mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

Environmental Impact Assessment
And
Environmental Management Programme

for Listed Activities Associated with the Proposed Active Water Treatment Plant at the Klipspruit Colliery, Mpumalanga Province

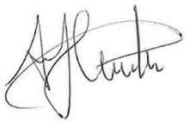
SUBMITTED FOR ENVIRONMENTAL AUTHORISATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 AND THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT, 2008 IN RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (MPRDA) (AS AMENDED).

Name of Applicant:	South32 SA Coal Holdings (Pty) Ltd
Tel no:	013 689 4531
Fax no:	086 718 2070
Postal Address:	P.O Box 61820, Marshalltown, Johannesburg
Physical Address:	Portion 12,Farm Klipfontein 3 IS, Ogies, 2230
File Reference Number SAMRAD:	**MP 30/5/1/2/2/125 MR**

Digby Wells and Associates (South Africa) (Pty) Ltd. Co. Reg. No. 2010/008577/07. Turnberry Office Park, 48 Grosvenor Road, Bryanston, 2191. Private Bag X10046, Randburg, 2125, South Africa
Tel: +27 11 789 9495, Fax: +27 11 069 6801, info@digbywells.com, www.digbywells.com

This document has been prepared by Digby Wells Environmental.

Report Type:	**Draft EIA and EMPr**
Project Name:	**Environmental Impact Assessment and Environmental Management Programme Report for the Proposed Water Treatment Plant at the Klipspruit Colliery, Mpumalanga Province**
Project Code:	**SOU5014**

Name	Responsibility	Signature	Date
Anita Gutu	Report Compiler		July 2018 Updated February 2020
Xanthe Taylor	Report Review		August 2018
Brett Coutts	Senior Review		August 2018

IMPORTANT NOTICE

In terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 as amended), the Minister must grant a prospecting or mining right if among others the mining "will not result in unacceptable pollution, ecological degradation or damage to the environment".

Unless an Environmental Authorisation can be granted following the evaluation of an Environmental Impact Assessment and an Environmental Management Programme report in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA), it cannot be concluded that the said activities will not result in unacceptable pollution, ecological degradation or damage to the environment.

In terms of section 16(3)(b) of the EIA Regulations, 2014, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of section 17 (1) (c) the competent Authority must check whether the application has taken into account any minimum requirements applicable or instructions or guidance provided by the competent authority to the submission of applications.

It is therefore an instruction that the prescribed reports required in respect of applications for an environmental authorisation for listed activities triggered by an application for a right or a permit are submitted in the exact format of, and provide all the information required in terms of, this template. Furthermore, please be advised that failure to submit the information required in the format provided in this template will be regarded as a failure to meet the requirements of the Regulation and will lead to the Environmental Authorisation being refused.

It is furthermore an instruction that the Environmental Assessment Practitioner must process and interpret his/her research and analysis and use the findings thereof to compile the information required herein. (Unprocessed supporting information may be attached as appendices). The EAP must ensure that the information required is placed correctly in the relevant sections of the Report, in the order, and under the provided headings as set out below, and ensure that the report is not cluttered with un-interpreted information and that it unambiguously represents the interpretation of the applicant.

OBJECTIVE OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

The objective of the environmental impact assessment process is to, through a consultative process: -

- determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
- describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
- identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
- determine the: -
    - nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
    - degree to which these impacts: -
    - can be reversed;
    - may cause irreplaceable loss of resources, and
    - can be avoided, managed or mitigated.
- identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
- identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;
- identify suitable measures to manage, avoid or mitigate identified impacts; and
- identify residual risks that need to be managed and monitored.

EXECUTIVE SUMMARY

Introduction

South32 SA Coal Holdings (Pty) Ltd (hereafter South32) intends to construct a modular Water Treatment Plant (WTP) for treating mine affected water at its Klipspruit Colliery (KPS) located near Ogies in the Mpumalanga Province (the project). The purpose of the WTP is to treat mine affected water from the Balancing Dam to an acceptable standard and subsequently release this water into the Saalklapspruit.

This report constitutes the draft Environmental Impact Assessment (EIA) and Environmental Management Programme (EMPr) Report which is submitted to Interested and Affected Parties (I&APs) and relevant Authorities for review and comment in terms of the application for Environmental Authorisation (EA) under the NEMA EIA Regulations, 2014 (as amended).

Project applicant

The details of the Project Applicant are included in the table below.

Company name:	South32 SA Coal Holdings (Pty) Ltd
Responsible person:	Josua Bekker
Contact person:	Thembani Mashamba
Physical address:	Portion 12, Farm Klipfontein 3 IS Ogies, 2230
Telephone:	013 689 4531
Email:	thembani.mashamba@south32.net

Project overview

South32 owns KPS, near Ogies in the Mpumalanga Province. 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 considered the preferred alternative to address this, and South32 proposes to construct a modular WTP and ancillary infrastructure to treat mine-affected water.

The WTP is to be established within the operational area of the mine and will be modular in design and constructed in three phases, starting at a capacity of 2Ml/day upgradeable to 3.3Ml/day (Phase 1), and then increased in increments of 3.3Ml/day to 10Ml/day (Phase 2 and

Phase 3). 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.

Need and Desirability of the Project

South32 intends to continue and expand its KPS mining operation until the end of the Life of Mine (LOM). With the progression and expansion of mining at KPS, the affected water that is being generated exceeds the reuse capacity within the operation whilst the storage capacity within the mine water management system has reached its limits. To this end, an alternative measure for water management is required to reduce the risks associated with excessive mine affected water storage at KPS, namely the risk of spillages or discharges to the natural environment.

The treatment and release of affected mine water has been deemed the most feasible option to maintain KPS's water balance. As previously indicated, South32 intends to treat the water to the RWQOs for the Wilge River Catchment Region. The control measures in place to test water prior to being released will also ensure an overall improved water quality to the receiving stream. This will alleviate current and future pressures on the manage water management system as well as reintroduce the valuable resource to the natural environment. A similar treatment and water release process has been previously undertaken at KPS.

Purpose of this report

This EIA and EMP Report aims to outline the project activities and examine environmental and social effects caused by the implementation of the project. It aims to identify the potential impacts, based on the specialist investigations undertaken, that could result from the proposed project activities (positive or negative), and to propose management measures for such impacts.

Environmental consultants

Digby Wells Environmental (Digby Wells) has been appointed by South32 as the independent Environmental Assessment Practitioner (EAP) to conduct the EIA according to NEMA and Integrated Water Use Licence (IWUL) according to the National Water Act, 1998 (NWA) as well as the associated specialist studies and the required Public Participation Process (PPP) for the proposed project. The details of the Environmental Assessment Practitioner are contained in the table below.

Company name:	Digby Wells Environmental
Contact person:	Xanthe Taylor
Physical address:	Turnberry Office Park, 48 Grosvenor Road,

	Bryanston, 2191
Telephone:	011 789 9495
Email:	xanthe.taylor@digbywells.com

Approach and methodology for the Public Participation Process

A Public Participation Process (PPP) was initiated during the Scoping Phase, which is central to the investigation of environmental and social impacts, as it is important that stakeholders that may be affected by the project are given an opportunity to identify concerns and to ensure that local knowledge, needs and values are understood and taken into consideration as part of the impact assessment process. The comments from the stakeholders from the Scoping Phase are included in the Comment and Response Report (CRR) (Appendix 3). The CRR will be updated after the public review of this report.

This draft EIA and EMPr has been submitted to the public for their input and comments for a period of 30 days. The commenting period is from the 21 February 2020 and ends on 23 March 2020. The draft EIA and EMPr is available for review on the Digby Wells website (www.digbywells.com). Copies are available from the Digby Wells Public Participation Office as well as at the locations listed below:

- Emalahleni Public Library;
- Ogies Public Library; and
- Kriel Public Library

The draft EIA and EMPr will be updated with all the comments received from the Interested and Affected Parties (I&APs) prior to submission to the DMR for consideration. Once the DMR has made a decision this will be communicated to all the registered I&APs.

Environmental Baseline

KPS is situated approximately 30 km west of Emalahleni near the town of Ogies within the Nkangala Magisterial District of the Mpumalanga Province. The Mining Right Area is bordered by the N12 Road to the north; R545 Road to the east and R555 Road to the south. Mining activities commenced in October 2003 and comprise of open pit mining utilising strip mining and truck and shovel mining methods. The proposed WTP is located in the south-eastern corner of KPS with the proposed discharge point into the Saalklapspruit located to the north of the KPS mine boundary.

KPS occupies a total footprint of 1647 ha. The estimated total area of disturbance is 50 ha for the WTP project, totalling 3% of KPS. The WTP Project area is characterised as disturbed land/ rehabilitated areas which was previously mined as part of the KPS operation. Vegetation has re-established around the proposed discharge point; however extensive alien plant species can be observed. Two wetlands are present within the KPS boundary, namely large

channelled valley bottom wetland that drains north into the Saalklapspruit system, and a hillslope seep which is located in the south-east corner of the project area.

Project alternatives

The Project alternatives considered for this project include the following:

- An activity alternative and location alterative for the WTP in terms of the environmental sensitivities associated with areas where developments are planned;
- WTP design with specific focus on waste generated by the plant;
- Pipeline routes which considered environmental sensitives and progressive mining and rehabilitation activities planned at KPS; and
- The No-go alternative.

Impact Assessment Summary

The EIA and EMPr, the associated specialist studies and the PPP have been undertaken and completed in line with the legislative requirements discussed in Section 6 (Part A) of this report. A quantitative impact rating methodology was applied to determine the significance of the expected impacts pre-mitigation and post-mitigation. The table below provides a summary of the most significant impacts expected during the various phases of the project. It is noted that due to the disturbed nature of the project area and the magnitude of the proposed activities, the majority of the impacts identified are expected to be of minor or negligible significance.

Potential Impact	Aspects Affected	Pre-Mitigation Significance	Post-Mitigation Significance
Loss of topsoil resources as a result of construction of pipelines may occur as land is cleared along the pipeline routes.	Soil, Land Use and Land Capability	Moderate (negative)	Minor (negative)
Soil erosion and subsequent sedimentation of wetland and river systems; Reduction to catchment yields due to the operational infrastructure area as a result of water containment during the construction phase.	Wetlands; Aquatic Ecology; Surface Water	Moderate (negative)	Minor (negative)
Potential alteration of natural hydrology, channel width and reduced bank stability due to increased runoff associated with the proposed discharge into the Saalklapspruit.	Surface Water	Moderate (negative)	Minor (negative)

Instream water quality improvement as a result of dilution with treated water.	Surface Water	Major (positive)	Major (positive)
Restoration of runoff catchment yield as a result of reintroducing water lost to mining activities into the Saalklapspruit.	Surface Water	Major (positive)	Major (positive)
Rehabilitation of infrastructure footprint areas	Flora and Fauna	Moderate (positive)	Moderate (positive)

Conclusions and recommendations

The installation of a WTP has been deemed the most feasible option to maintain the water balance at KPS. This will reduce the risk of spillages or discharges of mine affected water to the natural environment which would have a significant negative impact on the natural environment. The preferred location of the WTP is on disturbed land within KPS which was strategically selected to avoid further environmental disturbance within the Mining Right Area.

The findings of the impact assessment have shown that the project will have some moderately significant negative impacts on the receiving environment. However, due to the current disturbed nature of the project area, the majority of identified impacts are expected to be of minor or negligible negative significance. The project will also have some major positive impacts associated with the discharge of treated water into the Saalklapspruit.

Based on the assessment of the potential negative and positive impacts associated with the project, it is concluded that the proposed project should be authorised. Mitigation measures have been proposed to minimise the significance of the identified negative impacts and prevent any long-term negative effects.

Comments from I&APs are welcome throughout the process through the channels provided in this report.

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LIST OF ACRONYMS AND ABBREVIATIONS

AMD	Acid Mine Drainage
AP	Acid Generating Potential
ASTP	Average Score per Taxon
CARA	Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)
CR	Critical Endangered
CRR	Comments and Response Report
DD	Data Deficient
DEA	Department of Environmental Affairs
dBA	Decibels
Digby Wells	Digby Wells Environmental
DMR	Department of Mineral Resources
DWAF	Department of Water and Forestry
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
ELM	eMalahleni Local Municipality
EMP	Environmental Management Plan
EN	Endangered
FRAI	Fish Response Assessment Index
GDP	Gross Domestic Product
GN	Government Notice
HGM	Hydro-geomorphic Unit
HIA	Heritage Impact Assessment
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IHAS	Invertebrate Habitat Assessment System
IHI	Index of Habitat Integrity
IUCN	International Union for the Conservation of Nature
IWUL	Integrated Water Use Licence
IWULA	Integrated Water Use Licence Application

LC	Least Concern
KPS	Klipspruit Colliery
LoM	Life of Mine
MAE	Mean Annual Evaporation
mamsl	Metres Above Mean Sea Level
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
mbgl	Metres Below Ground Level
MIRAI	Macroinvertebrates Response Assessment Index
MPRDA	Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
NDCR	National Dust Control Regulations
NDM	Nkangala District Municipality
NE	Not Evaluated
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEM: AQA	National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)
NEM: BA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NFEPA	National Freshwater Ecosystem Priority Area
NHRA	National Heritage Resources Act, 1999 (Act No. 25 od 1999)
NT	Near Threatened
NWA	National Water Act, 1998 (Act No. 36 of 1998)
PCD	Pollution Control Dam
PCPP	Phola Coal Processing Plant
PES	Present Ecological Status
PPP	Public Participation Process
RCP	Rehabilitation and Closure Plan
RHP	River Health Programme
ROM	Run of Mine
RWQO	Resource Water Quality Objectives
South32	South32 SA Coal Holdings (Pty) Limited
SAHRA	South African Heritage Resources Agency
SANS	South African National Standards
SANAS	South African National Accreditation System

SASS5	South African Scoring System version 5
SHE	Safety, Health and Environment
SMME	Small, Medium and Micro Enterprises
SSC	Species of Special Concern
STP	Sewage Treatment Plant
TDS	Total Dissolved Solids
ToR	Terms of Reference
VU	Vulnerable
WARMS	Water User Registration Management Systems
WMA4	Water Management Area 4

Part A: Scope of Assessment and Environmental Impact Assessment Report

1 Introduction

South32 SA Coal Holdings (Pty) Ltd (hereafter South32) intends to construct a modular Water Treatment Plant (WTP) for treating mine affected water at its Klipspruit Colliery (KPS) located near Ogies in the Mpumalanga Province (the project). Feedwater for the WTP will originate from the Balancing Dam on KPS which currently accommodates mine affected water from the KPS operation.

The environmental-legal process includes the application for Environmental Authorisation for Listed Activities triggered in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and associated Regulations, namely the Environmental Impact Assessment (EIA) Regulations of 2014 (as amended). Concurrently, an application for an Integrated Water Use Licence (IWUL) in terms of the National Water Act, 1998 (Act No. 36 of 1998) (NWA) is being undertaken as part of the enviro-legal process for the WTP.

Digby Wells Environmental (Digby Wells) has been appointed by South32 as the independent Environmental Assessment Practitioner (EAP) to conduct the EIA according to the NEMA, and IWUL according to NWA as well as the associated specialist studies and the required Public Participation Process (PPP) for the proposed project.

The figure below provides a simplified schematic of the EIA process subject to this application.

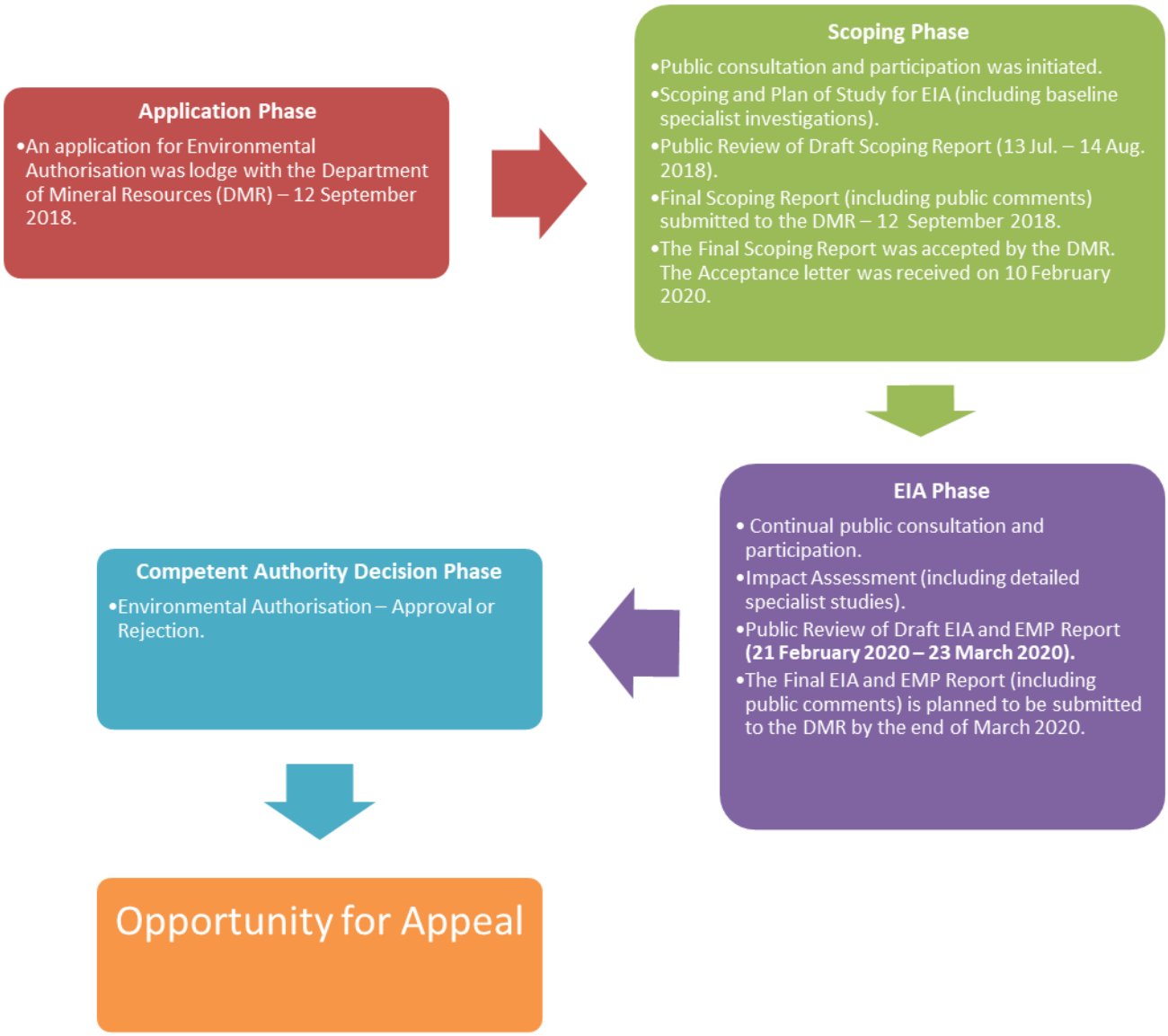


Figure 1-1: EIA Process[1]

This report constitutes the draft EIA and Environmental Management Programme (EMPr) which is submitted to Interested and Affected Parties (I&APs) and relevant Authorities for review and comment in terms of the application for Environmental Authorisation under the NEMA EIA Regulations, 2014 (as amended).

This EIA and EMPr aims to outline the project activities and examine environmental and social effects caused by the implementation of the project. It aims to identify the potential impacts,

[1] Due to the closure of the DMR Mpumalanga Regional Office between 03 September and 05 August 2019 a significant lag time was experienced in the EIA Process following the submission of the Environmental Authorisation Application and Final Scoping Report. The Process was reinitiated during October 2019 with the resubmission of the EA application.

based on the specialist investigations undertaken, that could result from the proposed project activities (positive or negative), and to propose management measures for such impacts.

A Plan of Study was submitted as part of the Scoping phase of this process and approved accordingly. This report has therefore been compiled in accordance to the approved Plan of Study. Finalisation of the EIA phase was delayed due to closure of the DMR from 3 September 2018 to 5 August 2019.

2 Item 3: Project Applicant

The details of the Project Applicant are included in the table below. The proposed duration of the authorisation is 10 years which is discussed in detail in Section 22 below.

Table 2-1: Project applicant details

Project Applicant:	South32 SA Coal Holdings (Pty) Ltd
Registration number:	1963/000537/07
Responsible Person:	Operations Manager, Klipspruit Colliery
Responsible person:	Josua Bekker
Contact person:	Thembani Mashamba
Physical address:	Klipspruit Colliery: Portion 12,Farm Klipfontein 3 Registration Division IS Ogies, 2230 South Africa
Postal address:	P.O Box 61820, Marshalltown, Johannesburg 2107
Telephone:	013 689 4531
Email:	thembani.mashamba@south32.net

2.1 Item 3(a)(i): Details of the EAP

Digby Wells has been appointed by South32 to facilitate and complete the enviro-legal applications for Authorisations required to develop and operate the proposed WTP. The details of the EAP are included in the table below.

Table 2-2: Contact details of the EAP

Name of Practitioner:	Digby Wells Environmental Xanthe Taylor
Telephone:	011 789 9495
Fax:	011 069 6801
Email:	xanthe.taylor@digbywells.com

2.2 Item 3(a)(ii): Expertise of the EAP

2.2.1 The Qualifications of the EAP

Xanthe Taylor holds the following degrees:

- BA English and Psychology - University of South Africa (UNISA); and
- BA Honours Environmental Management – UNISA.

Please refer to Appendix 1 for the EAP's curriculum vitae and qualification certificates.

2.2.2 Summary of the EAP's Past Experience

Xanthe Taylor started her career in environmental consulting in 2012. She has an honours degree in Environmental Management from UNISA. Ms Taylor's experience is mostly related to the mining industry managing applications governed by the NEMA, and both the 2010 and 2014 EIA Regulations thereunder, as well as the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002) (MPRDA).

Her experience comprises managing integrated mining applications: compiling application forms, Basic Assessment reports, Scoping reports, EIA reports, EMPs, Section 29 and Section 31 Amendment applications, Section 102 Amendment reports, exemption applications, appeals processes, and auditing.

3 Item 3(b): Description of the Property

The proposed project falls within the existing KPS Mining Right Area (MRA) which comprises various farm portions located near the town Ogies, Mpumalanga Province, adjacent to the N12 national road. KPS MRA occupies a total footprint of 1647 ha. The estimated total area of disturbance is 50 ha for the WTP project, totalling 3% of KPS. The regional and local setting of the project area is depicted in Plan 1 and Plan 2, Appendix 2.

The KPS MRA comprises several farm portions on the Farms Smaldeel 1 IS, Klipfontein 3 IS, Oogiesfontein 4 IS, Prinshof 2 IS, Bankfontein 216 IR, and Phola Plant No. 830-IS.

The proposed project subject to this application comprises several types of infrastructure including the WTP, temporary laydown area, feedwater pipeline, return water pipeline and clean water discharge pipeline which are discussed in detail in Section 5.2 below. This infrastructure spans over various properties within the KPS MRA with the centre coordinates

for the WTP being 26° 3'5.05"S 29° 2'22.04"E. Table 3-1 below provides the property details specifically associated with the WTP.

Table 3-1: Property Details

Farm Name:	▪ RE of Portion 41 of the Farm Oogiesfontein 4 IS ▪ Portion 63 of the Farm Oogiesfontein 4 IS ▪ Portion 2 of the Farm Prinshof 2 IS ▪ Portion 14 of the Farm Prinshof 2 IS ▪ RE of Portion 14 of the Farm Klipfontein 3 IS ▪ RE of Portion 12 of the Farm Klipfontein 3 IS ▪ Phola Plant No. 830-IS on the Farm Klipfontein 3 IS		
Application Area (Ha)[2]:	▪ WTP footprint area – 1.5 hectare (ha) ▪ Temporary laydown area (construction phase only) – 0.45 ha ▪ Feedwater pipeline – 1.5 km (7.5 ha) ▪ Clean water discharge line – Option 1 = 3.8 km (19 ha); Option 2 = 3.7 km (18.5 ha)		
Magisterial District:	Nkangala Magisterial District, Mpumalanga Province		
Distance and direction from nearest town:	Approximately 3 km east of the town Ogies		
21-digit Surveyor General Code for each farm portion:	**Farm**	**Surveyor General Code**	**Infrastructure**
	Remaining Extent (RE) of Portion 41 of the Farm Ogiesfontein 4	T0IS00000000000400041	▪ Discharge Line Option 1 ▪ Discharge Line Option 2
	Portion 63 of the Farm Ogiesfontein 4	T0IS00000000000400063	▪ Discharge Line Option 2
	Portion 2 of the Farm Prinshof 2	T0IS00000000000200002	▪ Discharge Line Option 1 ▪ Discharge Line Option 2
	Portion 14 of the Farm Prinshof 2	T0IS00000000000200014	▪ Discharge Line Option 1 ▪ Discharge Line Option 2
	RE of Portion 14 of the Farm Klipfontein 3	T0IS00000000000300014	▪ Feed Water Line to WTP
	RE of Portion 12 of the Farm Klipfontein 3	T0IS00000000000300012	▪ WTP

[2] An allowance of a 50 m corridor has been made for all pipeline infrastructure.

			▪ Temporary Laydown Area ▪ Discharge Line Option 1 ▪ Discharge Line Option 2
	RE of Portion 12 of the Farm Klipfontein 3	T0IS00000000000300012	▪ WTP ▪ Temporary Laydown Area ▪ Discharge Line Option 1 ▪ Discharge Line Option 2

4 Item 3(c) of Appendix 3: Locality Map

An A3 Locality Map is attached as Plan 2 in Appendix 2 and shown in Figure 4-1 below.

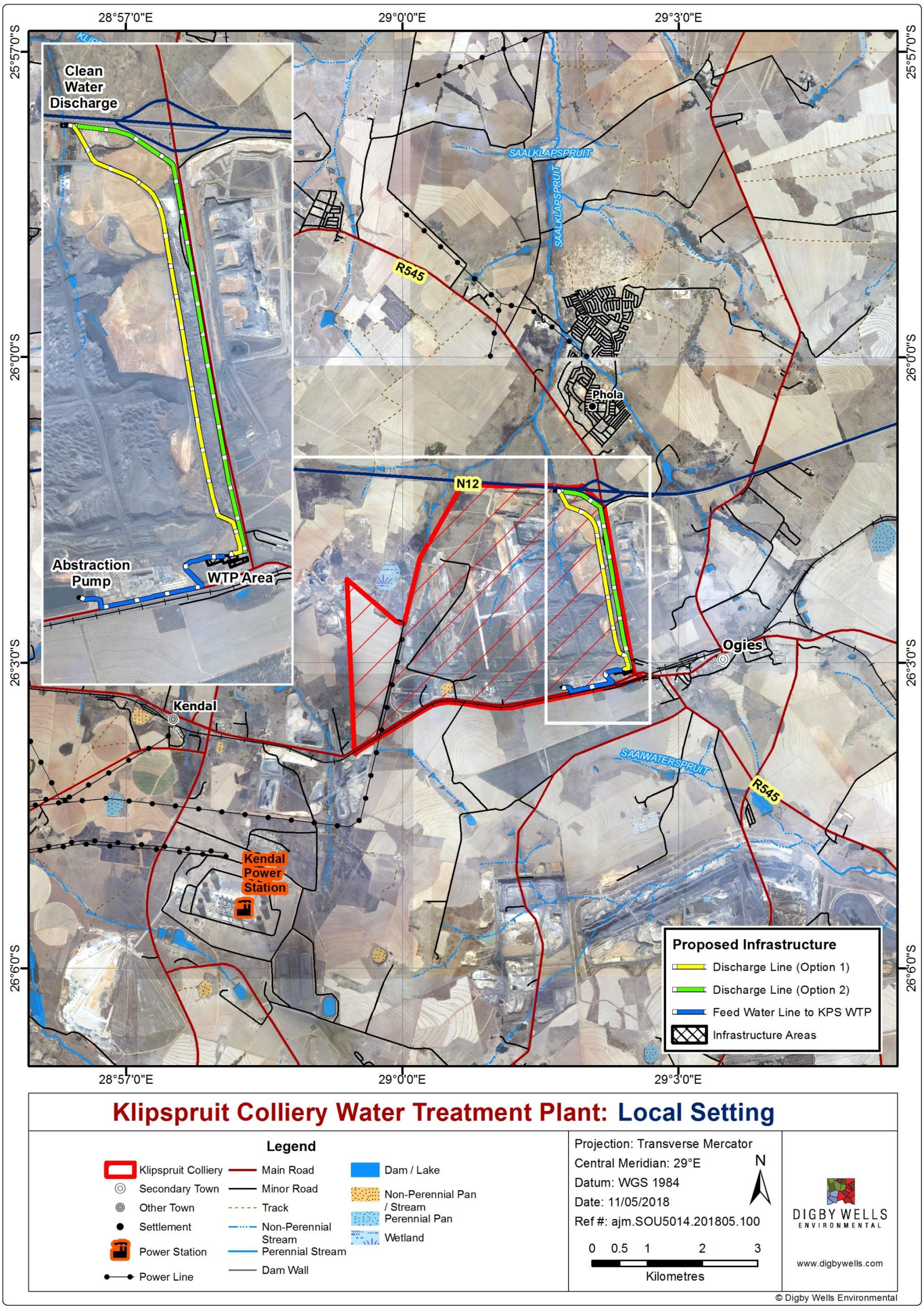


Figure 4-1: Local Project Setting

5 Item 3(d) of Appendix 3: Description of the Scope of the Proposed Overall Activity

The project entails the construction and operation of a WTP and associated infrastructure for the purpose of treating water from various sources related to the KPS operation and subsequently releasing the treated water into a tributary of the Saalklapspruit. The proposed WTP is a modular WTP capable of treating up to 10 Ml/day at full capacity and is proposed to be constructed in three incremental phases.

The key infrastructure includes:

- A Feedwater 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 Feedwater 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 1.5 hectares (ha) 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.

The proposed project Infrastructure Layout Plan is provided in Figure 5-1. This plan is also included as an A3 map as Plan 3, Appendix 2. Further detail pertaining to this infrastructure at its operation is provided in Section 5.2 below.

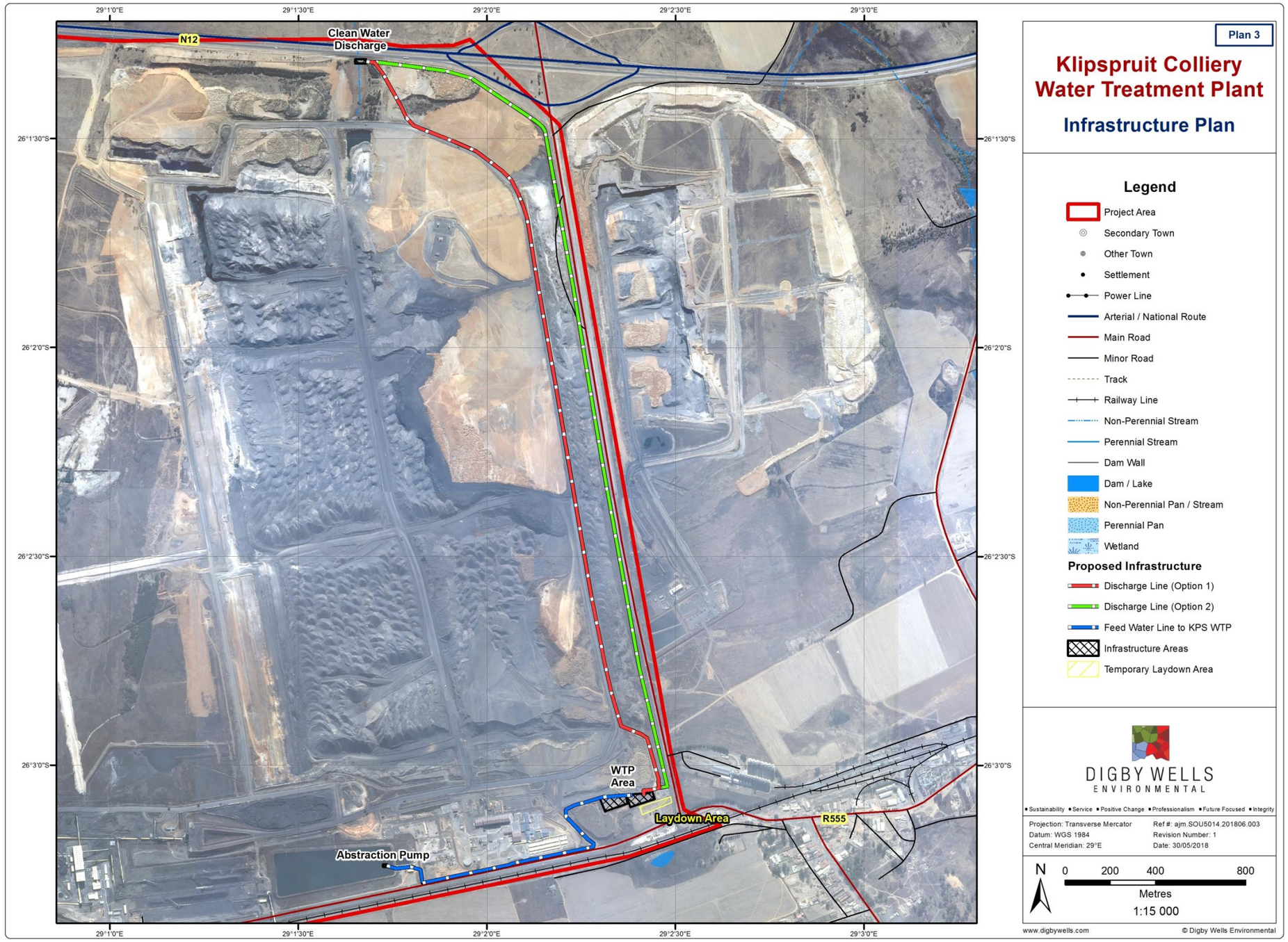


Figure 5-1: Infrastructure Layout Plan

5.1 Item 3(d)(i): Listed and Specified Activities

Together with the EIA Regulations, 2014 (as amended)[3], the Minister published Regulations in terms of Sections 24 and 24D of the NEMA for Activities that require Environmental Authorisation prior to their commencement.

Activities identified in Listing Notice 1 (GN R 327) or Listing Notice 3 (GN R 324) requires a Basic Assessment Process be followed when applying for Environmental Authorisation. Activities identified in Listing Notice 2 (GN R 325) require the Scoping EIA Process to be undertaken. The proposed project involves activities which are identified in Listing Notices 1 and 2 and therefore requiring the Scoping EIA Process to be followed.

Table 5-1 provides the Listed Activities in terms of NEMA associated with the proposed project requiring authorisation. These triggered Activities were identified during the Scoping Phase of this project and no subsequent amendments have been made.

[3] As amended by GN R 326 of 07 April 2017.

Table 5-1: Listed Activities associated with the project

Name of Activity		Aerial extent of the activity	Listed Activity	Applicable Listing Notice
1	**Clean water pipeline** *The development of infrastructure exceeding 1000 metres in length for the bulk transportation of water or storm water-* *(i) with an internal diameter of 0,36 metres or more; or* *(ii) with a peak throughput of 120 litres per second or more;* *excluding where-* *(a) such infrastructure is for bulk transportation of water or storm water or storm water drainage inside a road reserve; or* *(b) where such development will occur within an urban area.*	3.8 km (19 ha)	X – 9 (i) and /or (ii)	GN R 983 (as amended by GN R 327) – Listing Notice 1
2	**Feedwater, return water and sewage pipelines** *The development and related operation of infrastructure exceeding 1 000 metres in length for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes-* *(i) with an internal diameter of 0,36 metres or more; or* *(ii) with a peak throughput of 120 litres per second or more;* *excluding where-* *(a) such infrastructure is for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes inside a road reserve or railway line reserve; or* *(b) where such development will occur within an urban area.*	1.5 km (7.5 ha)	X – 10 (i) or (ii)	GN R 983 (as amended by GN R 327) – Listing Notice 1.
3	**Dissipation structure** *The development of-* *(i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or* *infrastructure or structures with a physical footprint of 100 square metres or more;*	120 m^2	X – 12	GN R 983 (as amended by GN R 327) – Listing Notice 1.

	Name of Activity	Aerial extent of the activity	Listed Activity	Applicable Listing Notice
	where such development occurs- *(a) within a watercourse;* *(b) in front of a development setback; or* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;-* *excluding-* *(aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour;* *(bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies;* *(cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies;* *(dd) where such development occurs within an urban area;* *(ee) where such development occurs within existing roads, road reserves or railway line reserves; or* *(ff) the development of temporary infrastructure or structures where such infrastructure or structures will be removed within 6 weeks of the commencement of development and where indigenous vegetation will not be cleared.*			
4	**Dissipation structure and activities taking place within a watercourse** *The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse;* *but excluding where such infilling, depositing, dredging, excavation, removal or moving-* *(a) will occur behind a development setback;* *(b) is for maintenance purposes undertaken in accordance with a maintenance management plan;* *(c) falls within the ambit of activity 21 in this Notice, in which case that activity applies;* *(d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or*	120 m^2	X – 19	GN R 983 (as amended by GN R 327) – Listing Notice 1.

Name of Activity		Aerial extent of the activity	Listed Activity	Applicable Listing Notice
	(e) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies.			
5	**Construction and operation of the WTP** *The development and related operation of facilities or infrastructure for the treatment of effluent, wastewater or sewage with a daily throughput capacity of more than 2 000 cubic metres but less than 15 000 cubic metres.*	WTP – 1.5 ha Laydown area – 0.4 ha	X – 25	GN R 983 (as amended by GN R 327) – Listing Notice 1.
6	**Water Use Licence (for discharge of treated water into the Saalklapspruit)** *The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent, excluding-* *(i) activities which are identified and included in Listing Notice 1 of 2014;* *(ii) activities which are included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies;* *(iii) the development of facilities or infrastructure for the treatment of effluent, polluted water, wastewater or sewage where such facilities have a daily throughput capacity of 2 000 cubic metres or less; or* *(iv) where the development is directly related to aquaculture facilities or infrastructure where the wastewater discharge capacity will not exceed 50 cubic metres per day.*	WTP - 1.5 ha Laydown area – 0.4 ha	X – 6	GN R 984 (as amended by GN R 325) – Listing Notice 2

5.2 Item 3(d)(ii): Description of the Activities to be Undertaken

KPS is situated approximately 30 km west of Emalahleni near the town of Ogies within the Nkangala Magisterial District, Mpumalanga Province. The MRA is bordered by the N12 Road to the north; R545 Road to the east and R555 Road to the south (refer to Plan 1, Appendix 2 for the Local Setting). Mining activities commenced in October 2003 and comprise of open pit mining utilising strip mining and truck and shovel mining methods.

Water collected from the mining area, which is sourced mainly from pit dewatering and runoff from designated dirty areas such as workshops, haul roads and the coal washing plant, is stored in the KPS Balancing Dam which is located west of the plant area. To manage the colliery's water balance, South32 intends to treat and release excess mine affected water from the Balancing Dam to the release standard of the river catchment.

To do this, the installation of a modular WTP capable of treating up to 10 Mega litres per day (Ml/day) is proposed. The associated infrastructure, as listed above, is discussed in the subsequent subsections.

5.2.1 WTP and temporary laydown area

The WTP will occupy a total footprint of 1.5 ha on disturbed land (centre coordinates: 26° 3'5.05"S 29° 2'22.04"E) to accommodate a WTP with a maximum throughput of 10 Ml/day as well as facilities for the use and storage of hazardous chemicals used in the treatment process. During the construction phase, a laydown area will be located adjacent to the WTP for the storage of tools and equipment. This temporary laydown area will occupy a total footprint of 0.4 ha.

The WTP is proposed to be constructed in three phases. Phase 1 will commence at a capacity of 2Ml/day, upgradeable to 3.3Ml/day. Phase 2 will introduce an additional 3.3Ml/day to a total 6.6Ml/day. Phase 3 will increase the capacity by an additional 3.3Ml/day, totalling an approximate 10Ml/day capacity. Contaminated water will be abstracted from the Balancing Dam at KPS and pumped to the WTP. After treatment, clean water that complies with the RWQOs for the Wilge River Catchment is proposed to be discharged into a tributary of 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.

5.2.2 Feedwater and return water pipeline

A feedwater line comprising of a pump station at the Balancing Dam and 1.5 km HDPE pipeline will be in place to pump contaminated water from the Balancing Dam (pumping point coordinates: 26° 3'15.15"S; 29° 1'43.35"E) to the WTP. The pipeline will run along the R555 road servitude before passing underneath the KPS mine entrance to the WTP area.

A return water HDPE pipeline will be constructed along the same route as the feedwater pipeline between the Balancing Dam and WTP which will allow for the WTP to return water which does not meet the RWQOs for the Wilge system during the WTP calibration period for the various instalment Phases. Online instrumentation will be installed at the WTP capable of indicating whether water is appropriate for release. The return water pipeline will also be utilised to pump dirty water accumulated at the WTP area to the Balancing Dam.

The coordinates for the feedwater and return water pipelines are included in the table below.

Table 5-2: Feedwater and Return Water Pipeline Coordinates

	Latitude	Longitude
Start point (from abstraction pump)	26°03'14.395"S	29°01'43.995"E
Middle point	26° 3'13.226"S	29°02'08.871"E
End point	26°03'04.412"S	29°02'23.206"E

5.2.3 Clean water pipeline and discharge

Once treated to a suitable standard, water from the WTP will be released directly into the tributary of the Saalklapspruit via a HDPE clean water pipeline. Two options for the pipeline are proposed to accommodate current advancing mining and rehabilitation activities at KPS along the pipeline route. To this end, both pipeline routes will be utilised at some point during the operation of the project (refer to Plan 3, Appendix 2). Due to current mine dumps over the area proposed for Option 2, which is the preferred route, this area is currently unavailable for use. As such, Option 1 will be utilised initially until such a time as the preferred route is accessible. Option 1 of the clean water pipeline is 3.8 km in length while Option 2 is 3.7 km in length.

The coordinates for the clean water and discharge pipelines are included in the table below.

Table 5-3: Clean Water and Discharge Pipeline Coordinates

Infrastructure	Point	Latitude	Longitude
Line Option 1	Start point (from WTP)	26°03'04.345"S	29°02'24.981"E
	Middle point	26°02'04.713"S	29°02'16.156"E
	End point (at discharge point)	26°01'18.96"S	29°01'40.768"E
Line Option 2	Start point (from WTP)	26°03'04.242"S	29°02'23.388"E
	Middle point	26°02'08.335"S	29°02'11.458"E
	End point (at discharge point)	26°01'18.969"S	29°01'40.788"E

The discharge point (discharge point coordinates: 26° 1'18.83"S; 29° 1'39.57"E) is located within the KPS MRA adjacent to the N12 Road. A dissipation structure will be constructed at the discharge point to ensure that discharge is done in a manner that will not significantly impact or increase the natural velocity of the stream, thus minimising the risk of erosion and further sedimentation.

As indicated above, water will be treated to the release standard of the river catchment. The RWQOs, as prescribed by the Department of Water and Sanitation (DWS), for the Wilge River Catchment Region which forms part of the Upper and Middle Olifants Catchment will be adhered to. Table 5-4 provides the RQWOs to be adhered to.

Table 5-4: RWQOs for the Wilge River Catchment

Parameter	WQO	Unit
SO_4	200	mg/L
F	2.5	mg/L
Al	0.105	mg/L
As	0.095	mg/L
Cd	0.003	mg/L
Cr (VI)	0.121	mg/L
Cu	0.006	mg/L
Hg	0.00097	mg/L
Mn	0.99	mg/L
Pb	0.0095	mg/L
Se	0.022	mg/L
Zn	0.0252	mg/L
Chlorine	3 µg/L dissolved.1 µg/L free Cl	
Endosulfan	0.00013	mg/L
Atrazine	0.0785	mg/L

5.2.4 Supporting Infrastructure

The operation of a WTP will require the following supporting infrastructure:

- A new powerline from the existing Ring Main Unit One at the sewage plant and new transformer (22kV/525V) at the WTP site; and
- Change houses and ablution facility at the WTP site.

A dedicated entrance from the R555 road along the southern boundary of the KPS MRA will be constructed to access the WTP site directly. Internal existing mining haul roads will be utilised to access the pipeline routes and discharge point into the Saalklapspruit tributary.

6 Item 3(e): Policy and legislative Context

An application in terms of NEMA to obtain Environmental Authorisation has been submitted to the Department of Mineral Resources (DMR) for the Listed Activities provided in Section 5.1 above. Various policy and legislative requirements are applicable to the Environmental Authorisation application and assessment process as detailed in Table 6-1 below.

Table 6-1: Policy and Legislative Context

Applicable legislation and guidelines used to compile the report	Reference where applied
<u>The Constitution of the Republic of South Africa, 1996 (the Constitution)</u> Under Section 24 of the Constitution it is clearly stated that: *Everyone has the right to* *(a) an environment that is not harmful to their health or well-being; and* *(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that -* *(i) Prevent pollution and ecological degradation;* *(ii) Promote conservation; and* *(iii) Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.*	South32 is undertaking a Scoping and EIA process to identify and determine the potential impacts associated with the proposed WTP installation. Mitigation measures recommended will aim to ensure that the potential impacts are managed to acceptable levels to support the rights as enshrined in the Constitution.
<u>National Environmental Management Act, 1998 (Act No 107 of 1998) and EIA Regulations (December 2014)</u> NEMA, as amended, was set in place in accordance with Section 24 of the Constitution. Certain environmental principles under NEMA have to be adhered to, to inform decision making for issues affecting the environment. Section 24 (1)(a) and (b) of NEMA state that: *The potential impact on the environment and socio-economic conditions of activities that require authorisation or permission by law and which may significantly affect the environment, must be considered, investigated and assessed prior to their implementation and reported to the organ of state charged by law with authorizing, permitting, or otherwise allowing the implementation of an activity.* The EIA Regulations, Government Notice (GN) Regulation (R) 982 were published on 04 December 2014 and promulgated on 08 December 2014 together with the amended Listing Notices: GN R326, (EIA Regulations) GN R 327 (Listing Notice 1); GN R325 (Listing Notice 2) and GN R324 (Listing Notice 3) of 7 April 2017.	Activities associated with the proposed WTP installation are identified as Listed Activities in the Listing Notices (as amended) and therefore require environmental authorisation prior to being undertaken. This Scoping and EIA Process has been duly informed by the requirements of the NEMA and Regulations thereunder.

Applicable legislation and guidelines used to compile the report	Reference where applied
Mineral and Petroleum Resource Development Act. 2002 (Act No. 28 of 2002) (MPRDA) The MPRDA sets out the requirements relating to the development of the nation's mineral and petroleum resources. It also aims to ensure the promotion of economic and social development through exploration and mining related activities. The MPRDA ensures that environmental management principles as set out in the NEMA are applied to all mining operations. The MPRDA serves as a guideline for interpretation, administration and implementation of environmental requirements and ensures that mineral resources are exploited in a sustainable manner to serve both present and future generations.	The proposed WTP is associated with mining-related activities and a MRA; therefore, the provisions set under the MPRDA will be duly observed.
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEMWA) On 29 November 2013, the list of waste management activities published under GN R718 of 3 July 2009 (GN R718) was repealed and replaced with a new list of waste management activities under GN R921 of 29 November 2013. Included in the new list are activities listed under Category A, B and C for which a Waste Management Licence (WML) may be required.	The activity thresholds associated with the proposed WTP do not trigger activities listed under NEMWA and therefore a WML is not applicable. However, the Act does make provision for the treatment of effluent which will be duly observed, and the norms and standards will be complied with. Refer to Section 8.2.3.4 for the discussion regarding waste disposal.
National Water Act, 1998 (Act No. 36 of 1998) (NWA) The NWA provides for the sustainable and equitable use and protection of water resources. It is founded on the principle that the National Government has overall responsibility for and authority over water resource management, including the equitable allocation and beneficial use of water in the public interest, and that a person can only be entitled to use water if the use is permissible under the NWA. GN R 704 was published in June 1999 and aims to regulate the use of water for mining and related activities for the protection of water resources and states the following: ▪ Regulation 4: No residue deposit, reservoir or dam may be located within the 1:100 year flood line, or less than a horizontal distance of 100 m from the nearest watercourse. Furthermore, person(s) may not dispose of any substance that may cause water pollution; ▪ Regulation 5: No person(s) may use substances for the construction of a dam or impoundment if that substance will cause water pollution; ▪ Regulation 6 is concerned with the capacity requirements of clean and dirty water systems, and ▪ Regulation 7 details the requirements necessary for the protection of water resources.	An Integrated Water Use Licence Application (IWULA) and an associated Integrated Water and Waste Management Plan (IWWMP) are required in terms of Section 21 of the NWA for the project. The WULA and IWWMP is being applied concurrently with this application for Environmental Authorisation and submitted to the DWS as the decision-making authority. The water uses under Section 21 of the NWA which is relevant to this project is Section 21(f) associated with the discharge of effluent into the natural environment, which triggers the EIA process. Section 21 (c) and (i) will also apply for the location of infrastructure in proximity to water courses.

Applicable legislation and guidelines used to compile the report	Reference where applied
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) The NEMBA regulates the management and conservation of the biodiversity of South Africa within the framework provided under NEMA. This Act also regulates the protection of species and ecosystems that require national protection and also takes into account the management of alien and invasive species. The following regulations which have been promulgated in terms of the NEM:BA are also of relevance: ▪ Alien and Invasive Species Lists, 2014 published (GN R.599 in GG 37886 of 1 August 2014); ▪ National Environmental Management: Biodiversity Act, 2004: Threatened and Protected Species Regulations; and ▪ National list of Ecosystems Threatened and in need of Protection under Section 52(1) (a) of the Biodiversity Act (GG 34809, GN R.1002, 9 December 2011).	A Fauna and Flora Impact Assessment has been undertaken which includes the characterisation of the natural habitat and provides mitigation measures that must be applied to sensitive habitats. Infrastructure associated with the project has been placed on already disturbed land as far as possible to reduce disturbance of natural vegetation.
National Noise Control Regulations, R.154 of 1992 (the Noise Regulations) promulgated in terms of Section 25 of the Environmental Conservation Act, 1989 (Act 73 of 1989) The National Noise-Control Regulations (GN R154 in Government Gazette No. 13717 dated 10 January 1992) (NCRs) form part of the Environmental Conservation Act and these Regulations apply to external noise. The NCRs differentiates between Disturbing Noise levels (which is objective and scientifically measurable which are generally compared to existing ambient noise level) and Noise Nuisance (which is a subjective measure and is defined as noise that "*disturbs or impairs or may disturb or impair the convenience or peace of any person*"). Local Authorities use Controlled Areas to identify areas with high noise levels. Restrictions have been set out for development that occurs in these Controlled Areas. These regulations make provision for guidelines pertaining to noise control and measurements. The regulations make reference to the use of the South African National Standards 10103:2008 (SANS) guidelines for the Measurement and Rating of Environmental Noise with Respect to Land Use, Health, and Annoyance and to Speech Communication. As such, a Noise Impact Assessment in accordance with the NCRs must be undertaken for submission to determine the potential disturbing and nuisance noise levels associated with a particular development.	A Noise Impact Assessment, including modelling, impacts and proposed mitigation measures has been undertaken for this EIA.

Applicable legislation and guidelines used to compile the report	Reference where applied
The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) is the overarching legislation that protects and regulates the management of heritage resources in South Africa. The Act requires that Heritage Resources Agency's in this case the South African Heritage Resources Agency (SAHRA) and Provincial Heritage Resources Authority of Mpumalanga (MHRA), be notified as early as possible of any developments that may exceed certain minimum thresholds. This act is enforced through the National Heritage Regulations GN R 548 (2000).	A Heritage Resource Management (HRM) process has been undertaken for the proposed project with the specific aim of detailing identified heritage resources within the site-specific area which may be disturbed. The pre-disturbance survey determined that no new heritage resources are associated with the project due to the highly disturbed nature of the site-specific project area. This therefore negates the need for a Heritage Impact Assessment (HIA).
GN R 1147 (Financial Provisioning Regulations), 2015 The Financial Provisioning Regulations prescribe methods for determining the quantum of financial provision for rehabilitation and mechanisms for providing for it. Section 41 (1) of the MPRDA has been repealed and Section 24P of the 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.	A rehabilitation plan and closure costing which is aligned with the GN R 1147 (as amended) has been compiled for the proposed WTP project and related disturbed area within the project boundaries and is presented in this EIA Report. This plan has been tied in with the existing rehabilitation plan for KPS.

7 Item 3(f): Need and Desirability of the Proposed Activities

South32 intends to continue and expand its KPS mining operation until the end of the Life of Mine (LOM). The Balancing Dam was designed and constructed to store water accumulating from the mining areas and this water is reused throughout the operation as far as possible. With the progression and expansion of mining at KPS however, the affected water that is being generated exceeds the reuse capacity within the operation whilst the storage capacity in mined out areas has reached its limits.

KPS currently has a positive water balance as a result of the dirty water make exceeding the re-use and storage capacity at the operation. With concurrent rehabilitation being implemented this dirty water make can be reduced, however, there is a potential risk of spillages or discharges to the natural environment if alternative measure for water management is not implemented.

Effective management of this risk is essential to continued operations and expansion at KPS ensuring access to coal resources as well as effective environmental management on site. Water treatment, and subsequent discharge into the natural environment, is thus required and South32 proposes to construct a modular WTP and ancillary infrastructure to treat the mine-affected water. This will alleviate current and future pressures on the Balancing Dam as well as reintroduce clean water that meets the RWQOs to the Saalklapspruit. Furthermore, measures will be put in place at the discharge point to ensure that discharge is done in a manner that will not significantly impact or increase the natural velocity of the stream.

Through this EIA Process, the potential impacts associated with the installation and operation of the WTP have been identified and mitigation measures have been established to avoid adverse environmental impacts. Where impacts are unavoidable, measures to reduce the significance of such impacts have been determined.

8 Item 3(g): Motivation for the Preferred Development Footprint within the Approved Site including a Full Description of the Process followed to reach the Proposed Development Footprint within the Approved Site

The location of the project has been determined based on the intended use of the WTP. The primary qualifying criteria for the WTP location focused on identifying sites within the KPS operational area that are able to accommodate the plant infrastructure as well as their proximity to the Balancing Dam and the tributary to the Saalklapspruit discharge point.

Furthermore, an important consideration was the state of the site options. Several areas within the KPS MRA have been rehabilitated following the completion of mining-related activities or have

not been disturbed as part of the operations. These areas were eliminated from consideration to prevent unnecessary disturbance to rehabilitated and natural areas.

The preferred development footprint is characterised as mostly disturbed, cleared land.

8.1 Item 3(g)(i): Details of the development footprint alternatives considered

A project alternative is defined as a possible course of action, in place of another, that would meet the same purpose and need (DEAT, 2004).

In an EIA process, project alternatives serve to determine the most effective way of meeting the objectives of that project. This is generally done through either enhancing the benefits of an activity and/or mitigating the negative impacts and risks of an activity.

According to the Department of Environmental Affairs (DEA) Criteria for Determining Alternatives in EIA Guideline (2004), there are various types or categories of alternatives, including:

- Activity alternative – consideration of different means to achieve the same project objective;
- Location alternative – alternative project sites in the same geographic area;
- Site layout alternative – consideration of the different options to place project infrastructure;
- Process/design alternative – alternative process/design/equipment;
- Routing alternative – consideration of different routes for linear infrastructure; and
- No-go alternative – the proposed project/activity does not proceed, implying that the current situation or status quo remains.

The above-mentioned categories of alternatives were considered and are detailed in the subsections below.

8.2 Item 2(h)(i): Details of all alternatives considered

8.2.1 Activity Alternatives

A solution for effective water management is required at KPS to reduce the risk associated with excessive water storage at KPS. Three possible alternatives were considered, namely the re-use of mine affected water at the operations, the use of the evaporators installed at Bankfontein or the treatment and release of water into the natural environment. The option of re-using water was

eliminated as the mine affected water generated exceeds the re-use capacity and the risk of spillage would persist while the option of utilising the evaporators at Bankfontein was disregarded due to the high costs and increased infrastructure requirements to the facility.

The treatment of mine affected water and subsequent release of clean water into the natural environment has therefore been deemed the most feasible option. This option is preferred as it alleviates current and future pressures on the Balancing Dam and reduces the risks associated with the storage of excessive amounts of water.

8.2.2 Location Alternatives

The site selection for the WTP infrastructure considered size requirements, proximities to the water abstraction and discharge point as well as the current environmental state of the footprint. Furthermore, the position of the WTP site determines the lengths of the dirty water collection-, treated water delivery- and final effluent pipelines. Four site options were considered based on a 0.5 ha footprint as follows (refer to Figure 8-1 below):

- WTP Site 1 – Adjacent to the Balancing Dam;
- WTP Site 2 – Across from Sub-Zero substation;
- WTP Site 3 – Across from Ramp 1 Void;
- WTP Site 4 – At Phola Plant;
- WTP Site 5 – Next to the Project offices.

Figure 8-1: WTP Site Options

The table below provides a summary of the WTP site options considered.

Table 8-1: WTP Site Comparisons

Parameter	Option 1	Option 2	Option 3	Option 4	Option 5 (Preferred)
Advantages	▪ Close to the Balancing Dam; ▪ Secure power supply close by; and ▪ Close to existing amenities	▪ Close to the Bankfontein Void ▪ Power supply close by	▪ Close to discharge point	▪ Close to the Balancing Dam; ▪ Secure Power supply close by; and ▪ Close to existing amenities.	▪ Close to the Balancing Dam; ▪ Secure power supply close by; ▪ Disturbed footprint; and ▪ Close to existing amenities
Disadvantages	▪ Space constraints	▪ Security concerns (far from existing amenities); and ▪ Blasting activities in close proximity.	▪ Security concerns (far from existing amenities); ▪ No power supply close; and ▪ Site requires levelling	▪ Space constraints ▪ ROM machinery interaction.	▪ None

Based on the comparison above, Option 5 is the preferred WTP location as it is in close proximity to the Balancing Dam and existing amenities required to support the WTP. The WTP can be accommodated on the footprint. The site is characterised as disturbed, cleared land.

8.2.3 Process/Design Alternatives

Process/design alternatives were considered in terms of water treatment options, the WTP design, the WTP technology as well as waste disposal options. These are discussed in the subsections below.

8.2.3.1 Water Treatment Options

Active-, passive- and *in-situ* treatment options were considered to treat the excessive mine affected water.

Passive treatment processes were disregarded as there is no configuration that can satisfy the treatment requirements to render the waste water stream fit for release off site due to the stringent discharge water quality requirements set by the DWS. An *in-situ* treatment was also disregarded

as an alternative as it too does not address the treatment requirements. Therefore, the water treatment solution will fall in the active treatment category where the water quality objectives can be met.

8.2.3.2 WTP Design

The WTP configuration considered a fixed installation and modular installation. The characteristics of each are provided in Table 8-2 below.

Table 8-2: WTP Design Options

Fixed Installation	Modular Installation
▪ Suitable for long term (> 10 years) water treatment requirements; ▪ Economy of scale benefits with regional plants; ▪ >20-year life subject to renewal and maintenance programs; ▪ Typically, 18 to 24-month construction period; and ▪ Engineering and process design optimisation possible for large volume (>10Ml/day) facilities.	▪ Suitable for medium term (2 – 10 years) water treatment requirements; ▪ 10-year life subject to renewal and maintenance programs; ▪ Typically, 9 to 18-month construction period ▪ Components designed for road transport to site – Off site fabrication and construction; ▪ Site layout and maintenance requirements increase in complexity with larger (>10Ml/day) capacity installations – no economy of scale benefit; ▪ Allows for the increasing/decreasing of the capacity of the facility by the addition/removal of modules; and ▪ Alternative processes (should the feed water quality change) can be added.

The proposed first phase of the WTP (2Ml/day upgradeable to 3.3Ml/day) is required for a period of between two to five years. Based on these characteristics, a modular installation is preferred as it will satisfy the operational period requirement and can be constructed in a shorter timeframe. Modular installation will also allow for adjustments to the treatment process if required. The ultimate total capacity required is 10 Ml/day which will be constructed in three phases starting from 2ML/day (upgradeable to 3.3Ml/day) and then two phases of 3.3 Ml/day increments thereafter.

8.2.3.3 WTP Technology

A variety of different treatment options are available for investigation. The qualifying criteria focused on the most effective treatment option based on the specific water quality characteristics at KPS. Based on the treatment requirements, the treatment process must cater for removal of dissolved metals, sulphates and soluble salts mainly. Although neutralisation of the feed water is not required, pH adjustment will likely be required to assist with the removal of the dissolved metals and for correction of the pH prior to discharge of the product water.

Various options based on the membrane processes for the removal of sulphates and soluble salt were explored and it has been deemed that the removal of sodium and chloride from the dirty water is best done using evaporation-based processes.

8.2.3.4 Waste Disposal

The WTP will produce gypsum sludge and brine that requires disposal. Two options were explored; namely on-site and offsite disposal. On-site disposal would require a dedicated waste facility in line with minimum requirements for the waste type produced which would be determined through a waste classification process. Important considerations associated with the on-site alternative include the required surface area, leachability and possible groundwater pollution.

The off-site disposal would entail dewatered sludge being trucked to an existing authorised waste disposal facility such as Holfontein. Based on the potential environmental impacts and cost of establishing an on-site facility, off-site disposal is preferred.

8.2.4 Routing Alternatives

The pipeline route determination considered shortest and most direct distances along existing infrastructure corridors. Longer pipeline routes are associated with increased impacts on the environment as more soil and vegetation is disturbed, and efforts to monitor for pipe breaks or leakages are increased.

One option for the feedwater pipeline was considered. The pipeline will run along the R555 road servitude before crossing over to the WTP area at the KPS mine entrance. This route is associated with two crossings of a clean water that drains at the KPS main entrance and Lowbed gate.

Two options for the clean water pipeline have been considered. These routes take into account current and future mining and rehabilitation activities along the route the pipelines traverse. Both pipeline routes will be utilised during the operation of the project. Ultimately Option 2 is the most desirable, however is inaccessible currently due to mine dumps. Option 1 therefore will initially be

utilised and runs along a haul road route, while Option 2 runs along the eastern edge of the MRA which will be subsequently utilised once mining/rehabilitation activities commence in the area.

8.2.5 No-Go Alternative

The no-go alternative entails maintaining the status quo and as such the excessive water management challenge being experienced at KPS will persist which may result in accidental or unauthorised discharge of mine affected water.

9 Item 3(g)(ii): Details of the Public Participation Process followed

The PPP was developed to ensure compliance with environmental regulatory requirements and to provide I&APs with an opportunity to evaluate the proposed project. The PPP was initiated during the Scoping Phase of the project and all stakeholder comments received to date have been captured in the Comments and Responses Report (CRR).

The subsection below provides a summary of PPP undertaken to date. A detailed Public Participation Chapter is included as Appendix 3.

9.1 Stakeholder Identification

During the Scoping Phase, various methods were utilised to develop a project specific stakeholder database which was representative of potentially interested or affected stakeholders. These methods included desktop searches as well as responses received from the various public documents released (newspaper advertisement, site notices, Background Information Document (BID) and notification letter).

Stakeholders were grouped into various categories such as land owners/occupiers, communities, relevant government organisations, non-governmental organisations (NGOs) and business enterprises.

Stakeholders were encouraged to register as I&APs throughout the PPP and the stakeholder database updated throughout the PPP with new stakeholders.

9.2 Directly Affected Landowners

Ingwe Surface Holdings Ltd is the directly affected landowner of all properties associated with the WTP Project, namely:

- RE of Portion 41 of the Farm Oogiesfontein 4 IS
- Portion 63 of the Farm Oogiesfontein 4 IS
- Portion 2 of the Farm Prinshof 2 IS

- Portion 14 of the Farm Prinshof 2 IS
- RE of Portion 14 of the Farm Klipfontein 3 IS

A Land tenure map is included as Plan 4, Appendix 2.

9.3 Public Consultation during the Scoping Phase

Table 9-1 provides a summary of the PPP activities undertaken during the Scoping phase, together with referencing materials under Appendix 3.

Table 9-1: Public Participation Scoping Phase Activities

Activity	Details	Reference in Report
Identification of stakeholders	Stakeholder database which represent various sectors of society, including directly affected and adjacent landowners, in and around the proposed project area.	**Appendix 3-1** Stakeholder database
Distribution of notification letter and BID	A BID, notification letter with Registration and Comment Form was emailed to stakeholders on **13 July 2018**.	**Appendix 3-2** Public Participation Materials
Placing of newspaper advertisement	An English advert was placed in the Witbank News on **13 July 2018**.	**Appendix 3-2** Public Participation Materials
Putting up of site notices	English site notices were put up at the boundary of KPS as well as public places including local libraries and municipal offices. The locations are provided in the Site Notice Report.	**Appendix 3-3** Site Notice Report
Announcement of Draft Scoping Report	Announcement of availability of the Draft Scoping Report was sent via email and SMS to stakeholders together with the formal project announcement on **13 July 2018**. Copies of the Scoping Report were made available at: ▪ Emalahleni Public Library; ▪ Ogies Public Library; and ▪ Kriel Public Library. The Draft Scoping Report was also made available on www.digbywells.com (under Public Documents). **(Comment period: 13 July – 14 August 2018)**	**Appendix 3-2** Public Participation Materials

Activity	Details	Reference in Report
Announcement of the Final Scoping Report	Final Scoping Report was submitted to the DMR on **12 September 2018**. A notification for availability of the Final Scoping Report was emailed and an SMS was sent to stakeholders on **12 September 2018**. The Final Scoping Report was made available on www.digbywells.com under Public Documents.	**Appendix 3-2** Public Participation Materials
Obtaining comments from stakeholders	Comments, issues of concern and suggestions received from stakeholders are captured in the CRR.	**Appendix 3-4** Comment and Response Report

9.4 Public Consultation during the EIA Phase

This Draft EIA and EMP Report serves to provide feedback on the findings of the specialist studies and the determined mitigation measures to avoid adverse environmental impacts as far as possible.

Table 9-2 provides summary of the PPP activities undertaken to date as well as those still to be undertaken during this EIA Phase of the process. The PPP material has been appended to this report as Appendix 3.

Table 9-2: Public Participation Impact Assessment Phase Activities

Impact Assessment Phase	
Announcement of Draft EIA and EMP Reports	Announcement of availability of the Draft EIA and EMPr Reports was sent via email and SMS to stakeholders on **20 February 2020**. Similar to the Scoping Report, copies of the Draft EIA and EMPr Reports were available at: ▪ Emalahleni Public Library; ▪ Ogies Public Library; and ▪ Kriel Public Library. The Draft EIA and EMPr will also be made available on www.digbywells.com (under Public Documents) and at the various stakeholder meetings. **(Comment period: 21 February 2020 – 23 March 2020)**
Obtaining comments from stakeholders	Comments, issues of concern and suggestions received from stakeholders will continue to be captured and included in the CRR during the EIA Phase.

Impact Assessment Phase	
Announcement of the Final EIA and EMP Report	Notification for availability of the Final EIA and EMPr Report will be emailed and sent via SMS to stakeholders. Copies of the reports will be made available Digby Wells Website www.digbywells.com under Public Documents.

9.5 Item 3(g)(iii): Summary of Issues Raised by I&APs

Views, concerns and objections provided by I&APs to date (Scoping Phase) have been captured in the CRR and includes responses provided (please refer to Appendix 3). Limited comments were received during the Scoping Phase of the project and no specific issues were raised. Following the public review period and consultation of this Draft EIA and EMPr, the CRR will be updated with all comments which are received.

10 Item 3(g)(iv): The Environmental Attributes associated with the Development Footprint Alternatives

This section provides a description of the baseline environment associated with the project area and region (where relevant). The purpose of understanding the environmental baseline conditions relates to the potential of the project to impact on the existing environment, and the potential for existing environmental aspects to influence a proposed development in terms of design, location, technology and layout.

A number of specialist studies were undertaken during the EIA phase for the proposed project and are appended to this report, as shown in Table 10-1 below.

Table 10-1: Specialist Reports and Associated Appendices

Specialist Study	Appendix
Soil, Land Use and Land Capability Assessment	Appendix 4
Flora and Fauna Assessment	Appendix 5
Wetland Assessment	Appendix 6
Aquatic Ecology Assessment	Appendix 7
Surface Water Assessment	Appendix 8
Groundwater Assessment	Appendix 9
Noise Assessment	Appendix 10
Visual Assessment	Appendix 11

Heritage Assessment	Appendix 12
Socio-economic Assessment	Appendix 13
Rehabilitation, Decommissioning and Financial Provision Assessment	Appendix 14

The subsection below provides the baseline bio-physical and socio-economic environmental conditions currently present on the project site. The information provided in this section has been obtained from the abovementioned specialist reports.

10.1 Regional Climate

The subsections below provide the climatic conditions in terms of temperature, precipitation, evaporation and wind characteristics of the project area.

10.1.1 Temperature and Precipitation

The temperature and precipitation data was obtained from previous studies undertaken for KPS (Digby Wells, 2016a). A three-year (2011-2013) average maximum, mean and minimum temperatures for the local area are displayed in Table 10-2. The average daily maximum temperatures range from 8.1°C in June to 21°C in February. Annual mean temperature is given as 14.8°C. The highest temperature recorded for the project site was 30.2°C, with the lowest recorded temperature of -1°C.

Table 10-2: Average Monthly Minimum, Maximum and Mean Temperature Values (Modelled Data, 01 January 2011 to 31 December 2013)

Temp (°C)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Monthly Maximum	20.4	21.0	19.7	14.6	12.2	8.1	9.2	11.9	14.4	17.7	19.6	20.1	**15.74**
Monthly Minimum	20.0	19.1	18.7	14.2	11.9	8.1	7.4	10.4	14.0	17.2	19.3	19.9	**15.02**
Monthly Mean	20.2	20.0	11.9	14.4	12.1	8.1	8.3	11.2	14.2	17.4	19.5	20.0	**14.78**

The three-year (2011 to 2013) annual total and mean precipitation for the area are 1 064.9 mm and 795.3 mm respectively, as displayed in Table 10-3. The highest monthly maximum precipitation was recorded at 228 mm for December and decreases to 4.1 mm in June. The

monthly minimum precipitation ranges between 0 mm in May and July to 192 mm recorded in December.

Table 10-3: Average Monthly Precipitation (Modelled Data, 01 January 2011 to 31 December 2013)

Precipitation (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
Monthly Maximum	153.7	115.1	70.9	70.6	20.8	4.1	13.0	17.3	53.1	178.3	140.2	228.1	**88.75**
Monthly Minimum	149.1	45.7	32.8	19.3	0.0	1.3	0.0	8.6	6.6	33.0	98.8	192.0	**48.94**
Monthly Mean	151.4	80.4	20.8	45.0	10.4	2.7	6.5	13.0	29.8	105.7	119.5	210.1	**66.26**

10.1.2 Evaporation

Monthly evaporation data was obtained from the Water Resources of South Africa, 2012 Manual (WR2012). Table 10-4 below provides a summary of the evaporation for the project.

Table 10-4: Summary of evaporation data

Evaporation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
Symons Pan Evaporation (mm)	180.8	170.6	187.8	184.5	153.8	151.8	116.7	98.3	79.8	87.4	115.7	149.9	**1677**
Lake Evaporation Factor	0.81	0.82	0.83	0.84	0.88	0.88	0.88	0.87	0.85	0.83	0.81	0.81	**N/A**
Lake Evaporation (mm)	146.4	139.9	155.9	155.0	135.3	133.6	102.7	85.5	67.9	72.5	93.7	121.4	**1410**

In this area, higher evaporation rates are experienced during the months of January, March and April whilst low evaporation occurs in August, September and October. The potential average annual evaporation rate of 1 410 mm is higher than the average annual precipitation rate of 686 mm. This area is thus a semi-arid area.

10.1.3 Wind

The wind speed and direction characteristics for the region were obtained for a three year period (January 2011 to December 2013) from the Lakes Environmental database. The predominant wind direction is from the north-northeast accounting for about 8.4% of the time, and north (8%)

with wind speed greater than 5.4 m/s occurring 9% throughout the period (Figure 10-1). Secondary wind speeds were also observed from the east southeast (7%) and east (6%). Over the three year period, winds capable of generating dust occurred for some 33 days/year.

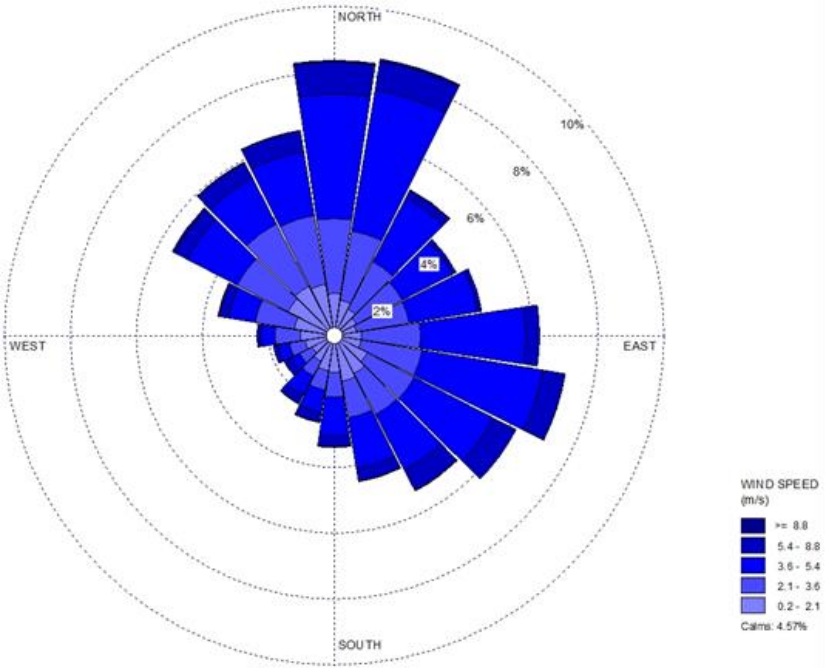


Figure 10-1: Surface wind rose for KPS (modelled data, 01 January 2011 – 31 December 2013)

The seasonal patterns show spring has been dominated by winds from the north (16%) and north-north-east (13.3%) respectively. Wind speed greater than 5.4 m/s was observed 14% of the time. Average wind speed was 3.74 m/s and 2.3%. Summer was dominated by winds from the north-north-east (13%) and north (12%), and winds between 5.4 m/s was observed 3.7% of the time in spring. In autumn, winds from east-south-east (10%), and south-east (9.7%) dominated. Wind greater than 5.4 m/s capable of generating dust occurred some 5.2% of the time. Winter was dominated by winds from the south-east (10%), east-south-east (9.8%) and north (8%) with winds greater than 5.4 m/s occurring 12% of the time. For details overview of the meteorology, reference should be made to the previous report (Digby Wells, 2016a).

10.2 Regional Geology

The project area occurs within the Witbank Coalfield. The sequence of the Karoo Supergroup in the project area comprises of the Ecca Group and underlying Dwyka Group. The sediments

typically found in the Ecca Group comprise coarse to fine grained sandstones, siltstone, shale and coal which often occur as interbedded units.

10.3 Topography

The topography of the project area and its surrounds is characterised as undulating with numerous small ridges and valleys with a maximum elevation of 1 612 m above mean sea level (mamsl) in the south and decreases to 1 482 mamsl in the north. The majority of the project area has gentle slopes of less than 4 degrees, with isolated slopes of between 4 degrees and 11.3 degrees occurring along the sides of the ridges and river valleys.

10.4 Soils, Land Use and Land Capability

The Soil and Land Capability Assessment undertaken during the EIA Phase is appended to this report as Appendix 4. To establish the baseline soils and land capability condition the following methodologies were employed:

- **Desktop Assessment and Literature Review** – existing land type data (Land Type Survey Staff, 1972 - 2006) was used to determine the general soil patterns and terrain types.
- **Soil sampling and analysis** – two soil samples were collected at the proposed WTP location and laydown area. A chemical analysis was undertaken in an accredited laboratory for indicators of acidity, fertility and texture.
- **Land Capability** – the land capability, which is defined as the most sustainable land use under rain-fed conditions, was determined by assessing a combination of soil, terrain and climatic features. The assessment was done in accordance with the approach adopted by Schoeman *et al.* (2000).
- **Land Use** – Land use was mapped using aerial imagery and then ground-truthed during the site visit.

Further detail pertaining to the methodology of the Assessment is provided in the specialist report, Appendix 4.

10.4.1 Land Type and Soil Form

The dominant land type covering the proposed WTP area, laydown area and pipeline routes is classified as a Ba4 Land Type which is identified with Hutton, Avalon and Glencoe Soil Forms, and the underlying geology consists of shale and sandstone of the Ecca Group of the Karoo Sequence, as depicted in Plan 5, Appendix 2. Table 10-5 provides further detail regarding the identified Soil Form characteristics associated with the Ba4 Land Type.

Table 10-5: Dominant soil type and soil forms

Soil Forms	Characteristics
Hutton	Well drained, usually slightly acidic and have a low cation capacity due to their clay mineral composition.
Avalon	Free-draining and chemically active soils with manganese and iron oxides accumulating under conditions of fluctuating water table resulting in the formation of localised mottles or soft iron concretions.
Glencoe	Moderately suitable for crop production depending on the depth of the soil. The impermeable plinthic material of shallow Glencoe soils can hinder rooting depth and cause periodic waterlogging which is unsuitable for crop production.

10.4.2 Land Capability (Agricultural Potential)

The dominant land capability class in the project area is Class IV (Moderate Grazing), as depicted in Plan 6, Appendix 2. During the Scoping Phase it was provided that the project area's land capability is characterised as Class III (Moderate Cultivation) based on a desktop assessment of the Land Type Survey database. However, the in-field assessment (visual observations and soil conditions) confirmed the site to be characterised by Class IV.

Land in Class IV has severe limitations that restrict the choice of plants which can be grown and requires special conservation practices. Limitations influence clean cultivation, time of planting, tillage, harvesting and choice of crops. Soils in Class IV may be used for pasture, wildlife, food and cover. Use for cultivated crops is limited as a result of the effects of one or more permanent features such as its severe susceptibility to water and wind erosion and low moisture holding capacity.

It is noted however that the land associated with the WTP project area is disturbed mining area as part of the KPS operation.

10.4.3 Land Use

The project area falls entirely within the KPS mining areas, therefore, the current land use, as depicted in Plan 7, Appendix 2, is mining.

10.4.4 Soil Chemical and Physical Characteristics

Two soil samples were analysed, from the proposed WTP area (Sample ID 085) and laydown area (Sample ID 086), for chemical and physical properties.

The physico-chemical analysis revealed the general following properties of the samples:

- **Soil pH** – the soil pH has a direct influence on plant growth potential and the samples revealed pH levels of 4.8 and 5.2 at 085 and 086 respectively which is characterised as Acidic;
- **Cations** – the levels of the basic cations (Calcium, Magnesium, Potassium and Sodium) are determined for agronomic purposes which normally follow the same trend as outlined for soil pH and texture. Cations levels in both samples were generally not considered toxic;
- **Phosphorus** – the samples reveal that phosphorus levels in the project area are very low which is limiting on ecosystem functioning and would require Phosphorus fertilisation if considered for agricultural purposes;
- **Soil Organic Carbon** – the soil organic carbon provides an indication of the organic matter in soil. The samples generally revealed low levels of organic carbon content and would therefore require external nutrient if considered for agricultural purposes; and
- **Soil Texture** – the soil texture of the samples are characterised as sandy clay loam based on the percentage distribution of sand, silt and clay present. This indicates the soil associated with the project area have moderate water holding capacity based on the clay and silt content.

The fertility status of the soil sampled is therefore considered moderate. The soil samples were found to be acidic in terms of pH which is due to the existing mining conditions resulting in leaching of nutrients on the bare surfaces as well as increases the availability of heavy metals.

10.5 Flora and Fauna

A Fauna and Flora Assessment was undertaken and is appended to this report as Appendix 5. One wet season in-field survey was carried out to establish the baseline vegetation and faunal environment in the project area. The following methodologies were employed:

- **Desktop Assessment** – available literature was gathered on the regional natural vegetation, species diversity and species composition of the general vegetation. This information was used to gain an understanding of the broad environmental setting of the project area.
- **Vegetation Survey** – the Braun-Blanquette method (Braun-Blanquette, 1964) was utilised during the in-field survey to record trees, shrubs, grasses and herbs within the project area. From this, a species list was compiled of all species occurring within the project area in addition to other previously recorded species in the study area and a list of Species of Special Concern (SSC) was developed.

- **Fauna Survey** – the faunal survey was conducted concurrently with the vegetation survey where all faunal species encountered on site were identified and recorded. The survey was supported by a desktop assessment of all faunal species previously recorded within the area. The survey included recordings of mammals, avifauna, herpetofauna, macro-invertebrates as well as potential red data faunal species.

Further detail pertaining to the methodology employed for the study is provided in the specialist report, Appendix 5.

10.5.1 Flora Characteristics

10.5.1.1 Regional Vegetation

The project area is situated within the Grassland Biome within the Eastern Highveld Grassland (GM12) vegetation type (Mucina and Rutherford, 2006). This vegetation type occurs in Mpumalanga and Gauteng provinces and is considered to be endangered with approximately 44% altered primarily by cultivation, plantations, urban sprawl, mining, and building of road and dam infrastructure. The plant form / ecological type comprises of graminoids, herbs, geophytic, semiparasitic and aquatic herbs as well as succulent herbs and low shrubs.

The distribution of the regional vegetation type is show in Plan 8, Appendix 2.

10.5.1.2 Species of Special Concern

The New Plants of South Africa (NEWPOSA) website list was obtained from the South African National Biodiversity Institute (SANBI) website. This list provides all the Red Data plant species officially recorded by SANBI for Quarter degree square grid (2628 BB and 2629 AA). For a plant species to be included in this list, a specimen collected in this grid must be supplied to SANBI.

The plant species list obtained from the SANBI website show eleven species (classified as vulnerable or near threatened), and two species (classified as rare) that might occur within the area of the site that have been recorded in the grid reference. These species are listed in Table 10-6.

Table 10-6: Protected plant species

Species	Threat status[4]	SA Endemic
Aloe cooperi Baker subsp. Cooperi	LC	No
Aloe reitzii Reynolds var. reitzii	NT	Yes
Brachystelma minor E.A.Bruce	VU	Yes
Brachystelma stellatum E.A.Bruce & R.A.Dyer	Rare	Yes
Crassula setulosa Harv. var. deminuta (Diels) Toelken	NE	Yes
Crassula setulosa Harv. var. setulosa forma setulosa	NE	Yes
Cryptocarya transvaalensis Burtt Davy	LC	No
Dactylis glomerata L.	NE	No
Dianthus zeyheri Sond. subsp. natalensis S.S.Hooper	NE	Yes
Disa alticola H.P.Linder	VU	Yes
Disa zuluensis Rolfe	EN	Yes
Eucomis autumnalis (Mill.) Chitt. subsp. clavata (Baker) Reyneke	NE	No
Eucomis vandermerwei I.Verd.	VU	Yes
Graderia linearifolia Codd	VU	Yes
Habenaria barbertoni Kraenzl. & Schltr.	NT	Yes
Helichrysum aureum (Houtt.) Merr. var. argenteum Hilliard	NE	Yes
Jamesbrittenia macrantha (Codd) Hilliard	NT	Yes
Khadia alticola Chess. & H.E.K.Hartmann	Rare	Yes
Lydenburgia cassinoides N.Robson	NT	Yes
Protea parvula Beard	NT	No
Zantedeschia pentlandii (R.Whyte ex W.Watson) Wittm.	VU	Yes

[4] Threat Status Key in terms of the International Union for the Conservation of Nature (IUCN): LC – Least Concern, NT – Near Threatened; VU – Vulnerable; and NE – Near Endangered.

10.5.1.3 Site-Specific Flora

Four vegetation communities were identified within the project area, namely natural grassland vegetation, degraded grassland, riparian vegetation and a transformed vegetation unit. These vegetation communities are discussed separately below.

10.5.1.3.1 Natural Grassland Habitat

This vegetation was found in small pockets mainly at the discharge point area outside of the mine boundary. The habitat is characterised by open vegetation cover which is predominantly made up of a grassy layer of *Aristida junciformis.* Despite the high level of vegetation degradation in the immediate surrounding environment, due to mining activities taking place, this portion of grassland displays attributes of the Eastern Highveld Grassland and can therefore be considered to be of medium ecological sensitivity. Figure 10-2 presents photographic evidence of the landscape.

Figure 10-2: Natural Grassland Habitat Type

10.5.1.3.2 Degraded Grassland

Degraded Grassland was identified at the discharge point area within the mining boundary. The immediate surroundings of the discharge point within the mining boundary constitute a previously disturbed mining area which has subsequently been rehabilitated. This area is characterised by open vegetation cover with a continuous grassy layer. The grassland type is considered degraded grassland with indigenous flora species and a range of dominant species including *Aristida spp* being present. Furthermore, secondary succession grassland species were noted within this habitat. This vegetation unit can therefore be considered to be of low ecological sensitivity. Figure 10-3 presents photographic evidence of the degraded grassland landscape.

Figure 10-3: Degraded Grassland Habitat Type

10.5.1.3.3 Riparian vegetation

Two wetland habitats with a combined area of 43.3 ha are located within 500 m of the proposed WTP area and discharge area (including the associated pipeline routes). The wetlands are characterised as a channelled valley bottom wetland and a hillslope seep wetland respectively (refer to Section 10.6 below). These habitats are dominated by *Typha capensis*, *Paspalum dilatatum* (Dallis Grass), *Juncus effusus* (Common Rush), *Eragrostis gummiflua* (Gum Grass), and *Andropogon eucomus* and were found to be moderately to severely modified as a result of mining activities, livestock grazing and alien plant invasion (including *Acacia mearnsii* (black wattle), *Eucalyptus camaldulensis* (red river gum), *Salix babylonica* (weeping willow)). The ecological sensitivity of this vegetation unit can be considered to be low, however it is noted that these systems remain functional and capable of supporting faunal species that utilise the area for breeding and foraging purposes. Figure 10-4 presents photographic evidence of the riparian vegetation habitat type.

Figure 10-4: Riparian Vegetation Habitat Type

10.5.1.3.4 Transformed Vegetation Habitat

Transformed vegetation was identified at the proposed WTP area. This area is devoid of natural habitat and characterised by existing disturbance as a result of mining activities which has resulted in the transformation of the habitat to secondary grassland conditions. The area is dominated by alien invader species which impedes its ecological functioning and integrity and is

therefore considered to be of low ecological sensitivity. Furthermore, due to its transformed state, it is unlikely that any threatened faunal taxa would persist in this area. Figure 10-5 presents photographic evidence of the transformed vegetation habitat at the proposed WTP area.

Figure 10-5: Transformed Vegetation Habitat Type

10.5.1.4 Alien Invasive Plant Species

Alien invasive plants can be defined as non-native to the ecosystem under consideration and the introduction thereof causes or is likely to cause economic or environmental harm (Invasive Species Advisory Committee, 2006). These species generally out-compete native vegetation for space, nutrients, water, and other environmental requirements required for growth resulting in the transformation of the native ecosystem in such a manner that compromises the ecological integrity of the ecosystem (Van Wilgen *et al*., 1999).

Alien plant species in South Africa have been classified according to NEMBA into the following categories:

- Category 1a: Species requiring compulsory control;
- Category 1b: Invasive species controlled by an Alien Invasive Species Management Programme;
- Category 2: Invasive species controlled by area, and;
- Category 3: Invasive species controlled by activity.

A total of 13 Alien Invasive Plant Species (AIP's) were recorded on site (Bromilow, 2010) eight of these have been assigned alien invader plant categories according to the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA) and NEMBA, as provided in Table 10-7 below.

Table 10-7: AIP's Recorded on Site

Scientific Name	Common Name	NEMBA Status

Acacia mearnsii	Black-wattle	Category 1b
Bidens bipinnata L.	Spanish blackjack	Weed
Cosmos bipinnatus	Cosmos	Category 1b
Conyza albida	Tall fleabane	Weed
Cortaderia selloana	Common pampas grass	Category 1b
Gomphocarpus fruticosus	Milkweed	Exotic
Pennisetum clandestinum	Kikuyu grass	Category 1b
Salix babylonica	Weeping willow	Category 2
Persicaria lapathifolia	Spotted Knotweed	Category 1b
Solunum incanum	Sodom apple	Medicinal weed
Solanum mauritianum	Bugweed	Category 1b
Targetes minuta	Tall Khaki Weed	Weed
Verbena bonariensis	Tall Verbena	Category 1b

10.5.2 Faunal Characteristics

10.5.2.1 Mammals

Table 10-8 provides a list of the mammal species recorded within the project area. The project area has a relatively low faunal diversity due to the disturbed nature of the site. According to Skinner and Chimimba, (2005), a total of 82 mammal species may occur in the local study area, however only three of these were recorded during the infield survey conducted.

Table 10-8: Mammal Species Recorded in the Project Area

Common Name	Scientific Name	Threat Status	Habitat
Highveld Gerbil	*Tatera brantsi*	Least concern	Grassland
Porcupine	*Hystrix africaeaustralis*	Least concern	Grassland
Water mongoose	*Atilax paludinosus*	Least concern	Riparian
Yellow mongoose	*Cynictis penicillate*	Least concern	Grassland

10.5.2.2 Bats

According to Skinner and Chimimba, (2005), 14 species of bats could potentially utilise the local study area during nocturnal foraging bouts; however, no roosts for any bat species were located in the study plots. No bat species were recorded during the infield survey conducted. This has been attributed to the lack of preferred habitat and the disturbed nature of the project site.

10.5.2.3 Avifauna

Birds serve as indicators of biological integrity and environmental health. Bird communities and ecological condition are linked to land cover. As the land cover of an area changes, so do the types of birds present in that area (The Bird Community Index, 2007). A total of 57 bird species were recorded during the infield survey. The full detailed list is provided in the specialist report, Appendix 5. Notably, of the 57 bird species recorded, 55 species have a Threat Status of Least Concern while the remaining two species are not considered.

10.5.2.4 Important Bird Area

Important Bird Areas (IBAs) are sites that have been identified as globally important for the conservation of avifaunal species. More than 12 000 IBA's have been identified globally. At present, South Africa has 124 IBA's (101 of global-, and 21 of regional importance), covering over 14 million hectares of habitat for our threatened, endemic and congregatory birds. The proposed WTP will not traverse any IBA.

10.5.2.5 Herpetofauna

The persistence and metapopulation structure of many herpetofauna species is dependent on aquatic environments and terrestrial biotic corridors as well as broadly defined habitat types, in particular; terrestrial, arboreal (tree-living), rupiculous (rock-dwelling), and wetland associated vegetation cove. Basal cover was poor in many places and would not provide adequate cover for herpetofauna species during the dry season. No reptiles were encountered during the infield survey. This is primarily due to the lack of diversity of the habitat associated with the project area.

10.5.2.6 Invertebrates

Insects are important biological resources that are crucial for ecosystem functioning in which they occur. They perform a number of important functions including aerating soil, pollinating plants, and controlling insect and plant pests. No invertebrates were recorded during the infield survey.

10.5.3 Sensitivity of the Site

Two biodiversity management plans exist for the Mpumalanga Province, namely the Mpumalanga Biodiversity Conservation Plan (MBCP) and a more recent version called the Mpumalanga Biodiversity Sector Plan, 2013 (MBSP). These plans serve as a spatial biodiversity tool aimed at contributing to sustainable development in Mpumalanga as well as form part of national scale biodiversity planning. The MSBP recognises the following categories with respect to the natural vegetation of the Province:

- Protected Areas;
- Critical Biodiversity Areas;
- Other Natural Areas;
- Ecological Support Area; and
- Modified.

Further detail pertaining to the MSBP categories and their associated description is provided in the specialist report, Appendix 5. The project area falls within the Modified category which characterises areas in which significant or complete loss of natural habitat and ecological function has taken place.

The overall ecological sensitivity of the site in terms of the MSBP is depicted in Plan 9, Appendix 2.

10.6 Wetlands

A Wetland Assessment was undertaken and is appended to this report as Appendix 6. One wet season field survey was carried out to delineate the wetlands present within the project area and establish the baseline wetland Present Ecological State (PES). The following methodologies were employed:

- **Desktop Assessment** – existing wetland assessments for the project area were reviewed to understand the area together with a review of applicable legislation. Desktop wetland delineation within the project area was undertaken utilising detailed aerial imagery (Southern Mapping, 2015).
- **Wetland Delineation** –an infield assessment was carried out for site verification of the wetland and riparian delineation in accordance with guidelines established by the Department of Water and Forestry of South Africa (DWAF), 2005 using the terrain unit, soil form, soil wetness and vegetation indicators to delineate the boundaries of the wetland areas.
- **Wetland Integrity Assessment** – the wetland integrity was determined using the WET-Health tool, as prescribed by Kotze *et al*. (2007) to measure the PES of wetlands associated with the project area based on the structure and function of the wetlands. Furthermore, the Ecological Importance and Sensitivity (EIS) was derived using the DWAF, 1999 established methods in conjunction with Rountree and Kotze, (2012).

Further detail pertaining to the methodology of the Assessment is provided in the specialist report, Appendix 6.

10.6.1 Wetland Delineation and Classification

Two wetland systems totalling 43.2 ha fall within the 500m of the proposed WTP area and discharge area (including the associated pipeline routes). The delineated wetlands are depicted in Plan 10, Appendix 2. These comprise a large channelled valley bottom wetland that drains north into the Saalklapspruit system, and a hillslope seep which is located in the south-east corner of the project area. The breakdown of the wetland types per area is detailed in Table 10-9. The Hydro-geomorphic (HGM) Units are subsequently described.

Table 10-9: Wetland HGM Units

HGM Unit	HGM Unit Type	Area (ha)
1	Channelled Valley Bottom	31.7 ha
2	Hillslope Seep	11.5 ha

The buffer zones relating to the wetlands are illustrated in Plan 11, Appendix 2. Zones of Regulation of 100m around each wetland have been assigned according to the regulations on use of water for mining and related activities aimed at the protection of water resources (GN 704 of 4 June 1999).

10.6.1.1 HGM Unit 1

HGM Unit 1 is a channelled valley bottom wetland covering 31.7 ha (refer to Plan 10, Appendix 2). This wetland type is described as valley bottom areas with a well-defined stream channel (in this case Saalklapspruit) which is characterised by the net accumulation of alluvial deposits or may have steeper slopes and be characterised by the net loss of sediment. Most wetlands located upstream of the N12 Road have been destroyed as a result of mining activities, however there is evidence of rehabilitation of a portion of this wetland such as sloping and revegetation. One species is present within the wetland system, namely *Chloris* sp., which is not an obligate or facultative wet grass species and is not suited to revegetate wetland habitat. In addition, *Typha capensis* (Common Bulrush) and the invasive *Acacia mearnsii* (Black Wattle) were dominant in the un-mined area of the wetland. Figure 10-6 below presents photographic evidence of HGM Unit 1.

The current impacts observed include:

- Destruction of portions of the wetland previously authorised due to mining activities, however, some of these areas are in the process of being rehabilitated;
- The rehabilitated area has been vegetated with *Chloris* sp. only, resulting in a homogenous environment, hindering the ability of the system to maintain biodiversity;
- Stormwater is directed into the wetland downstream of the N12, thus increasing the potential for contamination to the stream;
- Cattle-grazing activities were noted downstream of the N12, resulting impacts such as overgrazing, trampling and erosion which in turn increases sedimentation reporting to the wetland systems. Sedimentation alters the natural hydrological and geomorphological functioning of wetlands and may have an impact on aquatic life;
- Impaired water quality which may be further aggravated due to additional loading of phosphates and nitrates from cattle grazing;
- Potential impaired water quality resulting from municipal sewage leakages; and
- Disturbance as a result of mining leading to the infestation of alien and invasive plant species (e.g. *Acacia mearnsii*, *Persicaria*), further limiting the ability of the hydromorphic grasslands to function.

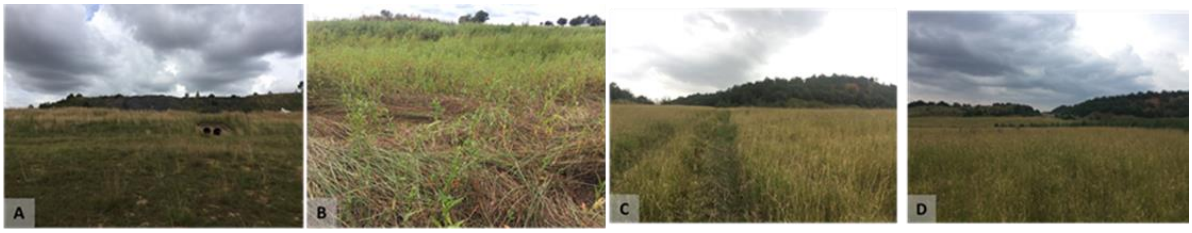


Figure 10-6: HGM Unit 1

(A: Habitat downstream of the N12, illustrating the storm water drains; B: Invasion by *Persicaria* downstream of the N12; C and D: Habitat upstream of the N12)

10.6.1.2 HGM Unit 2

HGM Unit 2 is a hillslope seep wetland covering approximately 11.5 ha located adjacent to the proposed WTP area (refer to Plan 10, Appendix 2). This wetland type is characterised by colluvial (transported by gravity) movement of materials. Water inputs are mainly from sub-surface flow and outflow is usually via a well-defined stream channel connecting the area directly to a stream channel.

The wetland is largely disturbed with major impacts to hydrology, geomorphology and vegetation. Figure 10-7 below presents photographic evidence of HGM Unit 2.

The existing impacts observed include the following

- A railway crossing and the R555 transect the wetland, which has resulted in fragmentation of the natural system, altered hydrology, compaction of soils in some places and loss of vegetation;
- Stockpiling and the digging of trenches within the wetland has altered the topography of the site, thereby modifying the pattern of flow to a large extent, increasing sedimentation and erosion and facilitating the growth of AIPs; and
- AIPs are prolific in the area due to clearing of vegetation and soil disturbance. This has impacted the ability of wetlands to maintain biodiversity.

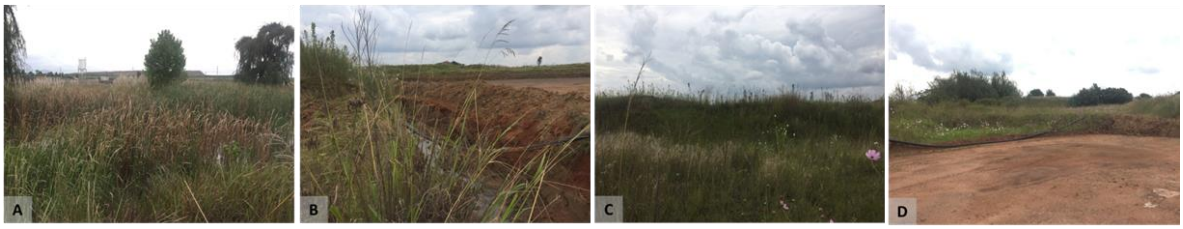


Figure 10-7: HGM Unit 2

(A: Wetland vegetation remaining, including *Typha capensis*; B: A trench dug to drain the wetland; C: Soil stockpiling altering topography; D: cleared areas)

10.6.2 Wetland Sensitivity

10.6.2.1 Present Ecological State

Table 10-10 indicates the PES scores for the delineated HGM Units. The wetlands within the project area are both categorised as *Largely Modified* (Category D).

The mining activities observed in the upstream portion of HGM Unit 1 have resulted in significant alterations to the hydrology and geomorphology of the system. However, recent rehabilitation activities (infilling, sloping) may have a positive impact to this system in the future. Impacts related to the N12 road crossing have also resulted in altered water retention and distribution patterns.

Similarly, significant alterations to the geomorphology and hydrology of HGM Unit 2 were observed due to the road, railway crossings and the various excavations observed at the time of the assessment.

Table 10-10: Present Ecological Health Scores

HGM Unit	Hydrological Health Score	Geomorphological Health Score	Vegetation Health Score	Final Ecological Health Score	PES Score
1	6.5	2.2	5.3	4.94	D
2	6	0.5	7.6	4.85	D

10.6.2.2 Ecological Importance and Sensitivity

Table 10-11 indicates the EIS scores for the HGM Units with the final EIS score for both wetlands being *Moderate*.

Although the wetlands are modified, they do still provide *Marginal* (HGM Unit 2) to *Moderate* (HGM unit 1) hydrological importance services, such as flood attenuation and assimilation of toxicants and nitrates.

The wetlands are largely transformed; however the wetlands do provide some habitat for indigenous fauna and flora. This is more so for HGM Unit 1 where the downstream portion still has some large areas of intact vegetation which could provide habitat for red data species.

In general, the values are *Moderate* for 'Direct Human Benefits'. Some agricultural activities occur on the edges of the wetlands; however impacts related to these activities are minor. HGM Unit 1 provides water to the Phola area which is used extensively for grazing.

Table 10-11: EIS Scores

HGM Unit	EIS	Hydrological/Functional Importance	Direct Human Benefits	Final EIS Score	Final EIS Category
1	1.7	1.5	1.8	1.8	Moderate
2	1.8	0.9	1	1.8	Moderate

10.7 Aquatic Ecology

The Aquatic Biodiversity Assessment is appended to this report as Appendix 7. The study comprises of a single survey undertaken during May 2018. The location of the sample points are depicted in Plan 12, Appendix 2. The following methodology was employed for the Assessment:

- **Desktop Assessment** – the aquatic system associated with the project area were identified according to their specific Sub-Quaternary Reach (SQR) as described by DWS. Furthermore, literature pertaining to the SQR was reviewed to aid the understanding of the baseline conditions.
- **Water Quality** – *in situ* water quality variables were to be taken from three identified sampling sites labelled K3, K4 and K5, and were assessed for temperature, conductivity, pH, Dissolved Oxygen concentrations and saturation levels. No samples could be taken at K3 due to accessibility issues.
- **Habitat Integrity** – an Intermediate Habitat Integrity Assessment (IHIA) was completed to assess the integrity of the habitats from a riparian and instream perspective against the criteria and classes prescribed by Kleynhans (2015).
- **Aquatic Macroinvertebrates** – the aquatic macroinvertebrates assessment included the use of the following associated indices:
    - Integrated Habitat Assessment System (IHAS) – IHAS was used to measure the variability aquatic macroinvertebrate biotopes available at the time of the survey. The IHAS score is expressed as a categorised percentage that ultimately describes the quantity, quality and diversity of available macroinvertebrate habitat relative to an "ideal" diversity of available habitat.

- South Africa Scoring System Version 5 (SASS5) – the SASS5 index was used to assess the status of riverine macroinvertebrates based on the presence of aquatic invertebrates families and their perceived sensitivity to water quality changes. SASS results are expressed both as an index score (SASS Score) and the Average Score per Recorded Taxon (ASPT value).
- Macroinvertebrates Response Assessment Index (MIRAI) – the MIRAI was used to provide a habitat based cause-and-effect foundation to interpret the deviation of the aquatic invertebrate community from the calculated reference conditions for the Bushveld Basin. The results of the MIRAI provide an indication of the baseline ecological category and subsequently assist in determining the PES.

- **Eco-Status** – based on the assessments above, the PES of tributaries considered in the study is determined utilising the River Eco-status Monitoring Programme (REMP) Ecological Classification manual by Kleynhans and Louw (2007).

Further detail pertaining to the methodology of the Assessment is provided in the specialist report, Appendix 7.

10.7.1 Aquatic System Characterisation

The project area falls within the Wilge River Catchment and the watercourse of concern consists of the upper reaches of the Saalklapspruit (i.e. B20G-01099 SQR). Further detail pertaining to the hydrological setting associated with the project is provided in the Surface Water baseline, Section 10.8, below. An unclassified tributary of this SQR is planned to receive the proposed KPS WTP discharge. Table 10-12 below outlines the gathered Present Ecological Status and Ecological Importance and Sensitivity (PESEIS) information pertaining to the Saalklapspruit SQR of concern (DWS, 2018).

Table 10-12: Desktop Information for the Upper Saalklapspruit SQR (B20G-01099)

Component	Obtained Data
SQR Length	41.57 km
Present Ecological Status	C (moderately modified)
Ecological Importance (EI)	High
Number of expected fish species	4
Number of expected macroinvertebrate taxa	39
Ecological Sensitivity (ES)	High

Fish and invertebrate sensitivity to physio-chemical modifications	Moderate
Invertebrate velocity sensitivity	High
Stream size sensitivity to flow and water level changes	High
NFEPA Status	None

(Source: B20G-01099)

According to the data gathered above (DWS, 2018), the Saalklapspruit is characterised as moderately modified (ecological category C) and impacts are mainly attributed to mining effluent, agricultural lands, exotic vegetation as well as abstractions and increased flows to the system.

Furthermore, the EI of the reach is considered to be high due to important expected invertebrate taxa rather than fish species (DWS, 2018). The ES of the reach is also considered to be high due to the expectance of flow-dependent invertebrates and additional vertebrates (i.e. fish) sensitive to flow and water level changes (DWS, 2018). Due to the small stream size of the river, sensitivity of the river to changes in flow and water levels has also been classified as high (DWS, 2018).

10.7.1.1 Saalklapspruit Findings

According to a previous biomonitoring study of the system, the Saalklapspruit appears to be in a severely impacted state (Ecology International, 2017). Findings from the current study indicate similar conditions which categorised the habitat, according to the IHI, as Ecological Category F (critically modified) for both instream and riparian habitat. The mining activities in upper reaches of this tributary have resulted in severe modification of the reference hydrology and morphology of the Saalklapspruit.

Furthermore, leaking municipal sewage has been observed entering the system for an extending period of time with open man holes observed during the current survey, as shown in Figure 10-8 below. This impact has almost certainly deteriorated the water quality of the tributary and the adjoining Saalklapspruit SQR.

Figure 10-8: Open sewage cover with signs of flow into the Saalklapspruit

10.7.2 *In Situ* Water Quality

Table 10-13 outlines findings from the in-situ water quality assessment of the sampled sites. It is important to note that no RWQOs have been set for the B20G quaternary catchment within which the watercourses of concern are located (DWS, 2016). Therefore, guidelines utilised in this study have been obtained from DWAF (1996). Furthermore, it is noted that no sample was collected at Site K3 due to an accessibility issue.

Table 10-13: *In situ* water quality findings

Site	K3	K4	K5	Recommended Guidelines
Temperature (ºC)	DRY	18.2	16.0	-
pH		6.94	8.24	6.5-9
Conductivity (µS/cm)		139.2	317.0	<700
Dissolved Oxygen (mg/l)		5.87	7.03	-
Saturation Percentage		76.2	77.0	80-120
Red shading indicates constituents exceeding recommended guidelines as stipulated in DWAF (1996)				

With the exception of the saturation percentages at both K4 and K5, all other recorded constituents were within the recommended guidelines. The saturation percentages were found to be slightly below the recommended value of 80% which is regarded as problematic for aquatic biota if such conditions persist (DWAF, 1996). This finding is likely due to the natural impounded wetland nature resulting in reduced flow and consequently lower oxygen levels in the upper reaches of the watercourse. In addition, sewage influences noted by Ecology International (2017) and current study have also impacted on the oxygen levels in the assessed watercourses.

The pH findings at both sampling sites were recorded within the recommended guideline values (DWAF, 1996). The findings at K4 were similar to those recorded during the 2017 biomonitoring period (Ecology International, 2017), whereas the pH recorded at K5 increased notably from the previous study. A possible cause for this increase can be due to the lack of potentially acidic water flowing from the KPS upstream activities as noted in the Ecology International (2017) study.

Conductivity findings at both sampling sites were also below the recommended guideline value of 700 µS/cm and fairly similar to those recorded during the 2017 study. Temporal and spatial variation of the pH and conductivity was however found between the findings of the previous monitoring period and the current study. It is clear that the conductivity at downstream K5 is being influenced by water high in dissolved solid content flowing from the KPS upstream activities as indicated by the high conductivity recorded during the 2017 survey at K3. However, the conditions at K5 are most likely also influenced by the sewage input into the system.

10.7.3 Index of Habitat Integrity

The Index of Habitat Integrity (IHI) was conducted on approximately 10 km of the Saalklapspruit SQR starting from upstream of K4 where the SQR runs parallel to the N12 highway. Observations from satellite imagery together with findings from the site visit were utilised in the IHI calculation. Results from the Saalklapspruit IHI are presented in Table 10-14 below.

Table 10-14: IHI findings for the watercourse draining from the KPS Colliery

Habitat Component	IHI Score (%)	Ecological Category
Instream	42.37	D
Riparian	43.26	D

The results from the IHI indicate that both the instream and riparian habitat associated with the assessed reach are in a largely modified state (Ecological Category D), which indicated a large loss of natural habitat, biota and basic ecosystem functions.

Instream modifications observed during the study include farm dams, road crossings and agricultural practices along the reach which appear to be impacting on the hydrology of the system. During the timing of the survey the upstream KPS mining activities appeared to have minimal impacts on the downstream hydrology as notable flow was observed at K5 even during, what is considered, the dry season (i.e. winter). Furthermore, raw sewage entering from the Saalklapspruit has severely impacted on the water quality of the assessed Saalklapspruit SQR, contributing heavily to the modified instream score. Agricultural encroachment and urbanisation near the SQR has resulted in the removal of riparian vegetation. This impact together with the influence of livestock and exotic vegetation encroachment, have contributed to the largely modified score of the riparian habitat component.

10.7.4 Aquatic Macroinvertebrates

The sections below outline the findings from the various macroinvertebrate indices utilised in the study.

10.7.4.1 Integrated Habitat Assessment System

The results from the IHAS conducted during the study are presented in Table 10-15. In addition, the summer findings from the previous biomonitoring study (Ecology International, 2017) have been utilised for seasonal comparison.

Table 10-15: IHAS findings for the study

Site	K3	K4	K5
Summer 2017			
IHAS	Water level too low	43.64	50.91
Interpretation		Poor	Poor
Winter 2018			
IHAS	DRY	41.82	50.91
Interpretation		Poor	Poor

IHAS findings during the summer 2017 survey indicate poor macroinvertebrate habitat availability at both K4 and K5. Similar findings were also recorded during this project specific study where the available macroinvertebrate habitat at the same sites was also classified as poor. The current low IHAS scores and overall poor characteristics of the available macroinvertebrate habitat at both sampling sites can most likely be attributed to the lack of flow and cobbles, which largely

contribute to ideal macroinvertebrate habitat conditions, compounded by algal presence, potentially forming from sewage input, observed at the sites.

10.7.4.2 South African Scoring System

The SASS5 findings from survey undertaken are presented in Table 10-16 below.

Table 10-16: SASS5 results for the May 2018 survey

Site	K3	K4	K5
SASS5 score	DRY	62	76
Number of taxa		14	19
Average score per taxa		**4.43**	**4.00**

The SASS5 assessment resulted in a total of 14 ad 19 taxa being sampled at K4 and K5 respectively. The resultant SASS5 scores ranged from 62 at K4 to 76 at K5. This increase in SASS5 score at K5 in comparison to K4 can most likely be attributed to the higher IHAS score recorded at the site, despite the available macroinvertebrate habitat at both sites being poorly categorised (Table 10-15 above). The average sensitivity scores per sampled taxa at both sites were low ranging from 4.00 at K5 to 4.43 at K4. This indicates that the current macroinvertebrate assemblages in the assessed aquatic systems comprise of tolerant families.

10.7.4.3 Macroinvertebrate Response Assessment Index

The results from the site based MIRAI conducted during the study are outlined in the Table 10-17 and Table 10-18 below for Site K4 and Site K5 respectively.

Table 10-17: MIRAI findings for Site K4

Invertebrate Metric Group	Score Calculated
Flow modification	52.7
Habitat	44.9
Water Quality	41.0
Ecological Score	**46.41**
Ecological Category	**D**

The MIRAI findings for K4 indicate that the macroinvertebrate assemblage in a largely modified state (Ecological Category D). The largest contributing metric group to this modified score

appears to be due to poor water quality at the site possibly resulting from sewage influences entering into the system from the Saalklapspruit. Figure 10-9 below displays signs of sewage contaminated water entering into the Saalklapspruit from the Saalklapspruit. The habitat metric group is also largely influencing this modified score as numerous taxa with a preference for specific biotopes, such as cobbles, gravel and sand, were not sampled (e.g. Caenidae and Gomphidae). Flow modification, according to the MIRAI findings, is also prevalent and influencing the macroinvertebrate assemblages recorded during the study. This can partially be attributed to the KPS mining activities that have taken place in the upper reaches of the watercourse of concern. However, mining activities in the upper reaches of the Saalklapspruit and in a tributary upstream from the site (i.e. GPS coordinates: 26° 02'06.55"S 28°59'57.28"E) appear to be impacting the flow to a greater extent compared to the KPS mining activities.

Figure 10-9: Signs of dirty water flowing into the Saalklapspruit from the Saalklapspruit

Table 10-18: MIRAI findings for Site K5

Metric Group	Score Calculated
Flow modification	49.4
Habitat	54.8
Water Quality	42.6
Ecological Score	**49.07**
Ecological Category	**D**

The MIRAI findings for Site K5 indicate that the macroinvertebrate assemblage in a largely modified state (Ecological Category D). The largest contributing metric group to this modified

score appears to be due to poor water quality at the site. Sewage related issue has been an ongoing event for some time and which were also noted in the 2017 aquatic biomonitoring study. This impact is most likely driving the low score observed in the MIRAI water quality metric and is contributing largely to the overall largely modified Ecological Category.

10.7.5 Eco-Status

The results of the PES determination are presented in Table 10-19. It is important to note that this PES constitutes only for the B20G-01099 SQR and not the unclassified tributary originating from K3.

Table 10-19: Present Ecological State for the B20G-01099 SQR

Metric Group	Ecological Score	Ecological Category
Riparian vegetation	40.00	D/E
Site K4 Macroinvertebrates	46.41	D
Site K5 Macroinvertebrates	49.07	D
Present Ecological State	**47.55**	**D**

The PES determination deduced that the assessed Saalklapspruit SQR (B20G-01099) is in a largely modified state (Ecological Category D) according to the riparian and macroinvertebrate data gathered for the SQR.

10.8 Surface Water

The Surface Water Assessment is appended to this report as Appendix 8. An infield assessment was conducted during March 2018 to collect water samples at strategically selected monitoring points along relevant streams to determine the baseline conditions which are likely to be impacted by the proposed discharge. The sampling points are depicted in Plan 13, Appendix 2. South32 has an established Surface Water Monitoring Programme which was utilised in conjunction with the collected samples to establish the baseline conditions within the project area. The following methodologies were employed in this assessment:

- **Desktop Assessment** – a literature survey was undertaken to gather information on the project area. A desktop assessment of the catchment characteristics (rivers/streams, pans and dams) was conducted using Geographical Information System (GIS) tools.
- **Water Quality Assessment** – during the infield assessment, five water samples were collected and sent to an accredited laboratory (Aquatico) for analysis. Water quality results

were compared to the existing baseline quality and the resource water quality of the Wilge River Catchment to determine the water quality trends and current status.

- **Floodline Delineations** – the 1:100 year floodlines were delineated on the Saalklapspruit to determine the level of impact or the change in flood extent due to the proposed discharge of treated water into the stream. The floodlines were modelled for two scenarios (pre-discharge and post discharge)

Further detail pertaining to the methodology of the Assessment is provided in the specialist report, Appendix 8.

10.8.1 Hydrological Setting

The project area is located in the Olifants Water Management Area 4 (WMA 4), with the proposed WTP footprint and associated pipeline falling within quaternary catchments B20G, this quaternary catchment lies in the greater Wilge River Catchment, which is located upstream of the Loskop Dam Catchment. The quaternary catchments in relation to the project area are shown in Plan 14, Appendix 2.

Table 10-20 present the surface water attributes of the B20G quaternary catchment namely Mean Annual Precipitation (MAP), Mean Annual Runoff (MAR), and Mean Annual Evaporation (MAE) as determined by the Water Resources of South Africa 2012 Study (WR2012).

Table 10-20: Summary of the surface water attributes of the B20G quaternary catchment

Quaternary Catchment	Catchment Area (km^2)	Rainfall Zone	MAP (mm)	MAR (mm)	MAR $m^3 x 10^6$	Evaporation Zone	MAE (mm)
B20G	519.4	B2C	669	44.0	22.87	4A	1689

10.8.1.1 Streamflow Evaluation

There are no streamflow measuring stations along the Saalklapspruit or the surrounding Grootspruit and Tweefonteinspruit. The Saalklapspruit is considered as an ephemeral stream and as such does not flow throughout the year.

During the 2014 site assessments done by Digby Wells, however, flow measurements were taken using a flow meter to obtain the average velocity of the Saalklapspruit when there is flow. The average flow on the downstream section of Saalklapspruit was measured to be 0.1 m/s, with the maximum flow estimated to be 0.2 m/s.

10.8.1.2 Land and Surface Water Use

On a more regional scale, the Wilge River catchment's land use is rural in nature comprising of agriculture practices around the towns of Bronkhorstspruit and Delmas (DWAF, 2009). Coal mining, which was historically concentrated in the Middelburg and Witbank Dam Catchments, has expanded into the Wilge River Catchment and as such the current predominant surface water uses within the catchment can be generalised to comprise of agriculture (irrigation) and coal mining. The majority of irrigation agriculture practiced is located downstream of Loskop Dam.

10.8.2 Water Quality

Water quality monitoring at KPS and the surrounding areas commenced in 2004. Selected water quality variables at the selected monitoring points were evaluated between the period 2014 to 2018 to determine prevailing water quality trends. Furthermore, during this infield assessment undertaken by Digby Wells samples were collected from strategically selected monitoring points were analysed to determine the baseline water quality status (refer to Plan 13, Appendix 2). The water quality results have been described and interpreted in subsection below.

10.8.2.1 Water Quality Trends

Time series graphs were developed to demonstrate the water quality trends of various parameters based on the Wilge River catchment RWQOs. Amongst the parameters with set, only water quality data for Sulphates (SO4), Fluoride (F), Aluminium (Al), and Manganese (Mn) was available, these parameters were used to describe the current and historical water quality for the Saalklapspruit. Other parameters (mostly metals) which have not been analysed as part of the existing monitoring programme have been included in the updated/proposed monitoring programme on this report (refer to the Specialist report for the detailed proposed Monitoring Programme).

A summary of the observed trends for these variables is provided in subsections below with the time series graphs subsequently provided. The long straight lines within the time series graphs indicate the absence of monitoring results along those periods, this could likely be periods of low runoff or no rainfall and as such no measurements were recorded during those periods.

Water quality trends for Canal 1 (located immediately downstream of the western mine boundary along the N12) and Canal 2 (located immediately downstream of the eastern mine boundary along the N12 and is the proposed discharge point), benchmarked with the Wilge RWQO are shown in Figure 10-10, Figure 10-11, Figure 10-12 and Figure 10-13 respectively.

SO4 levels have mostly been fluctuating within the Wilge RWQO with the exception of late 2016 where elevated levels have been observed at Canal 2 monitoring point. A decline in the levels was observed in the middle of 2017 and the recent monitoring shows levels that are within the

Wilge RWQO. A decrease or downward trend has been observed on the recent water quality for both Canal 1 and 2.

F levels are within the objective limits throughout the monitoring period between 2014 until recently in July 2018. An observed spike on Canal 1 graph may possibly be an error during data recording. This is evident by the uniform graph or levels of F that are observed throughout this period. Although there are some periods of volatile fluctuations which exceed the Olifants RWQO for Al, it has been within the limits for a period of two years until recently in July. Manganese has also been fluctuating below and above the Olifants RWQO throughout the monitoring period, however, the recent months have shown improvement on manganese levels which is below the Olifants RWQO.

Generally, disruption of coal strata during mining accelerates pyrite oxidation by exposing surface areas of the reactive mineral to weathering. Acidic mine water in a coal mines are mostly related to this process and the water is usually characterized by low pH, high SO4, and hardness and lower iron (Liu et al. 1991). Although pH limits are not provided on the Olifants RWQO, pH trend graph was plotted to give an indication of any potential contamination from the mine. The pH of pure water is 7 and the normal range for pH in surface water systems is 6.5 to 8.5, whilst the pH range for groundwater systems is between 6 to 8.5. Based on the pH trend on Figure 5 5, there is indication of mine water contamination at these two monitoring points.

Water quality results for other monitoring points (SOUSW1, WelSW7/K17 and WelSW8) also show fluctuating trends of Al and SO4 (Figure 10-14 and Figure 10-15). Elevated Al levels which exceed Wilge RWQO were observed from 2015 until beginning of 2017, the same trend was also observed on SO4 levels. However, the two parameters have shown great improvement on the recent water quality results and currently within the Wilge RWQO.

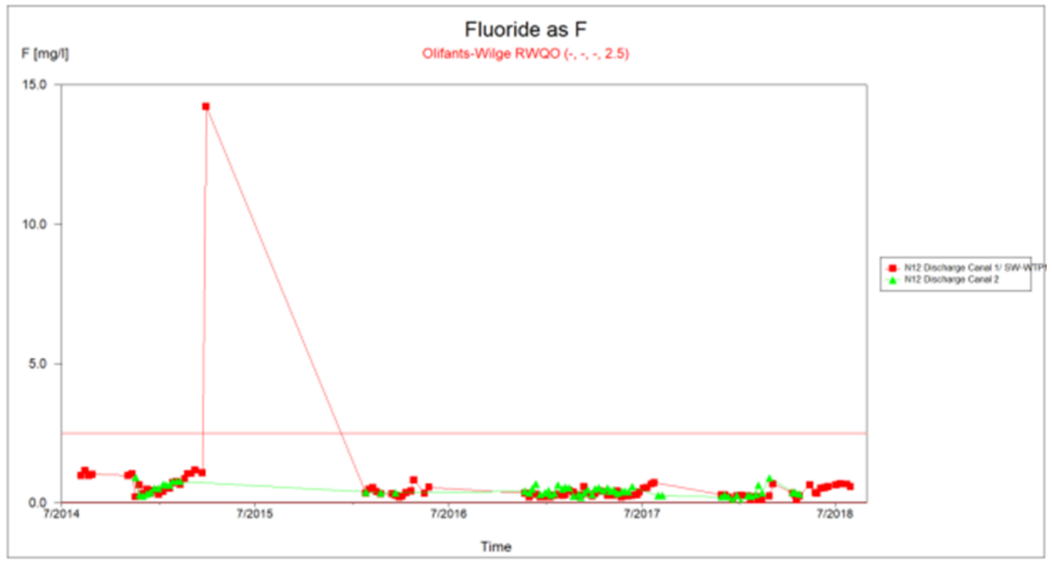


Figure 10-10: F water quality trend for discharge canal 1/SW-WTP1 and discharge canal 2

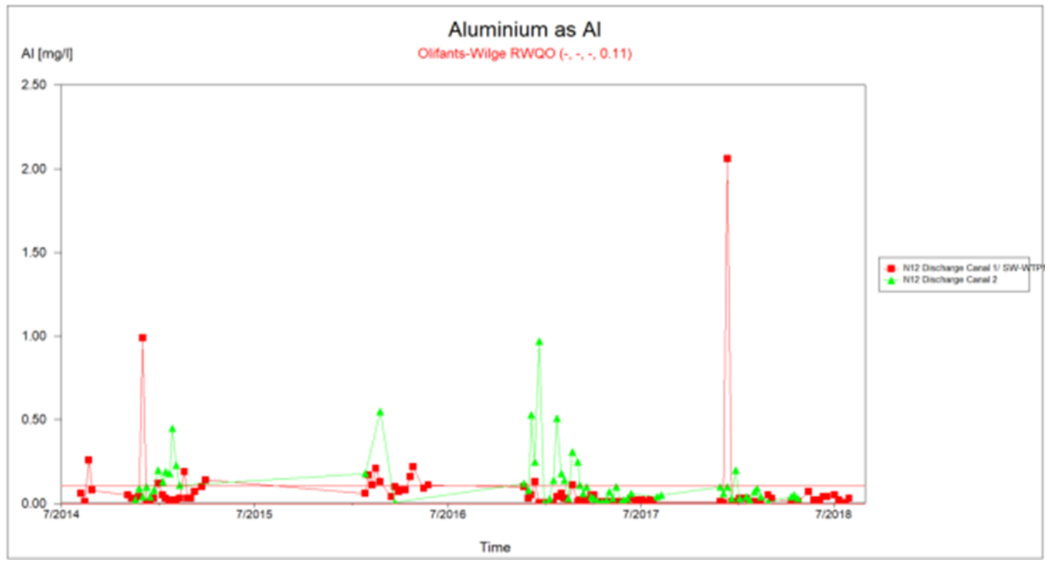


Figure 10-11: Al water quality trend for discharge canal 1/SW-WTP1 and discharge canal 2

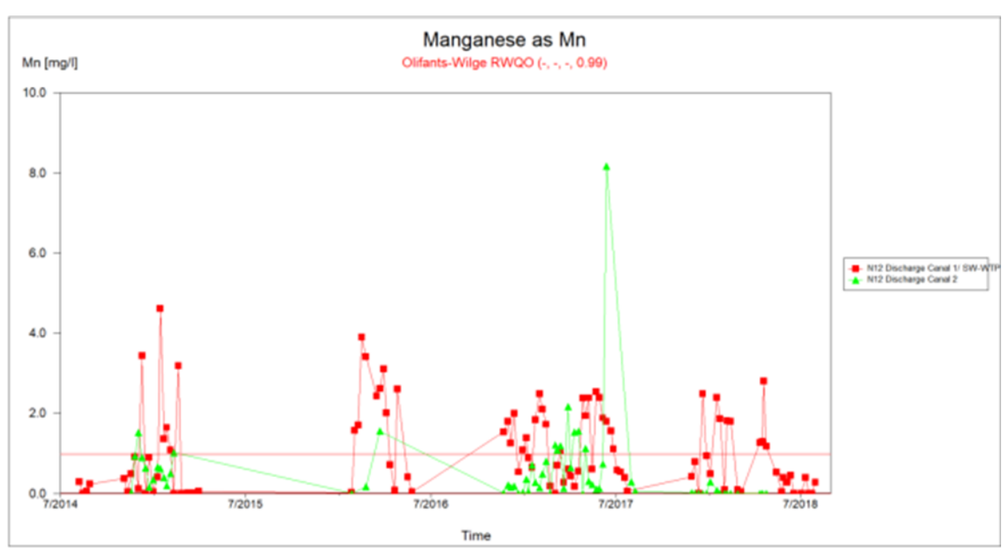


Figure 10-12: Mn water quality trend for discharge canal 1/SW-WTP1 and discharge canal 2

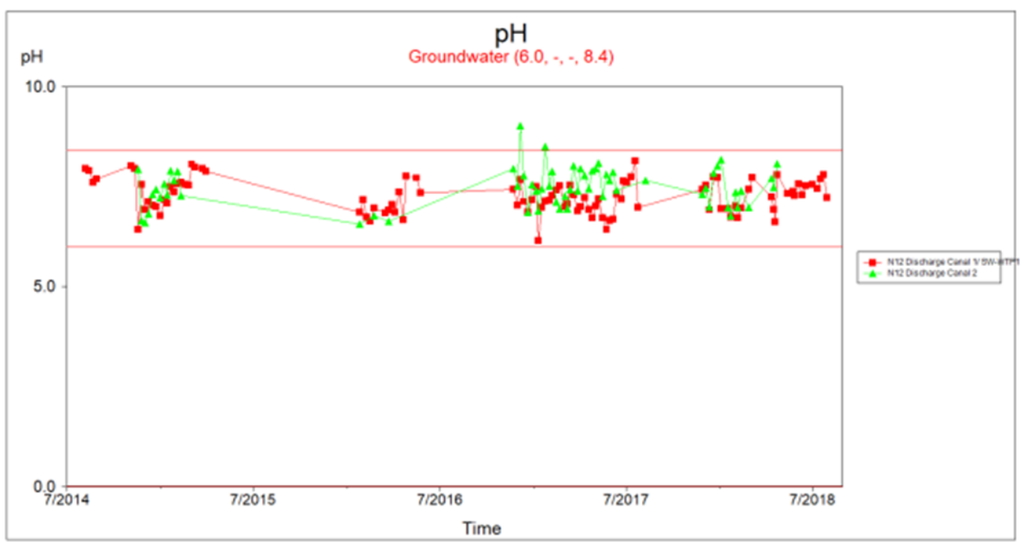


Figure 10-13: pH water quality trend for discharge canal 1/SW-WTP1 and discharge canal 2

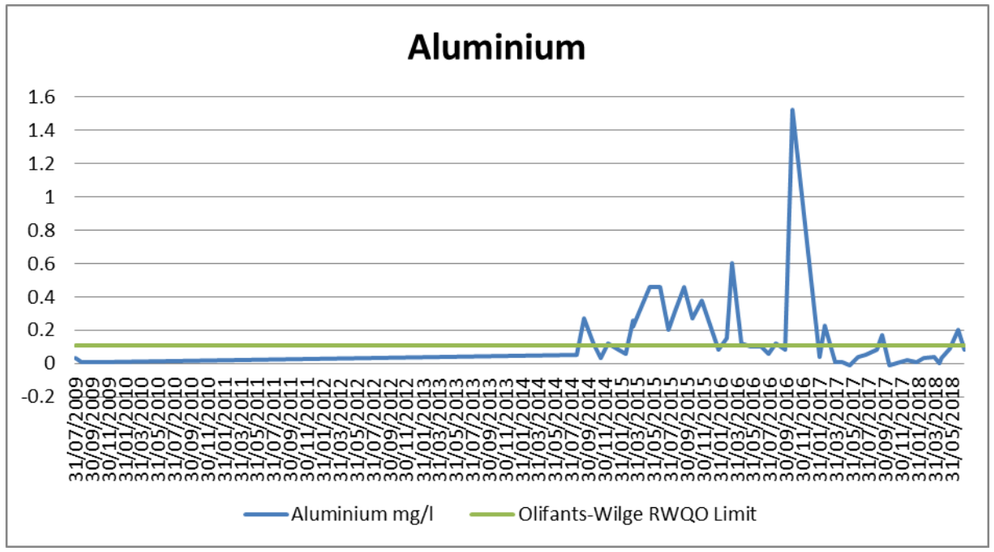


Figure 10-14: Al trend at the downstream monitoring location (WelSW7/K17-Phola Bridge)

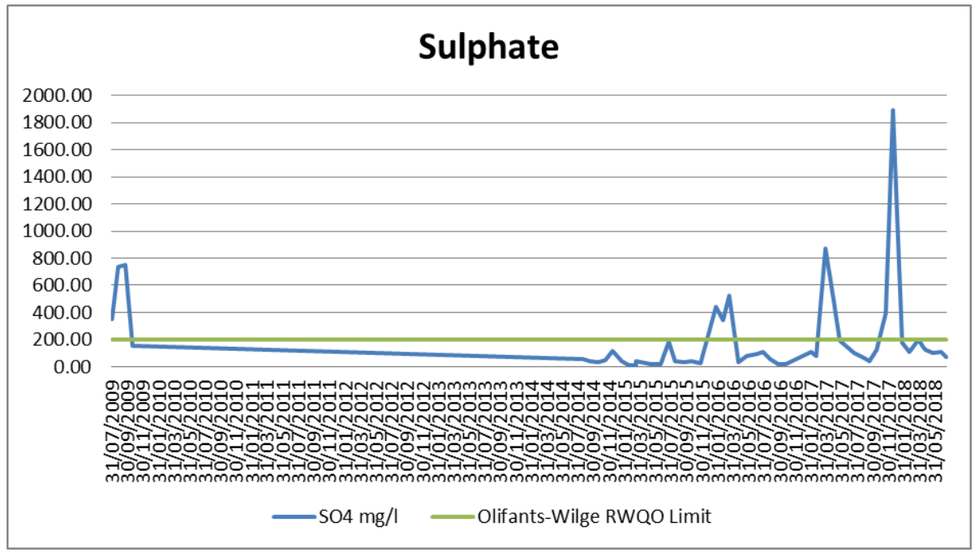


Figure 10-15: SO4 trend at the downstream monitoring location (WelSW7/K17-Phola Bridge)

10.8.3 Floodlines Delineations

The 1:100 year floodlines were delineated on the Saalklapspruit to determine the level of impact or the change in flood extent due to planned discharge of treated water. The floodlines were modelled for two scenarios (pre-discharge and post discharge). The detailed methodology is provided in the specialist report, Appendix 8.

The delineated catchment for the floodlines determination is illustrated in Plan 15, Appendix 2. This catchment includes portions of the rehabilitated areas within the MRA as run-off emanating from this area contributes to the water that reports into the Saalklapspruit. The catchment characteristics, runoff coefficient, rainfall intensities and calculated peak flows are provided in Table 10-21.

Table 10-21: Catchment characteristics

MAP (mm)	686
Catchment Area (km²)	15.6
Longest Watercourse (km)	4.8
Height Difference along 10-85 (m)	14
Average Slope along 10-85 (m/m)	0.00389
1:100 Year Runoff Coefficient	0.407
Tc (hr)	1.88
1:100 Year Average Rainfall Intensity (mm/h)	66.3
Peak Flow Method	Rational
1:100 Year Peak Flow (m³/s)	116.85
Discharge Rate (m³/s)	0.02 m³/s
Post Discharge 1:100 Year Peak Flow (m³/s)	116.87

Plan 16 in Appendix 2, illustrates the modelled floodline scenarios. Scenario 1 constitutes the current situation at the mine while Scenario 2 makes provision for the proposed discharge volume where water will be discharged into the Saalklapspruit at a calculated rate of 0.02m^3/s.

Plan 16 shows that there is very little difference between the two floodline scenarios as the amount of water that is proposed to be discharged into the Saalklapspruit will not make a significant change on the flood peak.

The floodline determination therefore concludes that the proposed discharge of treated water (at the full capacity of 10 Ml/day) will not have an impact on the 1:100 year flood inundation along the Saalklapspruit.

10.9 Groundwater

The Groundwater Assessment is appended to this report as Appendix 9. South32 has an established Groundwater Monitoring Programme and the existing records were utilised to assess the baseline conditions within the project area. The groundwater monitoring boreholes assessed are shown in Plan 17, Appendix 2. The following methodologies were employed for this assessment:

- **Site Visit** – a site visit was undertaken in May 2018 to establish the groundwater setting of the project area as well as verify the monitoring boreholes which were considered for the assessment.
- **Desktop Assessment** – available geological data, hydrogeological maps, reports and other databases were reviewed to gain an understanding of the broader hydrogeological background. Groundwater quality monitoring data (received from South32) was analysed to determine the current groundwater quality in the vicinity of the project area and determine whether the boreholes have been affected by pollution.

Further detail pertaining to the methodology of the Assessment is provided in the specialist report, Appendix 9.

10.9.1 Groundwater Setting

The project area is located in the Wilge River Catchment which comprises of three distinct groundwater systems as follows, according to Hodgson and Krantz (1998):

- Upper weathered aquifer;
- Fractured aquifer; and
- Pre-Karoo fractured aquifer.

The upper weathered aquifer occurs predominantly as a perched aquifer overlying impermeable shale or clay layers. The upper weathered aquifer is usually low yielding but has an excellent water quality as a result of dynamic groundwater flow washing away leachable salts.

The fractured aquifer occurs beneath the weathered aquifer and within fresh sediments. The sediments are typically well cemented and limit significant permeation of water, with the presence of secondary structures or fractures providing the only pathway for groundwater movement. The yields for the aquifer system are typically low and the coal seams frequently display the highest hydraulic conductivities.

The Pre-Karoo aquifers are located at great depths and, as a result, have only been intersected on a few occasions. The boreholes that have intersected the Pre-Karoo aquifer are general low yielding and have inferior water quality and recharge capabilities due to the overlying Dwyka tillite.

10.9.2 Groundwater Levels and Flow Direction

Groundwater level data was acquired from the KPS ongoing monitoring database. The recorded data reveals that groundwater levels vary between 1.1 and 19.9 metres below ground level (mbgl), with an average of 8.8 mbgl. Groundwater level time series, in Figure 10-16 below, shows that groundwater level fluctuations have been relatively shallow varying from 1 mbgl to 15 mbgl with the exception of borehole BSW3 which reflects a possible groundwater abstraction or dewatering nearby. The groundwater elevation varies from 1591mamsl and 1501 mamsl.

The groundwater flow direction is predominantly in a south to north direction varying slightly at various sites as shown in Plan 18, Appendix 2.

Table 10-22: KPS Groundwater Level

Site ID	X m (WGS29)	Y m (WGS29)	Groundwater Level (mbgl)		
			30/04/2018	25/05/2018	27/06/2018
KGMB10	3503.594	-2883061	1.11	1.11	1.11
KGMB9	732.8722	-2883719	4.16	4.60	5.28
KGMB13	-899.654	-2882131	8.22	8.38	8.3
KGMB4	3741.852	-2880535	6.82	8.87	8.15
KGMB7	1687.491	-2882710	8.80	8.78	9.5
KGMB8	-862.613	-2882935	3.45	3.79	3.86
BSW3	3672.977	-2879636	18.83	21.51	23.33
BWS4	4367.32	-2881941	14.07	15.02	Blocked
KGMB11B	-8.90731	-2882310	19.99	19.99	Dry
KGMB6	3687.146	-2882583	3.28	2.98	Dry
KGMB16	2319.232255	-2882768	2.91	3.43	3.64
KGBH17	1081.146475	-2882054	14.63	14.67	14.78

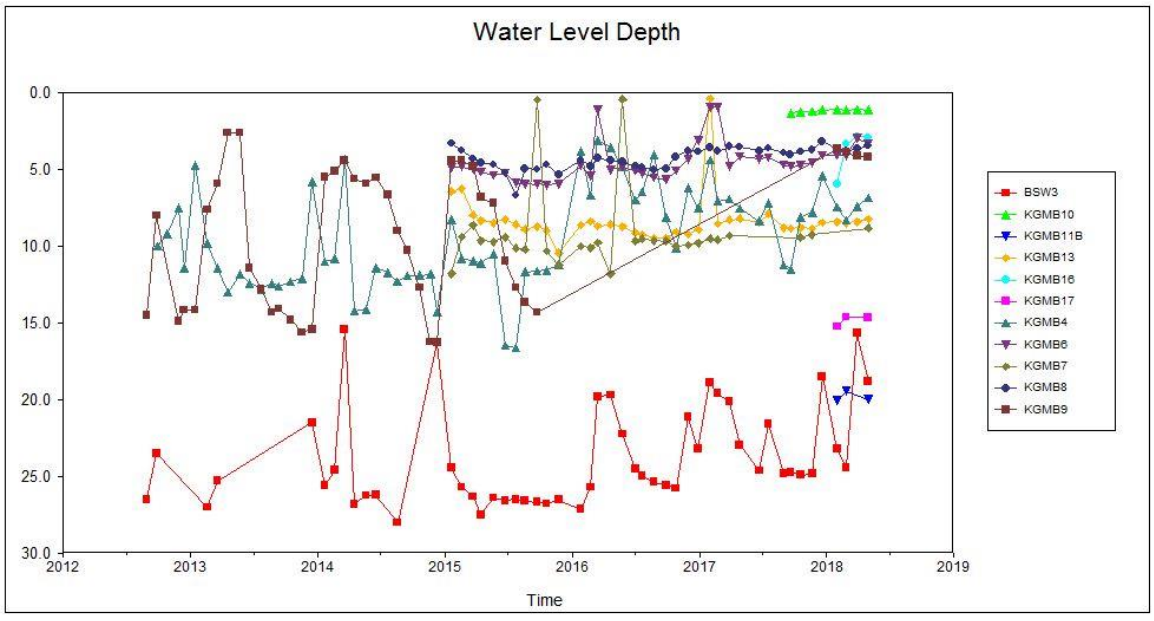


Figure 10-16: Groundwater Level Trend

10.9.3 Groundwater Quality

Groundwater quality data was supplied by South32 and is presented in Table 10-23; Table 10-24 and Table 10-25 below. To determine the baseline groundwater quality in and around the proposed WTP project area, water quality variables have been compared to the limits set out in the approved WUL for the KPS. Long-term trends were also analysed for pH, TDS and SO_4 as illustrated in Figure 10-17, Figure 10-18 and Figure 10-19 respectively. The subsections below provide an interpretation of the analysed data.

10.9.3.1 Water Quality Results

pH values varied between 3.38 at BWS4 and 7.6 at KGMB4 with an average of 6.6. All boreholes are below the recommended WUL limits of 8.79. The acidic pH at BWS4 is indicative of possible contamination from berms and stockpiles area and/ or contamination from the neighbouring operations as the borehole is located between the two collieries. With the exception of BWS4, the pH levels are within an acceptable range for drinking water as per DWS' general guidelines (pH of 6 to 8).

All samples fall within the recommended WUL limits for EC, Na, K and Cl concentration, and within the WUL limits of 32.56 mg/L for Ca concentration except BSW4, KGMB6 and KGMB16. While, borehole BWS4 exceeds the WUL limit of 32.71 for Mg concentration.

Borehole BSW3, BWS4, KGMB4, KGMB6 and KGMB16 all exceed the recommended WUL SO_4 concentration of 10.4 mg/l except borehole KGMB9 and KGMB11B. All samples exceed the WUL limits of 0.11mg/l for NO_3 concentrations except for KGMB6. While all samples exceed the recommended WUL limits of 0.14 mg/L for F concentration.

In summary, BWS4 seems to be the most contaminated borehole (based on the pH and SO_4 levels) compared to other boreholes.

BSW3, KGMB9 and KGMB13 have been characterised as un-impacted boreholes with pH levels typically ranging between 5.8 to 8.2 and EC values of around 66mS/m. Table 10-24 below presents the concentrations of these boreholes which are representative of un-impacted groundwater present within the project area. The concentrations found at BWS4 were deemed to represent typical groundwater for an impacted (contaminated) borehole as shown in Table 10-25. This borehole is characterised by an acidic pH with relatively high TDS and SO_4 levels. The time series trend of these concentrations is subsequently illustrated in the figures below. The high sulphate can be directly traced back to the oxidation of the sulphur mineralogy associated with the coal in the area which causes Acid Mine Drainage (AMD) (low pH and higher SO_4). As previously indicated in Section 10.9.3.1, the acidic pH coupled by high SO_4 and TDS at BWS4 is indicative of possible contamination from berms and the stockpiles area.

Table 10-23: Groundwater quality monitoring data in March 2018

Sample ID	Date	pH	EC	TDS	TSS	Alkalinity	Turbidity	Ca	Mg	Na	K	Cl	SO_4	NO_3-N	F	Al	Fe	Mn	$N\text{-}NH_4$	PO_4	Si
WUL		8.79	75.52	NS	NS	NS	NS	32.56	32.71	44	NS	36.34	10.36	0.11	0.14	NS	NS	NS	NS	NS	NS
KGMB4	2018/03/29	7.6	19	100	90	30	25	5	3	9	1	5	15	8	<0.2	0.01	<0.01	<0.01	0.2	<0.1	3
KGMB9	2018/03/29	6.6	12	276	238	7	121	4	4	9	1	5	1	50	<0.2	0.01	0.01	0.02	<0.2	<0.1	6
BSW3	2018/03/29	7.06	25	264	20	70	12	14	8	21	6	17	15	29	<0.2	0.01	0.01	<0.01	<0.2	<0.1	3
BWS4	2018/03/29	3.38	88	702	131	-	196	73	38	41	3	11	436	14	0.23	0.12	0.47	0.49	0.26	<0.1	4
KGMB11B	2018/03/29	6.21	13	82	416	58	270	8	3	11	4	4	6	1	<0.2	0.54	0.12	0.08	<0.2	<0.1	27
KGMB6	2018/03/29	7.05	45	328	38	98	99	39	21	24	7	32	118	<0.1	0.21	0.02	0.01	0.08	<0.2	<0.1	8
KGMB16	2018/03/29	6.5	40	324	20	58	22	35	19	24	5	5	173	2	0.35	0.01	0.02	0.45	<0.2	<0.1	4

Table 10-24: Background (typical) groundwater quality data for selected boreholes at Klipspruit Colliery

BH ID	BH Statistics	pH	EC mS/m	TDS mg/l	TSS mg/l	Total Alkalinity	Turbidity	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	Cl mg/l	SO_4 mg/l	NO_3-N mg/l	F mg/l	Al mg/l	Fe mg/l	Mn mg/l	$N\text{-}NH_4$ mg/l	PO_4 mg/l	Si mg/l
BSW 3	No. of Samples	15																			
	Minimum	7.0	24.9	170.0	16.4	70.0	4.1	14.0	8.0	19.3	5.6	11.5	3.9	0.6	0.3	0.0	0.0	0.0	0.2	<0.1	2.1
	Average	7.6	39.2	275.6	57.1	160.1	33.4	30.3	14.2	27.1	8.4	15.3	17.4	10.6	0.3	0.1	0.5	0.7	3.3	-	3.3
	Maximum	8.2	66.3	382.0	200.0	318.0	96.7	56.7	27.0	41.0	12.9	22.2	57.1	35.7	0.5	0.6	5.2	1.7	12.3	<0.1	4.8
KGM B9	No. of Samples	9																			
	Minimum	5.8	6.2	9.0	9.0	5.0	9.0	0.4	1.3	8.9	1.0	3.3	1.0	3.5	<0.2	0.0	0.0	0.0	0.3	<0.1	5.8
	Average	6.5	10.1	136.7	243.4	16.9	101.8	3.6	3.2	9.4	2.5	4.3	4.3	26.8	-	0.0	0.2	0.1	0.9	-	8.7
	Maximum	7.0	14.3	276.0	411.0	34.0	206.0	4.7	4.8	10.6	5.1	8.3	11.7	50.0	<0.2	0.1	0.8	0.9	2.4	<0.2	11.4
KGM B13	No. of Samples	12																			
	Minimum	6.3	6.7	50.0	0.8	5.0	3.7	1.4	0.9	4.5	3.1	2.2	2.2	4.8	<0.2	0.0	0.0	0.0	0.2	0.0	6.8
	Average	6.5	8.2	65.3	19.9	8.8	13.5	2.8	2.0	7.0	4.0	4.6	4.6	21.7	-	0.2	0.2	0.0	0.3	0.0	8.0
	Maximum	7.0	10.1	86.0	77.6	18.0	32.4	4.1	3.5	9.1	5.3	6.6	9.0	32.0	<0.2	0.9	0.8	0.0	0.3	0.0	8.7

Table 10-25: Typical groundwater quality for (BWS4) an impacted boreholes

BH ID	BH Statistics	pH	EC mS/m	TDS mg/l	TSS mg/l	Total Alkalinity	Turbidity	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	Cl mg/l	SO_4 mg/l	NO_3-N mg/l	F mg/l	Al mg/l	Fe mg/l	Mn mg/l	$N\text{-}NH_4$ mg/l	PO_4	Si
BWS4	Number of Samples	10																			
	Minimum	3.0	11.6	78.0	48.0	11.0	7.9	7.8	3.5	7.5	2.1	3.9	19.6	0.4	0.2	0.0	0.0	0.0	0.2	<0.1	3.6
	Average	5.6	92.5	757.0	188.1	16.8	142.4	86.6	45.3	56.4	4.0	11.1	461.7	21.0	0.2	0.1	0.4	0.3	0.3	-	6.4
	Maximum	7.1	230.0	2102.0	410.0	34.0	312.0	267.0	137.0	142.0	5.9	23.0	1330.0	43.2	0.2	0.2	2.0	0.5	0.4	<0.1	8.4

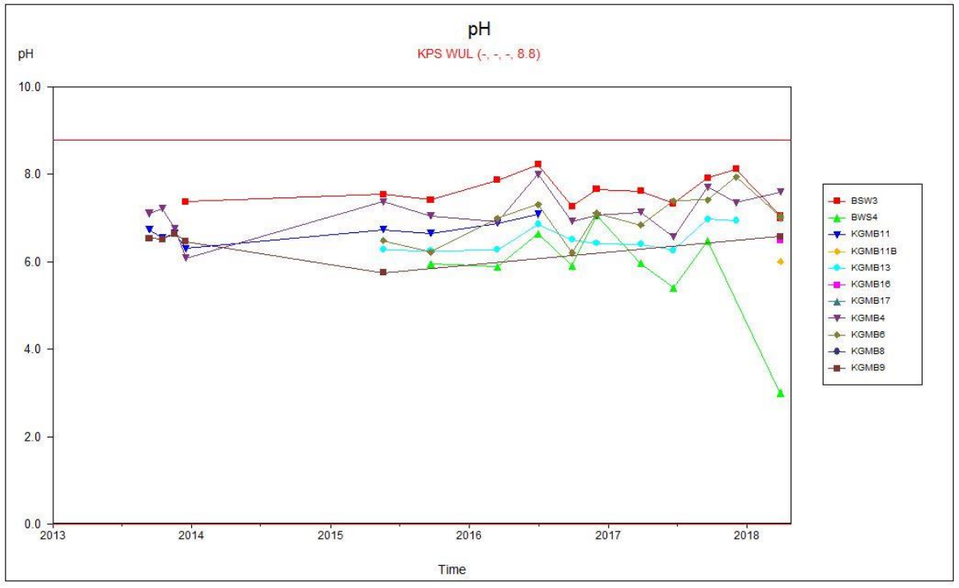


Figure 10-17: : pH trend analysis in groundwater

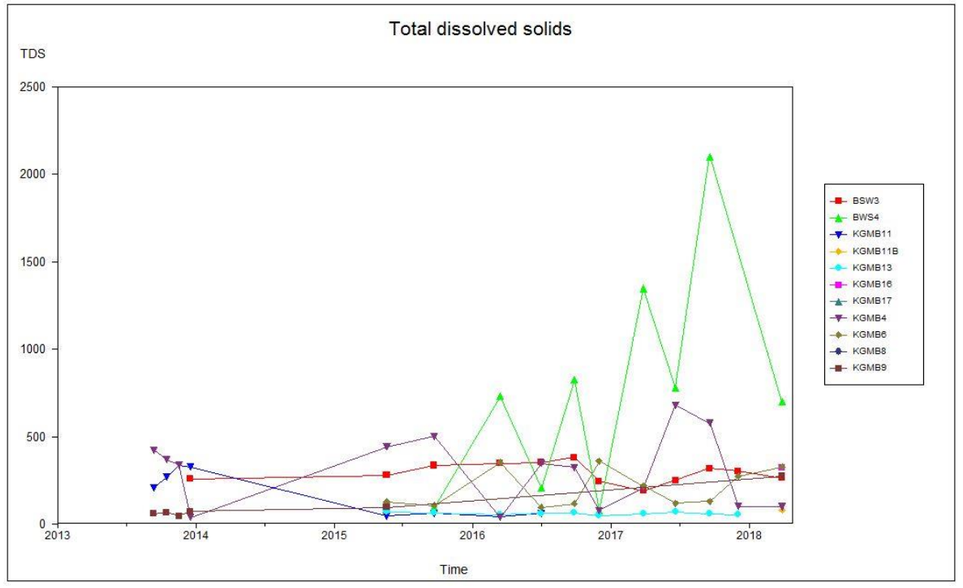


Figure 10-18: Total dissolved solids in groundwater

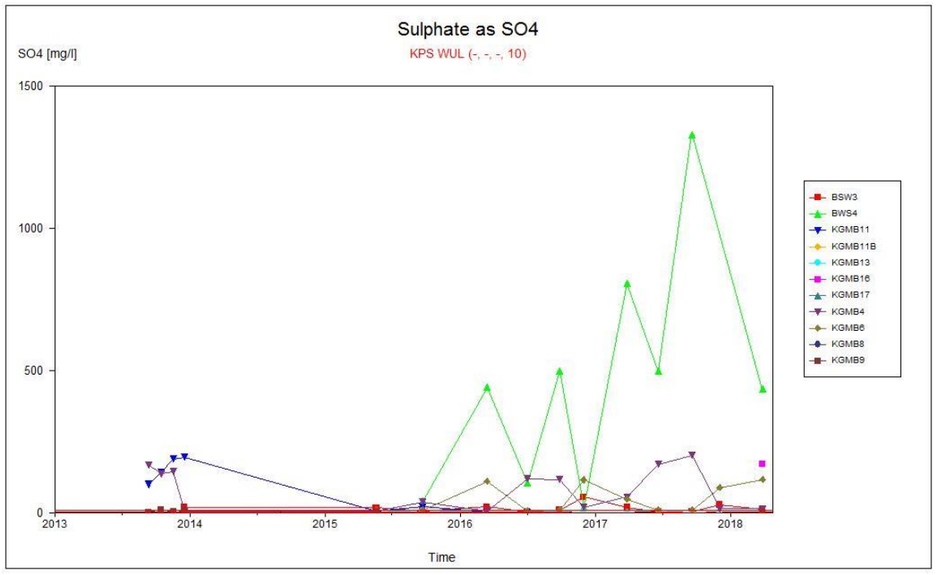


Figure 10-19: Sulphate trend in groundwater

10.9.3.2 Diagnostic Plots

The water chemistry was also displayed using a Piper diagram as shown in Figure 10-20 which is used to classify the water type by plotting the ratios of the major cations (Ca, Mg, Na and K) and anions (Cl, SO_4 and HCO_3+CO_3) as two points in tri-linear fields. The diagram shows that the water can be classified into three main groups:

- Group 1: The calcium-magnesium-bicarbonate type water (left quarter of the Piper diagram), enriched with alkalinity as a dominant anion. This water type is not impacted by mine and its signature is indicative of recently recharged to dynamic flow (within the aquifer) with some cation mixing;
- Group 2: The sodium-bicarbonate dominant water (bottom quarter) is typical of dynamic groundwater flow within an aquifer, with the sodium replacing calcium and magnesium in solution. This water type is not impacted by mine; and
- Group 3: The sulphate dominant type water (top quarter) characterised by their increased SO4 signature, with no dominant cation. KGMB6 and KGMB16 fall in this group. The lack of alkalinity means that the water does not have buffering capacity to neutralise acid. This chemical signature indicates that these boreholes are mine-impacted with increased sulphate being the main constituent of concern as a result of AMD.

Boreholes plotting with centred zone (including right quarter) are indicative of mixing within the aquifer possibly due dynamic groundwater flow.

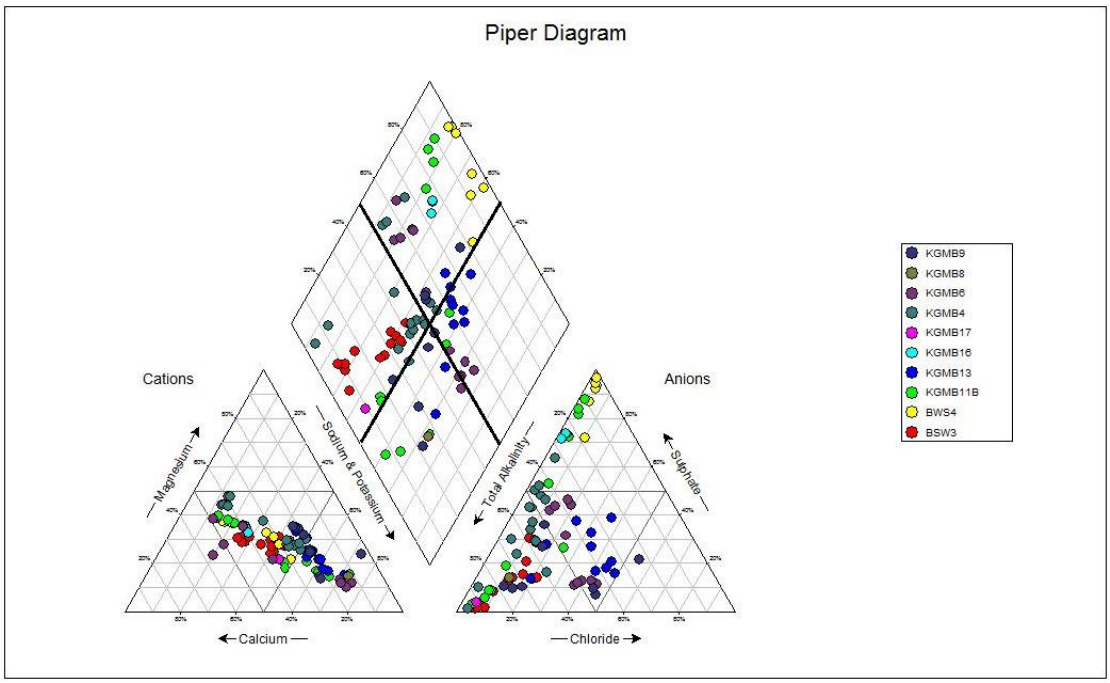


Figure 10-20: Time series Piper diagram

10.10 Noise

The Noise Assessment is appended to this report as Appendix 10. To establish the background noise condition the following methodologies were employed:

- **Desktop Assessment** – a literature review and desktop assessment of the applicable Noise Regulations was undertaken. Furthermore, the guidelines provided by SANS 10103:2008 "The measurement and rating of environmental noise with respect to annoyance and to speech communication" were reviewed for the assessment.
- **Fieldwork** – A site visit was undertaken during May 2018, where noise measurements were taken at the Pride Milling Operation which was chosen as the closest receptor located approximately 100 m east from the proposed project footprint (refer to Plan 19, Appendix 2). Historical noise measurement data from previous studies was also analysed as part of the assessment.
- **Noise Quantification** – Predictive modelling was performed for the proposed mining activities through the use of the modelling software SoundPlan. The software specialises in computer simulations of noise pollution dispersion. Estimates of the cumulative mining noise levels from the study were derived from the noise emissions from all the major noise-generating components and activities of the proposed project.

Further detail pertaining to the methodology of the Assessment is provided in the specialist report, Appendix 10.

10.10.1 Baseline Results

The noise meter recording as well as the rating limits according to the SANS 10103:2008 guidelines are presented in Table 10-26.

Table 10-26: Results of the baseline noise measurements

Sample ID	SANS rating limit guidelines			Measurement details		
	Type of district	Period	Typical rating level dBA	L_{Aeq} dBA	Maximum/Minimum dBA	Date
1	Industrial	Daytime	70	56	83 / 51	24/05/2018
		Night time	60	55	81 / 49	24/05/2018
	Indicates L_{Aeq} levels above either the daytime or night time rating limit guideline					

10.10.1.1 Daytime Results

Based on the daytime results, the existing ambient noise levels (56dBA) at the Pride Milling Operation are below the SANS rating levels for the maximum allowable outdoor daytime limit for ambient noise in industrial districts (70dBA). The following were the main noise causing sources influencing the ambient noise at the receptor:

- Intermittent birdsong by the various avifauna species during the daytime;

- Trucks and other vehicles entering and leaving the milling premises; and
- Vehicles passing on the R545 and R555.

10.10.1.2 Night Time Results

Based on the night time results, the existing ambient noise levels (55dBA) are above the SANS rating levels for the maximum allowable outdoor night time limit for ambient noise in industrial districts (60dBA). The main noise causing sources influencing the ambient noise at the receptor were trucks and other vehicles entering and leaving the milling premises and vehicles passing on the R545 and R555.

Historical noise monitoring taken at the rural agricultural areas to the south of KPS indicates that the noise levels measure around 53dBA during the daytime and 48dBA at night. The main audible sound comes from the vehicle traffic on the R555 as well as the production activities at Phola Plant especially during the night time.

10.11 Visual

The Visual Impact Assessment (VIA) is appended to this report as Appendix 11. To describe the visual character of the baseline environment of the project area, the following methodologies were employed:

- **Desktop Assessment** – the VIA was based on desktop assessment which made use of GIS tools to evaluate the topography of the receiving in combination with aerial photography which was utilised to examine existing features on the surface relative to the proposed project footprint.
- **Viewshed Analysis** – theoretical viewshed models were created using the Viewshed Tool of the ArcGIS 3D Analyst Extension. Three models were run, namely for existing infrastructure; existing infrastructure and WTP project infrastructure; and only the proposed infrastructure. The viewshed models depict worst case scenarios and show the areas from which the project may potentially be visible.

Further detail pertaining to the methodology and assumed infrastructure heights utilised for the viewshed analysis are provided in the specialist report, Appendix 11.

10.11.1 Visual Characteristics

The general topographical characteristics of the project area are described in Section 10.3 above. The elevation of the proposed infrastructure ranges from 1 510 mamsl at the clean water discharge point at the northern extent of the proposed pipelines to 1 580 mamsl at the WTP area. The topography of the project area is depicted in Plan 20, Appendix 2. The topography forms a moderate level of visual screening with topographic screening at the ridge to the south of the project area. Low lying areas in the valleys of the rivers also provide a level of visual screening.

10.11.2 Viewshed Model and Sensitive Receptors

The viewshed models were run to determine areas where only the proposed new infrastructure will be visible to quantify the impact of only the newly proposed infrastructure.

These theoretical viewshed models were based on the topography only and do not take the screening effect of vegetation into account. These viewshed models depict the worst case scenario and show the areas from which the project may potentially be visible. For each of the viewshed model scenarios determined, the potential visual receptors were identified. Based on the findings of desktop work conducted, the following categories were used for the theoretical viewshed model:

- 0 – 1 km: Potentially high visual exposure;
- 1 – 2 km: Potentially moderate visual exposure; and
- 2 – 5 km: Potentially low visual exposure

Table 10-27 provides a summary of the three viewshed scenarios and the extent of visual exposure for identified sensitive receptors. The potential visual receptors within the daytime viewshed include residents of the Ogies and Phola settlements, and road users along the N12 national Road and R545 regional road as well as receptors at the Kendal Power Station. The specific proposed project has a low exposure as it will not be particularly noticeable in the landscape to receptors within the viewshed area considering the receptors have been visually impacted upon by larger and more intrusive mining operations and therefore is associated with a low visual sensitivity. However, the identified receptors (residents of the settlements of Ogies and Phola, and road users) of the project can be said to have high visual sensitivity as they include residential receptors. The topography of the area will provide partial screening of the project area therefore providing moderate Visual Absorption Capacity (VAC).

Ultimately, the project has a low visual intrusion as there will be a minimal change in the existing land use and the project will therefore blend in well with the surroundings.

Table 10-27: Viewshed Model Outcomes and Sensitive Receptors

Model	Outcome	Sensitive Receptors		
		0 – 1 km	1 – 2 km	2 – 5 km
Existing infrastructure	The theoretical viewshed model for the existing infrastructure with a 5 km buffer around the KPS operation where visual exposure is likely is depicted in Plan 21, Appendix 2. Due to the disturbed nature of the receiving environment, the visual impact of the existing infrastructure is minimal outside of this 5 km zone of influence. This daytime viewshed model covers an area of approximately 76.69km^2	Phola southern extent, Ogies (partial), N12, R545	Phola, Ogies (partial), N12, R545	Phola, Ogies, N12, R545
Exiting Infrastructure and Proposed Infrastructure	The theoretical viewshed model for the existing infrastructure and proposed infrastructure with a 5 km buffer around the KPS operation where visual exposure is likely is depicted in Plan 22, Appendix 2. Similarly, the existing disturbed nature of the receiving environment results visual impact of the proposed infrastructure is minimal outside of this 5km zone of influence. This daytime viewshed model covers an area of approximately 50.14km^2	Phola southern extent, Ogies (partial), N12, R545	Phola, Ogies (partial), N12, R545	Phola, Ogies, N12, R545
Proposed Infrastructure Only	The theoretical viewshed model was defined by removing the viewshed of the existing infrastructure with only the proposed infrastructure remaining in an attempt to quantify the direct viewshed. This theoretical viewshed model with a 5 km buffer around the KPS operation where visual exposure is likely is depicted in Plan 23, Appendix 2. The same parameters and buffers were used as for the existing and proposed viewshed. This net daytime theoretical viewshed model covers an area of approximately 3.86 km^2	Ogies	Phola, Ogies, R545	Phola, Ogies

10.12 Heritage

A HRM Process has been undertaken for the proposed project with the specific aim of detailing any identified heritage resources within the specific project area which may be disturbed. The following methodology was employing in the undertaking of the assessment:

- **Desktop Assessment** – information was gathered and reviewed relating to known archaeological and heritage resources within and surrounding the project area. This included a desktop study comprising a review of existing heritage assessments undertaken for KPS and an integration of applicable legislation and regulations.
- **Field survey** - A physical pedestrian survey was conducted in May 2018 and aimed at locating and describing heritage resources falling within proposed development footprints.

Due to the disturbed nature of the specific development footprint subject to this application, no new heritage resources are associated with the project. This negated the need for a HIA to be undertaken. However, in line with the provisions set out under the NHRA, the HRM Process, limited to the submission of a Notification of Intent to Develop (NID) to SARHA, was undertaken and given the case number 12710. This NID is appended to this report as Appendix 12.

The subsections below provide the cultural heritage baseline description applicable to the regional and local study area. Furthermore, a description of the known heritage resources in relation to the project area is provided.

10.12.1 Archaeological Context

Table 10-28 presents an overview of the broad timeframes for the major periods of the past in Mpumalanga.

Table 10-28: Archaeological periods in Mpumalanga, adapted from Esterhuysen & Smith (2007)

The Stone Age	Earlier Stone Age (ESA)	2 million years ago (mya) to 250 thousand years ago (kya)
	Middle Stone Age (MSA)	250 kya to 20 kya
	Later Stone Age (LSA)	20 kya to 500 Common Era[5] (CE)
A gap appears in the records in Mpumalanga between approximately 7000 and 2000 Before Common Era (BCE).		

[5] Common Era (CE) refers to the same period as *Anno Domini* (“In the year of our Lord”, referred to as AD): i.e. the time after the accepted year of the birth of Jesus Christ and which forms the basis of the Julian and Gregorian calendars. Years before this time are referred to as ‘Before Christ’ (BC) or, here, BCE (Before Common Era).

Farming Communities	Early Farming communities (EFC)	500 to 1400 CE
	Late Farming Communities (LFC)	1100 to 1800 CE
Historical Period	-	1500 CE to 1850 (Behrens & Swanepoel, 2008)

The region is underlain by the greater Springs-Witbank Coalfield, which makes up a portion of the coal-bearing Ecca Group within the Karoo Supergroup. Other significant features within the Ecca Group include the Pietermaritzburg, Vryheid and Volksrust Formations (Groenewald & Groenewald, 2014).

The Vryheid Formation is the primary potential fossil-bearing layer underlying the project area and, as such, is of very high palaeo-sensitivity (SAHRA, 2013b; 2017). These layers were deposited roughly 180 million years ago in a deltic environment. Fossil plants that could be expected within the Vryheid Formation include: *Glossopteris* leaves, roots and inflorescences; and Calamites stems. Mammal-like reptiles and mammals may potentially be included in coal deposits, but these are rarely preserved with plant fossils (Bamford, 2012; 2016).

The archaeological record begins with the Stone Age. In southern Africa, this comprises three broad phases, determined according to the stone tools and the material culture produced by the various hominid species through time. These phases are: the ESA, MSA and LSA (as defined in Table 10-28 above).

The ESA is not represented in the available data and is therefore not considered in this assessment. The MSA dates from approximately 300 kya to 20 kya and is characterised by the use of good-quality raw material (Clark, 1982; Deacon & Deacon, 1999). Early MSA lithic industries are characterised by high proportions of blades, as well as beads, bone tools, ochre and pendants. The LSA dates from 40 kya to the historical period. The lithics characterising the LSA are highly specialised, where specific tools were created for specific purposes (Mitchell, 2002). Diagnostic tools include scrapers and segments and bone tools are also included in LSA assemblages. In southern Africa, the LSA is closely associated with hunter-gatherers, which may include San groups, such as the Basarwa and Bathwa (Makhura, 2007). These peoples are commonly regarded as being the first inhabitants of Mpumalanga.

The Farming Community is divided into the EFC and the LFC; however, only the latter is represented in the regional study area. The LFC is represented by stonewalling or other tangible surface indicators including ceramics and evidence of domesticated animals (e.g. faunal remains or dung deposits). The historical period[6] is commonly characterised by contact between Europeans and Bantu-speaking African groups and the written records associated

[6] In southern Africa, especially in Mpumalanga, the last 500 years represents a formative period that is marked by enormous internal economic invention and political experimentation that shaped the cultural contours and categories of modern identities outside of European contact. This period is currently not well documented, but is being explored through the 500 year initiative (Swanepoel, *et al.*, 2008)

with this interaction. However, the division between the LFC and historical period is largely artificial, as the people, politics and trends continue between the LFC and the historical period.

Throughout the transitions between the LFC and the historical period (and throughout the historical period as well), population growth, climatic variation and trade significantly impacted the groups on the Mpumalanga Highveld, resulting in the rise of power blocs, violent displacement and political displacement (Makhura, 2007). European settlers, trader, missionaries and travellers moving into the interior further added to the instability across the Mpumalanga Highveld (Landau, 2010).

Within the project area, coal deposits have been exploited since the 1860s, by European settlers (Pistorius, 2008). Ogies, the town, was established in 1885 on the farm Ogiesfontein (Falconer, 1990) which coincided with an upswing in the coal mine industry, as seen by the opening of several mines in 1889 in the area, including: the Brugspruit Agies, Douglas Mine (at Balmoral), Maggies Mine, and the Steelkoolspruit Mine.

10.12.2 Identified Heritage Resources

Figure 10-21 presents a breakdown of the tangible heritage resources identified within the region. In total, the figure considers 610 recorded heritage resources based on desktop identification. The predominant heritage resources demonstrate affiliations with burial grounds and graves (62.6%) and the historical built environment (30.3%). This notwithstanding, expressions of all phases of the Stone Age, the LFC, recent history and historical battlefields have also been recorded.

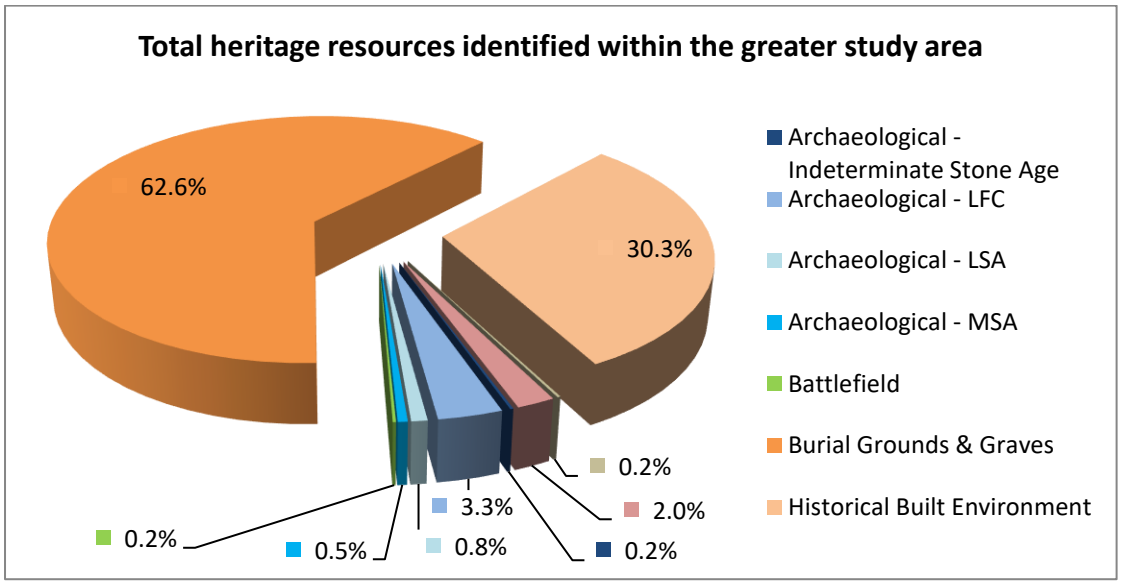


Figure 10-21: Heritage resources identified within the greater study area

Graves and other archaeological sites were identified within the KPS area and an extensive HRM Processes (inclusive of a HIA) have been undertaken by various specialists since the inception of KPS. Identified graves in the area have since been relocated accordingly.

10.13 Socio-economic

The Social Impact Assessment (SIA) is appended to this report as Appendix 13. To describe the socio-economic characteristics of the baseline environment of the project area, a desktop assessment was undertaken. Information was collated from various sources which included previous SIAs related to KPS as well as other secondary sources including census data, applicable Integrated Development Plans (IDP) and Spatial Development Frameworks (SDF).

The socioeconomic characteristics of the project area have been categorised in terms of change processes. The change processes that were considered in this scoping assessment included the following:

- **Geographic processes** refer to the processes that affect the land use of the local area.
- **Demographic processes** refer to the composition of the local community in terms of variables such as age, gender, race, language, etc.
- **Economic processes** refer to the economic activities in the local society, including an assessment of peoples' livelihoods, and to a lesser extent, the macro-economic factors that affected the local community as a whole.
- **Institution and Legal processes** refer to the processes that affect service delivery to the local area.
- **Socio-cultural processes** refer to the local culture of the area, i.e. the way in which the local community lives.

The socio-economic baseline profile presented in the following subsections focuses on a primary and secondary study areas, namely Emalahleni Ward 30 for the primary study area; and Nkangala District Municipality (NDM) and Emalahleni Local Municipality (ELM) for the secondary study area.

10.13.1 Geographical Processes

Geographical processes relate to land use patterns and infrastructure in the area. According to the Emalahleni Spatial Development Framework (SDF), the local municipality is the most industrialised area in the district, characterised by a large concentration of underground and open pit coal mines, and power stations.

10.13.1.1 Land Use within the Primary Study Area

KPS is situated in Ward 30 of ELM and the closest human settlement is the town of Ogies, located along the R555, some 600m to the east of KPS and the proposed WTP site. Phola is located approximately 4.5 km north of the site, along the R545. Ogies forms part of the Richards Bay export initiative through its proximity to the southern railway line and the Ogies railway station that handles a substantial portion of the country's rail freight. Ogies is also a service centre to the surrounding farms and is home to grain silos, service industries and a

co-operative. According to the ELM SDF, the land around Ogies and Phola is prime agricultural land, causing some conflict between urbanisation, agriculture and mining.

10.13.2 Demographical Processes

Demographical processes refer to the composition of the local population and consider variables such as population size, growth and density, gender, age, household sizes and spatial distribution of the population. As the proposed WTP will be located in the mine's existing footprint (i.e. a brown-fields area), the primary area of impact is defined as Ward 30 of the ELM (the ward in which the mine is situated).

10.13.2.1 Baseline Demographical Profile

According to Census 2011, Mpumalanga consists of approximately 4 million people who make up roughly 7.8% of the population of South Africa (Statistics South Africa, 2011; Wazimap, 2017). The province has 17 local municipalities grouped into three districts. The NDM is home to close on 1.4 million people, or roughly a third of the population of Mpumalanga. The NDM consists of six local municipalities, of which ELM is the biggest, in terms of the population. The ELM population size is around 395 466 people, or 30.23 % of the population of NDM (9.79 % of the population of Mpumalanga). Ogies, the closest town to the proposed WTP, has a population of 1 230 people in 352 households (Census 2011). An overview of the demographic profile of both the primary and secondary study areas is presented in Table 10-29 below.

Table 10-29: Overview of the Population Size within the Greater Study Area

Population	Ward 30	ELM	NDM	Mpumalanga
Total population	13 617	395 466	1 308 129	4 039 939
Population density (people/km^2)	53	147	77	53
Total households	3 994	123 560	366 307	1 102 205
People per household	3	3	4	4

Source: Adapted from Wazimap (2017) using Census 2011 data

According to Statistics SA (Statistics by Place, 2011), 95.4% of the population of ELM live in an urban setting and 4.6% of the population live on farms.

Table 10-30 below presents an overview of the racial breakdown of the population within the greater study area. The population is made up of a predominantly Black African population with each of the other races represented in each of the study areas. ELM includes a higher than average white population.

Table 10-30: Population Groups in Percentages Across the Greater Study Area

Population Group	Ward 30	ELM	NDM	Mpumalanga
Black African	95.7	81.3	87.9	90.7

Population Group	Ward 30	ELM	NDM	Mpumalanga
Coloured	1.0	1.7	1.1	0.9
Indian/Asian	0.4	0.9	0.7	0.7
White	2.4	15.7	9.9	7.5
Other	0.6	0.4	0.3	0.2

Figure 10-22 below presents an overview of the age distribution of the secondary study area. From this graph it is evident that the working age population (ages between 15 and 64) are the predominant age group in all areas. The NDM overall has the largest group of children (aged 14 and younger), followed by Ward 30. The senior citizen category (aged 65+) are the smallest age group in all areas – especially in Ward 30 where they only constitute approximately 2.5% of the population.

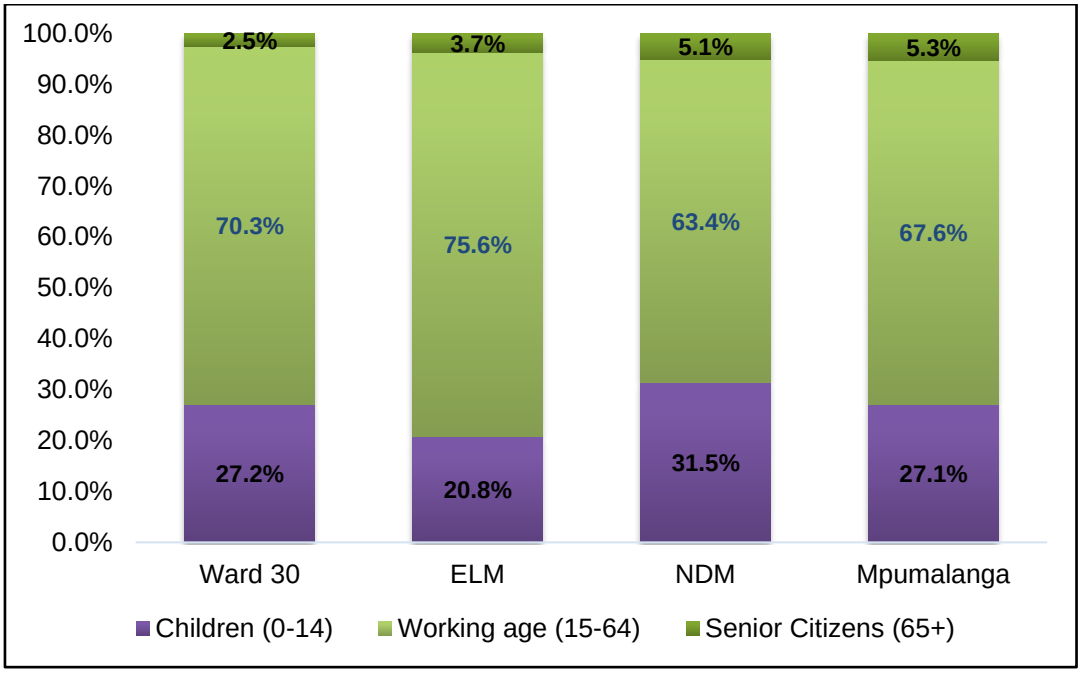


Figure 10-22: Age-range distribution of the populations within the greater study area

The population of the greater study area is fairly evenly spread between the two genders. Ward 30, ELM and NDM have slightly more males, whereas Mpumalanga as a whole has a large female population.

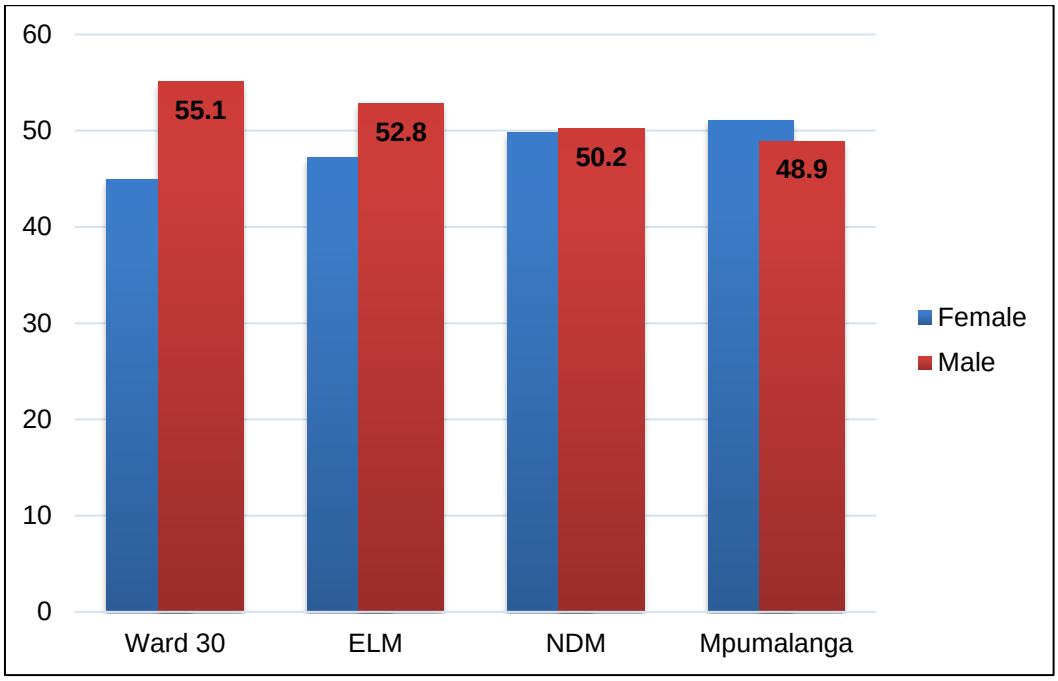


Figure 10-23: Gender-distribution (%) of the populations within the greater study area

10.13.3 Economic Processes

The economic baseline profile provides a description of the current economic activities within the study area. It typically considers variables such as employment rates, employment sectors, and the education profile of the community.

10.13.3.1 Baseline Economic Profile

An overview of the education profile of the greater study area is presented in Figure 10-24 below. From this graph it is evident that the vast majority of people have obtained some level of secondary education (this includes people who are still at school). Close to a third of the population has completed their secondary and tertiary education. On average, less than 10% of the population in the greater study area have had no schooling (including children who are not yet of school going age).

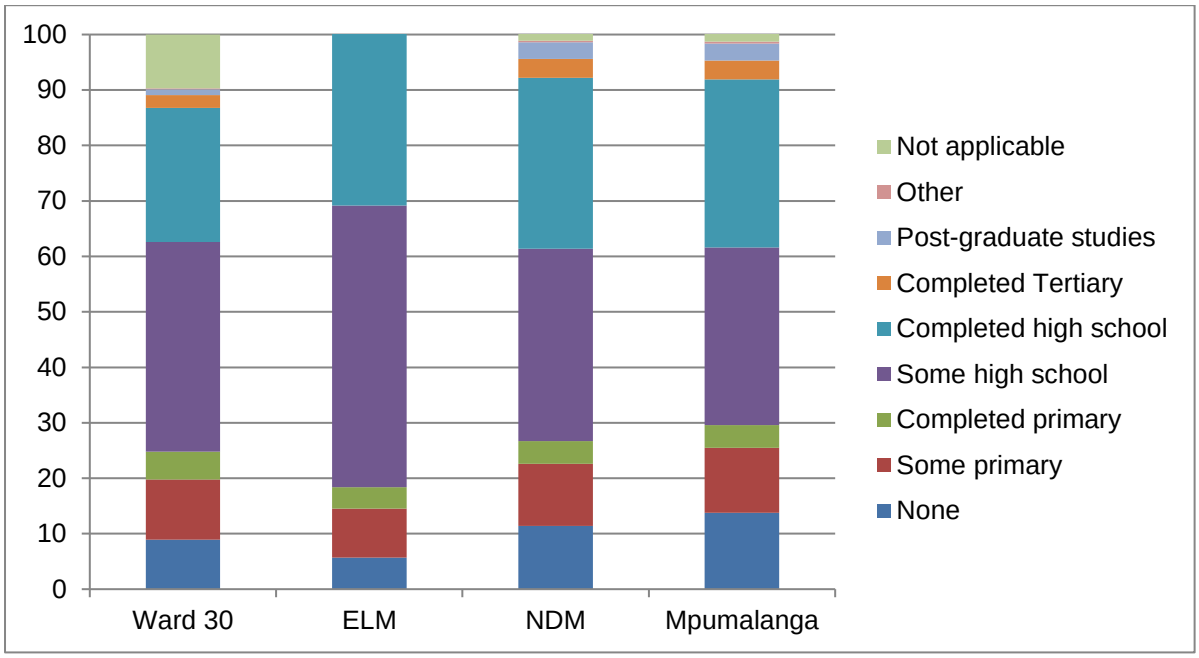


Figure 10-24: Education profile of the greater study area

Figure 10-25 below shows the employment status for the population within the greater study area. Emalahleni has an overall employment rate of 69.2% whereas the primary study area averages at 60.2%. The unemployment rate, including work-seekers, averages approximately a third of the overall population, which is a higher unemployment rate compared to the national employment rate average.

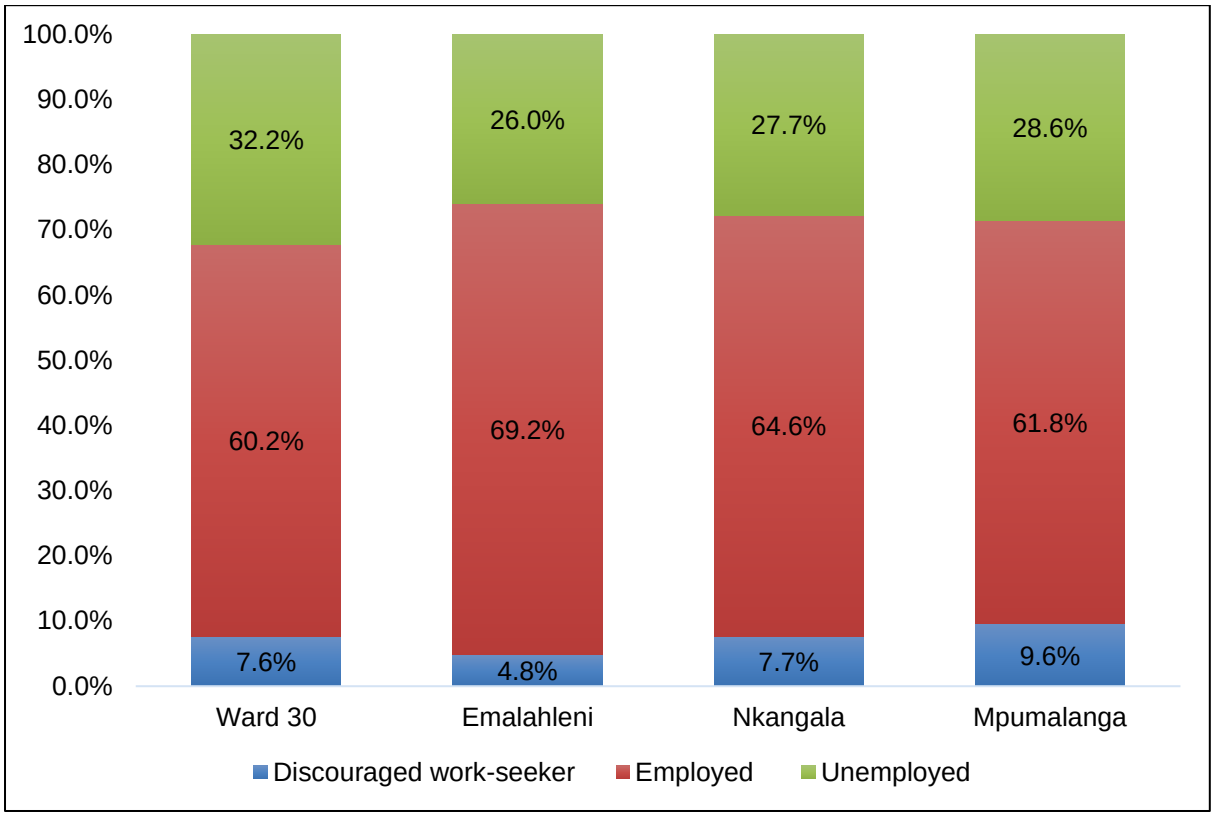
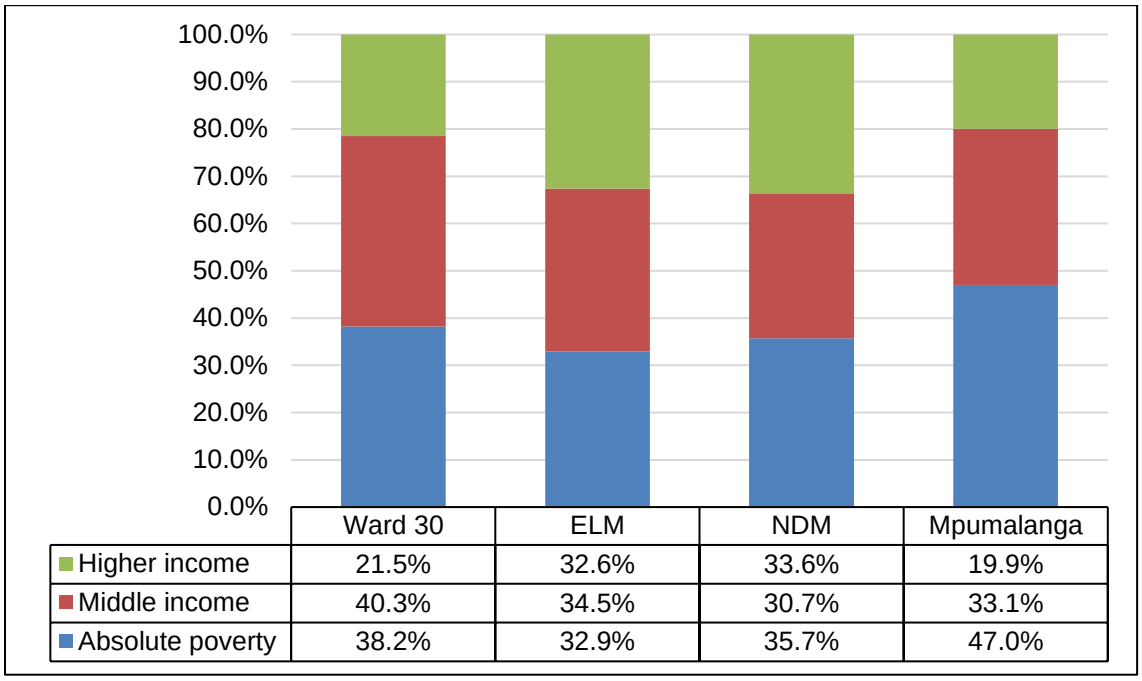


Figure 10-25: Employment status within the population of the greater study area

Linked to the employment rate above, the annual household income of the greater study area is presented in Figure 10-26 below. The primary study area by far has the most households (close on a half, 40.3%) who are considered middle-class (defined as ≤ R 76 000 per annum). Both the ELM and the NDM have a fairly large concentration of households, 32.6% and 33.6% respectively, who fall into the higher income bracket (R 76 801 or more per annum).



	Ward 30	ELM	NDM	Mpumalanga
Higher income	21.5%	32.6%	33.6%	19.9%
Middle income	40.3%	34.5%	30.7%	33.1%
Absolute poverty	38.2%	32.9%	35.7%	47.0%

Figure 10-26: Annual household income across the greater study area (2011)

According to the ELM IDP for 2018-2019, the number of households who receive a social grant has increased by more than 30,000 between 2011 and 2016. This is indicative of a population becoming more reliant on public resources to meet their basic needs.

In 2015, the Gross Domestic Product by Region (GDP-R) for NDM constituted R 123 billion (NDM, 2017). This makes up 41.2% of the Gross Domestic Product (GDP) of Mpumalanga and 3.1% of the national GDP. This was the largest contribution to Mpumalanga in terms of the district municipalities. The economy of NDM has shown an average annual increase of 1.4% between 2005 and 2015, compared to an average annual increase of 1.95% for Mpumalanga (and 2.58% for South Africa) for the same period. ELM contributed R 60.21 billion to NDM (48.82%), despite showing negative average annual growth between 2005 and 2015.

Table 10-31 summarises the most important broad economic sectors in terms of the Gross Value Added (GVA). The table also highlights the economic sectors which employ the most people within the study area.

Table 10-31: Economic structure within the greater study area, adapted from NDM

Economic Contributors	Ward 30	ELM	NDM	Mpumalanga
Largest	Not known	Not known	Mining	Mining
Second largest	Not known	Not known	Community Services	Community Services
Third largest	Not known	Not known	Trade	Trade
Contributors of employment				

Economic Contributors	Ward 30	ELM	NDM	Mpumalanga
Largest	Not known	Not known	Trade	Trade
Second largest	Not known	Not known	Community services	Community services
Third largest	Not known	Not known	Mining	Finance

ELM is predominantly industrial and was originally known for mining (NDM, 2017). The Tress Index, which is a measure of how diverse the economy is within the municipality, was utilised. A Tress Index of zero represents a totally diverse economy while a number closer to 100 represents a more vulnerable economy to exogenous variables. ELM has a Tress Index rating of 25.6 which indicates a fairly diverse economy. The economy includes 27 'hubs' and over 883 business, including multi-national corporations. Many of which are linked to the mining industry. NDM has a Tress Index of 48 and Mpumalanga has a rating of 35.4 which demonstrates a slightly higher economic vulnerability than the ELM.

10.13.4 Empowerment and Institutional Processes

Empowerment and Institutional processes relate to the role, efficiency and operation of government sectors and other organisations within the area in terms of service delivery.

10.13.4.1 Home ownership

The ownership of households is more varied across the different study areas, as shown in Figure 10-27. In Ward 30, full ownership is the most common type of home ownership. This is indicative of the length of time people have been residing in the area (assuming the average bond period is 20 years), which in turn would increase their place attachment. People with a stronger place attachment are more likely to become involved in a project process that might affect their quality of life in an attempt to influence the outcome of the decision taken by the competent authority.

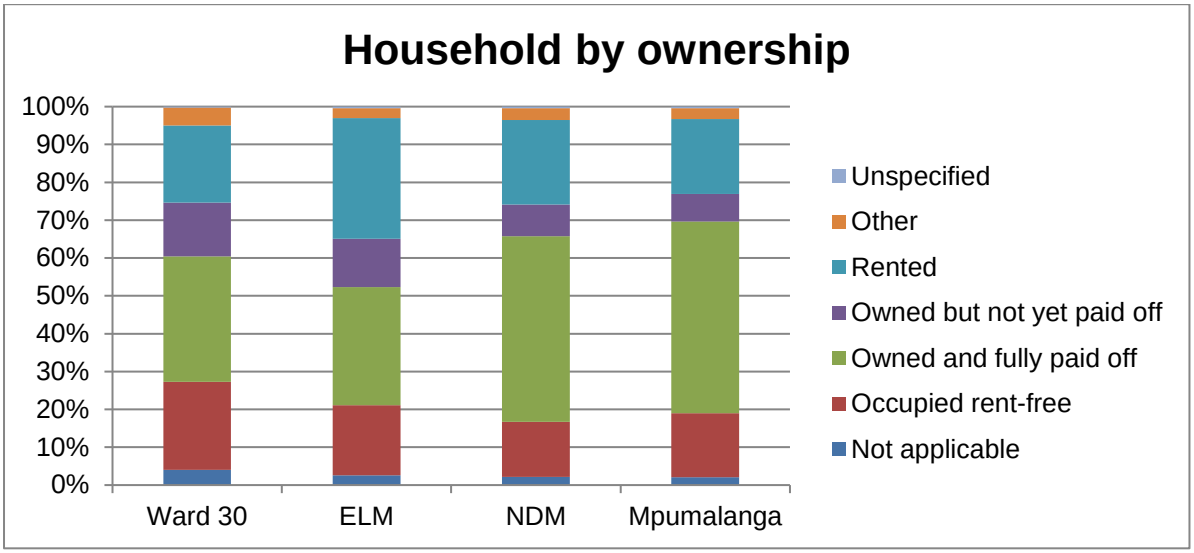


Figure 10-27: Ownership by households within the greater study area

10.13.4.2 Municipal Services

An overview of households' access to municipal services is provided in Table 10-32 below. The majority of households within the greater study area have access to municipal services, with the exception of refuse removal where most people rely on their own forms of waste disposal, including informal disposal at unlicensed sites. The majority of households have toilets however, only 55.5% are connected to the sewage system or septic tank.

The majority of households (80.6% on average) in the ELM (including Ward 30) receive their water from the local authority, which means that it should be treated water.

Table 10-32: Overview of Municipal Services within the Greater Study Area

Type of Service	Ward 30	ELM	NDM	Mpumalanga
Energy – cooking	To be determined (tbd)	Electricity (70,8%)	tbd	tbd
Energy – heating	tbd	Electricity (63,0%)	tbd	tbd
Energy – lighting	tbd	Electricity (73,4%)	tbd	tbd
Refuse removal	Removed by local authority (55.6%)	Removed by local authority (74.3%)	Own disposal (51.3%)	Own disposal (51.9%)
Sanitation services	RDP and above (55.5%)	RDP and above (73.6%)	RDP and above (61.6%)	RDP and above (54.5%)
Water	Regional/local water scheme (73.3%)	Regional/local water scheme (87.8%)	Regional/local water scheme (83.5%)	Regional/local water scheme (73.6%)

10.13.5 Socio-Cultural Processes

Socio-cultural processes relate to the way in which humans behave, interact and relate to each other and their environment, as well as the belief and value systems which guide these interactions.

10.13.5.1 General Background of the Primary Study Area (Ogies and Phola)

Ogies serves as the main service centre to the surrounding farms and is home to a number of grain silos, service industries and a co-operative. The ELM SDF (2015) classifies the agricultural land around Ogies and Phola as “prime agricultural land”, which places pressure on development priorities, i.e. maintaining the balance between agricultural use and urbanisation and other forms of land use (e.g. mining, power production, etc.). The SDF states that maintenance of public spaces and resources, for example roads, open spaces, public buildings, etc., are generally lacking and require attention.

Phola is a township located approximately 5 km north of Ogies, north of the N12. Informal settlement appears to be quite common in Phola and can be found on the southern and northern boundaries as well as the central parts of the town.

The economy of these two towns is not very diversified – most of its residents are employed at either the Kendal power station or nearby mines. Future spatial development is curbed by the extent of coal undermining in the area.

10.13.5.2 Crime Rate

There is one police station in Ogies servicing the primary study area. Considering the crimes reported at this police station between 2011 and 2016 (see Figure 10-28), it is evident that the number of crimes reported was fairly stable between 2011 and 2014. It then peaked in 2014/5, after which the overall incidence of crime again decreased somewhat in 2015/16. Most crimes reported are crimes against the person and includes murder, attempted murder, sexual offences, all forms of assault, and robbery. This is followed by commercial crime, including shoplifting and property-related crimes (house burglaries and theft of and from vehicles).

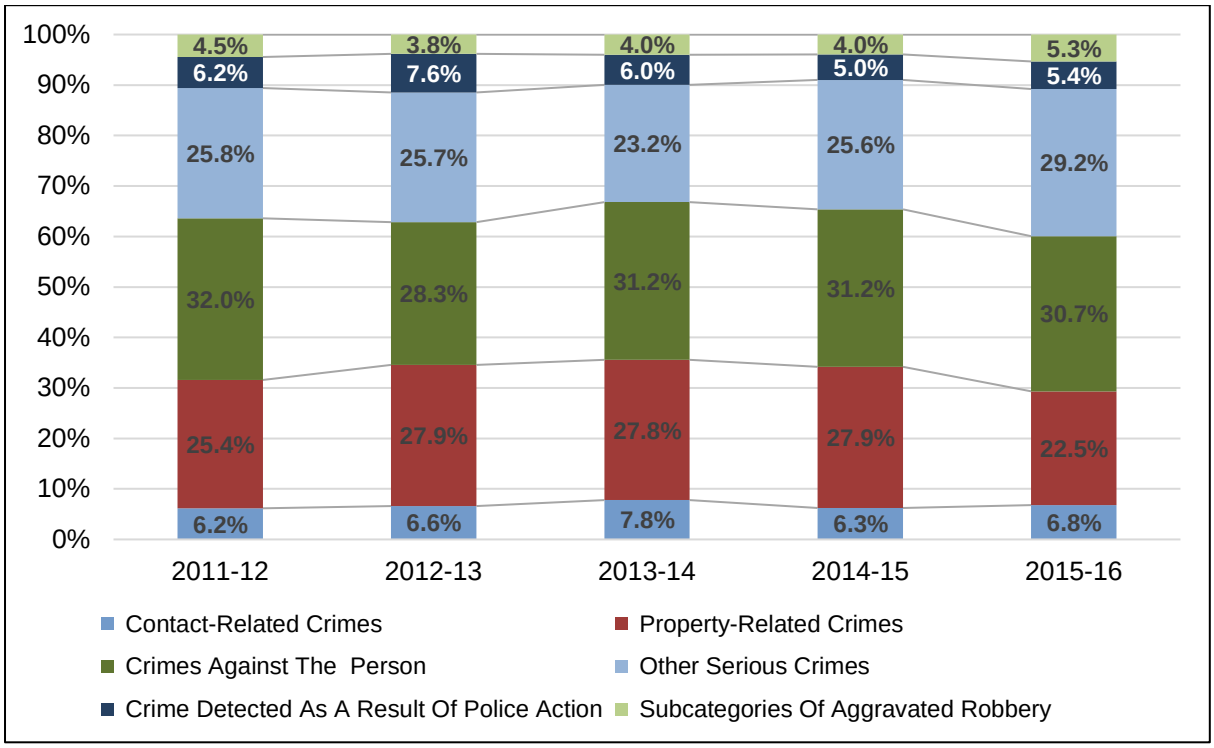


Figure 10-28: Crime Rate as reported at the Ogies Police Station (2011-2016)

10.13.5.3 Health

In 2015, an estimated 212 000 people in NDM were HIV positive (NDM, 2017). This represents 32.1% of the population of the district and was calculated using the model created to estimate HIV/AIDS rates by the Actuarial Society of Southern Africa (ASSA) in 2008. The estimation includes an average annual growth of 3.31% between 2005 and 2015 for NDM. This annual growth rate is higher than that of Mpumalanga and South Africa.

Table 10-33 below provides an overview of the health services in the greater study area. Even though there are a number of healthcare practitioners in Ogies and one clinic, there are no hospitals close-by and patients are referred to the hospitals in Emalahleni, some 30 km from site.

Table 10-33: Health care facilities within the greater study area

Facility type	Ward 30	ELM	NDM
Hospital		3	9
Community Health Centres		5	22
Clinic	1	10	68
Mobile clinic (functioning)		6	18
Mobile clinic (non-functioning)		3	11

11 Item 3(g)(v): Impacts and Risks Identified including the Nature, Significance, Consequence, Extent, Duration and Probability

This section aims to rate the significance of the identified potential impacts pre-mitigation and post-mitigation. The potential impacts identified in this section are informed by the baseline investigations presented in Section 10 above and are a result of both the environment in which the project activity takes place, as well as the activity itself.

The potential impacts are discussed per environmental feature / aspect and according to each phase of the project i.e. the Construction, Operational and Decommissioning / Post Closure Phases. The activities associated with each project phase are summarised in the table below.

Table 11-1: Project Activities

Phase of Project	Activity
Construction phase	▪ Site Clearing (pipeline routes and portion of laydown area); and ▪ Establishment of infrastructure (WTP and associated pipelines).
Operational phase	▪ Operation of WTP and pipelines; ▪ Discharge of treated water into the Saalklapspruit; ▪ Storage, handling and disposal of hazardous and non-hazardous waste; and ▪ Maintenance of infrastructure.
Decommissioning, rehabilitation and closure phase	▪ Demolition and removal of all infrastructure; ▪ Rehabilitation, including spreading of soil, re-vegetation and profiling or contouring; ▪ Storage, handling and disposal of hazardous and non-hazardous waste; and ▪ Post-closure monitoring and rehabilitation

11.1 Identified Potential Impacts

The subsections below provide the identified potential for the environmental aspects investigated in this EIA for each project phase. Furthermore, the significance, extend, duration and probability of the potential impact are detail and possible mitigation measure that could applied are provided for each potential impact. It is noted that only direct impacts are assessed in this section, potential risks are detailed in Section 11.2 below.

11.1.1 Soils, Land Use and Land Capability

11.1.1.1 Construction Phase

Construction activities on the site will lead to land clearing and disturbance of the soil and the potential generation of dust. The clearing of vegetation, the exposing of soil during construction of the project (pipeline routes and laydown area) and unearthing of the pipelines,

may lead to erosion due to wind or water. Soil compaction is also anticipated as a result of vehicle movement on soil surfaces during the construction phase. Soil compaction reduces infiltration rates and ability for plant roots to penetrate the soil. The current land capability of the project area is low as a result of existing mining related activities therefore will not experience any change.

11.1.1.1.1 Impact Ratings

The construction phase impacts on soil, land use and land capability are rated in Table 11-2, Table 11-3 and Table 11-4.

Table 11-2: Potential Impacts for the loss of topsoil as a resource (Dust, erosion and soil compaction)

Dimension	Rating	Motivation	Significance
Activity and Interaction: Clearing of vegetation and land			
Impact Description: Removal of vegetation and land clearing may result in dust generation and erosion. The movement of heavy machinery on soil surfaces causes compaction which reduces the vegetation's ability to grow and consequently facilitate erosion.			
Prior to Mitigation/Management			
Duration	3	Topsoil will be removed in preparation of the foundations for proposed WTP and impact is not more than 10 years	Minor (negative) – 32
Extent	3	Impact is limited to the development site area	
Intensity	2	Moderate loss of topsoil and damage of physical resources during construction	
Probability	4	Loss of topsoil will probably occur during construction	
Nature	Negative		
Mitigation/Management Actions			
▪ Only clear vegetation when and where necessary; ▪ Only remove topsoil when and where necessary; ▪ Only the designated access routes are to be used; ▪ If erosion occurs, corrective actions must be taken to minimise any further erosion from taking place; and ▪ Ensure proper storm water management designs are in place at WTP.			
Post-Mitigation			
Duration	2	Impact will be less than 5 years if mitigation measures are implemented	Negligible (negative) - 18

Dimension	Rating	Motivation	Significance
Extent	2	Loss of topsoil will occur within and around the project site	
Intensity	2	Loss of topsoil may result in degradation	
Probability	3	If mitigation measures are followed the impact will be lower	
Nature	Negative		

Table 11-3: Potential impacts for the loss of land capability and land use

Dimension	Rating	Motivation	Significance
Activity and Interaction: Clearing of vegetation and land			
Impact Description: Removal of soil layer will impact on the land capability and vegetation can no longer be supported. The land capability has already been impacted as a result of mining activities and therefore land use and land capability will remain in its current state.			
Prior to Mitigation/Management			
Duration	4	The removal of soil reduces the land capability and impact can be reversed	Minor (negative) - 40
Extent	3	Loss of land capability will be limited to the project area.	
Intensity	3	The land capability has been already reduced and land use will remain mining.	
Probability	4	By removing the topsoil the impact on land capability and land use is probable	
Nature	Negative		
Mitigation/Management Actions			
▪ No land capability mitigation measures are possible during this phase; and ▪ Effective monitoring and management of topsoil areas for compaction, erosion and compaction.			

Table 11-4: Potential Impacts for the loss of soil as a result of pipeline construction

Dimension	Rating	Motivation	Significance
Activity and Interaction: Site clearing for the construction of pipelines			
Impact Description: Loss of topsoil resources as a result of construction of pipelines may occur as land is cleared along the pipeline routes.			
Prior to Mitigation/Management			
Duration	5	Pipeline will be in place for the duration of the project.	Moderate (negative) - 78
Extent	3	Loss of topsoil (compaction and erosion) will occur within the pipeline route.	
Intensity	5	Loss of usable topsoil as pipelines will be constructed	
Probability	6	Excavating the soil will certainly impact on the soil	
Nature	Negative		
Mitigation/Management Actions			
▪ Only clear vegetation where the infrastructure will be developed and avoid cultivated areas where feasible; ▪ Only the designated access routes are to be used; and ▪ If erosion occurs, corrective actions must be taken to minimise any further erosion from taking place.			
Post-Mitigation			
Duration	4	Impact on soils will be less than a year if mitigation measures are implemented	Minor (negative) - 40
Extent	2	Loss of soil (compaction and erosion) will only occur within project area	
Intensity	4	Impact will be reduced if mitigation measures are implemented	
Probability	4	If mitigation measures are followed the impact will occur	
Nature	Negative		

11.1.1.2 Operational Phase

The potential impacts for soil resource are mostly associated with the construction phase based on the activities to be undertaken. Overall the operational phase is expected to have low negative significance on soil resources. The only further or persistence impacts anticipated during the operational phase are soil compaction from vehicle movement linked to maintenance activities and potential soil erosion where there is bare soil.

11.1.1.2.1 Impact Ratings

The operational phase impacts on soil, land use and land capability are rated in Table 11-5.

Table 11-5: Maintenance of the pipeline route

Dimension	Rating	Motivation	Significance
Activity and Interaction: Maintenance of pipeline routes			
Impact Description: The maintenance and inspections of the pipeline for contamination and erosion			
Prior to Mitigation/Management			
Duration	5	When the soil has eroded the impact will be permanent and is potentially irreversible	Minor (negative) - 30
Extent	2	Compaction and erosion will occur on a limited scale	
Intensity	3	Impact will be reduced if mitigation measures are implemented	
Probability	3	Impact is unlikely to occur if mitigation measures are implemented	
Nature	Negative		
Mitigation/Management Actions			
▪ Maintenance and inspections on the pipeline above surface must be done on to minimise compaction and erosion. ▪ Check for leakages on the feedwater pipelines regularly to avoid major contamination.			
Post-Mitigation			
Duration	2	Impact on soil can be less than a year if mitigation measures are implemented	Negligible (negative) - 14
Extent	2	Compaction and erosion will occur on a very limited scale	
Intensity	3	Intensity of the impact on soils will be reduced if mitigation measures are implemented	
Probability	2	Impact will rarely occur if mitigation measures are followed	
Nature	Negative		

11.1.1.3 Decommissioning and Rehabilitation Phase

The decommissioning and closure phase will comprise of the removal of infrastructure and subsequently rehabilitating disturbed areas. Similarly, to the operational phase, the potential

impacts on soil resources associated with these activities include soil compaction linked to vehicle movement and soil erosion which could result in the loss of topsoil. During rehabilitation, the impacted areas will be rehabilitated as per the rehabilitation guideline (refer to Appendix 14). Rehabilitated areas must be assessed for compaction, contamination and possible erosion, corrected and protected immediately.

11.1.1.3.1 Impact Ratings

The decommissioning impacts described are rated in Table 11-6.

Table 11-6: Impact rating during decommissioning of the infrastructure

Dimension	Rating	Motivation	Significance
Activity and Interaction: Demolishing of the infrastructure and removal of pipelines			
Impact Description: Decommissioning of associated infrastructure will cause compaction and erosion if rehabilitation is not done correctly.			
Prior to Mitigation/Management			
Duration	5	The impact on soils will occur if mitigations are not implemented	Minor (negative) - 36
Extent	2	Impact will occur on a limited scale	
Intensity	5	The intensity of the impact is serious and will be irreversible if mitigation measures are not implemented leading to chemical and physical degradation of the soil	
Probability	3	Impact will be unlikely to occur, if mitigation measures are not implemented will lead to compaction, erosion and loss of topsoil	
Nature	Negative		
Mitigation/Management Actions			
▪ Rehabilitate according to the rehabilitation plan; ▪ Return the land conditions capable of supporting prior land use or uses equal or better than prior land use to the extent feasible or practical.; ▪ Plant native vegetation to prevent erosion and encourage self-sustaining development of a productive ecosystem; and ▪ Remove buildings to foundation level. Demolished rubble must be disposed of in accordance with the approved Rehabilitation Plan.			
Post-Mitigation			
Duration	2	Impact will be less than a year if rehabilitation measures are implemented correctly	Negligible (negative) - 14

Dimension	Rating	Motivation	Significance
Extent	2	Impact will occur on a limited scale	
Intensity	3	The intensity will be reduced if mitigation measures are implemented	
Probability	2	Impact will be unlikely to occur if mitigation measures are implemented	
Nature	Negative		

11.1.2 Flora and Fauna

11.1.2.1 Construction Phase

Site clearing during the construction phase for the establishment of infrastructure will affect the current habitat and vegetation type. It is noted that the project area is characterised by mostly disturbed land and will therefore have minimal impact. The potential exists for alien plant species invasion as a result of fragmentation to vegetation cover. It is noted that the dominance of alien invader species was observed within the project area and therefore this impact is of particular concern for the natural grassland encountered at the discharge point. In terms of faunal species, disturbance of the habitat and an increase in noise and vehicular movement may result in the migration of fauna species.

11.1.2.1.1 Impact Ratings

The impact of construction of infrastructure on vegetation and fauna habitat associated with the site is rated in Table 11-7, Table 11-8 and Table 11-9 respectively.

Table 11-7: Potential Impacts due to Construction of Infrastructure

Activity and Interaction: Construction of infrastructure require vegetation clearing			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Direct loss of floral species/vegetation types and biodiversity			
Prior to mitigation/management			
Duration	Beyond Project Life (3)	Total loss of floral species/vegetation will occur.	Minor (negative) – 56
Extent	Local (2)	Removal of vegetation could occur without planning, thereby affecting the development site area.	
Intensity	Moderate (-3)	The pipeline footprint covers natural areas; disturbed grassland and mine rehabilitated areas.	
Probability	Definite (7)	It is likely that total destruction of vegetation types will occur.	

Activity and Interaction: Construction of infrastructure require vegetation clearing			
Dimension	**Rating**	**Motivation**	**Significance**
Nature	Negative		
Mitigation/Management actions			
▪ Limit degradation and destruction of natural environment to designated pipeline project areas by keeping the footprint of the disturbed areas to the minimum and within designated areas only, preferably the already disturbed areas. Re-vegetate open areas to limit erosion, which will also aid in water infiltration and flood attenuation. ▪ Avoid sensitive landscapes such as riparian areas, and wetland areas that were encountered on site as far as possible, as mentioned previously. ▪ Manage nationally restricted alien invasive plant species in accordance with the established SOP at KPS.			
Post- mitigation			
Duration	Permanent (2)	Short Term, mitigation measures prescribed will ensure this.	Negligible (negative) – 24
Extent	Limited (2)	If contractors adhere to mitigation such as to limit the footprint of disturbance to only essential areas.	
Intensity	Minor (-2)	Dependent on sensitivity of the specific site.	
Probability	Probable (4)	This impact will occur	
Nature	Negative		

Table 11-8: Loss of Species of Special Concern

Activity and Interaction (Construction of infrastructure (Pipelines) require vegetation clearing)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Potential loss of species of special concern (protected species)			
Prior to mitigation/management			
Duration	Beyond Project Life (3)	Loss floral species/vegetation will occur within the footprints of infrastructure, with no management.	Minor (negative) – 56
Extent	Local (2)	Species/habitat loss will only occur within the project site.	
Intensity	Moderate (-3)	Sensitive species could be present in natural areas and riparian areas.	
Probability	Definite (7)	It is likely that destruction of protected species will occur without management measures.	

Activity and Interaction (Construction of infrastructure (Pipelines) require vegetation clearing)			
Dimension	**Rating**	**Motivation**	**Significance**
Nature	Negative		
Mitigation/ Management actions			
▪ Limit degradation and destruction of natural environment to designated project areas by keeping the footprint of the disturbed areas to the minimum and within designated areas only. Re-vegetate open areas to limit erosion, which will also aid in water infiltration and flood attenuation. ▪ Avoid sensitive landscapes such as riparian and wetland areas as far as possible while undertaking construction activities. ▪ Applications for permits for removal of certain plants, where required by provincial authorities. If plants of SSC are to be removed, they should be either translocated to a similar habitat to the donor site or relocated to a nursery.			
Post management			
Duration	Medium term (3)	With vegetation management including rehabilitation, vegetation can recover.	Negligible (negative) – 24
Extent	Limited (2)	If contractors adhere to mitigation such as to limit the footprint of disturbance to only essential areas.	
Intensity	Moderate - negative (-3)	Dependent on sensitivity of the specific site.	
Probability	Unlikely (3)	It is unlikely that compaction will have an effect after rehabilitation	
Nature	Negative		

Table 11-9: Alien Vegetation Establishment

Activity and Interaction (Construction of infrastructure (Pipelines) require vegetation clearing)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Alien vegetation establishment			
Prior to mitigation/ management			
Duration	Beyond Project Life (6)	Alien vegetation will colonise any area that is available (open areas), with no mitigation this problem will persist and spread.	Minor (negative) – 56
Extent	Municipal area (4)	Such an infestation can easily spread to the entire municipal area and infest water sources.	

Activity and Interaction (Construction of infrastructure (Pipelines) require vegetation clearing)			
Dimension	**Rating**	**Motivation**	**Significance**
Intensity	Serious Loss (-4)	Serious loss of sensitive habitats and species due to alien vegetation colonisation.	
Probability	Likely (5)	It is unlikely that without mitigation measures, alien vegetation will establish	
Nature	Negative		
Mitigation/ Management actions			
▪ Manage nationally restricted alien invasive plant species by ensuring the removal of vegetation during construction and operation are controlled so that no open areas occur. ▪ Manage nationally restricted alien invasive plant species in accordance with the established SOP at KPS.			
Post management			
Duration	Short term (2)	Alien vegetation colonisation will be eradicated through Management Plan.	Negligible (negative) – 18
Extent	Limited (2)	An infestation will not be allowed to spread.	
Intensity	Minor (-2)	Only limited areas will experience this for a short duration.	
Probability	Unlikely (3)	It is unlikely that alien vegetation will establish if mitigation is adhered to.	
Nature	Negative		

11.1.2.2 Operational Phase

The operational phase will comprise of the operation of the WTP and associated infrastructure as well as subsequent discharge of treated water into the Saalklapspruit. No specific activity is expected to directly lead to impacts on to flora and fauna.

11.1.2.3 Decommissioning and Rehabilitation Phase

During the decommissioning and rehabilitation phase, disturbed areas will be revegetated to restore natural vegetation and habitat types. Potential impacts including erosion and the encroachment of alien invasive plant species may persist, however, these are likely to be of low significance if rehabilitation is carried out accordingly.

Rehabilitation constitutes a positive impact which is likely to improve the current state of the project footprint (degraded grassland).

11.1.2.3.1 Impact Rating

The impact of the restoration of vegetation and rehabilitation of the project area are rated in Table 11-10 and Table 11-11.

Table 11-10: Restoration of Vegetation

Activity and Interaction: Rehabilitation of infrastructure footprint areas			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Restoration of vegetation and habitat types.			
Duration	Short term (2)	If rehabilitation is not completed effectively it will accomplish the aim of avoiding erosion.	Minor (positive) +18
Extent	Very Limited (1)	Only certain parts of the site will have revegetated cover.	
Intensity	Moderate (3)	The effectiveness of the rehab will determine the intensity	
Probability	Unlikely (3)	It's unlikely that the rehabilitation will be effective	
Nature	Positive		
Mitigation/Management Actions			
▪ Revegetation will be undertaken in accordance with the developed Closure and Rehabilitation Plan (Appendix 14) no further measures to enhance this impact are proposed.			

Table 11-11: Rehabilitation of the Project Footprint

Activity and Interaction: Rehabilitation of infrastructure footprint areas			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Rehabilitation of infrastructure footprint areas			
Duration	Permanent (7)	If rehabilitation is completed successfully this impact will be permanent	Moderate (positive) +84
Extent	Local (3)	The general area beyond the project site will be positively impacted on.	

Intensity	Positive (4)	Vegetation will be restored.	
Probability	Almost certain (6)	With correct implementation this impact has a high probability of occurring	
Nature	Positive		
Mitigation/Management Actions			
▪ Rehabilitation will be undertaken in accordance with the developed Closure and Rehabilitation Plan (Appendix 14) no further measures to enhance this impact are proposed.			

11.1.3 Wetlands

11.1.3.1 Scientifically Determined Buffers

Scientific buffer zones were determined for the two HGM units applicable to the WTP Project. The buffers were determined through the application of the "Buffer Zone Guidelines for Wetlands, Rivers and Estuaries" (Macfarlane and Bredin, 2017). It is important to note the wetland buffer calculator is not recommended by the authors, for use in mining, or in relation to activities generating point source discharges, both of which are related to the proposed infrastructure areas. However, the calculator was applied to give some guidance on buffer width. Further detail pertaining to the methodology employed is provided in the specialist report, Appendix 6.

The determined buffers for the dissipation structure, associated with HGM unit 1 at the proposed Saalklapspruit discharge point and the WTP, associated with HGM unit 2 are discussed in the subsections below.

11.1.3.1.1 Dissipation Structure

As mentioned above, Macfarlane and Bredin (2017) indicate that buffer zones are not regarded as an appropriate tool for mitigation against point-source discharges, such as in the case of the discharge of treated water into HGM unit 1. It is suggested that these can be managed more effectively by targeting these areas through specific source-directed controls and treatment options. In this instance, the intention is to treat the water and dissipate discharge so as not to cause erosion. Therefore, the buffer width in this case, is based solely on the impact of the footprint of the dissipation structure and the pipeline. The table below details the calculated buffer. An impact assessment was conducted for two placement options of the dissipation structure; Option 1 assesses the placement of the structure within the wetland buffer and Option 2 assess the placement of the structure outside the proposed buffer. Refer to Section 10.2 of the Wetland Report in Appendix D.

Table 11-12: HGM Unit 1 Buffer Calculator

Aspect	Sector	Sub-sector	Rationale	Buffer width
Discharge	N/A	N/A	Tool not applicable	N/A
Footprint	Residential	Residential low impact	The footprint needs to be accounted for as it reduces water infiltration and increases runoff. The footprint is 0.09 ha and therefore the housing (low impact) is the most applicable as it will have a small footprint and mimic the type of impacts that are expected from the dissipation structure	13m
Pipeline	Service infrastructure	Pipelines for the transportation of waste water	Most applicable option. No option for treated water is available	50 m
Final buffer width				**50 m**

11.1.3.1.2 Water Treatment Plant

The WTP falls within the Mining Sector and within Plant and Plant Waste (high-risk `activities) sub-sector. As mentioned above, Macfarlane and Bredin (2017) indicate that buffer zones are not regarded as an appropriate tool for mitigation for mining, however has been applied for guidance in determining the buffer width. The table below details the calculated buffer.

Table 11-13: HGM Unit 2 Buffer Calculator

Aspect	Sector	Sub-sector	Rationale	Buffer width
WTP	Mining	Plant and plant waste from mining operations – high risk activities	High risk activities were selected as Klipspruit is a coal mine and this option is then automatically selected	61m

11.1.3.1.3 Conclusion

The findings of the scientifically calculated buffer indicate that the dissipation structure be placed 50 m from the edge of the delineated wetland. It is however suggested that the dissipation structure be located in the wetland as per the proposed design, and not outside of the wetland. The rationale behind this recommendation provided by the wetland specialist is that the water will flow over the buffer area as well as the remainder of the of the slope of the wetland in order to reach the water course (discharge into the Saalklapspruit). This alteration

in land use across the terrestrial surface area may result in the creation of a preferential flow path, altered vegetation structures, an increased potential for erosion and channelization and the associated sedimentation impacts further downstream, which may prove to have greater impacts on the wetland system than if the structure is located within the wetland as originally proposed, provided mitigation measures are adhered to.

With respect to the WTP infrastructure, the proposed design locates the majority of the WTP in the wetland buffer, but outside of the wetland. A small portion of the temporary laydown area is however located within a small portion of the wetland. The determined buffer is influenced by the sector input (coal mining) which is considered a high-risk activity. However, given the nature of the WTP Project, existing impacts to the wetland (Category D) and the buffer between the WTP and wetland area, it is the specialist's opinion that the location of the WTP within the buffer will not hinder significant impacts to the wetland. It is however suggested that the temporary laydown area be moved slightly to the east of the current proposed location so as to not be located directly in the wetland but should be within the buffer based on the modified nature of that area.

Based on the rationale provided above, the impacts for the Construction, Operational, Decommissioning and Rehabilitation Phases described below are based on the current placement of the infrastructure within the buffers of the delineated wetlands.

11.1.3.2 Construction Phase

Construction phase activities may result in erosion associated with land clearing and subsequent sedimentation of wetlands. This may lead to further loss of biodiversity and habitat fragmentation of the identified wetland systems. Furthermore, the containment of water through associated with designated dirty areas may result in the loss of catchment yields and surface water recharge to the systems further downstream which will adversely impact wetland functioning.

The change in PES for HGM unit 1 and HGM unit 2 was calculated based on the potential impacts associated with the construction of infrastructure within proximity to these systems as detailed in the wetland report (Appendix D) and below.

For HGM unit 1, the change in PES as a result of the construction of the dissipation structure and outlet has been based on the structure being placed within the wetland. The PES is expected to deteriorate from 4.9 to 5.22. Scores have not changed significantly due to the already disturbed nature of the site. This deterioration is mainly attributed to a slight increase in runoff potential due to a small area of hardened surface as well as some erosion and deposition. There will be increased flow due to the discharge of treated water, however, due to the structure of the WET-Health tables, as well as the fact that there is reduction in flows currently due to the destruction of an upstream portion of the wetland, the overall hydrological health score did not change.

The construction of the WTP infrastructure in relation to HGM unit 2 is not expected to have a significantly change on the PES score due to the already disturbed nature of the site. The PES is expected to deteriorate from 4.8 to 5. This deterioration is mainly attributed to a slight

increase in runoff potential due to a small area of hardened surface as well as some erosion and deposition.

To account for the slight deterioration in the PES scores due to the construction of the infrastructure, it is suggested that South32 remove the stands of alien invasive trees (predominantly *Acacia mearnsii*) within the wetland buffers, which will ultimately reduce the overall impacts posed to the wetlands over the long term. It is assumed that all mitigation measures listed in the impact assessment are adhered to.

Table 11-14: PES Scores for HGM unit 1

	Hydrological Health Score	Geomorphological Health Score	Vegetation Health Score	Final Ecological Health Score	PES Score
Pre-construction of dissipation structure	6.5	2.2	5.3	4.94	D
Post- construction of dissipation structure	6.5	2.4	6.1	5.22	D
With AIP removal	6.5	2.4	5.2	4.96	D

Table 11-15: PES Scores for HGM unit 2

	Hydrological Health Score	Geomorphological Health Score	Vegetation Health Score	Final Ecological Health Score	PES Score
Pre-construction of WWTP	6	0.5	7.6	4.85	D
Post-construction of WWTP	6	0.6	7.9	5	D
Post AIP mitigation	6	0.6	7.9	4.82	D

11.1.3.2.1 Impact Ratings and Mitigation Measures

The impact of construction activities on wetlands are rated in Table 11-16.

Table 11-16: Potential Impacts on Wetlands due to Site Clearance and Infrastructure Establishment

Dimension	Rating	Motivation	Significance
Activity and Interaction: Site clearance and infrastructure establishment			
Impact Description: Land clearing and the removal of vegetation may result in soil erosion and subsequent sedimentation of wetland and river systems. Furthermore, dirty water will be contained at the construction areas which may reduce catchment yields and surface water recharge to the systems further downstream. These impacts would adversely affect ecological integrity and functioning of wetland systems.			
Prior to Mitigation/Management			
Duration	Project life (5)	The impact will cease after the life of the project has been completed	Moderate (negative) – 78
Extent	Greater municipal area (4)	General scouring from sedimentation, as well as degraded habitat due to water quality deterioration will affect entire watercourse and river reaches.	
Intensity	Serious medium term environmental effects (4)	Due to the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious medium-term impacts.	
Probability	Almost certain (6)	Should no precautionary measures be implemented, further impacts to the wetlands present are considered highly probable.	
Nature	Negative		
Mitigation/Management Actions			
▪ Ensure soil management programme is implemented and maintained to minimise erosion and sedimentation; ▪ Erosion berms should be installed on roadways and downstream of stockpiles to prevent gully formation and siltation of the freshwater resources. ▪ The disturbed footprint must be limited to what is essential to avoid unnecessary clearing and compaction of soils; ▪ If it is absolutely unavoidable that any of the wetland areas present will be affected, disturbance must be minimised and suitably rehabilitated; ▪ Ensure that no incision and canalisation of the wetland features present takes place; ▪ Active rehabilitation, re-sloping, and re-vegetation of disturbed areas immediately after construction must be undertaken; ▪ All soils compacted as a result of construction activities should be ripped/scarified (<300mm) and profiled;			

Dimension	Rating	Motivation	Significance
▪ A suitable alien invasive plan control programme must be implemented and maintained to prevent further encroachment as a result of the disturbance; ▪ No unnecessary crossing of the wetland features and their associated buffers should take place and the substrate conditions of the wetlands and downstream stream connectivity must be maintained; ▪ No material may be dumped or stockpiled within any rivers, tributaries or drainage lines in the vicinity of the proposed pipeline; ▪ No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas and their associated zones of regulation. All vehicles must remain on demarcated roads and within the construction footprint; ▪ Wetlands should be monitored monthly during construction; and ▪ Appropriate sanitary facilities must be provided for the duration of the construction activities and all waste must be removed to an appropriate waste facility.			
Post-Mitigation			
Duration	Project life (5)	The impact will cease after the project has been completed.	Minor (negative) - 40
Extent	Limited (3)	Impacts will be limited only to the local area and will be rehabilitated accordingly on completion of the decommissioning phase.	
Intensity	Minor effects on the biological or physical environment (2)	Due to the impacted nature of the systems present, should the appropriate precautions and management or mitigation measures be employed, the project could result in only a minor ecological impact to the wetland systems present	
Probability	Probable (4)	Should the proposed project proceed, impacts to the ecological integrity of the systems present are still considered probable.	
Nature	Negative		

11.1.3.3 Operational Phase

The main activities during the operational phase that could result in impacts to the freshwater ecology of the area are associated with the storm water management systems (reduced water quantity of water reporting downstream), maintenance and operational activities such as discharge of the treated water. Associated impacts include soil compaction resulting in the hardening of surfaces, erosion where soil is left bare which may result in sedimentation of freshwater resources. Hardened surfaces have the potential to result in sheet runoff and there is likely to be a loss in wetland service provision in terms of flood attenuation, sediment trapping and assimilation of toxicants and other pollutants.

These impacts could lead to further loss of biodiversity and habitat fragmentation of the identified wetland systems. Furthermore, encroachment of alien invasive plant species is possible as the habitat is fragmented which further adversely impacts the ecological integrity by altering the natural vegetation profiles of the freshwater resources encountered in the vicinity of the project footprint.

Discharge of the water into the Saalklapspruit may result in contamination of the water, if not treated to the catchment standard. The increased volume of water could result in erosion and further channelization of the wetland, if the appropriate mitigation is not adopted at the discharge location.

11.1.3.3.1 Impact Ratings and Mitigation Measures

Table 11-17 summarises potential impacts to wetlands during the operational phase.

Table 11-17: Potential Impacts on Wetlands due to Operational Activities

Dimension	Rating	Motivation	Significance
Activity and Interaction: Operational Activities			
Impact Description: Reduced ecological integrity and functioning of wetlands as a result of stormwater management systems, maintenance and operational activities including the discharge of treated water into the Saalklapspruit.			
Prior to Mitigation/Management			
Duration	Project life (5)	The impact will cease after the life of the project has been completed.	Minor (negative) – 52
Extent	Greater municipal area (4)	Spills as well as degraded habitat due to water quality deterioration will affect entire watercourses and river reaches.	
Intensity	Serious medium term environmental effects (4)	Due to the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious medium term impacts.	
Probability	Probable (4)	Should no precautionary measures be implemented, further impacts to the wetlands present are considered probable.	
Nature	Negative		
Mitigation/Management Actions			
▪ Water should be treated and tested to ensure it meets appropriate standards before being released; ▪ Water must be tested at regular intervals to ensure that quality meets the appropriate standards;			

Dimension	Rating	Motivation	Significance
▪ Annual biomonitoring of wetland crossing points and at the point of discharge must take place; ▪ Aim to discharge the water diffusely to reduce channelisation and erosion of the wetland downstream; ▪ If it is absolutely unavoidable that any of the freshwater areas present will be affected, disturbance must be minimised and suitably rehabilitated; ▪ Ensure that no incision and canalisation of the freshwater features present takes place as a result of the proposed operational activities; ▪ All erosion noted within the operational footprint as a result of any potential surface activities should be remedied immediately and included as part of the ongoing rehabilitation plan; ▪ Erosion berms should be installed on roadways and downstream of stockpiles to prevent gully formation and siltation of the freshwater resources. ▪ An alien invasive plan control programme must be put in place so as to prevent further encroachment as a result of disturbance to the surrounding terrestrial zones; ▪ No unnecessary crossing of the wetland features and their associated buffers should take place and the substrate conditions of the wetlands and downstream stream connectivity must be maintained; ▪ No vehicles or heavy machinery may be allowed to drive indiscriminately within any freshwater areas and their associated zones of regulation. All vehicles must remain on demarcated roads; ▪ Monitor all systems for erosion and incision; ▪ Ensure soil management programme is implemented and maintained to minimise erosion and sedimentation; ▪ All soils compacted as a result of construction activities should be ripped/scarified (<300mm) and profiled; and ▪ Permit only essential personnel within the 100m zones of regulation for all freshwater features identified.			
Post-Mitigation			
Duration	Project life (5)	The impact will cease after the project has been completed and the pipeline decommissioned.	Negligible (negative) – 18
Extent	Limited (2)	Impacts will be limited only to the project footprint area and will be rehabilitated accordingly on completion of the decommissioning phase.	
Intensity	Minor effects on the biological or physical environment (2)	Due to the impacted nature of the systems present, should the appropriate precautions and management or mitigation measures be employed, the project could result in only a minor ecological impact to the wetland systems present.	
Probability	Improbable (2)	Should the proposed project proceed, impacts to the ecological integrity of the systems present are considered unlikely.	

Dimension	Rating	Motivation	Significance
Nature	Negative		

11.1.3.4 Decommissioning and Rehabilitation Phase

Impacts to wetlands associated with the decommissioning and rehabilitation phase include compaction of soils, potential loss of natural vegetation and the increased potential for erosion and sedimentation in the decommissioned areas and resulting in impacts further downstream.

Any temporary storage or dumping of decommissioned infrastructure within wetland areas, has the potential to result in loss of stream connectivity, loss of refuge areas, alterations to the terrain profiles of the areas and the creation of preferential flow paths, which may result in sedimentation, alterations to the vegetation structure of the area, encourage alien vegetation encroachment and result in increased erosion and sedimentation potentials.

Removal of vegetation and disturbance of soils in the vicinity of the decommissioning footprint is likely to give rise to an increased potential for encroachment by robust pioneer species and alien invasive vegetation species, further altering the natural vegetation profiles of the wetlands encountered in the vicinity of the decommissioning footprint.

11.1.3.4.1 Impact Ratings and Mitigation Measures

Table 11-18 and Table 11-19 summarise potential impacts to wetlands during the decommissioning and rehabilitation phase.

Table 11-18: Impacts on Wetlands due to the Decommissioning of Infrastructure

Dimension	Rating	Motivation	Significance
Activity and Interaction: Decommissioning of all infrastructure			
Impact Description: Reduced ecological integrity and functioning of wetlands as a result of potential soil compaction, erosion and consequent sedimentation of freshwater resources as well as potential encroachment of alien invasive plant species as a result of habitat fragmentations.			
Prior to Mitigation/Management			
Duration	Project life (5)	The impact will cease after the decommissioning, rehabilitation and closure phases of the project have been completed.	Minor (negative) – 52
Extent	Greater municipal area (4)	General scouring from sedimentation, as well as degraded habitat due to water quality deterioration will affect entire watercourse and river reaches.	
Intensity	Serious medium term environmental effects (4)	Due to the sensitivity of wetland systems in general and the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious medium-term impacts.	
Probability	Probable (4)	Should no precautionary measures be implemented, further impacts to the wetlands present are considered probable.	
Nature	Negative		
Mitigation/Management Actions			
▪ Ensure that sound environmental management is in place during the proposed decommissioning phase; ▪ All erosion noted within the decommissioning and rehabilitation area footprint should be remedied immediately and included as part of the ongoing rehabilitation plan; ▪ All soils compacted as a result of decommissioning activities should be ripped/scarified (<300mm) and profiled (see the Soil Specialist Report for more information); ▪ Permit only essential personnel within the 100m zones of regulation for all freshwater features identified; ▪ Wherever possible, restrict decommissioning activities to the drier winter months to avoid sedimentation of the freshwater resources further downstream; ▪ Wetlands and their associated zones of regulation are to be clearly demarcated and avoided wherever possible; ▪ Monitor all systems for erosion and incision; ▪ All areas where active erosion is observed should be ripped, re-profiled and seeded with indigenous grasses; ▪ No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas and their associated zones of regulation. All vehicles must remain on demarcated roads and within the project area footprint;			

Dimension	Rating	Motivation	Significance
▪ Ongoing wetland rehabilitation is necessary both within and in the vicinity of the proposed decommissioning, rehabilitation and closure footprint.			
Post-Mitigation			
Duration	Project life (5)	The impact will cease after the decommissioning, rehabilitation and closure phases of the project have been completed.	Negligible (negative) – 27
Extent	Limited (2)	Impacts will be limited only to the project footprint area and will be rehabilitated accordingly on completion of the decommissioning phase.	
Intensity	Minor effects on the biological or physical environment (2)	Due to the impacted nature of the systems present, should the appropriate precautions and management or mitigation measures be employed, the project could result in only a minor ecological impact to the wetland systems present	
Probability	Unlikely (3)	Should the proposed project proceed, and the appropriate management and mitigation measures be implemented, impacts are considered unlikely.	
Nature	Negative		

Table 11-19: Impacts on Wetlands due to Rehabilitation Activities

Dimension	Rating	Motivation	Significance
Activity and Interaction: Rehabilitation of disturbed areas			
Impact Description: Reduced ecological integrity and functioning of wetlands as a result of potential soil compaction, erosion and consequent sedimentation of freshwater resources as well as potential encroachment of alien invasive plant species as a result of habitat fragmentations.			
Prior to Mitigation/Management			
Duration	Project life (5)	The impact will cease after the rehabilitation of the project has been completed.	Minor (negative) – 52
Extent	Greater municipal area (4)	General scouring from sedimentation, as well as degraded habitat due to water quality deterioration will affect entire watercourse and river reaches.	

Dimension	Rating	Motivation	Significance
Intensity	Serious medium term environmental effects (4)	Due to the sensitivity of the flora wetland systems in general and the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious medium-term impacts.	
Probability	Probable (4)	Should no precautionary measures be implemented, further impacts to the flora and wetlands present are considered probable.	
Nature	Negative		
Mitigation/Management Actions			
▪ Ensure that sound environmental management is in place during the proposed decommissioning phase; ▪ Limit the footprint area of the decommissioning and rehabilitation activities to what is essential to minimise impacts as a result of vegetation clearing and compaction of soils (all areas but critically so in wetland areas); ▪ Wetlands and their associated zones of regulation are to be clearly demarcated and avoided wherever possible; ▪ An alien invasive plant management plan to be implemented and managed for the life of the proposed decommissioning, rehabilitation, closure and post-closure phases (see the Fauna and Flora Specialist Study for more information); ▪ As much vegetation growth as possible should be promoted within the proposed development area during all phases. In order to protect soils, vegetation clearance should be kept to a minimum; ▪ All areas where active erosion is observed should be ripped, re-profiled and seeded with indigenous grasses; ▪ Ongoing wetland rehabilitation is necessary both within and in the vicinity of the proposed decommissioning, rehabilitation and closure footprint; and ▪ Appropriate wetland monitoring techniques must take place on an annual basis for a period of at least 3 years post closure during the summer/wet season in order to identify any emerging issues, trends or improvements in the receiving environment.			
Post-Mitigation			
Duration	Project life (5)	The impact will cease after the rehabilitation and closure phases of the project have been completed.	Negligible (negative) – 24
Extent	Very limited (1)	Impacts will be limited only to isolated parts of the site where rehabilitation is taking place.	
Intensity	Minor effects on the biological or physical environment (2)	Due to the impacted nature of the systems present, should the appropriate precautions and management or mitigation measures be employed, the project could result in only a minor ecological impact to the wetland	

Dimension	Rating	Motivation	Significance
		systems present and in the long term may have positive impacts.	
Probability	Unlikely (3)	Should the proposed project proceed, and the appropriate management and mitigation measures be implemented, impacts are considered unlikely.	
Nature	Negative		

11.1.4 Aquatic Ecology

11.1.4.1 Construction Phase

Site access and the clearing of vegetation for pipeline infrastructure will most likely result in an increase in surface runoff, erosion and subsequently the amount of suspended and dissolved solids entering the downstream watercourse. These impacts will alter the hydrology and water chemistry of the affected watercourses and will negatively impact aquatic ecology. Increased in dissolved solids may result in a loss of certain taxa if their specific salinity tolerances are exceeded while an increase in suspended solids will directly alter aquatic habitats after deposition which in turn will negatively impact biotic community structure and can also directly impact aquatic biota through the accumulation of silt on respiratory organs (i.e. gills).

11.1.4.1.1 Impact Rating

Table 11-20 summarises potential impacts to the aquatic ecology identified during for the construction phase.

Table 11-20: Potential Surface Runoff Impact of the Construction Phase

Dimension	Rating	Motivation	Significance
Activity and Interaction: Site clearance and access for the construction of proposed pipeline infrastructure			
Impact Description: Vegetation and aquatic habitat (i.e. riparian) removal resulting in increased runoff, erosion, sedimentation and possible increase in contaminants / chemicals in the downstream watercourses.			
Prior to Mitigation/Management			
Duration	Project life (5)	Once vegetation is cleared for infrastructure, no revegetation will occur until removal of infrastructure or project closure.	Minor (negative) – 36
Extent	Limited (2)	Due to the usual dry nature of the upstream project area (Site K3) and the already mined through upstream area associated with the	

Dimension	Rating	Motivation	Significance
		construction footprint, this impact is expected to be limited.	
Intensity	Low - Negative (-2)	Due to the small footprint associated with the construction of the pipelines the proposed area for site clearance appears to be relatively small and is usually dry as indicated by Site K3 findings. Therefore, the intensity of runoff and its potential to carry contaminants is expected to be limited.	
Probability	Probable (4)	Runoff is likely to occur more than once during construction especially during high rainfall events.	
Nature	Negative		
Mitigation/Management Actions			
▪ Limit vegetation removal to the infrastructure footprint area only where removed or damaged vegetation areas (riparian or aquatic related) should be revegetated; ▪ Bare land surfaces downstream from construction activities should be vegetated to limit erosion from the expected increase in surface runoff from infrastructure; ▪ Environmentally friendly barrier systems, such as silt nets or in severe cases the use of trenches, can be used downstream from construction sites to limit erosion and possibly trap contaminated runoff from construction if the aforementioned vegetation management action is not an option. In severe run off cases, only noticeable throughout construction, trenches might be the sole management option; ▪ Storm water must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow (i.e. use of baffles at the end of canals or trenches if implemented); ▪ Water used at construction sites should be utilised in such a manner that it is kept on site and not allowed to run freely from the site into downstream watercourses as this water will most likely be contaminated and high is suspended solids; ▪ Construction chemicals, such as paints and hydrocarbons, should be used in an environmentally safe manner with correct storage as per each chemical's specific storage descriptions in order to attempt to limit entry into the downstream reaches; and ▪ Construction during high rainfall periods (i.e. usually December to March) should be avoided as far as practically possible to avoid increased surface runoff in attempt to limit erosion and the entering of external material (i.e. contaminants and / or dissolved solids) into the downstream aquatic systems.			
Post-Mitigation			
Duration	Project Life (5)	Once vegetation is cleared for infrastructure, no revegetation will occur until the closure phase of the project or removal.	Negligible (negative) – 16
Extent	Limited (2)	Runoff will most likely be restricted after mitigation to the area before the N12 highway.	
Intensity	Minor - Negative (-1)	If mitigation measures are all incorporated for the construction phase, the intensity of the	

Dimension	Rating	Motivation	Significance
		impact should decrease, especially due to the dry nature observed in the upper reaches.	
Probability	Improbable (2)	The likelihood of runoff occurring will be reduced by the mitigation actions and should only result in extreme cases or unexpected rainfall events.	
Nature	Negative		

11.1.4.2 Operational Phase

The major foreseeable impact associated with the operational phase of the project is the discharge of water into the downstream Saalklapspruit. The proposed discharge is likely to result in an alteration of the downstream hydrology due to increased flow. This will alter the flow preference of aquatic which are already established in the system and may destroy aquatic biota, especially vegetation depending on the magnitude of the flow. Associated impacts include erosion, sedimentation as well as bank and channel modifications.

The proposed discharge is planned to be treated to the Wilge River Catchment Region RQWOs and this water is also expected to flush/dilute the downstream watercourses. As such improvement of water quality can be expected and particularly improve the sewage related issues discussed above. The expected improved water quality in the downstream watercourses will benefit sensitive aquatic biota and in general the overall conditions if the increased flow has a limited impact.

11.1.4.2.1 Impact Ratings

Impacts ratings associated with the alteration of hydrology associated with the discharge is outlined in Table 11-21 with the water quality benefit outlined in Table 11-22.

Table 11-21: Hydrological Related Impact of the Operational Phase

Dimension	Rating	Motivation	Significance
Activity and Interaction: Increased flow in the downstream watercourses associated with the proposed WTP discharge			

Dimension	Rating	Motivation	Significance
Impact Description: High flow rates in the downstream watercourses will deter aquatic biota with a specific flow and habitat preferences and potentially result in erosion, sedimentation and bank and channel modification of said systems.			
Prior to Mitigation/Management			
Duration	Project life (5)	Discharge shall continue until cessation of the project.	Minor (negative) – 44
Extent	Local (3)	The impact is expected to remain inside the municipal area.	
Intensity	Moderate - Negative (-3)	The discharge is expected to potentially benefit ecosystem functioning. However, the intensity of erosion, sedimentation and stream morphological modifications is expected to occur.	
Probability	Probable (4)	High flow rates in systems that are characterised valley bottom wetlands has a relatively high probability of resulting in the described impacts	
Nature	Negative		
Mitigation/Management Actions ▪ Ensure that the discharge does not directly enter the Saalklapspruit system by allowing it to discharge before the river into a silt basin before flowing, to limit potential erosion and sedimentation; ▪ Energy dissipaters must be installed at the discharge point to avoid erosion of the riverbed and banks; ▪ Flow diffusing mechanisms should be implemented (e.g. baffles) to limit any potential erosion and sedimentation likely to be facilitated by the high discharge volume of the outfall; ▪ Monitoring of the culvert from the discharge to under the N12 highway should take place to ensure no backfill or pools start to form. This might require maintenance depending if the impact occurs; and ▪ Revegetation should occur in sections that have been washed out due to the increased flow. This should also occur in severe cases of erosion where rehabilitation of impacted watercourse banks should take place simultaneously with revegetation.			
Post-Mitigation			
Duration	Project Life (5)	Discharge shall continue to commence throughout the life of the project.	Negligible (negative) – 27
Extent	Local (3)	If the mitigation actions are implemented correctly, the extent of the impact is expected to occur only at areas immediately associated with the discharge.	

Dimension	Rating	Motivation	Significance
Intensity	Very low - Negative (-1)	If the intensity of the flow is reduced the aforementioned stream modifications will most likely be reduced.	
Probability	Unlikely (3)	Alteration of hydrology and increased flow in the downstream reaches is expected to occur despite mitigation measures. However, the likelihood of the consequential impacts is expected to be reduced.	
Nature	Negative		

Table 11-22: Water Quality of the Operational Phase

Dimension	Rating	Motivation	Significance
Activity and Interaction: Clean water being discharged into the degraded Saalklapspruit			
Impact Description: Clean water is proposed to be discharged into the unnamed tributary of the Saalklapspruit and eventually enter the Saalklapspruit SQR of concern.			
Prior to Mitigation/Management			
Duration	Project life (5)	Clean water discharge shall continue until cessation of the project.	Minor (Positive) + 44
Extent	Local (3)	Due to the expected large volume of water to be discharged, the extent of the improved water quality is expected to occur outside of the development site area.	
Intensity	Moderate - Positive (3)	Due to the severely poor water quality associated with the sewage influences in the Saalklapspruit, the clean water discharge is expected to notably improve water quality conditions in the system and adjoining Saalklapspruit SQR. However, limited to the local area due to downstream mining activities.	
Probability	Probable (4)	Based on the poor water quality conditions of the Saalklapspruit associated with the sewage input into the system, the clean water discharge has a high probability of improving downstream water quality conditions.	
Nature	Positive		

Dimension	Rating	Motivation	Significance
Mitigation/Management Actions No mitigation actions are required in order to improve the downstream water quality. However, it is essential that the water being discharged is in fact clean water that meets discharge standards. Hence, it is suggested that the discharge quality is closely monitored.			

11.1.4.3 Decommissioning and Rehabilitation Phase

Similar to the impacts associated with the construction phase, decommissioning and rehabilitation activities may potentially result in surface runoff, erosion and subsequently the amount of suspended solids entering the downstream watercourse. The occurrence of such impacts will in turn negatively impact biotic community structure and can also directly impact aquatic biota through the accumulation of silt on respiratory organs.

11.1.4.3.1 Impact Rating and Mitigation Measures

Table 11-23 outlines the impact ratings and management actions associated with aquatic ecology during the decommissioning and rehabilitation phase.

Table 11-23: Water quality of the Decommissioning Phase

Dimension	Rating	Motivation	Significance
Activity and Interaction: Removal of established infrastructure and site access associated with the decommissioning phase			
Impact Description: Workings and the use of machinery in the upstream area associated with the pipeline has the potential to degrade downstream water quality and chemistry depending on the extent of runoff from the decommissioning area.			
Prior to Mitigation/Management			
Duration	Medium Term (3)	The impact is only expected to take place during the decommissioning phase and can be reversed with minimal management.	Minor (negative) – 36
Extent	Municipal (4)	Runoff is expected to be limited. However, the expected increased volume of the downstream watercourses might influence the extent of water quality related impacts if contaminants from the decommissioning sites enter the systems.	

Dimension	Rating	Motivation	Significance
Intensity	Low - Negative (-2)	Due to the small footprint associated with the pipeline area associated with aquatic systems, infrastructure removal should be limited to a small enough area to have minimal implications to the downstream watercourses.	
Probability	Probable (4)	Runoff is likely to occur more than once during decommissioning especially during high rainfall events.	
Nature	Negative		
Mitigation/Management Actions			
▪ Limit infrastructure removal to the infrastructure footprint area only where removed or damaged vegetation areas (riparian or aquatic related) should be revegetated; ▪ Bare land surfaces downstream from the decommissioning activities should be vegetated to limit erosion; ▪ Drainage lines and compact natural areas / soils formed from vehicular use and general decommissioning activities should be rehabilitated to limit runoff; ▪ Chemicals, such as machinery oils and hydrocarbons, should be used in an environmentally safe manner with correct storage as per each chemical's specific storage descriptions to attempt to limit entry into the downstream reaches; and ▪ Decommissioning activities during high rainfall periods (i.e. usually December to March) should be avoided as far as practically possible to avoid increased surface runoff in attempt to limit erosion and the entering of external material (i.e. contaminants and / or dissolved solids) into the downstream aquatic systems.			
Post-Mitigation			
Duration	Medium term (3)	Runoff into the downstream watercourses will continue to occur throughout the decommissioning phase.	Negligible (negative) – 16
Extent	Limited (2)	The extent is most likely to drop slightly after mitigation actions are implemented. However, contaminants might extend past the immediate project area but will be limited if the runoff from decommissioning sites is reduced.	
Intensity	Very low - Negative (-1)	If runoff from the decommissioning sites is reduced, contaminants entering the downstream watercourses will be limited.	

Dimension	Rating	Motivation	Significance
Probability	Improbable (3)	The likelihood of runoff occurring will be reduced only slightly as the additional use of trenches and storm water diversion systems will not be utilised as it is the closure phase of the project.	
Nature	Negative		

11.1.5 Surface Water

11.1.5.1 Construction Phase

Site clearance and vegetation removal may result in an increased potential for soil erosion which leads to increase in the sediments on the runoff that reports into the natural stream (Saalklapspruit) thereby causing siltation. Dust generated during the construction activities caused by increased vehicular movements can also be deposited into the water course, thereby contributing to the accumulation of suspended solids in the water course. The impact of siltation will lead to the deterioration of water quality and adverse impacts on aquatic life as well as downstream water users. Due to the existing stormwater management structures and dust suppression measure that are in place within an existing KPS mine boundary however, this impact would most likely be of low significance.

11.1.5.1.1 Impact Rating and Mitigation Measures

Table 11-24 and Table 11-25 summarise potential impacts to surface water identified for the construction phase.

Table 11-24: Potential Impacts on Surface Water due to Siltation of Water Course

Dimension	Rating	Motivation	Significance
Activity and Interaction: Site clearing and vegetation removal			
Impact Description: Siltation of surface water resources due to increased suspended solids resulting from soil erosion.			
Prior to Mitigation/Management			
Duration	2	The impact will likely occur during the construction phase only	Negligible (negative) - 32
Intensity	2	This will have minor to medium-term impacts resulting in a reduction in water quality for immediate downstream users and the aquatic life	
Extent	4	The impacts will be localized to the nearby water resources from where the silt is being generated to the immediate downstream	

Dimension	Rating	Motivation	Significance
Probability	4	Without appropriate mitigation, it is probable that this impact will occur.	
Nature	Negative		
Mitigation/Management Actions			
▪ Where clearing of vegetation and excavation is required, this should be limited as far as possible to avoid unnecessary soil exposure; ▪ For any required soil stockpiles, these should be compacted and the slopes should be kept at minimal/low to avoid erosion by high runoff velocity from the stockpile and hence siltation of the streams; ▪ Dust suppression measures must be undertaken on the cleared areas during construction; ▪ Runoff from this area should be directed to the existing storm water management infrastructures and should not be allowed to flow into the stream; ▪ No water should be abstracted from the stream for construction; and ▪ All storage areas (fuels, paints, chemicals etc.) should be appropriately bunded and spill kits should be in place, and construction workers trained in the use of spill kits, to contain and immediately clean up any potential leakages or spills.			
Post-Mitigation			
Duration	2	The impact will likely only occur during the construction phase	Negligible (negative) - 8
Intensity	2	Should the impact occur, it will have minor medium-term impacts resulting in a reduction in water quality for downstream users and the aquatic life	
Extent	4	The impacts will be localized to the nearby water resources from where the silt is being generated to the immediate downstream	
Probability	2	With the existing measures already in place. It will be improbable for this impact to occur.	
Nature	Negative		

Table 11-25: Potential Impacts on Surface Water due to Water Contamination

Dimension	Rating	Motivation	Significance
Activity and Interaction: Site clearing and vegetation removal			
Impact Description: The impact of siltation resulting in the deterioration of water quality and adverse impacts on aquatic life as well as downstream water users.			
Prior to Mitigation/Management			
Duration	2	The impact will likely only occur during the construction phase	Minor (negative) - 48

Dimension	Rating	Motivation	Significance
Intensity	3	This will moderately impacts the water quality and the ecosystem functionality for downstream users	
Extent	3	The impacts may extend in the greater surrounding area from where the impact occurred	
Probability	4	Without appropriate mitigation, it is probable that this impact will occur	
Nature	Negative		
Mitigation/Management Actions			
▪ Where clearing of vegetation and excavation is required, this should be limited as far as possible to avoid unnecessary soil exposure; ▪ For any required soil stockpiles, these should be compacted and the slopes should be kept at minimal/low to avoid erosion by high runoff velocity from the stockpile and hence siltation of the streams; ▪ Dust suppression measures must be undertaken on the cleared areas during construction; ▪ Runoff from this area should be directed to the existing storm water management infrastructures and should not be allowed to flow into the stream; ▪ No water should be abstracted from the stream for construction; and ▪ All storage areas (fuels, paints, chemicals etc.) should be appropriately bunded and spill kits should be in place, and construction workers trained in the use of spill kits, to contain and immediately clean up any potential leakages or spills.			
Post-Mitigation			
Duration	2	The impact will likely only occur during the construction phase	Negligible (negative) - 24
Intensity	3	This will moderately impacts the water quality and the ecosystem functionality for downstream users	
Extent	3	The impacts may extend in the greater surrounding area from where the impact occurred	
Probability	2	With the existing measures already in place. It will be improbable for this impact to occur.	
Nature	Negative		

11.1.5.2 Operational Phase

Activities during the operational phase, namely discharging treated water into the Saalklapspruit, will increase the volumes and flow rate of the stream. This has the potential to impact on the stream by altering natural hydrology and stream channel morphology which consequently may lead to more frequent, larger magnitude, and shorter duration peak flows. Changes to the channel width may also occur as well as increased erosion and reduced bank stability.

The current water quality status recorded along the Saalklapspruit is impacted with concentration levels of various parameters above the Wilge River Catchment RWQO. As such, this water is generally considered to be of poor quality and contaminated. The project will result in the release of water that complies with the Wilge River Catchment RWQO into the

Saalklapspruit. This will release a positive impact as water will dilute the already impacted water and hence improves the in-stream water quality.

Clean and dirty water separation is implemented within the KPS Mining Right Area in accordance with the GN 704 of the NWA. This results in a reduction in catchment yield as dirty water is contained, reducing the amount of runoff reporting to the Saalklapspruit and the catchment as a whole. A decrease in the catchment yield may have an impact on the downstream water users as they may not have sufficient water supply for their needs, while also decreasing the required natural ecological flows. The proposed discharge of treated water into the Saalklapspruit would therefore be a positive impact on KPS' current impact on catchment yields as water released into the Saalklapspruit will compensate and restore the stream flows.

11.1.5.2.1 Impact Ratings and Mitigation Measures

Table 11-26, Table 11-27 and Table 11-28 summarise potential impacts to surface water identified for the operational phase.

Table 11-26: Alteration of natural hydrology due to Discharge into the Saalklapspruit

Dimension	**Rating**	**Motivation**	**Significance**
Activity and Interaction: Discharge of treated water into the Saalklapspruit			
Impact Description: Alteration of natural hydrology due to increased runoff which may also result in alterations in channel width may and reduced bank stability.			
Prior to Mitigation/Management			
Duration	5	The impact will occur for as long as the project life of WTP	Moderate (negative) - 78
Intensity	4	This may have serious to medium term the natural impacts to the hydrology and the general river well -being	
Extent	4	The impacts may extend in the greater surrounding area (Municipal) from where the impact occurred	
Probability	6	Without appropriate mitigation, it is almost certain that the impact will occur	
Nature	Negative		
Mitigation/Management Actions			
▪ Energy dissipaters must be installed at the discharge point to avoid erosion of the riverbed and banks. These could be in a form of gabions, silt trap, chutes spillway, etc. to ensure reduction of water velocity. ▪ Water quality monitoring should continue at the discharge outlet and downstream points of the Saalklapspruit to ensure the WTP effectiveness.			
Post-Mitigation			
Duration	5	The impact will occur for as long as the project life of WTP and could be	

Dimension	Rating	Motivation	Significance
		mitigated by recommendation made above	Minor (negative) – 39
Intensity	4	This may have serious to medium term the natural impacts to the hydrology and the general river well -being	
Extent	4	The impacts may extend in the greater surrounding area (Municipal) from where the impact occurred	
Probability	3	It is unlikely for this impact to happen if there are mitigation measures in place	
Nature	Negative		

Table 11-27: Water Quality Improvements due to Discharge into the Saalklapspruit

Dimension	Rating	Motivation	Significance
Activity and Interaction: Discharge of treated water into the Saalklapspruit			
Impact Description: Instream water quality improvement as a result of dilution of treated water that is discharged with the already impacted in-stream water.			
Prior to Mitigation/Management			
Duration	5	The impact will occur for as long as the project life of WTP	Major (positive) – 119
Intensity	7	This will have very significant impacts to the water quality and the general river well -being	
Extent	5	The impacts may extend in the provincial from where the impact occurred	
Probability	7	It is certain/ definite that this impact will occur (there is no mitigation for this impact)	
Nature	Positive		
Mitigation/Management Actions			
▪ No enhancement measures have been identified for this positive impact. It is noted that water quality monitoring should continuously be undertaken to ensure this positive impact is realised.			

Table 11-28: Improved Catchment Yields due to Discharge into the Saalklapspruit

Dimension	Rating	Motivation	Significance
Activity and Interaction: Discharge of treated water into the Saalklapspruit			
Impact Description: Restoration of runoff catchment yield as a result of reintroducing water lost to mining activities into the Saalklapspruit.			
Prior to Mitigation/Management			

Dimension	Rating	Motivation	Significance
Duration	5	The impact will occur for as long as the project life of WTP	Major (positive) – 119
Intensity	7	This will have very significant impacts to the water quality and the general river well -being	
Extent	5	The impacts may extend in the provincial from where the impact occurred	
Probability	7	It is certain/ definite that this impact will occur (there is no mitigation for this impact)	
Nature	Positive		
Mitigation/Management Actions			
▪ No enhancement measures have been identified for this positive impact.			

11.1.5.3 Decommissioning and Rehabilitation Phase

The decommissioning and rehabilitation phase will comprise of the demolition of surface infrastructure and the revegetation of the project footprint. It is noted that similarly to the activities associated with the construction phase; surface runoff, erosion and sedimentation may occur. It is expected that the significance of these impacts will be similar or lesser. No specific activity is expected to further directly lead to impacts to surface water.

11.1.6 Groundwater

11.1.6.1 Construction Phase

Site clearance and vegetation removal is not expected to have an impact on groundwater as clearance will likely take place above the water table. In the event that construction activities take place below the water table, this will result in the lowering of the water table.

The water table within the proposed project area is shallow, ranging between 1.1m to 3.28m below ground surface. Any site clearing or construction activities that would involve excavation below the water table depth will have a potential impact on the groundwater quantity and quality.

11.1.6.1.1 Impact Rating and Mitigation Measures

Table 11-29 summarises the potential impact associated with excavation below the table on groundwater.

Table 11-29: Potential Impacts during the Construction Phase

Dimension	Rating	Motivation	Significance
Activity and Interaction: Site clearing for the development of surface infrastructure			
Impact Description: Lowering of groundwater table as a result of site clearing and infrastructure establishment.			
Prior to mitigation/ management			
Duration	Short term (2)	Pre-construction and construction activities are expected to be short-lived.	Negligible (negative) – 8
Extent	Limited (2)	Site clearing will only occur within and immediately around the project site	
Intensity	Minor - negative (-1)	Any site clearing, removal of the top soil and vegetation and dewatering (if any) will have minor environmental significance.	
Probability	Unlikely (2)	Impact on the groundwater unlikely as the site clearance is expected to take place above the water table or cause environmental impact considering limited rock permeability, the duration and excavation depth.	
Nature	Negative		
Mitigation/ Management actions			
▪ Site clearance and removal of top soil and vegetation has to cover minimal area and it has to be managed efficiently and be carried in dry season where there is less chances of or no recharge into the aquifer; and ▪ Continue with current groundwater monitoring programme.			
Post- mitigation			
Duration	Short term (2)	Any lowering of the water table during the construction phase is expected to be shallow and recover relatively quickly	Negligible (negative) – 4
Extent	Limited (2)	Only the area in the site clearing area will be affected	
Intensity	Minimal - negative (-1)	Considering that the construction phase will be for a short period, the intensity will be minimal	
Probability	Unlikely (2)	It is unlikely for groundwater impact to occur during the construction phase, especially with the implementation of the above proposed management plan	

Dimension	Rating	Motivation	Significance
Activity and Interaction: Site clearing for the development of surface infrastructure			
Nature	Negative		

No further potential impacts to groundwater have been identified for the remaining phases of the project.

11.1.7 Noise

Predictive models were generated to quantify the expected noise levels associated with the project. The results of the predictive modelling depicted on Plan 24 to Plan 26, Appendix 2, for the construction and operational phases. The decommissioning phase was not modelled specifically as it is likely that it would have a similar or lesser impact than the construction phase.

11.1.7.1 Construction Phase

During the construction phase noise disturbance is expected from construction vehicles and machinery. The noise dispersion model run for the construction phase (Plan 24, Appendix 2) indicates that the expected noise will not measure above the ambient levels at the industrial, urban and rural receptors and therefore not impact on the surrounding receptors.

11.1.7.1.1 Impact rating and Mitigation Measures

Table 11-30 below summarises the rating of noise disturbance for the construction phase.

Table 11-30: Impact of noise during the construction phase

Dimension	Rating	Motivation	Significance
Activity and Interaction: Site clearance and vegetation removal			
Impact Description: Noise will emanate from the machinery and vehicles operating during the construction activities, however will not impact on any receptors.			
Prior and Post mitigation/ management			
Duration	Medium term (3)	Noise will be produced for the duration of the construction phase	Negligible (negative) – 21
Extent	Local (3)	It is expected that during construction noise will extend as far as development site area.	
Intensity	Minimal - negative (-1)	It is expected that during construction noise will have a minimal impact	
Probability	Unlikely (3)	It is unlikely that noise will impact on the surrounding receptors.	
Nature	Negative		

Dimension	Rating	Motivation	Significance
Mitigation/ Management action			
▪ No mitigation recommended due to negligible impact			

11.1.7.2 Operational Phase

The operational activities may impact on the ambient sound levels at surrounding receptors by causing noise disturbance. However, the operational scenarios were run for day and night times (refer to Plan 25 and Plan 26, Appendix 2). The noise modelling results indicate that the expected noise will not measure above the current ambient noise levels at the surrounding suburban and rural receptors, therefore not impacting on the surrounding receptors.

11.1.7.2.1 Impact Rating and Mitigation Measures

Table 11-31 summarises the rating of noise disturbance for the operational phase.

Table 11-31: Noise disturbance during the operational phase

Dimension	Rating	Motivation	Significance
Activity and Interaction: Operation of Water Treatment Plant			
Impact Description: Noise will emanate from the water treatment plant, however will not impact on surrounding receptors.			
Prior and Post mitigation/ management			
Duration	Project Life (5)	Noise will be produced for the duration of life of mine	Negligible (negative) – 27
Extent	Local (3)	It is expected that during operation noise will extend as far as development site area.	
Intensity	Minor - negative (-1)	It is expected that during operational phase noise will have a minor social impact	
Probability	Unlikely (3)	It is unlikely that noise will impact on the surrounding communities.	
Nature	Negative		
Mitigation/ Management action			
▪ No mitigation recommended due to negligible impact			

11.1.7.3 Decommissioning Phase

The decommissioning activities may impact on the ambient sound levels at surrounding receptors by causing noise disturbance. However, with the decommissioning activities using similar machinery and vehicles than the construction phase, it is expected that the significance of the noise impact during this phase will be similar.

11.1.7.3.1 Impact rating and mitigation measures

Table 11-32 summarises the rating of noise disturbance for the decommissioning phase.

Table 11-32: Noise disturbance during the Decommissioning Phase

Dimension	Rating	Motivation	Significance
Activity and Interaction: Dismantling and removal of the pump stations and pipeline infrastructure			
Impact Description: Noise will emanate from the machinery and vehicles operating during the decommissioning activities.			
Prior and Post mitigation/ management			
Duration	Medium term (3)	Noise will be produced for the duration of the decommissioning phase	Negligible (negative) – 21
Extent	Local (3)	It is expected that during decommissioning noise will extend as far as development site area.	
Intensity	Minimal - negative (-1)	It is expected that during decommissioning noise will have a minimal impact	
Probability	Unlikely (3)	It is unlikely that noise will impact on the surrounding receptors.	
Nature	Negative		
Mitigation/ Management action			
▪ No mitigation recommended due to negligible impact			

11.1.8 Visual

11.1.8.1 Construction Phase

The establishment of infrastructure and the related site clearing and construction activities will draw attention to the project area making receptors aware of the project. The construction phase will have negative visual impacts on the receiving environment.

Site clearing will have a minor negative visual impact on sensitive receptors considering the proposed footprint areas for both the WTP and the laydown area are already disturbed and cleared of natural vegetation. Construction of infrastructure is expected to have a moderate negative visual impact on the receiving environment. The surface infrastructure will change the sense of place slightly due to the addition of light industrial infrastructure. Construction activities are not expected to take place at night.

11.1.8.1.1 Impact Ratings and Mitigation Measures

The ratings of visual impacts associated with the construction phase are summarised in Table 11-33, Table 11-34 and Table 11-35.

Table 11-33: Potential Impact of Visual Intrusion due to Site Clearing

Dimension	Rating	Motivation	Significance
Activity and Interaction: (Site clearance and vegetation removal			
Impact Description: Site Clearance and removal of vegetation have a minor visual impact on the receiving environment.			
Duration	Medium Term (3)	The impact will occur during the construction phase.	Minor (negative) - 48
Extent	Local (3)	Site clearing activities will be visible from the area surrounding the construction site.	
Intensity	Minor - negative (-2)	Site clearing is expected to cause a moderate visual disturbance. The project Area is already disturbed and devoid of natural vegetation.	
Probability	Certain (7)	The impact will likely occur.	
Nature	Negative		
Mitigation/ Management action			
▪ Only remove vegetation within the infrastructure areas; ▪ Only remove topsoil within the infrastructure areas; and ▪ Apply dust suppression techniques to limit dust generated from the topsoil stockpiles.			
POST-MITIGATION			
Duration	Medium Term (3)	The impact will occur during the construction phase.	Minor (negative) - 42
Extent	Limited (2)	The extent of the impact will be reduced by implementing the mitigation actions listed above.	
Intensity	Minor - negative (-2)	The visual disturbance will be reduced by implementing the mitigation actions above.	
Probability	Highly Probable (6)	It is most likely that the impact will occur.	
Nature	Negative		

Table 11-34: Potential Impact of Visual Intrusion due to WTP Establishment

Dimension	Rating	Motivation	Significance
Activity and Interaction: Site clearance and vegetation removal			
Impact Description: Construction of the WTP is expected to have a moderate negative visual impact on the receiving environment.			
PRE-MITIGATION			

Dimension	Rating	Motivation	Significance
Duration	Project Life (5)	The impact will cease after project life.	Moderate (negative) - 77
Extent	Local (3)	The viewshed model indicates that the Project will be visible from a maximum distance of 5 km during the day.	
Intensity	Moderate - negative (-3)	Construction of the WTP is expected to cause a moderate visual disturbance.	
Probability	Certain (7)	The impact will definitely occur.	
Nature	Negative		
Mitigation/ Management action			
▪ Ensure the WTP infrastructure does not exceed the proposed heights; ▪ Where possible, surface infrastructure must be painted natural hues so that it blends into the surrounding landscape; ▪ Limit the footprint area of the surface infrastructure; ▪ Pylons and metal structures must be galvanised so as to weather to a matt grey finish rather than be painted silver. If the pylons and metal structures are painted, a neutral matt finish must be used; and ▪ Avoid construction activities at night. If construction activities take place at night then only areas where these activities are taking place should be lit and the number of lights and brightness must not exceed the minimum requirements for safety and security. Down lighting and low-pressure sodium light sources must be implemented to minimise light pollution. Lights should be directed inwards towards the Project area and not outwards from the Project area.			
Mitigation/ Management action			
Duration	Project Life (5)	The impact will cease after project life.	Minor (negative) - 54
Extent	Limited (2)	The extent of the impact will be reduced by implementing the mitigation actions listed above.	
Intensity	Moderate - negative (-3)	The visual disturbance will be reduced by implementing the mitigation measures above.	
Probability	Highly probable (6)	It is most likely that the impact will occur.	
Nature	Negative		

Table 11-35: Potential Visual Impact of Construction of Pipelines on the Receiving Environment

Dimension	Rating	Motivation	Significance
Activity and Interaction: Site clearance and vegetation removal			
Impact Description: Construction of pipelines is expected to have a minor-negative visual impact on the receiving environment.			
PRE-MITIGATION			
Duration	Project Life (5)	The impact will cease after project life.	Minor (negative) - 70
Extent	Local (3)	The pipelines will be visible from the surrounding area.	
Intensity	Low - negative (-2)	Construction of the pipelines is expected to have a low visual disturbance.	
Probability	Certain (7)	The impact will definitely occur.	
Mitigation/ Management action			
▪ Limit the footprint area of pipelines where possible; ▪ Limit the height of pipelines and any service paths/roads; and ▪ If possible, bury the pipelines to remove any long-term visual impact.			
POST-MITIGATION			
Duration	Project Life (5)	The impact will cease after project life.	Minor (negative) - 36
Extent	Limited (2)	The extent of the impact will be reduced by implementing the mitigation actions listed above.	
Intensity	Low - negative (-2)	The visual disturbance will remain but be reduced by implementing the mitigation actions above.	
Probability	Probable (4)	It is most likely that the impact will occur. The burying of the pipeline will remove any long-term impacts associated with the pipelines.	
Nature	Negative		

11.1.8.2 Operational Phase

The operational phase is characterised by operation of the WTP and associated pipelines. The operational phase is not expected to have further negative visual impacts on the receiving environment.

11.1.8.3 Decommissioning and Rehabilitation Phase

The closure and decommissioning phase is characterised by the removal of the WTP and all associated pipelines and infrastructure. The closure and decommissioning phase is expected to have minimal visual impacts on the receiving environment.

11.1.8.3.1 Impact Rating and Mitigation Measures

Table 11-36 summarises the ratings of visual impacts associated with the decommissioning and rehabilitation phase.

Table 11-36: Potential Impact of Visual Intrusion due to Demolition and Rehabilitation

Dimension	Rating	Motivation	Significance
Activity and Interaction: Demolishing of the infrastructure and removal of pipelines			
Impact Description: Closure of the WTP, pipelines and associated infrastructure is expected to have a negative visual impact on the receiving environment during the day.			
PRE-MITIGATION			
Duration	Permanent (2)	The impact will remain permanently.	Minor (negative) -16
Extent	Very Limited (1)	The removal of all surface infrastructure will mean that any remaining visual impact will be very limited to the immediate area.	
Intensity	Very low – negative (-1)	A very low impact is expected after the removal of surface infrastructure. Re-vegetation and resurfacing must take place to limit any remaining landscape scarring.	
Probability	Probable (4)	Their will likely remain an impact even after closure due to slight alteration to the landscape and land use.	
Nature	Negative		
Mitigation/Management Actions			
▪ No mitigation measures have been identified for this impact.			

11.1.9 Socio-economic

The project is not expected to have any direct socioeconomic impacts and therefore a quantitative impact assessment has not been undertaken. As previously indicated the “no-go” would result in the persistence of a health and safety risk to the community and the natural environment, namely potential uncontrolled discharges which could add to the pollutants entering the catchment.

The implementation of the project would likely result in improved water quality and increased water quantity within the local catchment as envisioned, this could result in positive induced impacts for surrounding communities (i.e. better water quality and quantities for downstream uses). This impact has been identified for the Institutional and Legal Process which, as defined above, pertain to processes that affect service delivery to the local area.

11.2 Unplanned Events and Low Risks

Unplanned events may occur during the project that may have potential impacts which will need mitigation and management. Table 11-37 below is a summary of the identified Project activities that may pose a risk (an impact at low probabilities). Not all potential unplanned events may be captured herein and this must therefore be managed by South32 throughout all phases.

Table 11-37: Unplanned Events, Low Risks and their Management Measures

Potential Project Risk (Unplanned Occurrences)	Aspect Potentially Impacted	Mitigation / Management / Monitoring
Hydrocarbon spills from vehicles and heavy machinery, hazardous materials or waste storage facilities.	Surface water; Groundwater; Wetlands; and Soil contamination.	▪ Hydrocarbons and hazardous materials must be stored in bunded areas and refuelling should take place in contained areas; ▪ Ensure that oil traps are well maintained; and ▪ Vehicles and heavy machinery should be serviced and checked on a regularly basis to prevent leakages and spills.
Spills/leaks from pipelines.	Surface water; Groundwater; Wetlands; and Soil contamination.	▪ Regular inspections of the pipeline for any leaks; and ▪ Ensure that storm water management structures are put in place to capture all spills.

11.3 Cumulative Impacts

Cumulative effects are caused by the accumulation and interaction of multiple stresses affecting the parts and the functions of ecosystems. Of particular concern is the knowledge that ecological systems sometimes change abruptly and unexpectedly in response to apparently small incremental stresses. For purposes of this report, cumulative impacts have been defined as “the changes to the environment caused by an activity in combination with either past, present, and reasonably foreseeable human activities”.

The subsections below generally discuss cumulative impacts associated with the environmental impacts assessed.

11.3.1 Soils, Land Use and Land Capability

The project area and its surroundings consist of mixed land uses ranging from residential areas, mining activities and agricultural activities. The land capability of the local area has therefore been greatly impacted. The proposed project is planned over land where the land capability has already been impacted. Therefore, the establishment of the project is not seen to contribute to cumulative impacts associated with soils, land use and land capability.

11.3.2 Flora and Fauna

There are currently several mines surrounding KPS, all of which are coal mines with associated impacts on biodiversity as a whole. These mining areas are directly adjacent to KPS and together these all have a high cumulative impact on the area as a whole. The construction of the WTP on site can be seen to have no discernible negative impact after mitigation measures are implemented, due to the impacted nature of the project area.

The opportunity exists for KPS to contribute to conservation in the region. Conservation of as much of the natural land in the area, and the creation of corridors linking other natural areas, would aid in conservation of ecosystems, flora and fauna. If this is achieved (permanently, not just over the life of the mine), then the mine itself will have a possible positive impact.

11.3.3 Surface Water, Wetlands and Aquatic Ecology

The wetlands and other freshwater resources in this area, including aquatic biota, are currently largely impacted as a result of various cumulative impacts from historical mining activities in the area. In addition, other impacts present in the vicinity of the proposed project area include agricultural cultivation, grazing activities, road and railway crossings and the associated servitudes. The proposed project will introduce positive impacts (improved water quality in the Saalklapspruit and increase water quantities) associated with these aspects which will extend to the local area.

11.3.4 Groundwater

Observing the project area and its surroundings (within 5 km radius of the project area) the area consists of mixed land uses ranging from undeveloped to semi-developed residential areas, a developed area (Ogies town), mining activities in south-west as well as agricultural activities. The potential cumulative impacts include:

- Possible depletion of natural water resources, or contamination of groundwater and surface water (deterioration of water quality at the Saalklapspruit river and in downstream areas) should the development not be managed properly (such as if wastewater treatment plant plan and monitoring programme is not implemented); and
- Existing water quality and quantity impacts from the mining activities.

11.3.5 Noise

Cumulative impacts should be considered for the overall improvement of ambient noise levels. The project is considered a causative source of noise pollution of negligible significance. The project is not expected to have cumulative impact or exacerbate current noise levels. This is primarily due to noise propagation not measuring above the rating levels of the surrounding suburban and rural receptors.

11.3.6 Visual

The cumulative impact on the surrounding environment and receptors is low due to the large scale existing degradation caused by numerous mines and mining activities in the project area and surrounds.

12 Item 3(g)(vi): Methodology used in Determining and Ranking the Nature, Significance, Consequence, Extent, Duration and Probability of Potential Environmental Impacts and Risks

Details of the impact assessment methodology used to determine the significance of physical, bio-physical and socio-economic impacts are provided below.

The significance rating process follows the established impact/risk assessment formula:

Significance = CONSEQUENCE X PROBABILITY X NATURE

Consequence = intensity + extent + duration

Where

And

Probability = likelihood of an impact occurring

And

Nature = positive (+1) or negative (-1) impact

The matrix calculates the rating out of 147, whereby intensity, extent, duration and probability are each rated out of seven as indicated in Table 12-1. The weight assigned to the various parameters is then multiplied by +1 for positive and -1 for negative impacts.

Impacts are rated prior to mitigation and again after consideration of the mitigation measure proposed in this EIA report. The significance of an impact is then determined and categorised into one of eight categories (The descriptions of the significance ratings are presented in Table 12-3).

It is important to note that the pre-mitigation rating takes into consideration the activity as proposed, (i.e., there may already be some mitigation included in the engineering design). If the specialist determines the potential impact is still too high, additional mitigation measures are proposed.

Table 12-1: Impact assessment parameter ratings

Rating	Intensity/Replacability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
7	Irreplaceable loss or damage to biological or physical resources or **highly** sensitive environments. Irreplaceable damage to **highly sensitive** cultural/social resources.	Noticeable, on-going natural and / or social benefits which have improved the overall conditions of the baseline.	International The effect will occur across international borders.	Permanent: The impact is irreversible, even with management, and will remain after the life of the project.	Definite: There are sound scientific reasons to expect that the impact will definitely occur. >80% probability.
6	Irreplaceable loss or damage to biological or physical resources or **moderate to highly** sensitive environments. Irreplaceable damage to cultural/social resources of **moderate to highly** sensitivity.	Great improvement to the overall conditions of a large percentage of the baseline.	National Will affect the entire country.	Beyond project life: The impact will remain for some time after the life of the project and is potentially irreversible even with management.	Almost certain / Highly probable: It is most likely that the impact will occur. <80% probability.

Rating	Intensity/Replacability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
5	Serious loss and/or damage to physical or biological resources or **highly** sensitive environments, limiting ecosystem function. Very serious widespread social impacts. Irreparable damage to highly valued items.	On-going and widespread benefits to local communities and natural features of the landscape.	Province/ Region Will affect the entire province or region.	Project Life (>15 years): The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Likely: The impact may occur. <65% probability.
4	Serious loss and/or damage to physical or biological resources or **moderately** sensitive environments, limiting ecosystem function. On-going serious social issues. Significant damage to structures / items of cultural significance.	Average to intense natural and / or social benefits to some elements of the baseline.	Municipal Area Will affect the whole municipal area.	Long term: 6-15 years and impact can be reversed with management.	Probable: Has occurred here or elsewhere and could therefore occur. <50% probability.

Rating	Intensity/Replacability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
3	Moderate loss and/or damage to biological or physical resources of **low to moderately** sensitive environments and, limiting ecosystem function. On-going social issues. Damage to items of cultural significance.	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.	Local Local extending only as far as the development site area.	Medium term: 1-5 years and impact can be reversed with minimal management.	Unlikely: Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur. <25% probability.
2	**Minor loss and/or effects** to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	Low positive impacts experience by a small percentage of the baseline.	Limited Limited to the site and its immediate surroundings.	Short term: Less than 1 year and is reversible.	Rare / improbable: Conceivable, but only in extreme circumstances. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures. <10% probability.

Rating	Intensity/Replacability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
1	**Minimal to no loss** and/or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	Some low-level natural and / or social benefits felt by a very small percentage of the baseline.	Very limited/Isolated Limited to specific isolated parts of the site.	Immediate: Less than 1 month and is completely reversible without management.	Highly unlikely / None: Expected never to happen. <1% probability.

Table 12-2: Probability/consequence matrix

Significance																																				
-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Consequence																																				

Table 12-3: Significance rating description

Score	Description	Rating
109 to 147	A very beneficial impact that may be sufficient by itself to justify implementation of the project. The impact may result in permanent positive change	Major (positive) (+)
73 to 108	A beneficial impact which may help to justify the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and / or social) environment	Moderate (positive) (+)
36 to 72	A positive impact. These impacts will usually result in positive medium to long-term effect on the natural and / or social environment	Minor (positive) (+)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the natural and / or social environment	Negligible (positive) (+)
-3 to -35	An acceptable negative impact for which mitigation is desirable. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the natural and / or social environment	Negligible (negative) (-)
-36 to -72	A minor negative impact requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the natural and / or social environment	Minor (negative) (-)
-73 to -108	A moderate negative impact may prevent the implementation of the project. These impacts would be considered as constituting a major and usually a long-term change to the (natural and / or social) environment and result in severe changes.	Moderate (negative) (-)
-109 to -147	A major negative impact may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects. The impacts are likely to be irreversible and/or irreplaceable.	Major (negative) (-)

12.1 Item 3(g)(vii): The Positive and Negative Impacts that the Proposed Activity (in terms of the initial site layout) and Alternatives will have on the Environment and the Community that may be affected

Section 8 above provides an explanation of the site layout, alternatives and aspects that were considered during the finalisation of the layout. The Impact Assessment detailed in Section 11 describes all identified potential impacts associated with the preferred site layout and planned project activities. The overall positive and negative impacts associated with the assessment alternatives are detailed in Table 12-4 below.

Table 12-4: Alternatives and Impacts

Alternative	Option	Positive Impact	Negative Impact
Water Treatment Options	Water Active	Can meet the RWQOs	Requires infrastructure that may impact the environment
	Passive	Less infrastructural requirements	Cannot meet the RWQOs
	In-Situ Treatment	Less infrastructural requirements	Cannot meet the RWQOs
WTP location	Option 1	In proximity to existing amenities therefore limiting area of disturbance	None identified.
	Option 2	In previously disturbed area	None identified.
	Option 3	In previously disturbed area	None identified.
	Option 4	In previously disturbed area	None identified.
	Option 5	In previously disturbed area	None identified.
WTP design	Fixed Installation	None identified.	1.5 ha footprint disturbance
	Modular installation	None identified.	1.5 ha footprint disturbance
WTP technology	None identified.	None identified.	Contamination risks associated with hazardous solid and liquid waste generation and storage

Alternative	Option	Positive Impact	Negative Impact
Pipeline routes	Option 1	No positive impact	Traverses rehabilitated lands and risk of contamination associated with spillages
	Option 2	Avoids rehabilitated area	Contamination risks associated with spillages
Waste Disposal	On-site disposal	-	Potential for leachability and possible groundwater pollution.
	Off-site disposal	No new waste impacts on KPS	Cumulative impacts/additional pressure on existing landfill site.
The No-Go Option	-	No positive impact anticipated	Continue to pose a health and safety risk to the community and the natural environment that could occur if mine affected water is inadequately managed.

12.2 Item 3(g)(viii): The possible Mitigation Measures that could be applied and the level of risk

Mitigation measures for each identified impact have been proposed and are presented with the impact ratings in Section 11.1 above.

12.3 Item 3(g)(ix): Motivation where No Alternatives Sites were considered

The alternatives considered for the project include activity, location process / design, routing alternatives as well as a “No-Go” alternative. These have been detailed in Section 8 above.

12.4 Item 3(g)(x): Statement motivating the Alternative Development Location within the Overall Site

The WTP project area is proposed to be located within the KPS MRA. This location has been determined based on its intended use, namely proximities to the Balancing Dam and discharge point at Saalklapspruit. An important consideration in the selection of a suitable site was the state of the site options. Several areas within the KPS MRA have been rehabilitated following the completion of mining-related activities or have not been disturbed as part of the operations. These areas were eliminated from consideration to prevent unnecessary disturbance on rehabilitated and natural areas. The preferred development footprint is characterised as disturbed, cleared land.

13 Item 3(h): Full Description of the Process undertaken to Identify, Assess and Rank the Impacts and Risks the Activity will impose on the Preferred Site (In respect of the Final Site Layout Plan) through the Life of the Activity

The identification, assessment and ranking of potential impacts associated with the proposed project were informed by the environmental and technical specialist investigations undertaken. The determined site sensitivities were also considered in the selection of the preferred project site. The initial site layout that was presented during the Scoping Phase was not changed during the EIA phase.

14 Item 3(i): Assessment of each identified potentially significant impact and risk

Table 14-1 presents the potential impacts assessed per project activity and per phase as well as their proposed mitigation / enhancement measures.

Table 14-1: Assessment of each Identified Impact as per each Activity

Activity	Potential Impact	Aspects Affected	Phase	Significance	Mitigation Type	Significance
1.Site clearing and vegetation removal; and 2.Establishment of infrastructure (WTP and pipelines)	Soil erosion, dust generation and soil compaction.	Soil, Land Use and Land Capability	Construction	Minor (negative)	▪ Minimise through site clearing procedures; ▪ Minimise through storm-water management plan; and ▪ Minimise through dust Monitoring Programme.	Negligible (negative)
	Loss of topsoil resources as a result of construction of pipelines may occur as land is cleared along the pipeline routes.	Soil, Land Use and Land Capability	Construction	Moderate (negative)		Minor (negative)
	Loss of land use and land capability	Soil, Land Use and Land Capability	Construction	Minor (negative)	▪ No land capability mitigation measures are possible during this phase; and ▪ Remedy through soil management programme.	Minor (negative)
	Direct loss of floral species/vegetation types and biodiversity	Flora and Fauna	Construction	Minor (negative)	▪ Minimise through Biodiversity Action Plan; ▪ Control through Alien Management Plan; and ▪ Control through Rehabilitation Plan	Negligible (negative)
	Potential loss of species of special concern (protected species)	Flora and Fauna	Construction	Minor (negative)	▪ Control through relocation of Red Data flora species; ▪ Minimise through Biodiversity Action Plan; ▪ Control through Alien Management Plan; and ▪ Control through Rehabilitation Plan	Negligible (negative)
	Alien vegetation establishment	Flora and Fauna	Construction	Minor (negative)	▪ Minimise through Biodiversity Action Plan; ▪ Control through Alien Management Plan; and ▪ Control through Rehabilitation Plan	Negligible (negative)
	Soil erosion and subsequent sedimentation of wetland and river systems; Reduce catchment yields and surface water recharge to the systems further downstream.	Wetlands	Construction	Moderate (negative)	▪ Minimise through soil management programme; and ▪ Minimise through Storm Water Management Plan	Minor (negative)
	Increased runoff, erosion, sedimentation and possible increase in contaminants / chemicals in the downstream watercourses.	Aquatic Ecology	Construction	Minor (negative)	▪ Minimise through soil management programme; and ▪ Minimise through Storm Water Management Plan	Negligible (negative
	Siltation of surface water resources due to increased suspended solids resulting from soil erosion.	Surface Water	Construction	Negligible (negative)	▪ Minimise through Storm Water Management Plan ▪ Control through Dust Management Plan	Negligible (negative)
	The impact of siltation resulting in the deterioration of water quality and adverse impacts on aquatic life and downstream water users.	Surface Water	Construction	Minor (negative)		Negligible (negative)
	Lowering of groundwater table.	Groundwater	Construction	Negligible (negative)	▪ Avoid through project designs	Negligible (negative)
	Noise disturbance from construction machinery and vehicles (however will not impact on any receptors).	Noise	Construction	Negligible (negative)	▪ Avoid through Vehicle and Machinery Maintenance Plan	Negligible (negative)

Activity	Potential Impact	Aspects Affected	Phase	Significance	Mitigation Type	Significance
	Site clearance resulting in visual impact on the receiving environment.	Visual	Construction	Minor (negative)	▪ Minimise through project designs; and ▪ Control through Dust Management Plan	Minor (negative)
	Visual disturbance caused by the establishment of WTP.	Visual	Construction	Moderate (negative)		Minor (negative)
	Visual disturbance caused by the establishment of pipelines.	Visual	Construction	Minor (negative)		Minor (negative)
3. Operation of WTP and pipelines; and 4.Maintenance of infrastructure	Soil erosion, soil compaction and soil compaction	Soils, Land Use and Land Capability	Operational	Minor (negative)	▪ Minimise through site clearing procedures; ▪ Minimise through storm-water management plan; and ▪ Minimise through dust Monitoring Programme.	Negligible (negative)
	Noise disturbance from WTP and maintenance activities (however will not impact on any receptors).	Noise	Operational	Negligible (negative)	▪ Avoid through Vehicle and Machinery Maintenance Plan	Negligible (negative)
	Reduced ecological integrity and functioning of wetlands.	Wetlands	Operational	Minor (negative)	▪ Minimise through soil management programme; and ▪ Minimise through Storm Water Management Plan	Negligible (negative)
5. Discharge of treated water into the Saalklapspruit	Reduced ecological integrity and functioning of wetlands.	Wetlands	Operational	Minor (negative)		Negligible (negative)
	Increased flow rates in the downstream watercourse deterring aquatic biota with a specific flow and habitat preferences; and also potentially result in erosion, sedimentation and bank and channel modification.	Aquatic Ecology	Operational	Minor (negative)	▪ Avoid through project designs; ▪ Minimise through Soil management programme; and ▪ Minimise through Storm Water Management Plan	Negligible (negative)
	Clean water entering the Saalklapspruit SQR of concern.	Aquatic Ecology	Operational	Minor (positive)	▪ Enhance through project designs; ▪ Control through Water Quality Monitoring Programme	Minor (positive)
	Alteration of natural hydrology, channel width may and reduced bank stability due to increased runoff.	Surface Water	Operational	Moderate (negative)	▪ Avoid through project designs; ▪ Minimise through soil management programme; and ▪ Storm Water Management Plan including dissipation structures	Minor (negative)
	Instream water quality improvement as a result of dilution with treated water.	Surface Water	Operational	Major (positive)	▪ Enhance through project designs; ▪ Control through Water Quality Monitoring Programme	Major (positive)
	Restoration of runoff catchment yield as a result of reintroducing water lost to mining activities into the Saalklapspruit.	Surface Water	Operational	Major (positive)	▪ Control through Water Quantity Monitoring Programme	Major (positive)
6. Demolition and removal of all infrastructure; and 7. Rehabilitation	Soil erosion and soil compaction if rehabilitation is not done correctly.	Soils, Land Use and Land Capability	Decommissioning and rehabilitation	Minor (negative)	▪ Minimise through site clearing procedures; ▪ Minimise through storm-water management plan and rehabilitation plan; and ▪ Minimise through Dust Monitoring Programme.	Negligible (negative)
	Restoration of vegetation and habitat types.	Flora and Fauna	Decommissioning and rehabilitation	Minor (positive)	▪ Minimise through Biodiversity Action Plan; ▪ Control through Alien Management Plan; and	Minor (positive)

Activity	Potential Impact	Aspects Affected	Phase	Significance	Mitigation Type	Significance
	Rehabilitation of infrastructure footprint areas	Flora and Fauna	Decommissioning and rehabilitation	Moderate (positive)	▪ Control through Rehabilitation Plan.	Moderate (positive)
	Reduced ecological integrity and functioning of wetlands as a result of potential soil compaction, soil erosion and consequent sedimentation of freshwater resources as well as potential encroachment of alien invasive plant species as a result of habitat fragmentations.	Wetlands	Decommissioning and rehabilitation	Minor (negative)	▪ Minimise through Soil management programme; and ▪ Minimise through Storm Water Management Plan	Negligible (negative)
	Workings and the use of machinery in the upstream area associated with the pipeline has the potential to degrade downstream water quality and chemistry depending on the extent of runoff from the decommissioning area.	Aquatic Ecology	Decommissioning and rehabilitation	Minor (negative)		Negligible (negative)
	Noise disturbance from decommissioning machinery and vehicles (however will not impact on any receptors).	Noise	Decommissioning and rehabilitation	Negligible (negative)	▪ Avoid through Vehicle and Machinery Maintenance Plan	Negligible (negative)
	Closure of the WTP, pipelines and associated infrastructure is expected to have a negative visual impact on the receiving environment during the day.	Visual	Decommissioning and rehabilitation	Minor (negative)	▪ Control through Dust Management Plan	Minor (negative)

15 Item 3(j): Summary of specialist reports

Numerous specialist impact assessments were undertaken for the proposed project. Separate specialist reports were compiled and have been attached as appendices to this report (refer to Table 10-1 above). The specialist input included the baseline environment, potential impacts and the recommended mitigation measures. Table 15-1 provides a summary of the key recommendations of the studies.

Table 15-1: Specialist Studies undertaken for the proposed WTP Project

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
Soils, Land Use and Land Capability Impact Assessment	▪ Runoff must be controlled and managed by use of proper storm water management facilities; ▪ Fuel and oil spills are common risks. If they occur, hydrocarbon spills should be remediated using commercially available emergency clean up kits; and ▪ Clearing and removal of soils should be done during dry months (May to September) if possible to reduce erosion and compaction on soils.	X - All recommendations have been considered and included in the EIA report.	Mitigation and management measures included in this report were recommended by the Soil Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5 and 6 and the monitoring provided in Section 8.
Flora and Fauna Impact Assessment	▪ The project area is mostly associated with degraded grassland. Disturbance should be maintained within this habitat as far as possible; ▪ Throughout the project life, re-vegetate of open areas must be undertaken to prevent erosion; ▪ Sensitive landscapes, namely riparian areas are present within the project area. These must be demarcated and strictly avoided; ▪ Applications for permits for removal of certain plants, where required must be undertaken accordingly; ▪ If plants of SSC are to be removed, they should be either translocated to a similar habitat to the donor site or relocated to a nursery.	X - All recommendations have been considered and included in the EIA report.	Mitigation and management measures included in this report were recommended by the Ecologist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5 and 6 and the monitoring provided in Section 8.

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
	▪ The further infestation of alien vegetation must be avoided through a comprehensive monitoring and removal programme.		
Surface Water Impact Assessment	▪ The current water quality status recorded along the Saalklapspruit is generally considered to be of poor quality and contaminated. The project will result in the release of clean water which will be a positive impact, improving the in-stream water quality and increasing catchment yields. Continuous testing of treated water is imperative to ensuring this positive impact is realised. ▪ A key potential impact associated with the proposed discharge into the Saalklapspruit is the alteration of the natural hydrology as well as reduced bank stability caused by erosion associated with water flows. It is imperative that energy dissipaters be installed at the discharge point to avoid erosion of the riverbed and banks. These could be in a form of gabions, silt trap, chutes spillway, etc. to ensure reduction of water velocity.	X - All recommendations have been considered and included in the EIA report.	Mitigation and management measures included in this report were recommended by the Hydrologist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5 and 6 and the monitoring provided in Section 8.
Wetlands Impact Assessment	▪ The proposed project is not expected to result in a direct loss of wetland habitat. Associated impacts such as soil erosion which could subsequently result in sedimentation of wetlands and river systems is however possible. It is therefore imperative that a soil management programme is implemented and maintained to minimise erosion and sedimentation; ▪ Access must be restricted within the 100m zone of regulation for all freshwater features identified; ▪ If it is absolutely unavoidable that any of the wetland areas present will be affected, disturbance must be minimised and suitably rehabilitated; and ▪ Wetlands should be monitored monthly during construction.	X - All recommendations have been considered and included in the EIA report.	Mitigation and management measures included in this report were recommended by the Wetland Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5 and 6 and the monitoring provided in Section 8.
Aquatic Ecology Impact Assessment	▪ Potential sedimentation of river systems may adversely impact aquatic biota. Therefore it is imperative that soil erosion measures are in place to the potential for sedimentation; ▪ High rainfall periods (i.e. usually December to March) should be avoided as far as possible during construction and decommissioning to possibly avoid increased surface runoff; and ▪ Discharge into the Saalklapspruit may increase low rates in the downstream watercourse deterring aquatic biota with a specific flow and habitat preferences. It is therefore recommended that armoured outlets utilising naturally occurring rocks be installed to reduce the intensity of the flow from the pipeline outlet or dissipation structures.	X - All recommendations have been considered and included in the EIA report.	Mitigation and management measures included in this report were recommended by the Aquatics Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5 and 6 and the monitoring provided in Section 8.
Noise Impact Assessment	The predictive generated to quantify the expected noise levels associated with the project show that there will be a negligible impact and noise disturbance will not impact any nearby receptors. Due to the negligible nature of the potential noise impact, it is not recommended that a noise monitoring programme be implemented from the onset. In the event of a complaint being received however, it is recommended to monitor the noise levels.	X - All recommendations have been considered and included in the EIA report.	Mitigation and management measures included in this report were recommended by the Soil Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5 and 6 and the monitoring provided in Section 8.

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
Visual Impact Assessment	▪ As much existing natural vegetation as possible should be retained, to conceal the development; ▪ Areas susceptible to dust should be frequently wetted by means of a water bowser during the construction phase; ▪ Surface infrastructure should be painted natural hues so as to blend into the surrounding landscape where possible; ▪ Educate receptors on the benefits of the project to change their perceptions of the visual impact; ▪ Natural vegetation screens are recommended around the perimeter of the project footprint; and ▪ An appropriate grievance mechanism should be developed to respond to grievances from receptors that relate to visual aspects.	X - All recommendations have been considered and included in the EIA report.	Mitigation and management measures included in this report were recommended by the GIS Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5 and 6 and the monitoring provided in Section 8.
Social Impact Assessment	It is recommended that any unskilled job opportunities be offered to community members from nearby Phola. This could include labour intensive activities such as site clearance by hand, fencing off the construction area, etc. The use of local labour will be in support of the mine's intention of showing goodwill to neighbouring communities and, at the same time, reduce the risk for conflict between newcomers and residents (often local feel 'foreigners' take away their opportunities).	X - All recommendations have been considered and included in the EIA report.	Mitigation and management measures included in this report were recommended by the Social Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 11, as well as the recommendations provided in Part B Sections 5 and 6 and the monitoring provided in Section 8.
Rehabilitation, Decommissioning and Financial Provision Assessment	The following is recommended to assist South32 in successfully carrying out the rehabilitation and closure of the WTP project at KPS: ▪ Regular water monitoring should take place to determine possible changes in water quality of nearby natural sources ▪ Brine 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.	X - All recommendations have been considered and included in the EIA report.	All mitigation and management measures included in this report were recommended by the Rehabilitation and Closure Specialist.

16 Item 3(k): Environmental Impact Statement

16.1 Item 3(k)(i): Summary if the Key Findings of the Environmental Impact Assessment

Due to the disturbed nature of the specific development footprint, the significance of most identified impacts specifically associated with the construction and operation of the proposed WTP would be minor to negligible, after mitigation has been adopted. The most significant negative impacts identified are associated with site clearing which may result in soil erosion and subsequent sedimentation of watercourses. In addition, alterations of the natural hydrology and aquatic biota may occur which is associated with increased stream flows as a result of the proposed discharge into the Saalklapspruit.

The proposed discharge of treated water into the Saalklapspruit has been deemed a major positive impact. The current water quality status recorded along the Saalklapspruit shows the system is negatively impacted and is considered to be of poor quality and contaminated. The project will result in the release of water that complies with the Wilge River Catchment RWQO which will dilute the already impacted water and hence improve the in-stream water quality. Discharging treated water will also increase catchment yields that will compensate for water diverted and contained for mining activities. More water will therefore be available within the catchment, benefiting the ecosystem and downstream water users.

16.2 Item 3(k)(ii): Final Site Map

The final proposed infrastructure layout plan is provided in Plan 3, Appendix 2.

16.3 Item 3(k)(iii): Summary of the Positive and Negative Implications and Risks of the Proposed Activity and Identified Alternatives

The key potential positive implications associated with the proposed project include the improved water quality and increased water quantity of the Saalklapspruit stream as a result of the discharge of treated water, and the reduced risk associated with the storage of excessive amounts of mine affected water, namely uncontrolled release into the natural environment.

The key negative implications include the loss of topsoil resources as a result of construction of pipelines, soil erosion and subsequent sedimentation of wetland and river systems from cleared areas as well as potential alterations of natural stream hydrology and channel width due to increased discharges into the Saalklapspruit.

The potential risks identified as a result of the proposed project include hydrocarbon spills from vehicles, heavy machinery, hazardous materials or waste storage facilities, and spills / leaks from pipelines.

Mitigation and management measures have been proposed for each identified impact. Should these be correctly implemented the significance of all impacts can be reduced to negligible or

minor. In terms of the positive implications, enhancement measures have been proposed to ensure that these impacts are realised.

In terms of alternatives, the treatment and subsequent release of water into the Saalklapspruit has been deemed the most feasible option to manage the risks associated with excess mine-affected water at KPS, whereby the associated negative impacts can be effectively managed.

17 Item 3(l): Proposed Impact Management Objectives and the Impact Management Outcomes for Inclusion in the EMPR

The EMP seeks to achieve a required end state and describes how activities that have, or could have, an adverse impact on the environment and surrounding communities will be mitigated, controlled and monitored. The key objectives of the EMP therefore are:

- To minimise the extent of an impact during the life of the project;
- To ensure appropriate restoration of areas affected by the project; and
- To prevent long term environmental degradation.

18 Item 3(m): Final Proposed Alternatives

The alternatives considered and motivations for the preferred alternatives are detailed in Section 8 above.

Ultimately the treatment and release of water into the Saalklapspruit has been deemed the most feasible option to negate the risks associated with the storage of excess mine affected water at KPS. The required infrastructure has been proposed on disturbed land to avoid disturbance of natural areas. Furthermore, two options for the clean water pipeline have been considered. These routes take into account current and future mining and rehabilitation activities along the route the pipelines traverse. Both pipeline routes will be utilised during the operation of the project.

19 Item 3(n): Aspects for Inclusion as Conditions of Authorisation

The EAP recommends the following conditions for the DMR to consider for inclusion into the Authorisation:

- The mitigation / enhancement measures contained in the EMP must be adhered to for the overall positive implication of the project to be realised;
- Adhere to Wilge River RWQO before release;
- An Environmental Control Officer (ECO) must be appointed for the construction phase;
- A WUL must be obtained prior to operations;
- Sludge/slurry accumulation cannot exceed 80 cubes at any one time, and cannot be stored for longer than 90 days, otherwise a WML must be applied for;

- Final design for dissipation structure must be appropriate for the receiving environment and signed off by an appropriately qualified engineer;
- WTP project must form part of external audits conducted at KPS.

The specialist studies and impact assessment have been based on the proposed preferred site layout. Should there be any changes to the project description or site layout plan as provided, the adequacy and accuracy of the work may be affected and additional studies may be required to assess the impacts of these proposed changes.

20 Item 3(o): Description of any Assumptions, Uncertainties and Gaps in Knowledge

The following general assumptions are applicable to this EIA study:

- The areas surveyed for various studies conducted were based on the preliminary infrastructure layout presented by South32;
- Slurry / brine to be stored on site will accumulate to “four truck loads” prior to removal but this combined volume has not been quantified to enable the EAP to effectively determine the requirement of a WML; Applicable norms and standard will be adhered to.
- The findings presented are based on professional experience, supported by a literature review, and extrapolated from the data collected at the time of field surveys conducted. Field surveys for all studies were limited to one season surveys; and
- Representative sampling methods were employed for the studies conducted and therefore the possibility of gaps in the data gathered exists.

Table 20-1 below presents the assumptions, uncertainties, limitations and knowledge gaps relevant to the various specialist studies undertaken

Table 20-1: Specialist Studies Assumptions, Uncertainties and Gaps

Specialist Study	Assumptions, uncertainties and gaps
Soils, Land Use and Land Capability	▪ Proposed pipeline routes were surveyed using aerial imagery and verified on site; ▪ A total of two soil samples were collected on the proposed infrastructure areas; and ▪ Information provided is based on auger points taken and observations on site.
Flora and Fauna	Whilst every effort is made to cover as much of the site as possible, representative sampling is done and it is possible that some plant and animal species that are present on site were not recorded during the field investigations, due to seasonality.

Specialist Study	Assumptions, uncertainties and gaps
Wetlands	▪ Wetlands have been assessed only within the 500m area of the proposed pipeline routes and the location of the associated WTP; and ▪ With ecology being dynamic and complex, certain aspects, some of which may be important, may have been overlooked. However, wherever possible, it is expected that the project area has been accurately assessed and considered, based on the field observations undertaken in April 2018 and the consideration of historical and existing studies and the desktop data available.
Aquatic Ecology	▪ The study comprised a single site survey during the month of May 2018 (i.e. a late-autumn survey). Therefore, any potential seasonal variations to the associated aquatic ecology within the assessed river reaches could not be definitively determined and ▪ Upstream sampling site (K3) was not accessible at the timing of the survey, as it was considered unsafe by the mine Health and Safety personnel. However, no outflow from this site was observed during the field survey and thus, it was considered to be dry for this study.
Surface Water	▪ Historical water quality results for the site were provided to Digby Wells by South32 and this is assumed to be correct historical water quality data representation of the site; ▪ The floodlines were developed for environmental and indicative purposes only and not for engineering design; and ▪ It is assumed that the survey data provided by the client is an accurate and up-to-date representation of the ground level terrain.
Groundwater	▪ Process description for the KPS mine water treatment plant was provided by South32 for the EIA report. The geochemical and waste classification of the slurry and brine was not undertaken as the plant has not been constructed and no pilot plant samples have been generated (no slurry or brine available). However, it is assumed that the geochemical waste, such as the slurry or brine, will be assessed by South32 for temporary storage on site to confirm the containment facility requirements. No geochemical waste is assumed to exist on the proposed project site; and ▪ It is assumed that discharged treated waste water will comply with DWS water quality standards.
Noise	▪ The construction phase is assumed to be carried out during daytime hours (06:00-22:00), and therefore only a daytime scenario was modelled for the construction phase and the subsequent impact of the construction phase refers only to the daytime; ▪ The resulting noise contours represent worst case LAeq at any receiver located 360 degrees in the horizontal plane around the noise sources. The noise modelling software is limited to calculating the predominant wind direction (or downwind conditions of propagation) per single receptor only. Calm wind conditions have therefore been included in the

Specialist Study	Assumptions, uncertainties and gaps
	model due to the number of surrounding receptors. Thus, the noise dispersion plots do not represent a typical seasonal scenario in the predominant wind direction but rather a yearly average of the area's meteorological conditions in all directions; ▪ Modelling follows a conservative, worst-case scenario approach assuming all activities for each phase are being carried out simultaneously; and ▪ The decommissioning phase was not modelled as it will likely produce similar results to that of the construction phase due to the similar vehicles and machinery involved.
Visual	A VIA is open to subjectivity. This subjectivity is due to the different opinions / responses receptors may have of a proposed project.
Socio-economic	▪ The sources consulted are not exhaustive, and additional information that might strengthen arguments or contradict information in this report and/or identify additional information might exist; ▪ The specialist endeavoured to take an evidence-based approach in the compilation of this report and did not intentionally exclude scientific information relevant to the assessment; ▪ It was assumed that the motivation for, and the ensuing planning and feasibility studies of the project were done with integrity, and that the information provided to date by the project proponent, the independent Two options for the clean water pipeline have been considered. These routes take into account current and future mining and rehabilitation activities along the route the pipelines traverse. Both pipeline routes will be utilised during the operation of the project. Ultimately Option 2 is the most desirable, however is inaccessible currently due to mine dumps. Option 1 therefore will initially be utilised and runs along a haul road route, while Option 2 runs along the eastern edge of the MRA which will subsequently be utilised once mining/rehabilitation activities commence in the area. EAP and the public participation consultant is accurate; ▪ At the time of the study, certain project information was not available and was therefore excluded from the detailed assessment. This relates to the availability of job opportunities during the construction and operational phases, the skills levels required and the possibility of the mine utilising local labour; ▪ The WTP components will mostly be constructed off-site and then transported to site for assembly. It was therefore assumed that job opportunities will be limited, but certain suggestions were made for the utilisation of local labour for unskilled tasks on site; and ▪ A traffic assessment was not required for this project and therefore the SIA did not consider any impacts related to an increase in construction / abnormal traffic to site or the impact this could have on local road users.

21 Item 3(p): Reasoned Opinion as to whether the Proposed Activity should or should not be authorised

21.1 Item 3(p)(i): Reasons why the activity should be authorised or not

Various specialist studies were undertaken during the EIA Phase of the project with the objective of identifying and weighing anticipated impacts and risks associated with the proposed project activities.

The findings of the impact assessment have shown that the project will have some moderately significant negative impacts on the receiving environment, namely; the loss of topsoil on cleared land (mainly along the proposed pipeline routes); soil erosion and subsequent sedimentation of wetland and river systems; visual disturbance caused by the establishment of infrastructure and the potential alteration of natural hydrology, channel width and reduced bank stability caused by increased runoff associated with water discharge. Due to the current disturbed nature of the project area, the majority of identified impacts are expected to be of minor or negligible negative significance after mitigation and management measures are implemented. The project will have positive implications which have been determined to be of major significance, namely; instream water quality improvements as a result of dilution with treated water; and restoration of runoff catchment yield as a result of reintroducing water into the Saalklapspruit previously lost to mining activities.

Based on the assessment of the potential negative and positive impacts associated with the project, it is concluded that the proposed project should be authorised. No long-term negative impacts are expected to arise from the project-specific activities should the proposed mitigation measures be correctly implemented. Furthermore, direct environmental and induced social impacts that are positive can be realised from the release of treated water into the Saalklapspruit. This project is deemed the most feasible alternative to manage excess mine-affected water currently accumulating at KPS. Some spin-off benefits from the project will allow mining to continue and rehabilitation to progress on site. The no-go alternative would maintain the status quo which presents a risk for uncontrolled discharging into the natural environment.

21.2 Item 3(p)(ii): Conditions that must be included in the authorisation

21.2.1 Specific conditions to be included into the compilation and approval of EMPR

The following specific conditions are proposed:

- All mitigation measures proposed in this report and attached specialist reports should be implemented;
- The established environmental monitoring programmes currently implemented at KPS must be extended to include the WTP project infrastructure and activities;

- Unskilled employment opportunities should first be provided to community members from nearby Phola and Ogies areas. This could include labour intensive activities such as site clearance and fencing activities; and
- The closure cost assessment should be updated and submitted as per the legislative requirements.

NEMWA Activities have not been applied for as South32 has committed to not store sludge/brine on site in excess of 80m^3 at any one time, or store waste for a period longer than 90 days. South32 is aware that these limitations may not be breached.

21.2.2 Rehabilitation Requirements

A Rehabilitation and Closure Plan (RCP) has been compiled for the proposed project and is appended to this report as Appendix 14. The intent of the RCP is to provide a vision, objectives, targets and criteria for final rehabilitation. Closure and rehabilitation is a continuous series of activities that begin at the commencement of the project and construction, and end with achievement of long-term site stability and the establishment of a self-sustaining ecosystem.

Table 21-1: Summary of Rehabilitation and Closure Actions

Target Area	Main Actions
WTP Infrastructure	▪ All Infrastructure should be removed, unless legally transferred or sold to another party; ▪ All infrastructure should be demolished to 1 m 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 conducted. 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.
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.

Target Area	Main Actions
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.

22 Item 3(q): Period for which the Environmental Authorisation is required

The preferred WTP technology opted for by South32 is that of a modular plant as opposed to a fixed installation. Modular installations have a shorter operational life than that of a fixed installation; typically 10 years subject to correct maintenance and management. It is therefore recommended that the Environmental Authorisation be valid for 10 years, to accommodate the increase in the WTP's capacity over the additional two phases.

23 Item 3(r): Undertaking

Please refer to Part B, Section 12 for the complete undertaking applicable to both the EIA and EMP sections of this report.

24 Item 3(s): Financial Provision

The estimated closure cost required for the rehabilitation and closure of the WTP project is and **R 2,396,465 (Excl. VAT)**. A contingency of 10% on all infrastructure costs has been allowed for while 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.

A detailed closure cost for proposed WTP is provided in Table 24-1 below.

Table 24-1: Detailed Financial Provision Estimate

	Description: Class A (Medium risk)	Unit:	A	B	C	D	E=A*B*C*D
			Quantity	Master rate	Multiplication Factor	Weighting factor 1	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 (excluding VAT)**	**R 1,964,316**
	Preliminary and General			12% of Sub Total 1			R235,717.91
	Contingency			10% of Sub Total 1			R196,431.59
	GRAND TOTAL						**R 2,396,465**

24.1 Item 3(s)(i): Explain how the aforesaid amount was derived

The Financial Provision has been calculated in accordance with the 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. The methodology included the following aspects:

- The DMR calculation model was compiled using Microsoft Excel. The standard DMR unit rates were escalated with CPI from 2005 to 2018;
- The WTP area was classified using the risk rating table as specified in the DMR guidelines to determine the primary risk class for the project; and
- The sensitivity of the project area was determined using sensitivity criteria for biophysical, social and economic aspects which ranked the project to be of medium sensitivity.

Further detail pertaining to the methodology employed is provided in the specialist report, Appendix 14.

The following assumptions are applicable to the calculated Financial Provision:

- 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;
- The costs for sludge and brine management were not included in this assessment; as it was indicated by South32 that the waste 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 HDPE pipeline (feed water and return water lines to KPS WTP and discharge line at the Saalklapspruit) is 5,328 m;
- The building with the overhead crane, chemical store, gypsum handling and future gypsum handling structure as labelled in the conceptual infrastructure layout plan were assumed to be steel structures;
- The office, ablution facilities and workshop were 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); and
- Maintenance and aftercare costs of rehabilitation have been included.

24.2 Item 3(s)(ii): Confirm that this amount can be provided for from operating expenditure

South32 will provide for closure as legally required. A liability assessment will also need to be undertaken annually to ensure the financial provision is in line with the closure cost.

25 Item 3(t): Deviations from the Approved Scoping Report and Plan of Study

25.1 Item 3(t)(i): Deviations from the methodology used in determining the significance of potential environmental impacts and risks

There were no deviations from the plan of study as stipulated in the Scoping Report.

25.2 Item 3(t)(ii): Motivation for the deviation

There were no deviations from the plan of study as stipulated in the Scoping Report.

26 Item 3(u): Other Information required by the Competent Authority

26.1 Item 3(u)(i)(1): Impact on the socio-economic conditions of any directly affected person

The SIA undertaken for the project is appended as Appendix 13. The project is not expected to have any direct socio-economic impacts. People within the vicinity of the project may experience some nuisance impacts (visual, noise and dust) however based on the magnitude of the proposed project, these impacts would be negligible.

26.2 Item 3(u)(i)(2): Impact on any national estate referred to in section 3(2) of the National Heritage Resources Act.

Due to the disturbed nature of the specific development footprint subject to this application, no new heritage resources were identified within or close to the proposed project footprint. This negated the need for a HIA to be undertaken. In line with the provisions set out under the NHRA, a NID to was submitted to SARHA. The NID is appended to this report as Appendix 12.

27 Item 3(v): Other matters required in terms of Sections 24(4)(a) and (b) of the Act

This section is not applicable to the proposed project.

Part B: Environmental Management Programme Report

1 Item 1(a): Details of the EAP

Digby Wells and Associates South Africa (Pty) Ltd (Digby Wells) has been appointed as the independent Environmental Assessment Practitioner (EAP) to undertake the EIA process and associated IWULA. The details of the EAP are provided in below.

Table 1-1: Contact Details of the EAP

Name of Practitioner:	Xanthe Taylor
Telephone:	011 789 9495
Fax:	011 069 6801
Postal Address	Private Bag X10046, Randburg, 2125, South Africa
Email:	xanthe.taylor@digbywells.com

2 Item 1(b): Description of the aspects of the activity

Refer to Part A: Section 10 for the list of aspects associated with the proposed project which have been assessed.

3 Item 1(c): Composite Map

The Composite Map is attached as Plan 27, Appendix 2.

4 Item 1(d): Description of Impact management objectives including management statements

4.1 Item 1(d)(i): Determination of closure objectives

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 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.

4.2 Item 1(d)(ii): The process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking a listed activity

South32 has established Environmental Response Plans/Procedures for KPS which are implemented in event of unintended environmental damage or pollution. These plans/procedures are aimed at rapidly and effectively managing emergency situations that may arise at the mine.

Personnel associated with the WTP project must be trained on these plans/procedures and copies must be made accessible. Figure 4-1 provides a general overview of the Emergency Response Procedure.

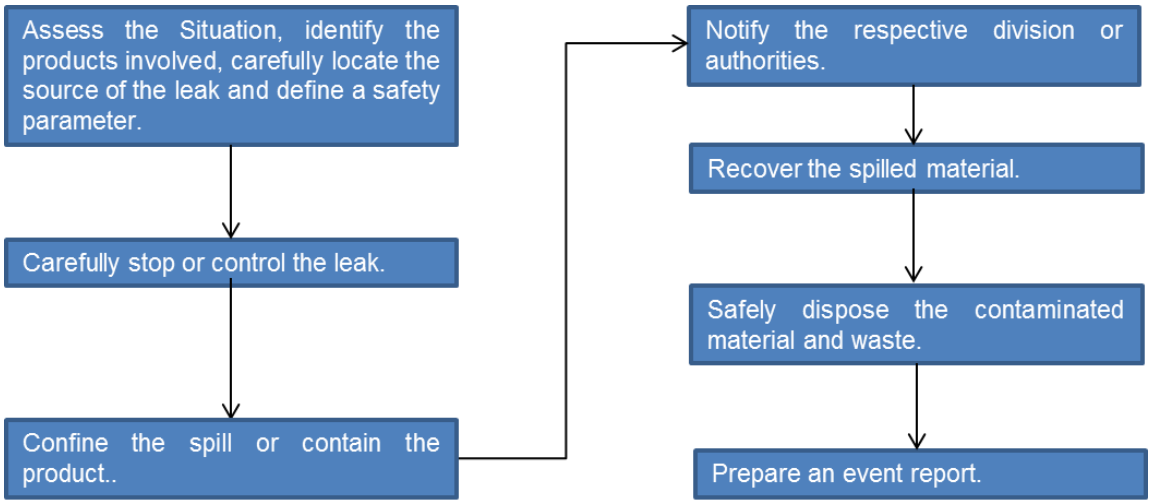


Figure 4-1: Emergency response procedure overview

4.3 Item 1(d)(iii): Potential risk of Acid Mine Drainage

This project addresses the management of mine affected water and thus is a mitigation measure for the potential risk of decant of acid mine drainage from Klipspruit Colliery.

4.4 Item 1(d)(iv): Steps taken to investigate, assess, and evaluate the impact of acid mine drainage

The potential risk for Acid Mine Drainage is not applicable to the proposed WTP project.

4.5 Item i(d)(v): Engineering or mine design solutions to be implemented to avoid or remedy acid mine drainage

The potential risk for Acid Mine Drainage is not applicable to the proposed WTP project.

4.6 Item 1(d)(vi): Measures that will be put in place to remedy any residual or cumulative impact that may result from acid mine drainage

The potential risk for Acid Mine Drainage is not applicable to the proposed WTP project.

4.7 Item 1(d)(vii): Volumes and rate of water use required for the mining, trenching or bulk sampling operation

Water to be processed through the WTP will be sourced from the Balancing Dam. No water will be directly abstracted from natural sources for this project. Following its treatment, water will be discharged into the Saalklapspruit at a rate of 0.02 m^3/s initially with an eventual discharge rate of 0.12 m^3/s when the WTP is capable of handling 10Ml/day.

4.8 Item 1(d)(viii): Has a water use licence has been applied for

South32 is in the process of applying for an IWULA from DWS as per the requirements of the NWA.

4.9 Item 1(d)(ix): Impacts to be mitigated in their respective phases

The proposed mitigation measures and its compliance with the relevant standards are presented in Table 4-1.

Table 4-1: Impacts to be mitigated

Activity	Aspect Affected	Phase	Size and scale of disturbance	Mitigation Type	Compliance with standards	Time period for implementation
1.Site clearing and vegetation removal; and 2.Establishment of infrastructure (WTP and pipelines)	Soil, Land Use and Land Capability	Construction	Infrastructure footprint (50ha)	▪ Only clear vegetation when and where necessary; ▪ Only remove topsoil when and where necessary ; ▪ Only the designated access routes are to be used; ▪ If erosion occurs, corrective actions must be taken to minimise any further erosion from taking place; and ▪ Ensure proper storm water management designs are in place. ▪ Effective monitoring and management of topsoil areas for compaction, erosion and compaction.	Minerals Council of South Africa Guidelines	Design and Construction Phase
	Flora and Fauna	Construction	Infrastructure footprint (50ha)	▪ Limit degradation and destruction of natural environment to designated project areas; ▪ Re-vegetate open areas to limit erosion, which will also aid in water infiltration and flood attenuation; ▪ Avoid sensitive landscapes such as riparian areas, and wetland areas that were encountered on site; ▪ Applications for permits for removal of certain plants, where required by provincial authorities; ▪ If plants of SSC are to be removed, they should be either translocated to a similar habitat to the donor site or relocated to a nursery; and ▪ If alien vegetation is encountered, these species should be removed in the correct way and timeously.	NEMA; and NEMBA.	Construction Phase
	Wetlands	Construction	44 ha	▪ Ensure soil management programme is implemented and maintained to minimise erosion and sedimentation; ▪ Erosion berms should be installed on roadways and downstream of stockpiles; ▪ The disturbed footprint must be limited to what is absolutely essential; ▪ If it is absolutely unavoidable that any of the wetland areas present will be affected, disturbance must be minimised and suitably rehabilitated; ▪ Ensure that no incision and canalisation of the wetland features present takes place; ▪ Active rehabilitation, re-sloping, and re-vegetation of disturbed areas immediately after construction must be undertaken; ▪ All soils compacted as a result of construction activities should be ripped/scarified (<300mm) and profiled in accordance with the guidelines set out in the Soils, Land Use and Land Capability Report (Appendix 4);	Section 19 of the NWA NEM:BA NEMA DWAF guidelines for the delineation of wetlands (2005); Mining and Biodiversity Guideline (DEA et al., 2013).	Design and construction phase
	Aquatic Ecology	Construction	Local	▪ Limit vegetation removal to the infrastructure footprint area only where removed or damaged vegetation areas (riparian or aquatic related) should be revegetated; ▪ Environmentally friendly barrier systems, such as silt nets or in severe cases the use of trenches, can be used downstream from construction sites to limit erosion and possibly trap contaminated runoff from construction; ▪ Storm water must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow;	NWA	Design and construction phase

Activity	Aspect Affected	Phase	Size and scale of disturbance	Mitigation Type	Compliance with standards	Time period for implementation
				▪ Ensure proper storm water management designs are in place at construction sites to prevent contaminants from entering the water course; ▪ Construction chemicals should be used and stored in an environmentally safe manner; and ▪ High rainfall periods (i.e. usually December to March) should be avoided during construction to possibly avoid increased surface runoff.		
	Surface Water	Construction	Local	▪ Clearing of vegetation and excavation should be limited as far as possible; ▪ For any required soil stockpiles, these should be compacted and the slopes should be kept at minimal/low to avoid erosion; ▪ Dust suppression measures must be undertaken on the cleared areas during construction; ▪ Runoff from this area should be directed to the existing storm water management infrastructures and should not be allowed to flow into the stream; ▪ No water should be abstracted from the stream for construction; and ▪ All hazardous material storage areas should be appropriately bunded and spill kits should be in place.	NWA	Design and construction phase
	Groundwater	Construction	Local	▪ Site clearance and removal of top soil and vegetation should be limited as far as possible and managed efficiently; and ▪ Continue with current groundwater monitoring programme.	NWA	Design and construction phase
	Visual	Construction	Local	▪ Only remove vegetation within the infrastructure areas; ▪ Only remove topsoil within the infrastructure areas; and ▪ Apply dust suppression techniques to limit dust generated from the topsoil spoils. ▪ Where possible, surface infrastructure must be painted natural hues so that it blends into the surrounding landscape; ▪ Avoid construction activities at night. If required, down lighting and low-pressure sodium light sources must be implemented to minimise light pollution; and ▪ If possible, bury the pipelines to remove any long-term visual impact.	To minimise the negative visual impacts caused by construction of infrastructure.	Construction Phase
3. Operation of WTP and pipelines; and 4.Maintenance of infrastructure	Soils, Land Use and Land Capability	Operational	Infrastructure footprint (50ha)	▪ Maintenance and inspections of pipelines must be done to minimise compaction and erosion; and ▪ Check leakages on the pipelines regularly to avoid major contamination.	Minerals Council South Africa Guidelines	Throughout Operational Phase
	Wetlands	Operational	44 ha	▪ Ensure that as far as possible all operational infrastructures are placed outside of freshwater areas and their associated 100m zones of regulation; ▪ Ensure that no incision and canalisation of the freshwater features present takes place as a result of the proposed operational activities; ▪ All erosion noted within the operational footprint should be remedied immediately and included as part of the ongoing rehabilitation plan; ▪ Erosion berms should be installed on roadways and downstream of stockpiles to prevent gully formation and siltation of the freshwater resources.	Section 19 of the NWA NEM:BA NEMA DWAF guidelines for the delineation of wetlands (2005);	Throughout Operational Phase

Activity	Aspect Affected	Phase	Size and scale of disturbance	Mitigation Type	Compliance with standards	Time period for implementation
				▪ An alien invasive plan control programme must be put in place so as to prevent further encroachment to the surrounding terrestrial zones; ▪ No unnecessary crossing of the wetland features and their associated buffers should take place and the substrate conditions of the wetlands and downstream stream connectivity must be maintained; and ▪ All soils compacted as a result of construction activities should be ripped/scarified (<300mm) and profiled.	Mining and Biodiversity Guideline (DEA et al., 2013).	
5. Discharge of treated water into the Saalklapspruit	Wetlands	Operational	Local	▪ Water should be treated and tested to ensure it meets appropriate standards before being released; ▪ Annual biomonitoring of wetland crossing points and at the point of discharge must take place; ▪ Water must be discharged diffusely to reduce channelisation and erosion of the wetland downstream;	NWA; NEMA	Throughout Operational Phase
	Aquatic Ecology	Operational	Local	▪ Limit potential erosion and sedimentation by discharging water before the river into a silt basin; ▪ Armoured outlets utilising naturally occurring rocks can be installed to reduce the intensity of the flow from the pipeline outlet to attempt to limit immediate erosion; ▪ Baffles/dissipation structures can be used to further diffuse flow from the pipeline if erosion issues persist; ▪ Monitoring of the culvert from the discharge to under the N12 highway should take place in order to ensure no backfill or pools start to form; and ▪ Revegetation should take place in sections that have been washed out due to the increased flow. ▪ No enhancement actions are required to improve the downstream water quality. However, it is essential that the water being discharged is in fact clean water that meets discharge standards.	NWA	Throughout Operational Phase
	Surface Water	Operational	Local	▪ Energy dissipaters must be installed at the discharge point to avoid erosion of the riverbed and banks. These could be in a form of gabions, silt trap, chutes spillway, etc. to ensure reduction of water velocity. ▪ Water quality monitoring should continue at the discharge outlet and downstream points of the Saalklapspruit to ensure the WTP effectiveness.	NWA	Throughout Operational Phase
6. Demolition and removal of all infrastructure; and 7. Rehabilitation	Soils, Land Use and Land Capability	Decommissioning and rehabilitation	Infrastructure footprint (50ha)	▪ Rehabilitate according to the rehabilitation plan; ▪ Return the land conditions capable of supporting prior land use or uses equal to/ better than prior land use; ▪ Plant native vegetation to prevent erosion and encourage a self-sustaining productive ecosystem; and ▪ Remove buildings to foundation level. Demolished rubble must be disposed of in accordance with Rehabilitation Plan.	Minerals Council of South Africa Guidelines	Throughout Decommissioning and Rehabilitation Phase
	Flora and Fauna	Decommissioning and rehabilitation	Infrastructure footprint (50ha)	▪ Revegetation should be undertaken in accordance with the developed Closure and Rehabilitation Plan (Appendix 14) no further measures to enhance this impact are proposed.	NEMBA	Throughout Decommissioning and Rehabilitation Phase
	Wetlands	Decommissioning and rehabilitation	44 ha	▪ All erosion noted within the decommissioning and rehabilitation area footprint should be remedied immediately;	NWA	Throughout Decommissioning

Activity	Aspect Affected	Phase	Size and scale of disturbance	Mitigation Type	Compliance with standards	Time period for implementation
				▪ All soils compacted as a result of decommissioning activities should be ripped/scarified (<300mm) and profiled; ▪ Permit only essential personnel within the 100m zones of regulation for all freshwater features identified; ▪ Wherever possible, restrict decommissioning activities to the drier winter months to avoid sedimentation of the freshwater resources further downstream; ▪ Wetlands and their associated zones of regulation are to be clearly demarcated and avoided wherever possible; ▪ Ongoing wetland rehabilitation is necessary both within and in the vicinity of the proposed decommissioning, rehabilitation and closure footprint.	DWAF guidelines for the delineation of wetlands (2005); Mining and Biodiversity Guideline (DEA et al., 2013).	and Rehabilitation Phase
	Aquatic Ecology	Decommissioning and rehabilitation	Local	▪ Bare land surfaces downstream from the decommissioning activities should be vegetated to limit erosion; ▪ Drainage lines and compact soils formed from vehicular use and general decommissioning activities should be rehabilitated to limit runoff; ▪ Chemicals, such as machinery oils and hydrocarbons, should be used in an environmentally safe manner and stored correctly to prevent spillage; and ▪ High rainfall periods (i.e. usually December to March) should be avoided during this phase in order to possibly avoid increased surface runoff in attempt to limit erosion.	NWA	Throughout Decommissioning and Rehabilitation Phase

5 Item 1(e): Impact Management Outcomes

A description of the objectives and outcomes of the EMP is outlined in Table 5-1.

Table 5-1: Objectives and outcomes of the EMP

Activities	Potential Impact	Aspects Affected	Phase	Mitigation Type	Standard to be achieved
1.Site clearing and vegetation removal; and 2.Establishment of infrastructure (WTP and pipelines)	Soil erosion, dust generation and soil compaction.	Soil, Land Use and Land Capability	Construction	▪ Minimise through site clearing procedures; ▪ Minimise through storm-water management plan; and ▪ Minimise through dust Monitoring Programme.	Soil Management in terms of the Minerals Council South Africa for Rehabilitation; and To prevent the loss of top soil as a resource
	Loss of topsoil resources as a result of construction of pipelines may occur as land is cleared along the pipeline routes.	Soil, Land Use and Land Capability	Construction	▪ Minimise through site clearing procedures; and ▪ Minimise through soil management programme.	
	Loss of land use and land capability	Soil, Land Use and Land Capability	Construction	▪ Minimise through soil management programme.	
	Direct loss of floral species/vegetation types and biodiversity	Flora and Fauna	Construction	▪ Minimise through Biodiversity Action Plan; ▪ Control through Alien Management Plan; and ▪ Control through Rehabilitation Plan	To minimise the loss of habitat
	Potential loss of species of special concern (protected species)	Flora and Fauna	Construction	▪ Control through relocation of Red Data flora species; ▪ Minimise through Biodiversity Action Plan; ▪ Control through Alien Management Plan; and ▪ Control through Rehabilitation Plan	To minimise the loss of Red Data plant species
	Alien vegetation establishment	Flora and Fauna	Construction	▪ Minimise through Biodiversity Action Plan; ▪ Control through Alien Management Plan; and ▪ Control through Rehabilitation Plan	To prevent further encroachment of alien plant species and limit fragmentation
	Soil erosion and subsequent sedimentation of wetland and river systems;	Wetlands	Construction	▪ Minimise through soil management programme; and ▪ Minimise through Storm Water Management Plan	To prevent unnecessary impacts on wetlands
	Reduce catchment yields and surface water recharge to the systems further downstream.	Wetlands	Construction	▪ Minimise through Storm Water Management Plan	To prevent water loss to wetlands
	Increased runoff, erosion, sedimentation and possible increase in contaminants / chemicals in the downstream watercourses.	Aquatic Ecology	Construction	▪ Minimise through soil management programme; and ▪ Minimise through Storm Water Management Plan	To prevent loss of aquatic habitats
	Siltation of surface water resources due to increased suspended solids resulting from soil erosion.	Surface Water	Construction	▪ Minimise through Storm Water Management Plan ▪ Control through Dust Management Plan	To prevent siltation of surface water resources
	The impact of siltation resulting in the deterioration of water quality and adverse impacts on aquatic life and downstream water users.	Surface Water	Construction	▪ Minimise through Storm Water Management Plan ▪ Control through Dust Management Plan	To prevent water contamination caused by siltation of surface water resources
	Lowering of groundwater table.	Groundwater	Construction	▪ Avoid through project designs	To prevent excavation below the water table
	Noise disturbance from construction machinery and vehicles (however will not impact on any receptors).	Noise	Construction	▪ Avoid through Vehicle and Machinery Maintenance Plan	To minimise noise levels

Activities	Potential Impact	Aspects Affected	Phase	Mitigation Type	Standard to be achieved
	Site clearance resulting in visual impact on the receiving environment.	Visual	Construction	▪ Minimise through project designs; and ▪ Control through Dust Management Plan	To minimise the negative visual impacts caused by site clearance
	Visual disturbance caused by the establishment of WTP.	Visual	Construction	▪ Minimise through project designs; and ▪ Control through Dust Management Plan	To minimise the negative visual impacts caused by the establishment of WTP
	Visual disturbance caused by the establishment of pipelines.	Visual	Construction	▪ Minimise through project designs	To minimise the negative visual impacts caused by the establishment of pipeline infrastructure
3. Operation of WTP and pipelines; and 4.Maintenance of infrastructure	Soil erosion, soil compaction and soil compaction	Soils, Land Use and Land Capability	Operational	▪ Minimise through site clearing procedures; ▪ Minimise through storm-water management plan; and ▪ Minimise through Dust Monitoring Programme.	Soil Management in terms of the Minerals Council South Africa for Rehabilitation; and To prevent the loss of top soil as a resource
	Noise disturbance from WTP and maintenance activities (however will not impact on any receptors).	Noise	Operational	▪ Avoid through Vehicle and Machinery Maintenance Plan	To minimise noise levels caused by the operation of the WTP and maintenance activities
	Sedimentation resulting in reduced ecological integrity and functioning of wetlands.	Wetlands	Operational	▪ Minimise through soil management programme; and ▪ Minimise through Storm Water Management Plan	To prevent unnecessary sedimentation on wetlands
5. Discharge of treated water into the Saalklapspruit	Increased stream flow resulting in reduced ecological integrity and functioning of wetlands.	Wetlands	Operational	▪ Avoid through project designs; ▪ Minimise through Soil management programme; and ▪ Minimise through Storm Water Management Plan	To prevent unnecessary impacts to wetlands
	Increased flow rates in the downstream watercourse deterring aquatic biota with a specific flow and habitat preferences; and also potentially result in erosion, sedimentation and bank and channel modification.	Aquatic Ecology	Operational	▪ Avoid through project designs; ▪ Minimise through Soil management programme; and ▪ Minimise through Storm Water Management Plan	To prevent extensive alterations or loss of aquatic habitat
	Clean water entering the Saalklapspruit SQR of concern.	Aquatic Ecology	Operational	▪ Enhance through project designs; ▪ Control through Water Quality Monitoring Programme	To enhance potential positive impacts associated with clean water discharge into a natural stream
	Alteration of natural hydrology, channel width may reduce bank stability due to increased runoff.	Surface Water	Operational	▪ Avoid through project designs; ▪ Minimise through soil management programme; and ▪ Storm Water Management Plan	To prevent extensive alterations or loss of aquatic habitat
	Instream water quality improvement as a result of dilution with treated water.	Surface Water	Operational	▪ Enhance through project designs; ▪ Control through Water Quality Monitoring Programme	To enhance potential positive impacts associated with clean water discharge into a natural stream
	Restoration of runoff catchment yield as a result of reintroducing water lost to mining activities into the Saalklapspruit.	Surface Water	Operational	▪ Control through Water Quantity Monitoring Programme	To enhance potential positive impacts associated with clean water discharge into a natural stream

Activities	Potential Impact	Aspects Affected	Phase	Mitigation Type	Standard to be achieved
6. Demolition and removal of all infrastructure; and 7. Rehabilitation	Soil erosion and soil compaction if rehabilitation is not done correctly.	Soils, Land Use and Land Capability	Decommissioning and rehabilitation	▪ Minimise through site clearing procedures and rehabilitation procedures; ▪ Minimise through storm-water management plan; and ▪ Minimise through Dust Monitoring Programme.	Soil Management in terms of the Minerals Council South Africa Guidelines for Rehabilitation; and To prevent the loss of top soil as a resource
	Restoration of vegetation and habitat types.	Flora and Fauna	Decommissioning and rehabilitation	▪ Minimise through Biodiversity Action Plan; ▪ Control through Alien Management Plan; and ▪ Control through Rehabilitation Plan.	To ensure revegetation is successful and results in the restoration of the natural habitat types
	Rehabilitation of infrastructure footprint areas	Flora and Fauna	Decommissioning and rehabilitation	▪ Minimise through Biodiversity Action Plan; ▪ Control through Alien Management Plan; and ▪ Control through Rehabilitation Plan.	To ensure revegetation is successful and results in the restoration of the natural habitat types
	Reduced ecological integrity and functioning of wetlands as a result of potential soil compaction, soil erosion and consequent sedimentation of freshwater resources as well as potential encroachment of alien invasive plant species as a result of habitat fragmentations.	Wetlands	Decommissioning and rehabilitation	▪ Minimise through Soil management programme; and ▪ Minimise through Storm Water Management Plan	To prevent unnecessary impacts on wetlands
	Workings and the use of machinery in the upstream area associated with the pipeline has the potential to degrade downstream water quality and chemistry depending on the extent of runoff from the decommissioning area.	Aquatic Ecology	Decommissioning and rehabilitation	▪ Minimise through Soil management programme; and ▪ Minimise through Storm Water Management Plan	To prevent contamination and loss of aquatic habitats
	Noise disturbance from decommissioning machinery and vehicles (however will not impact on any receptors).	Noise	Decommissioning and rehabilitation	▪ Avoid through Vehicle and Machinery Maintenance Plan	To minimise noise levels caused by decommissioning activities

6 Item 1(f): Impact Management Actions

A description of impact management actions, identifying the manner in which the impact management objectives and outcomes contemplated in paragraphs 4.9 and 5 (Part B) will be achieved in Table 6-1.

Table 6-1: Impact management actions

Activity	Potential Impact	Aspects Affected	Phase	Mitigation Measures	Compliance with standards
1.Site clearing and vegetation removal; and 2.Establishment of infrastructure (WTP and pipelines)	Soil erosion, dust generation and soil compaction.	Soil, Land Use and Land Capability	Construction	▪ Only clear vegetation when and where necessary; ▪ Only remove topsoil when and where necessary; ▪ Only the designated access routes are to be used; ▪ If erosion occurs, corrective actions must be taken to minimise any further erosion from taking place; and ▪ Ensure proper storm water management designs are in place.	Minerals Council South Africa Guidelines
	Loss of topsoil resources as a result of construction of pipelines may occur as land is cleared along the pipeline routes.	Soil, Land Use and Land Capability	Construction		Minerals Council South Africa Guidelines
	Loss of land use and land capability	Soil, Land Use and Land Capability	Construction	▪ No land capability mitigation measures are possible during this phase; and ▪ Effective monitoring and management of topsoil areas for compaction, erosion and compaction.	Minerals Council South Africa Guidelines
	Direct loss of floral species/vegetation types and biodiversity	Flora and Fauna	Construction	▪ Limit degradation and destruction of natural environment to designated project areas; ▪ Re-vegetate open areas to limit erosion, which will also aid in water infiltration and flood attenuation; and ▪ Avoid sensitive landscapes such as riparian areas, and wetland areas that were encountered on site.	NEMA; and NEMBA.
	Potential loss of species of special concern (protected species)	Flora and Fauna	Construction	▪ Applications for permits for removal of certain plants, where required by provincial authorities; and ▪ If plants of SSC are to be removed, they should be either translocated to a similar habitat to the donor site or relocated to a nursery.	NEMA; and NEMBA.
	Alien vegetation establishment	Flora and Fauna	Construction	▪ Revegetation during construction and operations so that no open areas occur. ▪ If alien vegetation is encountered, these species should be removed in the correct way and timeously as per the eradication programme.	NEMA; and NEMBA.
	Soil erosion and subsequent sedimentation of wetland and river systems; Reduce catchment yields and surface water recharge to the systems further downstream.	Wetlands	Construction	▪ Ensure soil management programme is implemented and maintained to minimise erosion and sedimentation; ▪ Erosion berms should be installed on roadways and downstream of stockpiles; ▪ The disturbed footprint must be limited to what is absolutely essential; ▪ If it is absolutely unavoidable that any of the wetland areas present will be affected, disturbance must be minimised and suitably rehabilitated; ▪ Ensure that no incision and canalisation of the wetland features present takes place; ▪ Active rehabilitation, re-sloping, and re-vegetation of disturbed areas immediately after construction must be undertaken; ▪ All soils compacted as a result of construction activities should be ripped/scarified (<300mm) and profiled in accordance with the guidelines set out in the Soils, Land Use and Land Capability Report (Appendix 4);	Section 19 of the NWA NEMBA NEMA DWAF guidelines for the delineation of wetlands (2005); Mining and Biodiversity Guideline (DEA et al., 2013)

Activity	Potential Impact	Aspects Affected	Phase	Mitigation Measures	Compliance with standards
	Increased runoff, erosion, sedimentation and possible increase in contaminants / chemicals in the downstream watercourses.	Aquatic Ecology	Construction	▪ Limit vegetation removal to the infrastructure footprint area only where removed or damaged vegetation areas (riparian or aquatic related) should be revegetated; ▪ Environmentally friendly barrier systems, such as silt nets or in severe cases the use of trenches, can be used downstream from construction sites to limit erosion and possibly trap contaminated runoff from construction; ▪ Storm water must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow; ▪ Ensure proper storm water management designs are in place at construction sites to prevent contaminants from entering the water course; ▪ Construction chemicals should be used and stored in an environmentally safe manner; and ▪ High rainfall periods (i.e. usually December to March) should be avoided during construction to possibly avoid increased surface runoff.	NWA
	Siltation of surface water resources due to increased suspended solids resulting from soil erosion.	Surface Water	Construction	▪ Clearing of vegetation and excavation should be limited as far as possible; ▪ For any required soil stockpiles, these should be compacted and the slopes should be kept at minimal/low to avoid erosion; ▪ Dust suppression measures must be undertaken on the cleared areas during construction; ▪ Runoff from this area should be directed to the existing storm water management infrastructures and should not be allowed to flow into the stream; ▪ No water should be abstracted from the stream for construction; and ▪ All hazardous material storage areas should be appropriately bunded and spill kits should be in place.	NWA
	The impact of siltation resulting in the deterioration of water quality and adverse impacts on aquatic life and downstream water users.	Surface Water	Construction		NWA
	Lowering of groundwater table.	Groundwater	Construction	▪ Site clearance and removal of top soil and vegetation should be limited as far as possible and managed efficiently; and ▪ Continue with current groundwater monitoring programme.	NWA
	Noise disturbance from construction machinery and vehicles (however will not impact on any receptors).	Noise	Construction	▪ No mitigation recommended due to negligible impact	National Noise Control Regulations Gauteng Noise Control Regulations
	Site clearance resulting in visual impact on the receiving environment.	Visual	Construction	▪ Only remove vegetation within the infrastructure areas; ▪ Only remove topsoil within the infrastructure areas; and ▪ Apply dust suppression techniques to limit dust generated from the topsoil spoils.	To minimise the negative visual impacts caused by construction of infrastructure.
	Visual disturbance caused by the establishment of WTP.	Visual	Construction	▪ Where possible, surface infrastructure must be painted natural hues so that it blends into the surrounding landscape; ▪ Limit the footprint area of the surface infrastructure; ▪ Avoid construction activities at night. If required, down lighting and low-pressure sodium light sources must be implemented to minimise light pollution; and ▪ If possible, bury the pipelines to remove any long-term visual impact.	To minimise the negative visual impacts caused by construction of infrastructure.
	Visual disturbance caused by the establishment of pipelines.	Visual	Construction		To minimise the negative visual impacts caused by construction of infrastructure.
3. Operation of WTP and pipelines; and	Soil erosion, soil compaction and soil compaction	Soils, Land Use and Land Capability	Operational	▪ Maintenance and inspections of pipelines must be done to minimise compaction and erosion; and ▪ Check leakages on the pipelines regularly to avoid major contamination.	Minerals Council South Africa Guidelines

Activity	Potential Impact	Aspects Affected	Phase	Mitigation Measures	Compliance with standards
4.Maintenance of infrastructure	Noise disturbance from WTP and maintenance activities (however will not impact on any receptors).	Noise	Operational	▪ No mitigation recommended due to negligible impact	National Noise Control Regulations Gauteng Noise Control Regulations
	Reduced ecological integrity and functioning of wetlands.	Wetlands	Operational	▪ Ensure that as far as possible all operational infrastructures are placed outside of freshwater areas and their associated 100m zones of regulation; ▪ Ensure that no incision and canalisation of the freshwater features present takes place as a result of the proposed operational activities; ▪ All erosion noted within the operational footprint should be remedied immediately and included as part of the ongoing rehabilitation plan; ▪ Erosion berms should be installed on roadways and downstream of stockpiles to prevent gully formation and siltation of the freshwater resources. ▪ An alien invasive plan control programme must be put in place so as to prevent further encroachment to the surrounding terrestrial zones; ▪ No unnecessary crossing of the wetland features and their associated buffers should take place and the substrate conditions of the wetlands and downstream stream connectivity must be maintained; ▪ All soils compacted as a result of construction activities should be ripped/scarified (<300mm) and profiled; and ▪ Permit only essential personnel within the 100m zones of regulation for all freshwater features identified.	Section 19 of the NWA NEMBA NEMA DWAF guidelines for the delineation of wetlands (2005); Mining and Biodiversity Guideline (DEA et al., 2013)
5. Discharge of treated water into the Saalklapspruit	Reduced ecological integrity and functioning of wetlands.	Wetlands	Operational	▪ Water should be treated and tested to ensure it meets appropriate standards before being released; ▪ Annual biomonitoring of wetland crossing points and at the point of discharge must take place; ▪ Water must be discharged diffusely to reduce channelisation and erosion of the wetland downstream;	NWA
	Increased flow rates in the downstream watercourse deterring aquatic biota with a specific flow and habitat preferences; and also potentially result in erosion, sedimentation and bank and channel modification.	Aquatic Ecology	Operational	▪ Limit potential erosion and sedimentation by discharging water before the river into a silt basin; ▪ Armoured outlets utilising naturally occurring rocks can be installed to reduce the intensity of the flow from the pipeline outlet to attempt to limit immediate erosion; ▪ Baffles/dissipating structures can be used to further diffuse flow from the pipeline if erosion issues persist; ▪ Monitoring of the culvert from the discharge to under the N12 highway should take place in order to ensure no backfill or pools start to form; and ▪ Revegetation should take place in sections that have been washed out due to the increased flow.	NWA
	Clean water entering the Saalklapspruit SQR of concern.	Aquatic Ecology	Operational	▪ No enhancement actions are required to improve the downstream water quality. However, it is essential that the water being discharged is in fact clean water that meets discharge standards.	NWA
	Alteration of natural hydrology, channel width may reduce bank stability due to increased runoff.	Surface Water	Operational	▪ Energy dissipaters must be installed at the discharge point to avoid erosion of the riverbed and banks. These could be in a form of gabions, silt trap, chutes spillway, etc. to ensure reduction of water velocity.	NWA

Activity	Potential Impact	Aspects Affected	Phase	Mitigation Measures	Compliance with standards
				▪ Water quality monitoring should continue at the discharge outlet and downstream points of the Saalklapspruit to ensure the WTP effectiveness.	
	Instream water quality improvement as a result of dilution with treated water.	Surface Water	Operational	▪ No enhancement measures have been identified for this positive impact. It is noted that water quality monitoring should continuously be undertaken to ensure this positive impact is realised.	NWA
	Restoration of runoff catchment yield as a result of reintroducing water lost to mining activities into the Saalklapspruit.	Surface Water	Operational	▪ No enhancement measures have been identified for this positive impact.	NWA
6. Demolition and removal of all infrastructure; and 7. Rehabilitation	Soil erosion and soil compaction if rehabilitation is not done correctly.	Soils, Land Use and Land Capability	Decommissioning and rehabilitation	▪ Rehabilitate according to the rehabilitation plan; ▪ Return the land conditions capable of supporting prior land use or uses equal to/ better than prior land use; ▪ Plant native vegetation to prevent erosion and encourage a self-sustaining productive ecosystem; and ▪ Remove buildings to foundation level. Demolished rubble must be disposed of in accordance with Rehabilitation Plan.	Minerals Council South Africa Guidelines
	Restoration of vegetation and habitat types.	Flora and Fauna	Decommissioning and rehabilitation	▪ Revegetation should be undertaken in accordance with the developed Closure and Rehabilitation Plan (Appendix 14) no further measures to enhance this impact are proposed.	NEMA; and NEMBA.
	Rehabilitation of infrastructure footprint areas	Flora and Fauna	Decommissioning and rehabilitation		NEMA; and NEMBA.
	Reduced ecological integrity and functioning of wetlands as a result of potential soil compaction, soil erosion and consequent sedimentation of freshwater resources as well as potential encroachment of alien invasive plant species as a result of habitat fragmentations.	Wetlands	Decommissioning and rehabilitation	▪ All erosion noted within the decommissioning and rehabilitation area footprint should be remedied immediately; ▪ All soils compacted as a result of decommissioning activities should be ripped/scarified (<300mm) and profiled; ▪ Permit only essential personnel within the 100m zones of regulation for all freshwater features identified; ▪ Wherever possible, restrict decommissioning activities to the drier winter months to avoid sedimentation of the freshwater resources further downstream; ▪ Wetlands and their associated zones of regulation are to be clearly demarcated and avoided wherever possible; ▪ Ongoing wetland rehabilitation is necessary both within and in the vicinity of the proposed decommissioning, rehabilitation and closure footprint.	Section 19 of the NWA NEMBA NEMA DWAF guidelines for the delineation of wetlands (2005); Mining and Biodiversity Guideline (DEA et al., 2013)
	Workings and the use of machinery in the upstream area associated with the pipeline has the potential to degrade downstream water quality and chemistry depending on the extent of runoff from the decommissioning area.	Aquatic Ecology	Decommissioning and rehabilitation	▪ Bare land surfaces downstream from the decommissioning activities should be vegetated to limit erosion; ▪ Drainage lines and compact soils formed from vehicular use and general decommissioning activities should be rehabilitated to limit runoff; ▪ Chemicals, such as machinery oils and hydrocarbons, should be used in an environmentally safe manner and stored correctly to prevent spillage; and ▪ High rainfall periods (i.e. usually December to March) should be avoided during this phase in order to possibly avoid increased surface runoff in attempt to limit erosion.	NWA
	Noise disturbance from decommissioning machinery and	Noise	Decommissioning and rehabilitation	▪ No mitigation recommended due to negligible impact	National Noise Control Regulations Gauteng Noise Control Regulations

Activity	Potential Impact	Aspects Affected	Phase	Mitigation Measures	Compliance with standards
	vehicles (however will not impact on any receptors).				
	Closure of the WTP, pipelines and associated infrastructure is expected to have a moderate negative visual impact on the receiving environment during the day.	Visual	Decommissioning and rehabilitation	▪ No mitigation measures have been identified for this impact.	To minimise the negative visual impacts caused by decommissioning of infrastructure.

7 Financial Provision

7.1 Item (i)(1): Determination of the amount of 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, due to the extension of the promulgation 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.

7.1.1 Item (i)(1)(a): Describe the closure objectives and the extent to which they have been aligned to the baseline environment described under Regulation 22 (2) (d) as described in 2.4 herein

The rehabilitation and closure objectives have been set out in Section 4.1 (Part B) above. The overarching objective for closure is to ensure that impacted land is rehabilitated in a manner that allows it to be ceded for other sustainable land uses. The majority of the project area is characterised as already disturbed land, therefore, rehabilitation and closure will be aimed at improving land beyond the current baseline as well as comply with national closure and rehabilitation regulatory requirements.

7.1.2 Item (i)(1)(b): Confirm specifically that the environmental objectives in relation to closure have been consulted with landowner and interested and affected parties

The RCP was made available for public review and comment together with this Draft EIA and EMP Report (please refer to Appendix 14). All comments received that pertain to the RCP will be record in the final EIA and EMP report.

7.1.3 Item (i)(1)(c): Provide a rehabilitation plan that describes and shows the scale and aerial extent of the main mining activities, including the anticipated mining area at the time of closure

A summary of the rehabilitation plan is presented in Table 21-1 (Part A) above. Please refer to Appendix 14 for the complete RCP associated with the project.

7.1.4 Item (i)(1)(d): Explain why it can be confirmed that the rehabilitation plan is compatible with the closure objectives

The RCP has been compiled in support of the primary closure objectives which are to remove unwanted infrastructure and rehabilitate the land to a suitable sustainable land use which provides a safe and stable environment for surrounding receptors.

7.1.5 Item (i)(1)(e): Calculate and state the quantum of the financial provision required to manage and rehabilitate the environment in accordance with the applicable guideline

The estimated closure cost required for the rehabilitation and closure of the WTP project is **R 2,396,465 (Excl. VAT)**. A contingency of 10% on all infrastructure costs has been allowed for while 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.

The detailed closure cost for proposed WTP is provided in Table 24-1 (Part A) above.

7.1.6 Item (i)(1)(f): Confirm that the financial provision will be provided as determined

South32 will provide for closure as legally required. A liability assessment will also need to be undertaken annually to ensure the financial provision is in line with the closure cost.

8 Monitoring compliance with and performance assessment

South32 will be responsible for the implementation of all monitoring, mitigation and management measures, as well as compliance with the EMPr. South32 has an established monitoring programme that is implemented at KPS. This programme will be expanded to include aspects associated with the WTP project area. The specific recommended environmental monitoring for the identified impacts associated with the WTP project is detailed below and subsequently summarised in Table 8-1 below.

The following will be monitored for the WTP:

- Continuous online EC and pH of the product water will be recorded;
- Weekly full spectrum analysis of the product water to be undertaken to illustrate compliance to RWQO;
- Continuous online flow recording of the product water quantity;
- Continuous online meters will be calibrated on monthly basis;
- Monthly report will be compiled which indicate the water quality and flow recordings; and

- The disposal of all products from reject streams will be disposed off-site in a responsible manner. Safe Disposal Certificates will be kept on record for all hazardous material disposals.

8.1 Item 1(g): Monitoring of impact management actions

South32 has an established monitoring programme for KPS that covers the various environmental aspects affected by mining and associated activities. This monitoring programme will be extended to include the activities associated with the WTP project. The key environmental aspects that need to be monitored for the WTP project include:

- Soil erosion, compaction and erosion;
- Vegetation cover;
- Alien vegetation establishment and weed management;
- Water quality and sedimentation of wetlands and discharged water into the Saalklapspruit;
- Groundwater quality;
- Aquatic biomonitoring; and
- Noise levels (if complaints are received).

Further detail of the monitoring requirements is provided in Table 8-1 below.

8.2 Item 1(h): Monitoring and reporting frequency

Table 8-1, below, discusses the monitoring and reporting frequency in detail.

8.3 Item 1(i): Responsible persons

The roles and responsibilities associated with the monitoring programme are set out in Table 8-1, below.

8.4 Item 1(j): Time period for implementing impact management actions

Table 8-1, below, captures the time period for implementing impact management actions.

8.5 Item 1(k): Mechanism for monitoring compliance

Table 8-1 sets out the monitoring and management programme of environmental impacts for the WTP project.

Table 8-1: Monitoring and Management of Environmental Impacts

Source Activity	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
All activities throughout the project	Flora and Fauna	Vegetation clearing at the project area must be monitored to ensure no unnecessary disturbance is taking place. This should be done on a weekly basis during the construction phase.	Environmental Specialist/ ECO	Monthly
		The encroachment of alien invasive plant species should be monitored within the project area on a monthly basis and appropriate corrective measures must be undertaken on a monthly basis.	Environmental Specialist/ ECO	Monthly
		Annual monitoring of general biodiversity and ensuring sustainable populations of both fauna and flora persist until closure. This includes impacts on vegetation structure and health; impacts on faunal populations and numbers; and Red Data Listed fauna and flora species (should it be recorded going forward).	Terrestrial Ecologist	Annually
	Soil erosion	Site inspection will be undertaken fortnightly by the site manager to ensure that all soil erosion mitigation measures are in place and implemented adequately.	Environmental Specialist/ ECO	Fortnightly
	Surface Water	Water quality and quantity should be monitored monthly as per the existing monitoring programme. The results should be benchmarked against the Wilge River Catchment RWQO to determine any impact on the quality of water (positive/negative). The specific monitoring elements are provided in the specialist report, Appendix 8.	Environmental Specialist/ ECO	Monthly
	Groundwater	Groundwater level and groundwater quality should be monitored on a quarterly basis at the established boreholes at KPS (refer to specialist report, Appendix 9).	Environmental Specialist/ ECO	Quarterly
	Wetlands	Wetlands should be monitored monthly during construction. Once the project is in its operational phase, annual biomonitoring of wetland crossing points and at the point of discharge must take place. Wetland monitoring should include all associated impacts including uncontrolled erosion, hydrocarbon spills etc. and remediated where needed	Environmental Specialist/ ECO	Monthly (during construction phase); Annual biomonitoring
	Aquatic Ecology	Bi-annual aquatic monitoring must be undertaken at the K3, K4 and K5 monitoring points to enable the detection of potential negative impacts brought about by the project. This programme should include the following aspects: ▪ Water Quality; ▪ Habitat Quality; and ▪ Macroinvertebrate assemblages.	Qualified Aquatic Ecologist	Bi-annually
	Dust, visual and noise	Dust suppression must be implemented and tied in with the existing dust monitoring network at KPS outside of the construction area. Furthermore, heavy machinery and vehicles must be maintained and serviced regularly and, if possible, a silencing system should be fitted. The project activities must only take place during daylight hours.	Environmental Specialist/ ECO	As and when required

Source Activity	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
	Use of hydrocarbons	Daily inspections of machinery must be undertaken and spill trays will be placed under the machinery to collect any hydrocarbon leaks and spillages in the event it is required. Should spillages occur, the soil must be cleared and treated utilising bioremediation techniques. Should the soil not be adequately treated on site, the soil must be removed from the sites and disposed of at a waste handling facility.	Environmental Specialist/ ECO	Daily
	Ablution facilities	Ablution facilities will be tied into the existing sewer system and must be monitored and maintained in line with current practices at KPS.	Environmental Specialist/ ECO	As and when required
	Domestic waste	Bins will be placed at various places around the project area to collect the domestic waste and will be disposed of at a registered waste handling facility. Waste management for the WTP area must be aligned to the established waste management procedures at KPS.	Environmental Specialist/ ECO	Weekly

9 Item 1(l): Indicate the frequency of the submission of the performance assessment report

In accordance with the NEMA EIA Regulations (2014), as amended, an external independent Environmental Audit will be undertaken every two years. The Environmental Audit Report will be submitted to the DMR and other relevant authorities where required.

10 Item 1(m): Environmental Awareness Plan

10.1 Item 1(m)(1): Manner in which the applicant intends to inform his or her employees of any environmental risk which may result from their work

The purpose of an Environmental Awareness Plan is to outline the methodology that will be used to inform employees of any environmental risks which may result from their work and the manner in which the risks must be dealt with to avoid contamination or the degradation of the environment.

The environmental awareness plan is primarily a tool to introduce and describe the requirements of the range of environmental and social plans for the proposed project during the life of the project.

The environmental awareness plan ensures that training needs are identified and appropriate training is provided. The environmental awareness plan should communicate:

- Importance of conformance with the environmental policy, procedures and other requirements of good environmental management;
- The significant environmental impacts and risks of an individual's work activities and the environmental benefits of improved performance;
- Individual's roles and responsibilities in achieving the aims and objectives of the environmental policy; and
- The potential consequences of not complying with environmental procedures.

The objective of this Environmental Awareness Plan is to:

- Inform employees and contractors of any environmental risks which may result from their work; and
- Inform employees and contractors of the manner in which the identified possible risks must be dealt with to prevent degradation of the environment.

In general, the purpose of implementing an Environmental Awareness Plan is to optimise the awareness of those partaking in all project activities which have the potential to impact negatively on the environment and in doing so, promote the global goal of sustainable development.

South32 has established methods of environmental awareness training of its employees and contractors. Health, Safety and Environmental training will be carried out and applicable for all personnel partaking in the project as well as any other activities within KPS to achieve the objectives set out above.

10.2 Item 1(m)(2): Manner in which risks will be dealt with in order to avoid pollution or the degradation of the environment

The established procedures at KPS for the internal communication between the various levels and functions of the organisation, and receiving, documenting and responding to relevant communication from I&APs will be made applicable to the WTP project.

Communication is a management responsibility. All line supervisors are responsible for effective communication within their own sections. Environmental risks will continue to be dealt with through training and communication to ensure minimal degradation of the environment.

11 Item 1(n): Specific information required by the Competent Authority

The financial provision for the environmental rehabilitation and closure requirements of mining operations is governed by NEMA, as amended, which provides in Section 24P that the holder of a mining right must make financial provision for rehabilitation of negative environmental impacts. The financial provision will be reviewed annually.

12 Item 2: Undertaking

The EAP herewith confirms:-

(a) the correctness of the information provided in the reports

(b) the inclusion of comments and inputs from stakeholders and I&APs ;

(c) the inclusion of inputs and recommendations from the specialist reports where relevant; and

(d) the acceptability of the project in relation to the finding of the assessment and level of mitigation proposed.

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Appendix 1: EAP CV and Qualification

Appendix 2: Plans

Appendix 3: Pubic Participation Chapter

Appendix 4: Soils, Land Use and Land Capability Impact Assessment

Appendix 5: Fauna and Flora Impact Assessment

Appendix 6: Wetlands Impact Assessment

Appendix 7: Aquatic Ecology Impact Assessment

Appendix 8: Surface Water Impact Assessment

Appendix 9: Groundwater Impact Assessment

Appendix 10: Noise Impact Assessment

Appendix 11: Visual Impact Assessment

Appendix 12: Cultural Heritage NID

Appendix 13: Socio-economic Impact Assessment

Appendix 14: Rehabilitation, Decommissioning and Financial Provision Assessment