possible.

To ensure vegetation establishment, the following should be done:

- Rehabilitated areas should be properly prepared;
- Woody patch cavities should be in-filled with suitable growth medium; and
- Growth properties should be improved by the addition of organic matter and fertilizer, where required.

To ensure successful rehabilitation at the KPS WTP, it is important to note vegetation types so that these can be replaced to some extent once mining has been completed.

9.2 Alien Invasive Species Management

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

and are easily spread which is detrimental to rehabilitation of vegetation. Alien Invasive Plants (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. *Nicotiana glauca (Wldetabak); Asclepias fruticose (Melkbos, Wildekapok); Pennisetum setaceum (Fountain grass) and Sutherlandia frutescens (Kankerbossie).*) anywhere within the project area;
- The transportation of soils or other substrates infested with alien species should be strictly controlled;
- Benefits to local communities as a result of the alien plant control programme should be maximised by not only ensuring that local labour is employed, but by also ensuring that cleared alien trees are treated as a valuable wood resource that can be utilised; and
- It is considered essential that appropriate veld management (particularly appropriate grazing levels and burning frequencies) should be applied to areas of secondary indigenous vegetation (e.g. secondary grassland of historically cultivated areas), and especially the grassland and wetland vegetation of untransformed habitats. Appropriate grazing levels and burning frequencies will not only ensure that good vegetation condition and biodiversity levels are maintained but will also serve to control the spread and increase in cover of palatable alien species such as *Paspalum dilatatum*.

To manage alien invasive species the following should be done:

- Mechanical methods including tree felling, hand pulling & ring barking should be implemented;
- Chemical control methods including selective/ non-selective, contact/ systemic herbicides as per regulations should be implemented;
- Category 1(a), & 1(b) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) listed species should be target for eradication;

- Preventative measures should be undertaken within the mine site area where natural vegetation occurs to combat bush encroachment and invasion of alien species which may result in the deterioration of natural resources; and
- Regular vegetation monitoring of the site should take place.

9.3 Threats Opportunities and Uncertainties

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

- Ensure that brine is managed and disposed-off at a licensed hazardous waste facility; and
- Adopting closure recommendations as identified in the respective specialist reports, with particular emphasis on social, water and biodiversity related aspects.

10 Financial Provision

Section 41 (1) of the MPRDA has been repealed and in terms of Section 24(P) in the NEMA as amended, which provides that the holder of a mining right must make financial provision for rehabilitation of negative environmental impacts. In addition to Section 24(P), the Regulations pertaining to the financial provision for prospecting, exploration, mining or production operations were promulgated on 20 November 2015.

Regulation 11 of the Financial Provision Regulations (GN R1147 in GG 39425 of 20 November 2015) requires that a holder of a Mining Right determines the financial provision based on the actual costs. This report did not, however, address any of the requirements of these regulations.

Digby Wells calculated the financial provision for the WTP at KPS according to the Department of Mineral Resources (DMR) guidelines set out by the 2005 *"Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision Provided by a Mine"*. The guidelines outline the methods for infrastructure removal and rehabilitation required for closure.

10.1 Methodology

The DMR calculation model was compiled using Microsoft Excel. The standard DMR unit rates were escalated with CPI from 2005 to 2018 (refer Table 10-1)

Table 10-1: Annual Escalation Rates

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
CPIX (%)	4.70%	7.10%	11.5%	7.10%	4.30%	5.00%	5.60%	5.70%	6.10%	4.60%	6.40%	5.28%	4.22%

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

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

The WTP area classification was done with a risk rating table as specified in the DMR guidelines (refer Table 10-2 to Table 10-6 below).

Table 10-2: Primary Risk Class for Type of Mineral Mined (KPS WTP Risk Class Highlighted in Red)

Mineral	Ore	Size: Large if > than (tpm)	Primary Risk Class			
			Large Mine		Small Mine	
			Mine and Mine waste	Mine, Mine Waste, Plant and Plant Waste	Mine and Mine Waste	Mine, Mine Waste, Plant and Plant Waste
Antimony		1000	A	A	C	C
Asbestos		0	A	A	A	A
Base metals (Copper, Cadmium, Cobalt, Iron ore, Molybdenum, Nickel, Tin, Vanadium)	Sulphide	10 000	A	A	C	A
	Oxide	10 000	C	A	C	A
Coal		0	A	A	A	A
Chrome		10 000	C	A	C	C
Diamonds and precious stones		10 000	C	B	C	C
Gold, silver, uranium		10 000	B	A	B	A
Phosphate		10 000	C	B	C	C

Mineral	Ore	Size: Large if > than (tpm)	Primary Risk Class			
			Large Mine		Small Mine	
			Mine and Mine waste	Mine, Mine Waste, Plant and Plant Waste	Mine and Mine Waste	Mine, Mine Waste, Plant and Plant Waste
Platinum		10 000	C	B	C	B
Mineral sands (Ilmenite, Titanium, Rutile, Zircon)		10 000	C	B	C	C
Zinc and Lead		10 000	C	A	C	A
Industrial Minerals (Andalusite, Barite, Bauxite, Cryolite, Fluorspar)		10 000	C	C	C	C

Table 10-3: Criteria Used to Determine the Area Sensitivity

Sensitivity	Sensitivity criteria		
	Biophysical	**Social**	**Economic**
Low	▪ Largely disturbed from natural state, ▪ Limited natural fauna and flora remains, ▪ Exotic plant species evident, ▪ Unplanned development, ▪ Water resources disturbed and impaired.	▪ The local communities are not within sighting distance of the mining operation, ▪ Lightly inhabited area (rural).	▪ The area is insensitive to development, ▪ The area is not a major source of income to the local communities.
Medium	▪ Mix of natural and exotic fauna and flora, ▪ Development is a mix of disturbed and undisturbed areas, within an overall planned framework, ▪ Water resources are well controlled.	▪ The local communities are in the proximity of the mining operation (within sighting distance), ▪ Peri-urban area with density aligned with a development framework, ▪ Area developed with an established infrastructure.	▪ The area has a balanced economic development where a degree of income for the local communities is derived from the area, ▪ The economic activity could be influenced by indiscriminate development.
High	▪ Largely in natural state, ▪ Vibrant fauna and flora, with species diversity and abundance matching the nature of the area, ▪ Well planned development, ▪ Area forms part of an overall ecological regime of conservation value, ▪ Water resources emulate their original state.	▪ The local communities are in close proximity of the mining operation (on the boundary of the mine), ▪ Densely inhabited area (urban/dense settlements), ▪ Developed and well-established communities.	▪ The local communities derive the bulk of their income directly from the area, ▪ The area is sensitive to development that could compromise the existing economic activity

Table 10-4: Weighting Factor 1 – Nature of Terrain

	Flat	Undulating	Rugged
Weighting factor 1: Nature of the terrain/ accessibility	1.00	1.10	1.20

Note:

- Flat - Generally flat over the mine area;
- Undulating - A mix of sloped and undulating areas within the mine area; and
- Rugged - Steep natural ground slopes (greater than 1:6) over the majority of the mine area.

Table 10-5: Weighting Factor 2 – Proximity to Urban Area

	Urban	Peri-urban	Remote
Weighting factor 2: Proximity to urban area where goods and services are to be supplied	1.00	1.05	1.10

Note:

- Urban - Within a developed urban area;
- Peri-urban - Less than 150 km from a developed urban area; and
- Remote - Greater than 150 km from a developed urban area.

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

The classification of KPS has been summarised in Table 10-6 below.

Table 10-6: Mine classification

Mine	Risk Class	Sensitivity	Terrain	Proximity to Urban Area
KPS	A	Medium	Flat	Peri Urban

10.2 Assumptions

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

- The infrastructure layout plan (Ref: SOU5014_Measurents_Working.pdf) and the conceptual infrastructure layout plan (Ref: WTP_Design_Drawing_10ML.PDF) were used by Digby Wells to digitize and measure the WTP infrastructure and areas requiring rehabilitation. This was deemed accurate and up to date;
- This closure cost assessment only focussed on the newly proposed infrastructure associated with the WTP at KPS. None of the existing infrastructure at the mine has been taken into consideration as it is understood that this forms part of the mine's annual closure cost assessments;
- The costs for brine management were not included in this assessment; as it was indicated by South32 that the brine will be managed offsite;
- All surface infrastructure will be demolished or removed from the mine at closure;
- The calculations do not account for any value recovered from the sale of plant, steel or other material;
- It was assumed that all temporary/mobile infrastructure (reactors, storage silos, and abstraction pumps) will be removed from site before closure;
- The total length of the steel pipeline (feed water line to KPS WTP and discharge line) is 5,328 m;
- The building with the overhead crane, chemical store, gypsum handling roof and future gypsum handling roof structure as labelled in the conceptual infrastructure layout plan were assumed to be steel structures;
- The gypsum handling and future gypsum handling base area was assumed to have a concrete bund wall;
- The office, toilets and workshop as labelled in the conceptual infrastructure layout plan was assumed to be single storey brick structures;
- It was assumed that there is a 300 m perimeter fence around the laydown area;
- All brick and concrete structures will be demolished to 1m below natural ground level;
- All inert waste (i.e. building rubble) will be disposed on site (used as backfill material for the open pits);
- A project management fee of 12% is applied to the total capital expenditure cost;
- A contingency of 10% is included to allow for unforeseen costs associated with contractors or rate increases; and
- Maintenance and aftercare costs of rehabilitation have been included.

10.3 Financial Provision Estimate

The estimated closure cost required for the rehabilitation and closure of the WTP at KPS is **R 2,755,935 (incl. VAT)** and **R 2,396,465 (Excl. VAT)**. A detailed closure cost for proposed WTP is provided in Table 10-7 below.

A contingency of 10% on all infrastructure costs has been allowed for. A 12% allowance has been included for project management fees. These fees account for the costs required to manage the closure and rehabilitation phase as well as provide personnel to monitor and maintain the rehabilitated areas after closure. It should also be noted that the DMR methodology includes VAT at 15%.

Table 10-7: WTP Detailed Financial Provision Estimate

	Description: Class A (Medium risk)	Unit:	A	B	C	D	E=A*B*C*D Amount (Rands)
Component			**Step 4.5**	**Step 4.3**	**Step 4.3**	**Step 4.4**	
1	Dismantling of processing plant and related structures (incl. overland conveyors and Power lines)	m^3	-	R 14.46	1.00	1.00	R 0
2 (A)	Demolition of steel buildings and Structures	m^2	1,015	R 201.48	1.00	1.00	R 204,504
2 (B)	Demolition of reinforced concrete buildings and structures	m^2	2,668	R 296.92	1.00	1.00	R 792,125
3	Rehabilitation of access roads	m^2	1,097	R 36.05	1.00	1.00	R 39,561
4(A)	Demolition and rehabilitation of electrified railway lines	m	-	R 349.94	1.00	1.00	R 0
4(B)	Demolition and rehabilitation of non-electrified railway lines	m	-	R 190.88	1.00	1.00	R 0
5	Demolition of housing and/or administration facilities	m^2	48	R 402.96	1.00	1.00	R 19,342
6	Opencast rehabilitation including final voids and ramps	ha	-	R 205,087.35	**0.52**	1.00	R 0
7	Sealing of shafts, adits and inclines	m^3	-	R 108.16	1.00	1.00	R 0
8(A)	Rehabilitation of overburden and spoils	ha	-	R 140,825.23	1.00	1.00	R 0
8(B)	Rehabilitation of processing waste deposits and evaporation ponds (basic, salt producing waste)	ha	-	R 175,395.28	1.00	1.00	R 0
8(C)	Rehabilitation of processing waste deposits and evaporation ponds (acidic, metal-rich waste)	ha	-	R 509,431.03	**0.80**	1.00	R 0
9	Rehabilitation of subsided areas	ha	-	R 117,919.92	1.00	1.00	0
10	General surface rehabilitation	ha	2	R 111,557.34	1.00	1.00	R 251,534
11	River diversions	ha	-	R 111,557.34	1.00	1.00	R 0
12	Fencing	m	300	R 127.25	1.00	1.00	R 38,176
13	Water management	ha	-	R 42,417.24	**0.67**	1.00	R 0
14	2 to 3 years of maintenance and aftercare	ha	2	R 14,846.03	1.00	1.00	R 35,103
15	Decommissioning of a 0.3 m diameter steel pipeline with plinths	m	5,328	R 92.04	1.00	1.00	R 490,431
							R 1,870,777
	Weighting Factor 2 (step 4.4)			**1,05**		**Sub Total 1**	**R 1,964,316**
	Preliminary and General			12% of Sub Total 1			R235,717.91
	Contingency			10% of Sub Total 1			R196,431.59
						Sub Total 2	**R 2,396,465**
	VAT (15%)						**R 359,470**
	GRAND TOTAL						**R 2,755,935**

11 Monitoring, Auditing and Reporting

The monitoring measures for the post-closure phase at the KPS WTP are provided in Table 11-1 and primarily consist of environmental monitoring. Monitoring provides information on whether rehabilitation methods employed are functioning correctly or not. Monitoring should provide an early indication of problems arising so that corrective management actions can be taken.

The post closure monitoring period will begin once scheduled decommissioning and rehabilitation activities for the site have been completed. The duration of post closure monitoring will be determined based on environmental performance and until it can be demonstrated that the rehabilitation work has achieved the agreed endpoints; however, at present, it has been assumed that post closure monitoring will not continue for more than 5 years. It is important that the data obtained during monitoring is used to gauge the success of rehabilitation. Negative monitoring findings should be clearly linked to specific corrective actions.

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 land use.

Table 11-2 sets out the proposed monitoring plan and audit requirements for the KPS WTP.

Table 11-1: Post Closure Monitoring Programme

Component / Aspect	Monitoring		Performance / success criteria	Corrective action
	Methodology	Frequency / duration		
Soil Management				
Soil fertility	▪ Undertake a visual assessment and delineate areas where poor vegetation growth has occurred; ▪ Submit soil samples to an accredit soil laboratory to conduct soil fertility analysis.	Yearly until soil fertility supports the final land use or for at least 2 years post-closure	▪ Soil analysis results comply with remediation targets at a 95 percentile level; and ▪ Self-sustaining vegetation establishment.	▪ Apply amelioration where required as informed by sampling undertaken.
Erosion	▪ Conduct a visual assessment to determine areas of potential erosion; and ▪ Undertake field investigations, fixed point photography to document the significance of the erosion occurring on site	Twice yearly for at least 2 years post-closure.	▪ No evidence of significant erosion; and ▪ Good vegetation cover and species composition.	As required: ▪ Re-shape areas to ensure that they are free-draining; ▪ Establish vegetation on bare patches; and ▪ Repair and stabilisation of erosion gullies and sheet erosion.
Post-mining end land use	▪ Assess activities completed, as well as legal and related documentation completed and signed-off; and ▪ Ensure rehabilitation measures are aligned to the end land use.	Once off, at mine closure.	▪ Area has been rehabilitated to an aesthetic quality not to compromise potential tourism; ▪ Transfer to third party operator has taken place once the area has been proven to be safe for redevelopment; ▪ Legal and zoning issues have been addressed; and ▪ Vegetation re-establishment, cover and composition are sustainable.	▪ Refer back to end land use approach and refine measures to be implemented in achieving the desired final land use.
Topography	▪ Conduct a visual assessment to determine areas of potential erosion; and ▪ Undertake regular digital surveys of rehabilitated areas to confirm that final topography is aligned with landform designs.	During rehabilitation phase	▪ No evidence of significant erosion. ▪ No evidence of water pooling on rehabilitated areas. ▪ The final profile achieved should be acceptable in terms of surface water drainage requirements and the end land use objectives.	As required: ▪ Re-shape areas to ensure that they are free-draining; and ▪ Refer back to end land use approach and refine measures to be implemented in achieving the desired final land use.

Vegetation establishment	▪ Determine whether re-established vegetation communities are on a trajectory of achieving a stable self-sustaining community dominated by species typical of the climax-species present in the adjacent areas:
	  ▪ Inspect rehabilitated areas to assess vegetation establishment and provide for early detection of erosion in recently planted/seeded areas (monthly);
	  ▪ Undertake fixed point photography at specific points at the rehabilitated sites to obtain a long term directly comparable method of determining changes in the landscape; and
	  ▪ Conduct evaluation of rehabilitated areas by means of field inspections. During these assessments' measurement of growth
		Yearly for at least 2 years post-closure.	▪ Limited to no erosion; and
			▪ Self-sustaining vegetation ecosystem.
				As required:
				▪ Re-vegetate poorly established rehabilitated areas;
				▪ Re-seed bare patches; and
				▪ Apply additional fertiliser and/or organic matter, depending on the condition of the vegetation and the initial organic material application.

Component / Aspect	Monitoring		Performance / success criteria	Corrective action
	Methodology	Frequency / duration		
	performance and species abundance will be carried out to determine: i. Plant basal cover and species abundance in the grassed areas. Estimates of vegetation canopy and ground cover as well as height; ii. Distribution, growth and survival of woody species; iii. Dominant plant species (woody and herbaceous); iv. Presence of exotic invasive species, and degree of encroachment; v. Browsing or grazing intensity; vi. Notes regarding erosion, such as, type, severity, degree of sediment build-up; and vii. Species composition and richness.			
Invasive alien species	▪ Visually inspect areas where invasive species have been previously eradicated and areas prone to invasive species (e.g. eroded/degraded areas, along drainage lines, etc.); and ▪ Undertake surveys on relevant sites where bush encroachment has previously been identified to determine the status quo of invasive vegetation.	Yearly for at least 2 years post-closure.	▪ Limit and/or prevent declared Category 1, 2 and 3 invader species establishing; ▪ Minimise extended threat to ecosystems, habitats or other species; ▪ Increase the potential for natural systems to deliver goods and services; and ▪ Minimise economic or environmental harm or harm to human health.	▪ Revisit mitigation measures; and ▪ Continue control and management.
General site status	▪ Conduct a visual assessment with respect to compliance of the afore-mentioned closure measures and to ensure that the site is aesthetically neat and tidy, and that no health or safety risks exist on site.	Once-off following implementation of rehabilitation measures.	▪ Waste/rubble free sites.	As required: ▪ Clear remnant rubble and dispose of in open pit as backfill material.
Surface Water Quantity	▪ Visually assess the functionality of the surface water drainage systems feeding surface water runoff from rehabilitated areas. ▪ Undertake field investigations, fixed point photography to document the significance of the erosion occurring on site.	After the first major rains of the season and after any major storm.	▪ No evidence of significant erosion; and ▪ No evidence of water pooling on rehabilitated areas.	As required: ▪ Re-shape areas to ensure that they are free-draining; and ▪ Refer back to end land use approach and refine measures to be implemented in achieving the desired final land use.
Surface Water and Groundwater Quality	▪ Sample and monitor surface and groundwater quality.	Bi-annually for at least 2 years post-closure.	▪ Water quality results within ranges of the WUL and/or DWS standards.	As required: ▪ Increase monitoring frequency and detect point sources. ▪ Optimise monitoring plan if needed.

Table 11-2: Monitoring Plan and Audit Requirements

Aspect	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	Establishment of alien plant species	Alien plant monitoring	Qualified botanist	Quarterly monitoring for 2 years	Monitoring
Groundwater & Surface water	Groundwater and surface water quality	▪ Macro Analysis i.e. Ca, Mg, Na, K, SO_4, 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 water consultant, using best practice guidelines and should be analysed by a SANAS accredited laboratory.	It is suggested that bi-annual samples be collected, extending to at least 2 years post closure. Post closure monitoring should continue until a sustainable situation is reached and after it has been signed off by the authorities.	Monitoring and Reporting
Soils	Erosion, loss of soil fertility, compaction	The rehabilitated area must be assessed for compaction, fertility and erosion.	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

Aspect	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	EMP/ RCP Conditions	Auditing against the conditions outlined within the approved EMP and EA (EMP Performance Assessment) or RCP at time of mine closure. To determine compliance to EMP or RCP conditions.	Environmental Officer/Independent Third Party.	Annual Performance Assessment	Audit Report
	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 of the Financial Provision Regulations.	Environmental Officer/Independent Third Party	Annually and must be audited by an independent auditor.	Financial Provision Report submitted to the DMR

12 Closing Statement

Mine closure and rehabilitation are an ongoing programme designed to restore the physical, chemical and biological quality or potential of air, land and water regimes disturbed by mining to a state acceptable to the regulators and to post mining land users. It begins 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. The activities associated with mine closure are designed to prevent or minimise adverse long-term environmental impacts, and to create a self-sustaining natural ecosystem or alternate land use based on an agreed set of objectives. The objective of mine closure is to obtain legal (government) and community agreement that the condition of the closed operation meets the requirements of those entities, whereupon the companies' legal liability is terminated. 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 South32 in carrying out successful rehabilitation.

The following is recommended to assist South32 in successfully carrying out the rehabilitation and closure at the KPS WTP:

- Regular water monitoring should take place to determine possible changes in water quality of nearby natural sources
- Brine and slurry should be managed at an appropriate licensed waste facility;
- Invasive alien plants should be removed on an ongoing basis; and
- Monitoring and maintenance of the rehabilitated areas should take place on an annual basis for at least 2 years post-closure.

13 References

Bromilow, C. 2010. Problem Plants of South Africa. Briza Publications, Pretoria.

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SRK Consulting Engineers and Scientists, March 2009: Klipspruit Colliery Revised and Consolidated EIA and EMP, Volume 1, South Africa.

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Prentec. June 2018. Klipspruit Colliery Mine Water Treatment Plant, Process description for Information of South 32.

Appendix A: Unwanted Events

Mine:	Klipspruit Colliery Water Treatment Plant	**DMR Reference:**	MP 30/5/1/2/2/125 MR			**Evaluation Year:**	2018			**Evaluators:**	Evaluators:
Location:	Mpumalanga Province					**Last Modified:**	17/08/2018			**Facilitator:**	Christine Reinecke
Hazard (Unwanted Event)	**Consequence(s)**	**Primary Risk Category**	**Raw Risk**			**Current Controls**	**Residual Risk**			**Possible New Controls**	**Accountability**
			Severity	**Likelihood**	**Risk Rank**		**Severity**	**Likelihood**	**Risk Rank**		
Not all infrastructure being removed during decommissioning	Collapse of remnant infrastructure which could lead to human injury or fatality.	Health & Safety	D	I	ALARP	Will remove WTP and related infrastructure during the decommissioning phase.	E	H	Maintain	Ensure all infrastructure is removed from site during the decommissioning phase.	Supervisor
Possible sedimentation at the wetland area adjacent to the proposed project area.	General scouring from sedimentation, as well as degraded habitat due to water quality deterioration could affect entire watercourse and river reaches	Natural Environment	D	I	ALARP	Only the areas earmarked for construction will be cleared and material will not be stockpiled in wetland areas.	E	H	Maintain	No material may be dumped or stockpiled within any wetland areas (or the buffers) in the vicinity of the proposed decommissioning footprint.	Supervisor
Possibility of not completely emptying the Brine Holding Tanks and spilling it in the surrounding environment.	Contamination of streams, wetlands and water courses in the surrounding area. Contamination of soil and groundwater resources.	Natural Environment	D	I	ALARP	Wetlands and their associated zones of regulation will be clearly demarcated and avoided wherever possible.	E	I	Maintain	Wetlands and their associated zones of regulation should remain clearly demarcated and avoided wherever possible.	Supervisor

Mine:	Klipspruit Colliery Water Treatment Plant	**DMR Reference:**	MP 30/5/1/2/2/125 MR			**Evaluation Year:**	2018			**Evaluators:**	Evaluators:
Location:	Mpumalanga Province					**Last Modified:**	17/08/2018			**Facilitator:**	Christine Reinecke
Hazard (Unwanted Event)	**Consequence(s)**	**Primary Risk Category**	**Raw Risk**			**Current Controls**	**Residual Risk**			**Possible New Controls**	**Accountability**
			Severity	**Likelihood**	**Risk Rank**		**Severity**	**Likelihood**	**Risk Rank**		
Possibility of failing to control alien invasive species on rehabilitated land.	Loss of biodiversity.	Natural Environment	E	H	Maintain		E	H	Maintain	Ensure that there is an AIP to address any issues on rehabilitated areas.	Supervisor
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	E	H	Maintain		E	H	Maintain	Frequent monitoring and maintenance of rehabilitated areas.	Supervisor
Possibility of not implementing the final Land Use Plan for the disturbed areas.	Land not having a functional use.	Natural Environment	F	H	Maintain		F	G	Maintain	"Ensure rehabilitation is conducted using a clear plan for the WTP area's end land use.	Supervisor