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INTEGRATED WATER AND WASTE MANAGEMENT PLAN

VLAKVARKFONTEIN COLLIERY

DOCUMENT DETAILS

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Abbreviations

ABET	Adults Basic Education Training
BOD	Biological Oxygen Demand
CMA	Catchment Management Area
CMS	Catchment Management Strategy
COD	Chemical Oxygen Demand
DEA	Department of Environmental Affairs
DME	Department of Mineral and Energy
DMR	Department of Mineral Resources
DWA	Department of Water Affairs (formerly DWAF)
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation (formerly DWA)
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EI	Ecological Importance
EIA	Environmental Impact Assessment
EIMS	Environmental Impact Management Services (Pty) Ltd.
EIS	Ecological Importance and Sensitivity
EMP	Environmental Management Plan
EMPR	Environmental Management Program
EMS	Environmental Management System
EO	Environmental Officer
ES	Ecological Sensitivity
ESMS	Environmental and Social Management System
GDP	Gross Domestic Product
HRDP	Human Resources Development Programme
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEMPR	Integrated Environmental Management Programme
ISO	International Organisation for Standardisation
IUA	Unit of Analysis
IWWMP	Integrated Water and Waste Management Plan
LED	Local Economic Development
LOM	Life of Mine
MAE	Mean Annual Evaporation
MAMSL	Metres Above Mean Sea Level

MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
MPRDA	Mineral and Petroleum Resources Development Act (Act 28 of 2002)
MSDS	Material Safety Data Sheets)
NEMA	National Environmental Management Act, (Act 107 of 1998).
NEMBA	National Environmental Management: Biodiversity Act (Act 10 of 2004)
NEMWA	National Environmental Management: Waste Act (Act 59 of 2008)
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act, Act 36 of 1998
NWRS	National Water Resource Strategy
PCD	Pollution Control Dam
PES	Present Ecological Status
PPP	Public Participation Process
PPR	Public Participation Report
PTN	Portion
RE	Remaining Extent
RMF	Regional Maximum Flood
RQO	Resource Quality Objectives
SANS	South African National Standards
SASS	South African Scoring System
SAWQG	South African Water Quality Guidelines
SDF	Standard Design Flood
SDS	Safety Data Sheet
SHE	Safety, Health and Environmental
SHEQ	Safety, Health, Environment and Quality
SLP	Social and Labour Plan
SWMP	Storm Water Management Plan
TDS	Total Dissolved Salts
WARMS	Water Authorisation Registration and Management System
WMA	Water Management Area
WML	Waste Management License
WMS	Waste Management Strategy
WCDSS	Water Conservation, Demand and Supply Strategy
WUL	Water Use Licence
WULA	Water Use Licence Application

EXECUTIVE SUMMARY

Environmental Impact Management Services (EIMS) (Pty.) Ltd. was appointed by Ntshovelo Mining Resources (Pty) Ltd (Ntshovelo) a subsidiary of Mbuyelo Coal (Pty) Ltd. (the Applicant) to submit an Integrated Water and Waste Management (IWWMP), as well as to compile and submit a Water Use Licence (WUL) application in terms of the National Water Act, 1998 (NWA) (Act 36 of 1998) for the Vlakvarkfontein Colliery

The Vlakvarkfontein Colliery is an existing opencast coal mine for the coal reserve situated on Portions 5, 13, and 18 of the Farm Vlakvarkfontein 213 IR. The mining area is situated approximately 30km north east of Delmas, and approximately 15km south west of Ogies. The N12 highway passes to the north of the mining area. The project falls within the Nkangala District Municipality and Delmas Local Municipality.

The mine is planning to extend the mining area within the existing mining right boundary. The Water Use Licence Applications (WULAS) were consolidated on 03 November 2016 and the licence number 03/B20F/AGJ/4858 was issued and file number 16/2/7/B100/C249. The mine also has a separate WUL for a second PCD (Licence nr.: 03/B20A/G/4845). The Applicant is proposing to expand the open cast mining operations at the Vlakvarkfontein Colliery, using the roll-over mining method, onto Portion 5 of the farm Vlakvarkfontein 213 IR. This area is within the existing approved mining right boundary, but was not specifically included and assessed in the approved Environmental Management Programme Report (EMPR) and associated environmental permits and authorisations. The proposed new mining operations will necessitate the relocation and re-establishment of the existing ancillary infrastructure associated with the current mining operations, including the Pollution Control Dam (PCD) and the administrative structures. It is also proposed to establish a coal processing plant (wash plant) to decontaminate the Run of Mine (RoM) coal. An application for the amendment to the existing Mine Works Programme (MWP) and EMPR, through a MPRDA Section 102 Application, and a full Environmental Impact Assessment (EIA) for the proposed new mining area is, therefore, required to support an application for environmental authorisation (EA) / waste management licence (WML) as applicable. A new WUL application needs to be undertaken for the relevant water uses that will be triggered due to the proposed extension project.

The approved water uses are as follows:

- Section 21(a) Taking of water from a water resource;
- Section 21(g) Disposing of waste in a manner which may detrimentally impact on a water resource; and
- Section 21(j): Removing, discharging or disposing water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.

CONTEXTUALISATION OF THE ACTIVITY

Vlakvarkfontein Colliery is an operating opencast coal mine, which makes use of a drill and blast, load and haul mining method with concurrent roll over rehabilitation. The proposed new mining area is approximately 103 ha in size. Most of the current mining infrastructure will have to be moved during or just after 2021 due to the western reserve mining coming within the 500 m blasting radius, which is normally the minimum safety area to be cleared during blasting. The only immediate new infrastructure required is the wash plant and possibly the coarse discard dump with dirty water management systems, and water treatment plant for the de-watering of the old underground workings. The mine and contractor's offices, contractors hard-park and diesel storage facilities, weighbridges and new PCD dam will be relocated when the western mining operations become dangerously close to the infrastructure.

WATER USES AND WASTE STREAMS

Vlakvarkfontein Colliery has two existing WULs (Licence no.: 03/B20F/AGJ/4858 and 03/B20A/G/4845) for the Vlakvarkfontein Colliery. The mine is applying for the following new or proposed water uses in terms of the National Water Act (NWA) (Act 36 of 1998) due to the extension of the mining within the existing Mining Right:

- Various Section 21 (g) water uses;
- Section 21 (c) and Section 21(i);

- Section 21 (e); and
- Section 21(j).

The main waste streams include domestic waste, hazardous waste and industrial waste.

PRESENT ENVIRONMENTAL SITUATION

Vlakvarkfontein Colliery falls within the Olifants Water Management Area (WMA). The mine falls within the Wilge River catchment, and the B20E and B20F quaternary drainage regions, which is drained by the Klipspruit (also referred to as the Leeuwfonteinspruit) and the Heuwelfonteinspruit. The Kipspruit and the Heuwelfonteinspruit are tributaries of the Wilge River, which eventually confluence with the Olifants River just upstream of the Loskop Dam.

One wetland type was identified within the 500 m project assessment boundary, namely a depression, which comprised of two units that are 100 m apart. The overall wetland health for the systems was determined to be that of a Largely Modified (D) system. The ecological importance and sensitivity (EIS) and direct human importance for the wetland was rated to be Low (D). The hydrological / functional importance was rated as Moderate (C). The expansion of the mining area will result in the loss of the delineated wetlands . Alternatively, should the depressions be avoided, and the surrounding areas be mined, the removal of the stockpiles and subsequent change to the topographical features will remove a source for hydrological inputs which will result in the loss of the wetlands. Additionally, the wetlands are considered to be a result of the mining operation, and are not regarded as natural systems.

The aquifer within which all impacts of the Vlakvarkfontein Colliery is likely to be confined is classified as a minor aquifer system. The seasonal variation of groundwater levels ranges from 2 m to 4 m probably as a result of rainfall recharge.

INTEGRATED WATER AND WASTE MANAGEMENT PLAN

The development of the IWWMP for this project was done in order to meet the water use authorisation requirements in terms of the NWA. The IWWMP clearly defines the responsibility and accountability for the execution of water and waste management. It also identifies and plans for future water and waste management needs and requirements.

The IWWMP further outlines the management of water and waste on site, and serves to document the methods employed, and the management of water and waste related emergencies that may arise. The IWWMP also details the minimisation of costs related to the management of water and waste by specifying how the efficiency of water and waste management systems are optimised, thereby minimising adverse environmental and social impacts related to water and waste management.

PUBLIC PARTICIPATION PROCESS

Interested and Affected Parties (I&AP's) identified were initially notified of the proposed WULA, and invited to register as an I&AP and submit any comments or concerns they may have. All registered I&AP's, including key stakeholders and landowners, have been notified of the availability of the IWWMP that has been placed out for public review. All issues and responses will be captured in the Public Participation Report and will be submitted to the (Department of Water and Sanitation (DWS).

IMPACT ASSESSMENT

The main potential impacts identified include:

- Surface water: water quality may decrease due to contaminated water discharge; loss of catchment yield during operation, and decant during decommissioning may impact surface water quality;
- Wetlands: Loss of wetlands due to mining, decreased water quality and as altered hydrological regime may occur; and

- Groundwater: groundwater quality may be impacted on due to acid mine drainage (AMD) formation and contamination of groundwater, while the groundwater quantity may decrease due to dewatering.

The final significance of these impacts varies from medium to high once the mitigation measures are implemented.

WATER AND WASTE MANAGEMENT

Potable water supply to the Vlakvarkfontein Colliery is obtained via an existing borehole. The mine extension will include a proposed water treatment plant. The Vlakvarkfontein Colliery requires a fair amount of water for dust suppression and for the processing plant. Process water needs can be supplied directly from the pit or PCD and subject to applicable water use licences may be used for dust suppression. A conceptual storm water management plan (SWMP) for the proposed project area has been developed. The water and salt balance has also been updated to include the extension of the mining area. The mine subscribes to the principles of waste minimization and recycling and waste streams are identifiable and quantifiable.

IWWMP ACTION PLAN

An IWWMP action plan in terms of wetlands, surface water, as well as ground water has been developed for the Vlakvarkfontein Colliery to ensure that the various water management strategies are implemented. The action plan identifies locations within the mine that need to be monitored, the parameters that should be included, as well as the applicable standard and the comparative target to be reached in terms of the implementation of the action plan. The frequency of monitoring is also included, while responsibility and accountability for the execution of the recommended water management related activities are clearly identified.

CONTROL AND MONITORING

The mine has implemented a water monitoring programme and has various strategies in place to ensure that responsible and accountable water management is implemented on site. Monitoring will be undertaken throughout the life of the mine and any monitoring findings will be reported to Department of Water and Sanitation. The mine will use the audit report findings to continually ensure that environmental protection measures are working effectively on site through a system of self-checking. The IWWMP (together with the annual Environmental Management Programme – EMPR) performance assessment) will be subject to regular audits. The IWWMP will be updated as per the results of the said audit.

CONCLUSION

The mine is applying for various Section 21 water uses in terms of the NWA. An exemption in terms of the provision of GN704 is required for activities falling within 100 m of a watercourse. The mine is committed to assisting the South African workforce and through the Social Labour Plan will ensure that the positive social and economic impacts of the mine are optimised.

Through the implementation of the various strategies, goals and objectives, as well the action plan of this IWWMP, Vlakvarkfontein Colliery will ensure the efficient and beneficial use of the water. The mine has made considerable investments, into the project.

The WUL is required for the duration of the Life of Mine, (LoM), however, it is proposed that the licence be issued for a period of at least twenty (20) years due to the long-term water management measures that are required to be put in place. The mine is committed to implementing and reviewing the IWWMP action plan included in this document (Section 6.6).

1 INTRODUCTION

Environmental Impact Management Services (EIMS) (Pty.) Ltd. was appointed by Ntshovelo Mining Resources (Pty) Ltd (Ntshovelo) a subsidiary of Mbuyelo Coal (Pty) Ltd. (the Applicant) to submit an Integrated Water and Waste Management (IWWMP), as well as to compile and submit the WUL application in terms of the NWA for the Vlakvarkfontein Colliery.

1.1 ACTIVITY BACKGROUND

The Vlakvarkfontein Colliery is an existing coal mine, located on Portions 5, 13, and 18 [1] of the Farm Vlakvarkfontein 213 IR. The mining area is situated approximately 30 km north east of Delmas, and approximately 15 km south west of Ogies. The N12 highway passes to the north of the mining area. The project falls within the Nkangala District Municipality and the Delmas Local Municipality.

Ntshovelo has an existing WUL for the Vlakvarkfontein Colliery (Licence no.: 4/B20F/AGJ/1131, dated 14 October 2011). The mine applied for an additional WUL, which was issued on 22 September 2016 (Licence no.: 03/B20A/G4845). The WULAs were consolidated on 03 November 2016 and the licence number 03/B20F/AGJ/4858 was issued and file number 16/2/7/B100/C249. The mine also has a separate WUL for a second PCD (Licence no.: 03/B20A/G/4845) (refer to Appendix A for a copy of the WULAs). The Applicant is proposing to expand the open cast mining operations at the Vlakvarkfontein Colliery, using the roll-over mining method, onto Portion 5 of the farm Vlakvarkfontein 213 IR. This area is within the existing approved mining right boundary, but was not specifically included and assessed in the approved Environmental Management Programme Report (EMPR) and associated environmental permits and authorisations. The proposed new mining operations will necessitate the relocation and re-establishment of the existing ancillary infrastructure associated with the current mining operations, including the Pollution Control Dam (PCD) and the administrative structures. It is also proposed to establish a coal processing plant (wash plant) to decontaminate the Run of Mine (RoM) coal. Therefore, a Section 102 Application is required for the amendment to the existing Mine Works Programme (MWP) and EMPR . Furthermore, a Scoping and Environmental Impact Assessment (EIA) process is required for the proposed new mining area as part of the application for environmental authorisation (EA) / waste management licence (WML). A new WULA needs to be undertaken for the relevant water uses that will be triggered due to the proposed extension project.

1.2 CONTACT DETAILS OF THE APPLICANT

The applicant is Ntshovelo Mining Resources (Pty) Ltd. The relevant contact person for the project is provided in Table 1 below.

Table 1: Applicant Details

Item	Company Contact Details
Name of Applicant:	Ntshovelo Mining Resources (Pty) Ltd
Name of Mine:	Vlakvarkfontein Colliery
Delegated responsible person:	Martha Mokonyane
Physical Address:	No 2 Robin Close Infinity Office Park Block A Cnr Michelle and Hennie Alberts Street Meyersdal 1448
Postal Address:	PO Box 90349 Bertsham 2013
Tel:	+27 11 867 0836

[1]

Item	Company Contact Details
Fax:	+27 11 867 0520
Email:	martham@mbuyelo.com

1.3 REGIONAL SETTING

Ntshovelo has developed the Vlakvarkfontein Colliery for the coal reserve located on Portions 5 and 18 of the Farm Vlakvarkfontein 213 IR. The mining area is situated approximately 30km north east of Delmas, and approximately 15km south west of Ogies. The N12 highway passes slightly north of the mining area. The project falls within the Nkangala District Municipality and the Delmas Local Municipality. See Figure 1 for the locality of Vlakvarkfontein Colliery.

Table 2: Distances to neighbouring towns

Town	Approximate distance
Ogies	15 km
Delmas	30 km
Bronkhorstspruit	30 km

1.4 PROPERTY DESCRIPTION

Table 3 indicates the farm portions that fall within the mining right area of the Vlakvarkfontein Colliery extension project. It also contains details on the location of the mine.

Table 3: Locality details

Farm Name	**Portions 5, and 18 of the Farm Vlakvarkfontein 213 IR.**		
Mining Right holder	Ntshovelo Mining Resources (Pty) Ltd (Ntshovelo) a subsidiary of Mbuyelo Coal (Pty) Ltd. is the holder of an approved Mining Right (MR) in respect of the following properties within the existing Vlakvarkfontein Colliery:		
Application Area (Ha)	The properties within the Vlakvarkfontein Colliery mining right area cover approximately 845 hectares (ha). The proposed new mining area, within the existing mining right, is approximately 103 hectares in size.		
Magisterial District	Nkangala District Municipality		
Property details	Farm Name:	Portion:	Title Deed
	Vlakvarkfontein 213 IR	5	T13419/2013
	Vlakvarkfontein 213 IR	18	T5731/2012

A description of the Title Deeds, registered landowners, and existing authorisations for each of these properties is provided in Table 4.

Table 4: Property details

Document	Consultant	Applicable Properties	Reference Number
MPRDA EIA and EMPR (2009)	Geovicon Environmental (Pty) Ltd.	Portion 3, 5 and 13 of Vlakvarkfontein 213 IR	MP 30/5/1/2/3/2/1 (300) EM
IWWMP and Water Use License (2011)		Portion 3, 5 and 13 of Vlakvarkfontein 213 IR	4/B20F/AGJ/1131
IWWMP and Water Use License Amendment (2014)	Geo Soil and Water CC	Portion 3, 5 and 13 of Vlakvarkfontein 213 IR	4/B20F/AGJ/1131
IWWMP Consolidation (2015)	Geo Soil and Water CC.	Portion 3, 5 and 13 of Vlakvarkfontein 213 IR	4/B20F/AGJ/1131

The Vlakvarkfontein Colliery mining right (MP 30/51/2/2/300 MR) was originally issued for Portions 5, 3 and 13 of the farm Vlakvarkfontein 213 IR. However, the Applicant did not purchase all the land and only bought Portion

5, Portion 3 and a small portion of Portion 13. Portion 3 and the small portion of Portion 13 were consolidated and is now called Portion 18. The mining right area, therefore, now includes Portion 5 and 18 of the farm Vlakvarkfontein 213 IR and mining will only take place over Portions 5 and 18. Figure 1 indicates the locality of the Vlakvarkfontein Colliery, and Figure 2 indicates the mining right boundary and the proposed opencast area. A copy of the mining right is attached in Appendix B.

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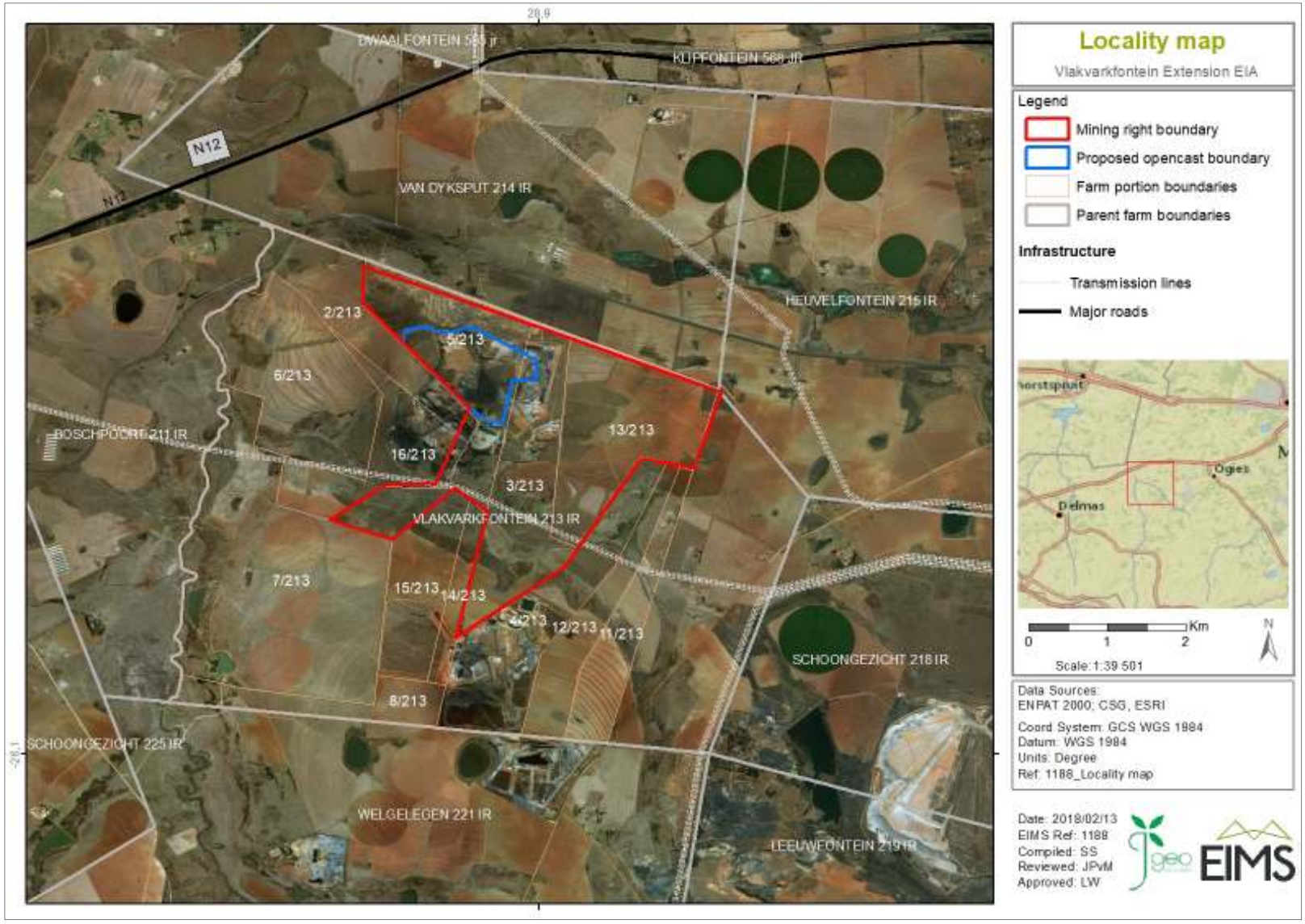


Figure 1: Location of the Vlakvarkfontein Colliery

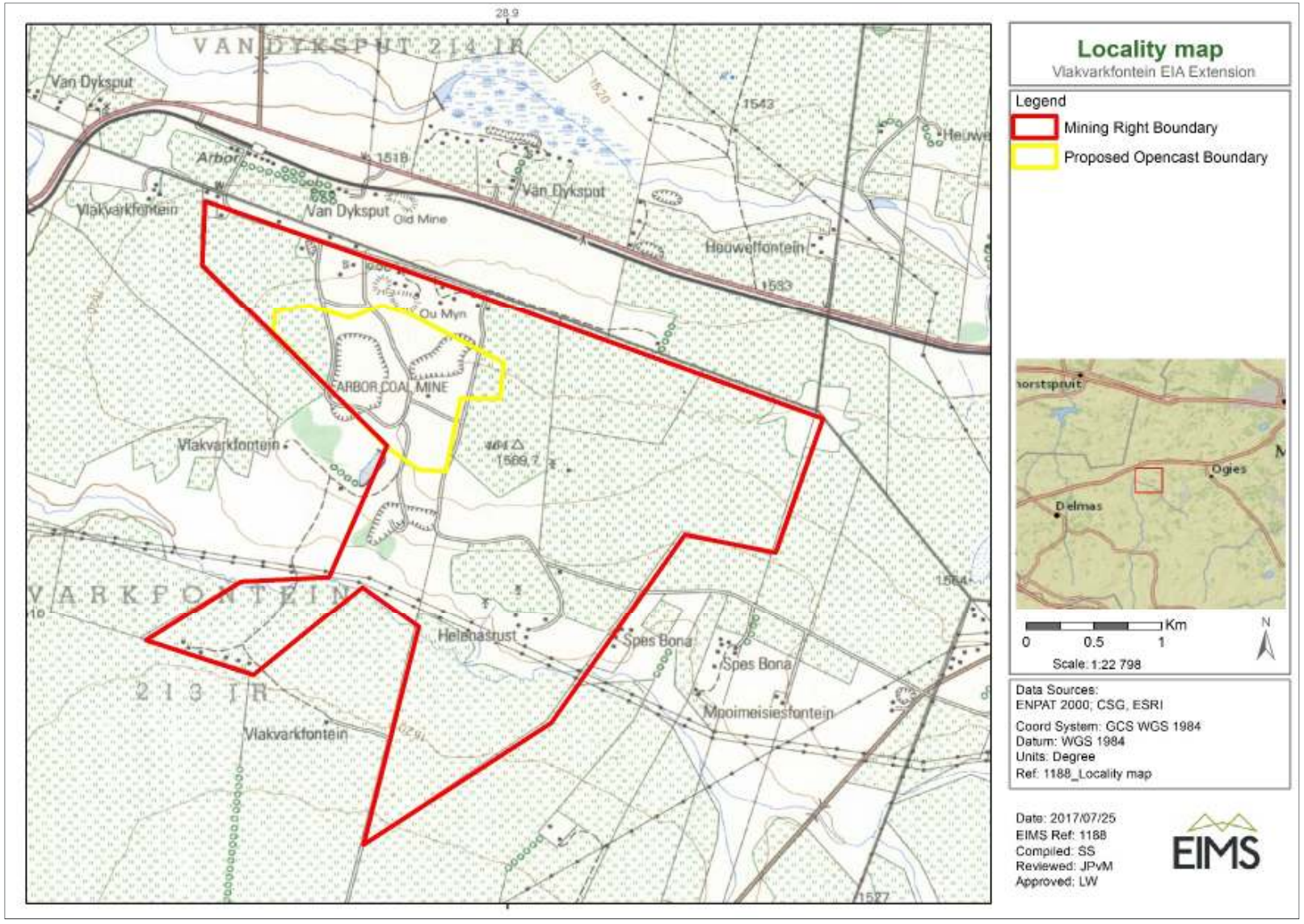


Figure 2: The mining right boundary of Vlakvarkfontein Colliery and the proposed opencast extension

1.5 PURPOSE OF IWWMP

Although the requirement for the compilation of an IWWMP was originally aimed at collating and rationalising the information submitted for Water Use Licence Applications (WULA) to the DWS, it has progressed beyond this purpose to:

- Provide the regulatory authorities with focused and structured information not only to meet their general information needs, but also to articulate the required management measures and actions to achieve the water and waste related performance on an on-going basis; and
- Provide direction and guidance to the water user on water and waste management of any activity.
- The IWWMP should be used in conjunction with other guidelines developed by DWS, such as the External Guideline on the Water Use Authorisation Process and the series of Best Practical Guidelines for water resource protection in the Industries and Mines. The Department and/or relevant Catchment Management Agencies (CMA) implement the integrated water resource management (IWRM) at source by means of an IWWMP.
- The Department requires an IWWMP as a simple feasible, implementable plan for water users based upon site specific programmes, also taking into account the National Water Resource Strategy (NWRS), Catchment Management Strategy (CMS), Resource Quality Objectives (RQO's) and sensitivity of the receiving water resource, upstream and downstream cumulative impacts of water use activities, external water use authorisation guidelines, as well as water use specific supplementary information requirements. The most important component of the IWWMP development process is the formulation of various strategies, goals and objectives for the water use or waste management of an activity, in accordance with the set philosophies and policies. The policies must address the four key areas related to IWWMP development, namely process water, storm water, groundwater and waste. The purpose of an IWWMP is as follows:
- Compilation of a site specific, implementable, management plan addressing all the identified water use and waste management related aspects (e.g. process water balances, storm water management, groundwater management, water re-use and reclamation, water conservation and demand management, waste minimization and recycling) of the specific activity, in order to meet set goals and objectives, in accordance with Integrated Water Resources Management principles;
- Provision of management plan to guide a water user regarding the water and waste related measures which must be implemented on site in a progressive, structured manner in the short, medium and long term;
- Documentation of all the relevant information, as specified in this guideline, to enable the Department to make the decision regarding the authorisation of a water use;
- Clarification of the content of the IWWMP for DWS officials and the water users, as the various regional offices of DWS might have different interpretations regarding the content of an IWWMP;
- Standardisation of the format of the supporting documentation which the Department requires during submission of a WULA;
- Provision of guidance on the content of information required in an IWWMP as part of the water use authorisation process and level of detail that the Department requires to enable them to evaluate the supporting documentation to make a decision on authorisation water use; and
- Ensuring that a consistent approach is adopted by the Department and the various Regional Offices and CMA's with regards to IWWMPs.

It is the responsibility of the water user to demonstrate to the Department that the selected management measures in the IWWMP action plan adhere to the "SMART" concept i.e.:

S	M	A	R	T
•Sustainable	•Measurable	•Achievable	•Resources Allocated	•Timeframe Specific

It is a Departmental requirement that a water user needs to compile an IWWMP for any one of the following purposes:

- As the supporting technical documentation for any IWULA;
- When converting Existing Lawful Use (ELU) to licensed water use; and
- In order to comply with the conditions of an existing water use licence (the main purpose of this document).

In line with the guidelines of the DWS Operational Guideline: Integrated Waste and Water Management Plan (2010), Figure 3 and Table 5 provides a guide to the structure of the IWWMP.

It is a Departmental requirement that a water user needs to compile an IWWMP for any one of the following purposes:

- As the supporting technical documentation for any IWULA (the main purpose of this document);
- When converting Existing Lawful Use (ELU) to licensed water use; and
- In order to comply with the conditions of an existing water use licence.

The implementation of the IWWMP is an interactive process whereas its performance is monitored on an annual basis. The assessment of the IWWMP document itself, as well as the submission of information relating to monitoring and auditing conducted in terms of it could lead to its shortcomings, which must be addressed in the annual update of the action plan of the IWWMP. This will ensure that the concept of continual improvement is applied throughout the life cycle of the activity (Operational Guideline: IWWMP dated February 2010 and GNR 267, the Water Use Licence Application and Appeals Regulations, dated March 2017).

In line with the guidelines of the DWS Operational Guideline: Integrated Waste and Water Management Plan (2010) and GNR 267, Water Use Licence Application and Appeals Regulations (2017). Table 5 provides a guide to the structure of the IWWMP.

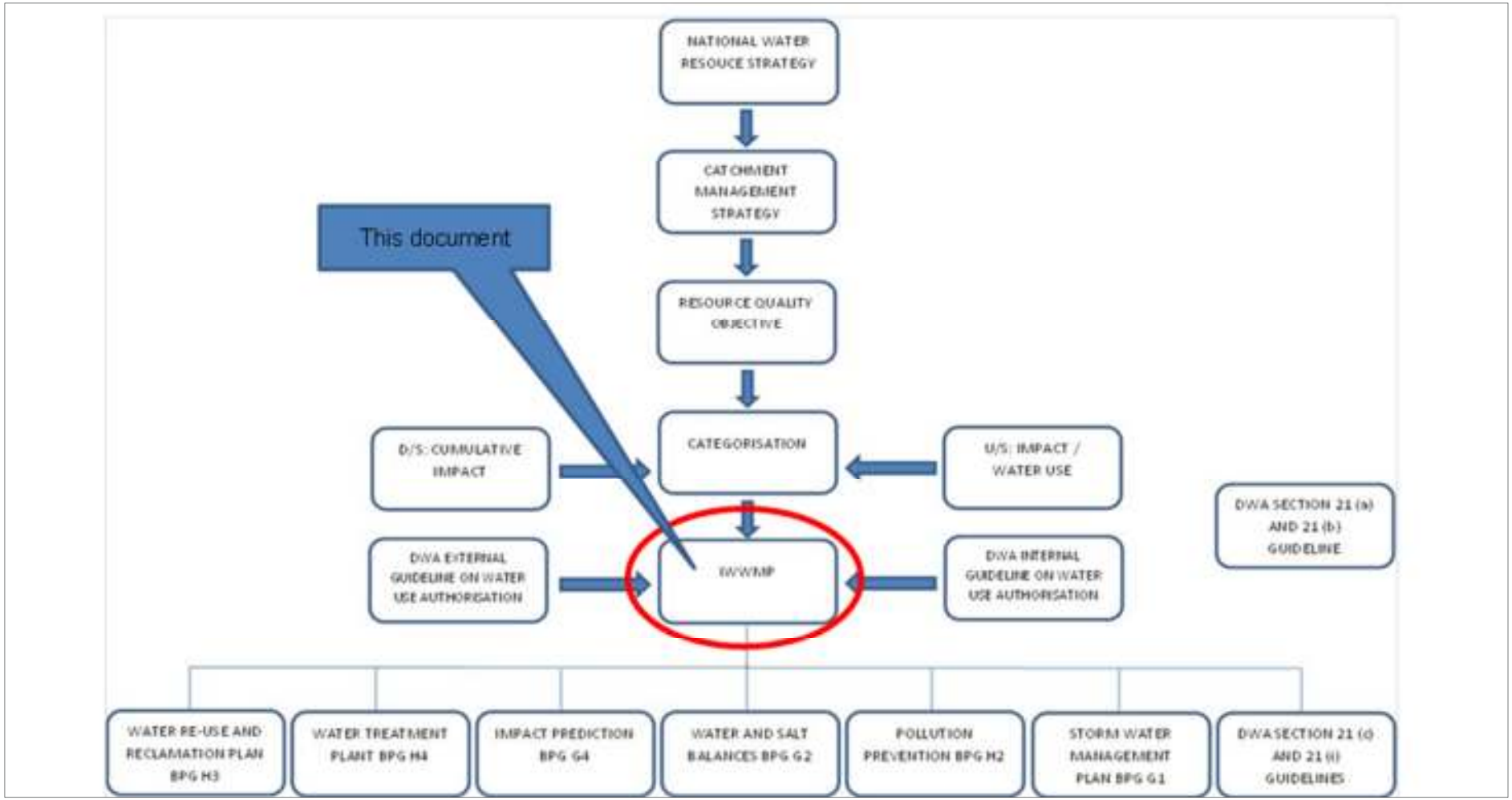


Figure 3: Schematic Layout of the IWWMP Approach

Table 5: Guide to the structure of the IWWMP

Guideline Item	Relevant IWWMP Section
Quantification of the Water Resource Problem	
Quantification of the Water Resource Problem	Section 4.2,
Are the existing water quality data adequate to identify contaminants of concern?	Section 4.2 and Section 4.4.
How well have the nature, extent and causes of the water management problems on site been identified?	Section 4.2, Section 4.4 and Section 5.11.
To what extent has the analysis and characterization of the problems considered current thinking on water resource management?	Section 4
Are there any discernible trends?	Section 4 & Section 5
Targets, Indicators and Monitoring	
Does the IWWMP define medium and long-term goals towards sustainable management of water resources?	Section 6.3
Does the IWWMP make provision for the establishment of indicators of progress and set annual and medium term targets?	Section 6.4
Are these indicators and targets appropriate and consistent with the policies and strategies considered for implementation of the IWWMP?	Section 6.6, Section 6.7 and Section 6.9
Are the proposed monitoring, review and evaluation as well as auditing systems adequate and sustainable?	Section 6.7
Priority Actions	
Does the IWWMP describe clear priorities for action, relevant to the goals and targets, feasibility in terms of achieving targets, their estimated costs, available resources, institutional capacities and effectiveness?	Section 6.6, Section 6.7 and Section 6.9
Does the water management strategy have an adequate and credible financial provisioning plan to support the implementation of the IWWMP?	Section 6.6

2 CONTEXTUALISATION OF THE ACTIVITY

The section below provides a detailed project description. The aim of the description is to indicate the activities that are performed at the mine. Furthermore, the detailed project description facilitates the understanding of the activities taking place that will result in impacts on the environment and for which mitigation measures are in place or plans are in place to implement these mitigation measures.

2.1 DESCRIPTION OF ACTIVITY

The Vlakvarkfontein Colliery coal deposit consists of an isolated basin surrounded and underlain by basement rocks, which are in turn overlain by Carboniferous Dwyka Group tillites and the coal bearing Vryheid Formation of Permian age. The seams attenuate and pinch out against the elevated basement rocks along the basin surrounded by basement rocks along the basin margins.

Vlakvarkfontein Colliery does not host the complete sequence of the Witbank coalfield coal seams, and only the No. 2 and No. 4 seams are well-developed and of economic interest. In places, a thin (often less than 10cm) No. 3 Seam is present, but this acts as more of a stratigraphic marker than coal resource. The No. 5 Seam does not occur at all having been eroded away. The stratigraphy of Vlakvarkfontein Colliery can be subdivided into two main sequences, these being a basal No. 2 Seam Sequence, overlain by the No. 4 Seam Sequence.

No faults or dolerites were intersected during exploration, although a couple of small dolerites were intersected during mining since 2010. The original resource block delineated represents the shallow opencast mineable coal lying immediately to the south and east of the defunct Arken Coal Mine underground workings. Further drilling added more confidence to the resources, and in 2016 some drilling was done in the old workings as well as west of the old workings. A full updated resource statement was not issued but the geological models were updated on a regular basis from where the mine designs were updated and extended as per the coal resources in the model. A decision was made to mine the old underground workings, as well as resources to the west, up to the point where the 2 seam sub-outcrops against the basement rocks.

2.2 EXTENT OF ACTIVITY

The Vlakvarkfontein Colliery mining right area covers approximately 845 hectares (ha). The proposed new mining area, located within the existing mining right, is approximately 103 ha in size.

2.3 KEY ACTIVITY RELATED PROCESSES AND PRODUCTS

Vlakvarkfontein Colliery is an operating opencast coal mine, which makes use of a drill and blast, load and haul mining method with concurrent roll over rehabilitation. Operations started approximately 50-100m east of the old underground workings with a north-south box-cut and advanced to the east (Figure 4). This portion or section of the mine was planned and indicated in the previous MWP and original mining right application. Very few resources are left in this section of the mine and it will be fully depleted in 2019. Rehabilitation of this area is concurrent and up to date. The more challenging resources in the old underground mine and the resources to the west of the mining right area, was only explored and decided to be proposed for mining in 2016.

The proposed mining will start with a north-south box-cut in the west where the 2 seam sub-outcrop occurs. Mining will progress in strips towards the east and eventually intersect the underground pillars (Figure 5 and Figure 6). Mining will continue through the old underground pillars and eventually through the barrier pillar that was left between the old underground section and the original opencast workings. The new open-cast operation will be initiated by the stripping of topsoil to expose the overburden of the proposed box-cut. The topsoil, subsoil, hards and carbonaceous hards will be hauled to a designated area and act as a berm between the community and the mine. All material types to be used for rehabilitation at a later stage and stockpiled separately to avoid mixing of material types. The anticipated strip ratio for the new open cast section is estimated at 1.75:1.

Once the topsoil is removed and stored appropriately, the overburden of the proposed box-cut is then drilled, blasted and removed to mine benches approximately 40 m wide and down to the 2 seams. The No. 4 Seam Sequence, where the box-cut will start in the west has been eroded away. The monthly estimated production

rate of the open-cast is estimated at 100 – 140 ktpm. A new coal processing facility will be built. Both the non-select coal, as well as the coal mined in the old underground pillars will be washed at the coal processing facility to get rid of the contamination to produce a saleable ESKOM product.

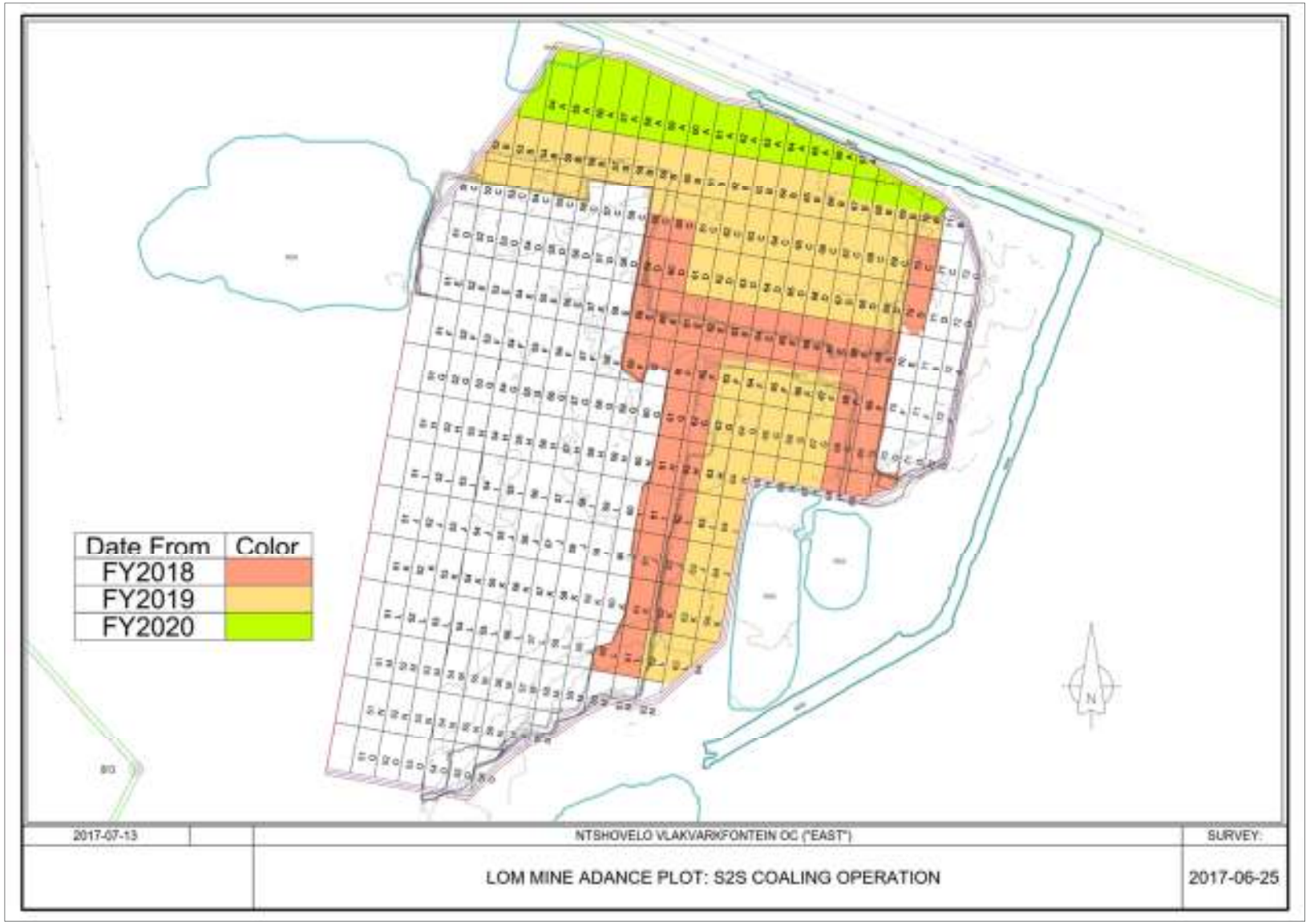


Figure 4: Two seam select (bottom seam) progress plot for LOM in current eastern opencast operation

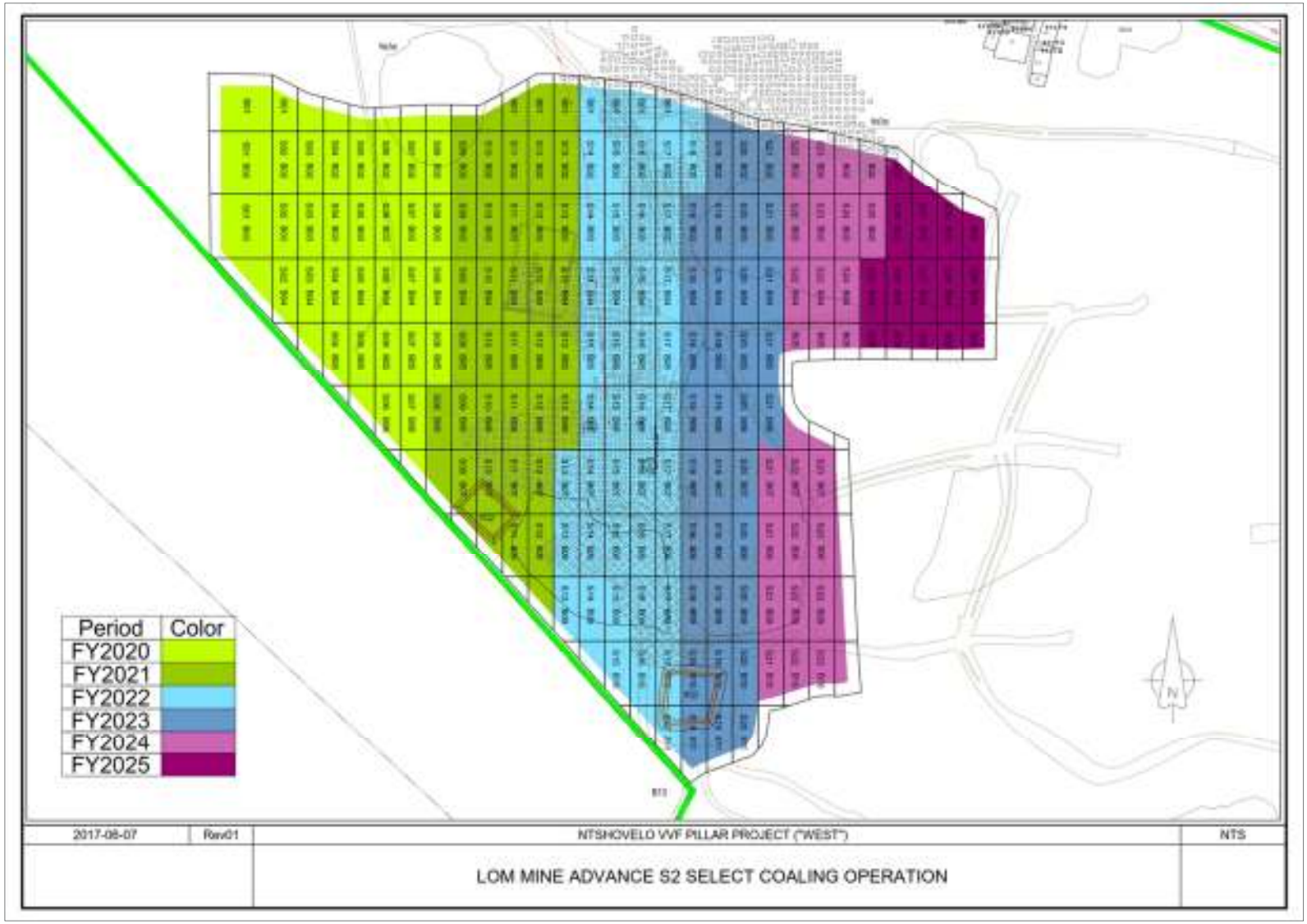


Figure 5: Two Seam – select and non-select (bottom seam) progress plot for LOM in proposed western opencast operation

Figure 6: Four Seam – select and non-select progress plot for LOM in proposed western opencast operation

2.4 PLANNED PRODUCTION RATE

This mine has been in operation since early 2010 and is selling the select seams on a RAW crush and screen basis to ESKOM at a rate of 100ktpm – 140ktpm to be used in some of their power stations. The non-select lower quality coal is currently sold on a cost recovery basis.

2.4.1 MINE SCHEDULE

Proposed mining operations in the west are scheduled to commence once all necessary environmental and other authorisations and licenses have been granted. The current production schedule is such that while production is tapering down in the current eastern operation of the mine, it will ramp up in the western operation to maintain a consistent product delivery to ESKOM. The LOM production schedule is presented in Figure 7, which indicates all material types and coal seams to be mined. The taper down in the eastern section of the mine and the ramp-up in the western section is indicated in Figure 8.

PRODUCTION WEST & EAST	Unit	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025	TOTAL
TOPSOIL	bcm	23 523	21 853	267 956	217 553	144 459	105 497	68 737	-	**849 578**
SOFTS	bcm	114 733	176 064	1 426 536	1 101 710	841 368	908 844	740 118	-	**5 309 374**
HARDS	bcm	947 649	1 387 567	840 769	1 097 423	1 423 833	1 395 319	914 183	-	**8 006 742**
S4N COAL	romt	110 289	41 826	-	23 784	63 936	167 173	143 039	-	**550 046**
S4S COAL	romt	295 248	224 340	-	89 086	115 228	401 913	356 248	-	**1 482 063**
S4PIL COAL	romt	-	-	-	348 964	468 533	56 407	-	-	**873 904**
S2 PARTING	bcm	990 021	1 525 892	685 064	1 208 343	878 735	775 311	1 075 590	62 156	**7 201 112**
S2S COAL	romt	644 752	1 142 064	1 112 123	373 651	185 625	391 387	604 625	342 809	**4 797 035**
S2N COAL	romt	-	-	573 695	127 859	45 744	145 716	117 807	69 797	**1 080 618**
S2PIL COAL	romt	-	-	147 876	1 048 300	1 270 614	806 293	164 127	3 592	**3 440 801**
TOTAL WASTE	bcm	2 075 926	3 111 376	3 220 326	3 625 028	3 288 395	3 184 971	2 798 628	62 156	**21 366 807**
TOTAL COAL	romt	1 050 289	1 408 230	1 833 694	2 011 643	2 149 679	1 968 889	1 385 846	416 197	**12 224 467**
TOTAL STRIP RATIO	bcm/romt	1,98	2,21	1,76	1,80	1,53	1,62	2,02	0,15	**1,75**

FIGURE 7: LIFE OF MINE (LOM) PRODUCTION SCHEDULE - ALL MATERIAL TYPES AND COAL

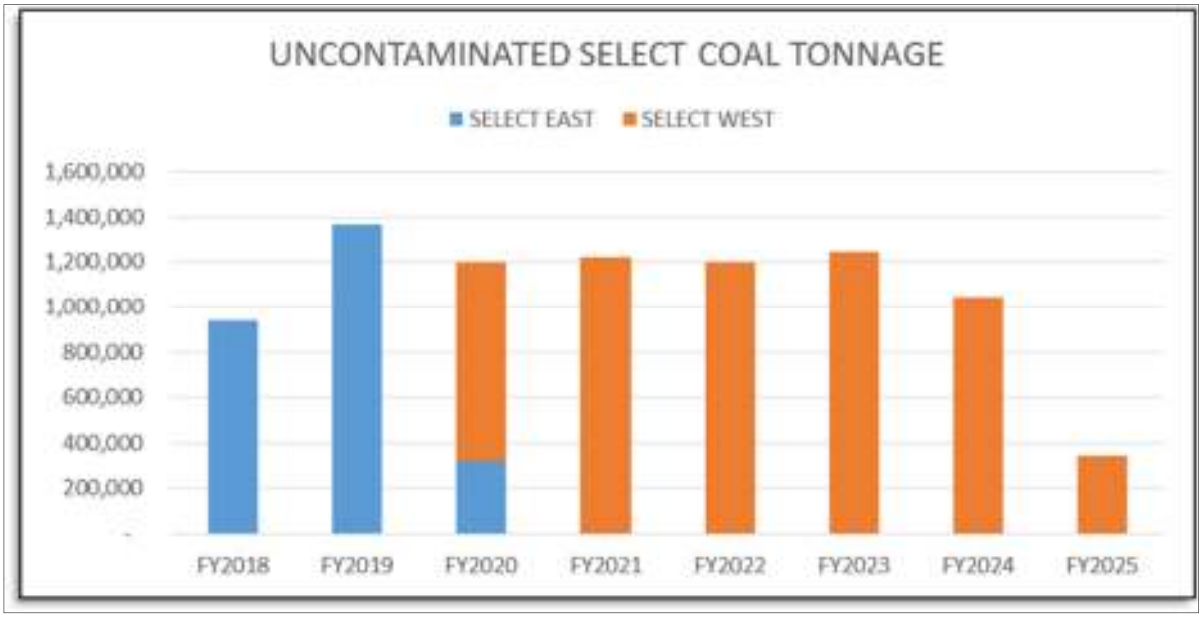


Figure 8: Production taper-down in east and ramp-up in west of the select coal seams

2.4.2 MINERAL PROCESSING

Only the select seams from the eastern resource are sold on a crushed and screened RAW basis to ESKOM. A jaw crushing plant is currently used for this processing where 100% of the select seams are sold.

A new processing facility Coal Handling and Processing Plant (CHPP) will be built for the proposed western resource to be mined. All RoM coal will be crushed to 110 mm in a rotary breaker where some of the large pieces

of stone will be separated. Select coal seams (<110 mm) will only go through a secondary crusher after the rotary breaker and then to the product stockpiles. All contaminated coal and non-select seams will go through a Dense Medium Cyclone (DMS) cyclone washing plant where the stone will be separated from the coal. The wash plant product will be blended in with the select product that was only crushed, to meet the quality specification of Eskom. The coarse waste will be dumped either on a discard dump on surface or in the open cast pit if permission is obtained from the relevant authorities. The fines from the wash plant will be dried in a filter press, and depending on the qualities, the filter cake may either be blended with the product, or also disposed of on the discard dump. Refer to the flow diagram presented in Figure 9, which indicates the proposed coal process.

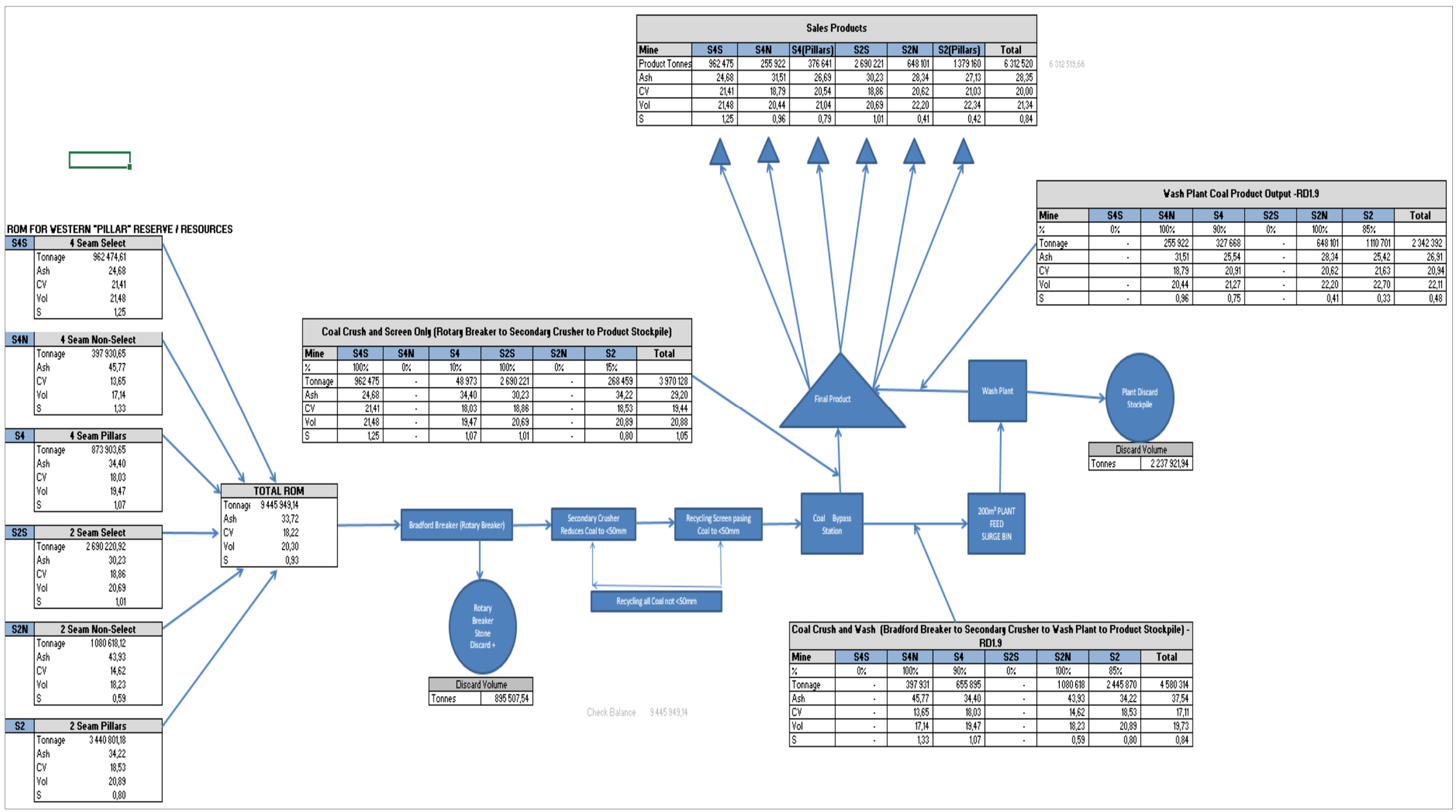


Figure 9: Process flow diagram for coal handling and preparation plant (CHPP) of the proposed western resource

2.5 ACTIVITY INFRASTRUCTURE DESCRIPTION

Most of the current mining infrastructure will have to be moved during or just after 2021 due to the western reserve mining coming within the 500 m blasting radius, which is normally the minimum safety area to be cleared during blasting. The legal requirements are covered by various acts such as the Explosives Act, 2003 (Act 15 of 2003) and the Mine Health and Safety Act, 1996 (Act No. 29 of 1996) The only immediate new infrastructure required is the wash plant and possibly the coarse discard dump with dirty water management systems and water treatment plant for the de-watering of the old underground workings. The mine and contractor's offices, contractors hard-park and diesel storage facilities, weighbridges and new PCD dam will be relocated when the western mining operations become dangerously close to the infrastructure.

As such, the infrastructure immediately required is listed below:

- CHPP;
- Coarse Discard Dump if not approved to dump plant discard back into pit;
- Temporary pollution control sump;
- Storm water management including clean and dirty water separation systems;
- Access and haul roads – slight changes;
- Water treatment plant;
- Pipelines;
- RoM stockpiles; and
- Product stockpile area.

The infrastructure that will be relocated includes:

- Weighbridges;
- Diesel storage;
- Hard park and workshops;
- Wash bay and oil trap;
- Mobile offices for mine, plant and contractor;
- Mobile ablution block;
- Contractors workshops and stores;
- Modular sewage treatment plant & prefabricated water purification plant;
- Temporary general waste storage area;
- Road truck waiting area with tarpaulin fitting area; and
- Mine access and security gates and fences.

The surface infrastructure to be utilised by the mine will mostly be prefabricated and easily portable. Where relevant, further information related surface infrastructure requirements is provided in detail below.

2.5.1.1 ADMINISTRATION BUILDINGS, ENGINEERING BAYS, WORKSHOPS AND OTHER BUILDINGS

The Vlakvarkfontein Colliery is an operating mine with a "Kwik Space" type mobile office block and an ablution facility that is shared by the mining contractor, the crushing plant contractor and the mine. The mobile office

block will serve as the base of operations for coordinating the mining operation and the ablution block will serve as a change room and ablution facility for employees. All of this will be relocated in about four years in 2021 / 2022. The mining contractor erected its own workshops and spares containers, which can also be relocated with little effort or cost.

2.5.1.2 HAZARDOUS GOODS STORAGE

Diesel storage is probably the biggest non-residue hazardous material on site and it is properly bunded according to regulatory requirements. Explosives are delivered as and when required from offsite locations. Oils and other lubricants and/or chemicals are also stored in approved bunded areas. The relevant Health and Safety Standards for the handling and storage of these goods will be strictly adhered to.

2.5.1.3 WATER TREATMENT PLANT

A water treatment plant will be constructed and operated in the south of the property from where water will be released in a controlled and monitored manner back into the nearby Klipspruit stream[2]. The majority of the water to be treated will originate from the dewatering of the current flooded old underground workings. Raw water from the old underground workings and excess water, if any from the PCD, will be pumped to the treatment plant where it will be treated to an acceptable standard to be released into the stream. A percentage of the water may be pumped to the second stage of the treatment plant unit where it will be treated to potable standards and used for drinking water purposes.

2.5.1.4 OIL AND WATER SEPERATOR

The current oil and water separators at the wash bay will be relocated with the offices and workshops and wash bay in 2021 / 2022.

2.5.1.5 WASHBAY

The wash bay that utilises a high pressure washer and complete with effluent separation, silt trap, as well as an oil and water separation system will be relocated to the new designated site in 2021 / 2022. All effluent will be collected in a sediment trap and effluent separation system to allow for the efficient collection of fines and solids as well as hydrocarbon separation.

2.5.1.6 WEIGHBRIDGE

A double weighbridge is currently in operation between the product stockpiles and the security gate. This weighbridge will need to be relocated in order for it to be close to the new product stockpile area in 2021 / 2022.

2.5.1.7 SITE ACCESS AND CONTROL

Access to the mine is controlled through a single entrance and exit point onto the mining area. 1. A 8 m high razor diamond-mesh fencing is utilised to ring fence the operational area, as well as the water dams. Strict access control is employed to optimise control over the flow of contractors and mine personnel to the operations area, as well as the product out of the mine. All visitors to the mine are required to sign in at the security checkpoint, which is located at the entrance gate and are required to go to the office, where a mine or contractor member of the personnel will have to be met on a pre-arranged basis. A third-party security company is utilised to ensure site access control. The access point will have to relocate to the east when the offices relocate.

2.5.1.8 HAUL ROADS

The planned haul road network for the proposed Vlakvarkfontein Colliery Extension Project can be seen on the Mining and Surface Infrastructure Plan in Figure **10**.

[2] The Klipspruit is at time also referred to as the Leeuwfonteinspruit

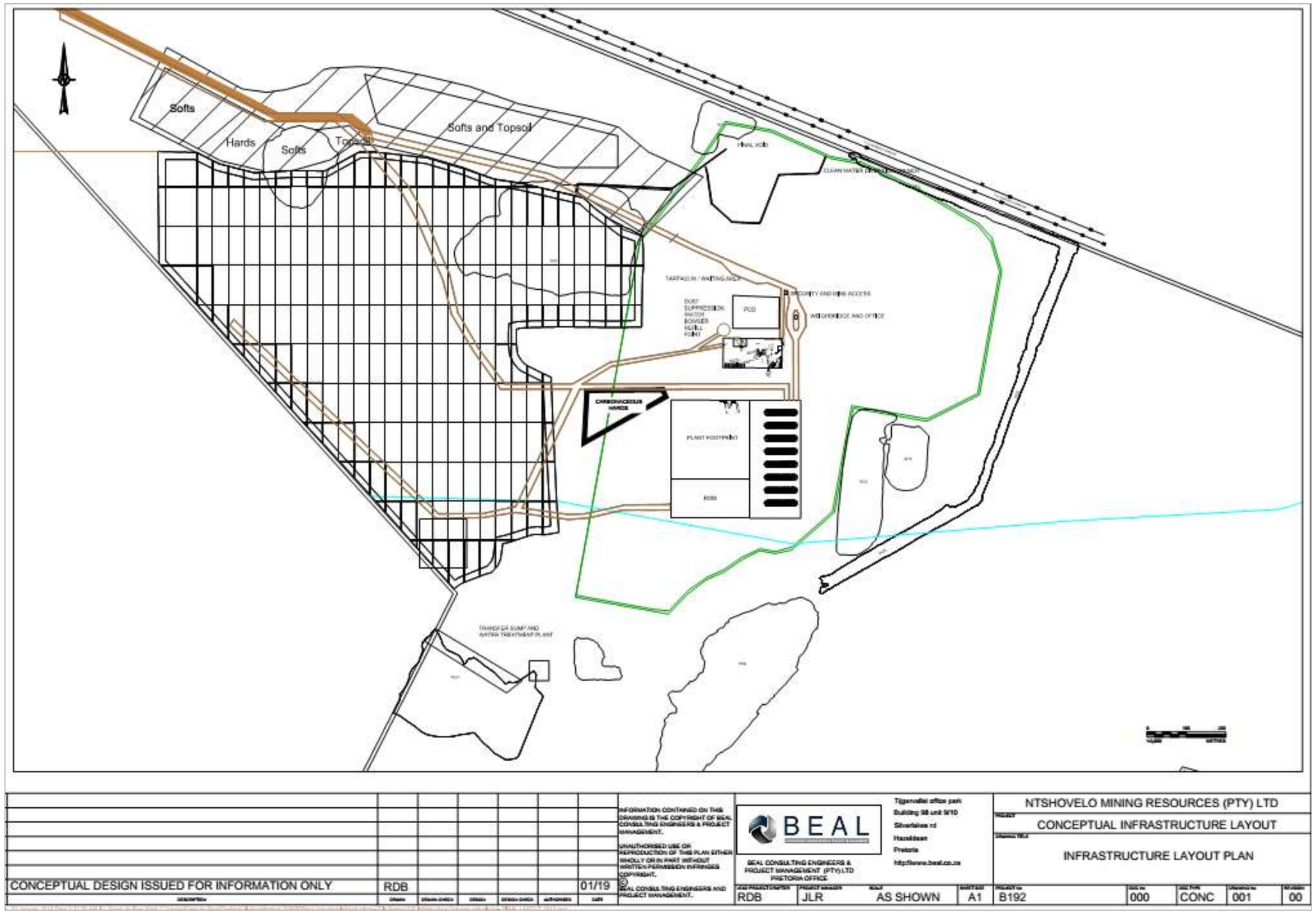


Figure 10: Mine and infrastructure layout plan

2.5.1.9 STOCKPILES

2.5.1.9.1 RUN OF MINE STOCKPILES

Coal mined in the opencast operation will be placed on the RoM stockpiles in front of the current crushing plant while mining is still taking place in the east. Coal will be placed in front of the rotary breaker if not tipped directly into the ROM tip when the new plant is built as part of the western resource project.

The crushed and screened coal, as well as the washed product will be blended onto 3000 t – 5000 t ESKOM stockpiles whilst awaiting laboratory results. On approval, the product will be transported to various ESKOM power stations. The Vlakvarkfontein Colliery "east" is almost mined out and the new CHPP (processing plant) is to relocated, as well as the run of mine stockpiles, the product stockpiles and the new coarse discard dump (if discard is not allowed to be dumped into the pit). All stockpiles will be located within a bunded or trenched area on top of the previous mined, but rehabilitated Vlakvarkfontein "east" area. The contaminated water will be free draining initially to a transfer sump from where the dirty water will be pumped to the current PCD (Figure **11**), and later will be freely draining into a new PCD. This water will form part of the water recycled between the CHPP, water treatment plant and used for dust suppression on the haul roads. The pollution control sump will be a temporary measure and the dirty water will be pumped from here to the current PCD dam until the old PCD dam is demolished due to mining and a new PCD dam is being built.

Figure 11: Current PCD at Vlakvarkfontein Colliery

2.5.1.9.2 NON-CARBONACEOUS STOCKPILES

Overburden stockpiles comprising of both hards and softs will be stockpiled in a long stockpile located between the community in the north, and the western resource mining area. The size of this berm will be minimised to enable optimal rehabilitation of the east and to minimise double handling. The berm will be 8 – 10 m high with a 30 – 40 m base. The first portion of the berm (from the west) will be located on the southern side of the road and then after it passes the current access road it will be located on the northern side of the road. The berm will only be built during the box cut phase and during the first year then roll over will continue.

2.5.1.9.3 SOIL STOCKPILES

Stripped soils, which includes top soil and sub soil will be stockpiled separately. This will ensure that the characteristics of soil stockpiles are suitable for the prevailing landscape and drainage conditions once they are replaced during rehabilitation. All topsoil stockpiles will be placed between the community and the western

resource mining area where practical, which will provide free drainage in all directions and added safety from erosion concerns. Topsoil stockpiles will also be placed in areas far removed from mining activities where they will not be accidentally impacted on or where they will need to be frequently moved.

2.6 KEY WATER USES AND WASTE STREAMS

In accordance with the requirements of the NWA, the applicant is required to compile and submit for adjudication, a WUL for the NWA Section 21 water uses as indicated in Table 6:

Table 6: Water Uses for Vlakvarkfontein Colliery

Water Use	Name	Purpose	Capacity / Volume	Co-ordinates		Farm	Conditions of Licence No 03/B20F/AGJ/4858 and 03/B20A/G/4845
				Latitude	Longitude		
Section 21(a) (Existing Water Use)	Borehole	Taking water from borehole for use at the mine	4 745 m^3/a	-	-	Vlakvarkfontein 213 IR	The license authorizes the taking of a maximum quantity of four thousand seven hundred and forty five cubic meters per annum (4 745 m^3/a) of water from borehole located on Portion 5 of the farm Vlakvarkfontein 213 IR based in an average of thirteen cubic meters per day (13 m^3/d), for domestic purposes.
Section 21(a) (New Water Use)	Borehole	Taking water from borehole for use at the mine	4 745 m^3/a	S26°3'22.03"	E28°53'43.89"	Vlakvarkfontein 213 IR (Portion 5 and Portion 18)	-
Section 21(c) and(i) (New water use)	Two Depressions	The expansion of the proposed mining area will result in the loss of the delineated wetlands due to mining 6 Culverts (mining operations)	-	S26°3'29.92"	E28°53'41.41"	Vlakvarkfontein 213 IR (Portion 5 and Portion 18)	-

Water Use	Name	Purpose	Capacity / Volume	Co-ordinates		Farm	Conditions of Licence No 03/B20F/AGJ/4858 and 03/B20A/G/4845
				Latitude	Longitude		
Section 21 c and i (New water use)	Mining operations (including roads, mining, culverts, within 500m of Klipspruit	Mining operations (including infrastructure) will occur within 500 m of the Klipspruit	-	S26°3'29.92"	E28°53'41.41"	Vlakvarkfontein 213 IR (Portion 5 and Portion 18)	-
Section 21 f (New Water Use)	Treated water discharge point	Water treated at treatment plant will be released into environment	Pumping rate over 300 days: 2 516 m^3/d = 120 m^3/hr = 33.5 l/s	S26°4'16.48"	E28°53'32.85"	Vlakvarkfontein 213 IR	-
Section 21(g) (Existing Water Use)	Pollution Control Dam 1	Disposing of water containing waste into PCD	-	S26°53'35.7"	E28°53'36.2"	Vlakvarkfontein 213 IR	This license authorizes the disposal of two hundred and twenty eight thousand six hundred and eight cubic meters per annum (228 608 m^3/a) of water containing waste on the farm Vlakvarkfontein 213 IR into the pollution control dam, based on an average of six hundred and twenty six cubic meters per day (626 m^3/d) into the pollution control dam

Water Use	Name	Purpose	Capacity / Volume	Co-ordinates		Farm	Conditions of Licence No 03/B20F/AGJ/4858 and 03/B20A/G/4845
				Latitude	Longitude		
Section 21(g) (Existing Water Use	Pollution Control Dam 2	Disposal of water dewatered from the open pits and dirty water run-off from the mining and stockpiles Pollution Control Dam 1 (PCD1)	1 652 832 m^3/a 99 500 m^3 Area: 0,73 ha	S26°11'49.0"	E28°51'44.5"	Vlakvarkfontein 213 IR	This PCD is licenced under Licence No. 03/B20A/G/4845.
Section 21(g) (Existing Water Use)	Coal Product Stockpile	Storing of coal product stockpile	2 400 000t/a	-	-	Vlakvarkfontein 213 IR	The Licensee is authorized to dispose coal product stockpiling of a maximum quantity of two million and four hundred thousand tons per annum (2 400 000 t/a) on the farm Vlakvarkfontein 213 IR based on an average of six thousand five hundred and seventy five tons per annum (6 575 t/a), for stockpile purposes.
Section 21(g) (Existing Water Use)	Carbonaceous Interburden Stockpile	Dispose of carbonaceous interburden stockpile	1 237t/a	-	-	Vlakvarkfontein 213 IR	The Licensee is authorised to dispose stockpiling of carbonaceous interburden of a maximum quantity of four hundred and fifty one thousand five hundred and thirty seven tons per annum (451 537 t/a) on the farm Vlakvarkfontein 231 IR, based on an average of one thousand two hundred and thirty seven tons per day (1 237 t/d) for stockpile of carbonaceous purposes.

Water Use	Name	Purpose	Capacity / Volume	Co-ordinates		Farm	Conditions of Licence No 03/B20F/AGJ/4858 and 03/B20A/G/4845
				Latitude	Longitude		
Section 21(g) (Existing Water Use)	Dust Suppression	Suppression of dust	73 000 m^3/a	-	-	Vlakvarkfontein 213 IR	The licensee is authorised to dispose of a maximum quantity of seventy three thousand cubic metres per annum (73 000 m^3/a) of water containing waste for dust suppression on the farm Vlakvarkfontein 213 IR, based on an average of two hundred cubic meters per day (200 m^3/d), for dust suppression.
Section 21(g) (Existing Water Use)	Septic Tank	Disposing of water containing waste into septic tank	2 628 m^3/a	-	-	Vlakvarkfontein 213 IR	The licensee is authorized to dispose of the maximum quantity of two thousand six hundred and twenty eight cubic meters per annum (2 628 m^3/a) of water containing waste into the septic tank, based on an average of seven cubic meters per day (7 m^3/d)
Section 21 (g) (New water use)	New PCD	Storage of dirty water	20 000m^3	S26°3'19.89"	E28°54'2.83"	Vlakvarkfontein 213 IR (Portion 5 and Portion 18)	-
Section 21 (g) (New water use)	Dust Suppression	Dust suppression	38 252 m^3/a	-	-	Vlakvarkfontein 213 IR (Portion 5 and Portion 18)	-

Water Use	Name	Purpose	Capacity / Volume	Co-ordinates		Farm	Conditions of Licence No 03/B20F/AGJ/4858 and 03/B20A/G/4845
				Latitude	Longitude		
Section 21 (g) (New water use)	New ROM Stockpile	Temporary storage of ROM Stockpile	180 000 t/m throughput Total storage will not exceed 90 000 t/d	S26°3'35.08"	E28°53'58.86"	Vlakvarkfontein 213 IR (Portion 5 and Portion 18)	-
Section 21(g) (New Water Use)	Carbonaceous hards stockpile	Dispose of carbonaceous interburden stockpile	Total storage will not exceed 1 million m^3	S26°'27.69"	E28°53'49.86"	Vlakvarkfontein 213 IR (Portion 5 and Portion 18)	-
Section 21(g) (New Water Use)	Discard disposal	Disposal of discard waste from wash plant into pit	1.2 million t/a maximum	S26° 3'13.27"	E28°53'11.15"	Vlakvarkfontein 213 IR (Portion 5 and Portion 18)	-
Section 21(g) (New Water Use)	Temporary storage of discard	Temporary storage of discard before disposing into pit.	50 000 t/d maximum	S26° 3'30.98"	E28°53'54.62"	Vlakvarkfontein 213 IR (Portion 5 and Portion 18)	-

Water Use	Name	Purpose	Capacity / Volume	Co-ordinates		Farm	Conditions of Licence No 03/B20F/AGJ/4858 and 03/B20A/G/4845
				Latitude	Longitude		
Section 21 (g) (New water use)	Water transfer point in southern void	Water will be pumped from underground and stored in the void before reuse / treatment / discharge	124 000 m^3	S26°'47.20"S	E28°53'38.23"	Vlakvarkfontein 213 IR (Portion 5 and Portion 18)	-
Section 21 (g) (New water use)	Water Treatment Plant	Treatment of waste water	Pumping rate over 300 days: 2 516 m^3/d = 120 m^3/hr = 33.5 l/s	S26°3'49.23"	E28°53'43.29"	Vlakvarkfontein 213 IR (Portion 5 and Portion 18)	-
Section 21 (g) (New water use)	Temporary storage of water in final void	Temporary storage of water	500 000 m^3	S26° 3'5.16"	E28°54'1.28"	Vlakvarkfontein 213 IR (Portion 5 and Portion 18)	-

Water Use	Name	Purpose	Capacity / Volume	Co-ordinates		Farm	Conditions of Licence No 03/B20F/AGJ/4858 and 03/B20A/G/4845
				Latitude	Longitude		
Section 21(j) (Existing water use)	Removal of underground water	Removal of underground water from open pit for safety of people and continuation of activities	111 916 m^3/a	-	-	Vlakvarkfontein 213 IR	The licensee is authorized to remove a total volume of one hundred and eleven thousand nine hundred and sixteen cubic meters per annum (111 916 m^3/a) of underground water from open pit, based on an average quantity of three hundred and seven cubic meters per day (307 m^3/d), and dispose of the underground water into the pollution control dam on the farm Vlakvarkfontein 213 IR and re-use this water for dust suppression.
Section 21 (j) (New Water Use)	Removal of water in final void	Removal of water in final void for the safety of people	500 000 m^3	S26° 3'5.16"	E28°54'1.28"	Vlakvarkfontein 213 IR (Portion 5 and Portion 18)	-
Section 21(j) (New water use)	Removal of underground water	Removal of underground water from open pit for safety of people and continuation of activities	Pumping rate over 300 days: 2516 m^3/d = 120 m^3/hr = 33.5 l/s	S26°3'13.27"	E28°53'11.15"	Vlakvarkfontein 213 IR (Portion 5 and Portion 18)	-

2.7 WASTE

Hazardous, industrial and general or domestic waste forms part of the waste stream generated at the Vlakvarkfontein Colliery. Non-hazardous domestic and industrial waste comprise of typical constituents such as paper, empty cans, glass, steel and plastic containers, scrap metal, piping and tubing (plastic, metal and rubber). However, the majority of non-residue industrial waste produced on site is hazardous. This includes used oil, degreasers, lubricants and containers, mostly contaminated. The volumes applicable to the identified waste stream will fluctuate with the requirements of the mine, but the mine has committed to not dispose of any waste on site. All waste streams will be temporarily stored on site until they are removed by an appointed waste contractor. The mine has committed to ensuring the following waste storage thresholds are adhered to:

- No more than 99 m^3 of general (domestic, non-hazardous) waste will be stored on site at any one time; and
- No more than 34 m^3 of industrial (hazardous) waste will be stored on site at any one time.

2.7.1 WASTE CLASSIFICATION

A waste classification (Appendix D) was completed. Ten samples were provided to WSP Environmental Proprietary Limited (WSP). Three of these (CKL 124, 125 and 130) were representative of the wash plant discard, with the remaining seven being representative of overburden. Samples were composited according to type (i.e. discard and overburden samples were kept separate) ahead of laboratory analysis. There was no interburden within the samples provided. The classification and characterisation process has indicated the discard to be hazardous given the concentration of sulphur. This will require disposal at a Type 3 (C / GLB+) facility and a safety data sheet (SDS) should be prepared for handling purposes.

The overburden has been classified as non-hazardous, therefore, not requiring a SDS. However, if this is to be managed by landfill disposal then a Type 3 (C / GLB+) facility would be appropriate. Under the current legislation, there is no legal provision to motivate for a lesser containment barrier system. This option is, however, provided for in draft legislation viz. the Proposed Amendments to the Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits, 2015 (GN R.1440 of 2016). This allows a pollution control barrier system to be determined on a case-by-case basis, based on a risk analysis conducted by a competent person. In the interim period, the DWS has indicated (viz. letter to the Chamber of Mines South Africa, 29/06/2016) that it will accept a risk-based approach to the determination of barrier requirements. It is, therefore, likely that the pollution barrier can be designed using the risk-based approach as per the GN R. 1440, which may allow for a lesser requirement. However, as this is draft legislation this must be endorsed by way of consultation with the appropriate authorities as part of this EIA process.

Waste rock material should not leach the main contaminant indicators at elevated levels and will not be acidic (i.e. no elevated metal concentrations). Considering a worst-case where all contamination instantaneously mixes into the aquifer each year, without considering clean upstream groundwater, the water quality concentrations in the aquifer should gradually improve over time. It is however estimated that concentrations in the aquifer will be <20% of the leach concentrations, 10 years after the placement of waste rock on surface. This was determined through consideration of the rainfall recharge rate, uncontaminated aquifers, the laboratory testing, saturated aquifer thickness, aquifer porosity, etc. Consequently, the aquifer will not be contaminated above the LCT0 threshold values.

Groundwater seepage velocity has been determined to range between 5.8m/a and 14m/a. Therefore, over the period that the waste rock stockpile will be operational (6-year operational and 1-year rehabilitation) the contamination plume will probably not exceed 100 m from the stockpiles, at concentrations lower than the LCT0 threshold values. This movement will also be in the direction of the pit.

It is recommended in the groundwater study (Appendix D), without any reservation, that an exemption should be granted from a liner system for the waste rock stockpile. The impact of the waste rock stockpile on groundwater quality is expected to be insignificant and it is likely that no groundwater quality impact will be observed.

It should also be noted here that the old open cast area at the Vlakvarkfontein Colliery was backfilled and this area needs special attention. The backfill material could be contaminated so when mining this area it will be imperative that the mine stockpile this material separately and do a waste classification on it before disposing of it.

Hazardous, industrial and general or domestic waste forms part of the waste stream generated at the Vlakvarkfontein Colliery. Non-hazardous domestic and industrial waste comprise of typical constituents such as paper, empty cans, glass, steel and plastic containers, scrap metal, piping and tubing (plastic, metal and rubber). However, the majority of non-residue industrial waste produced on site is hazardous. This includes used oil, degreasers, lubricants and containers, mostly contaminated. The volumes applicable to the identified waste stream will fluctuate with the requirements of the mine, but the mine has committed to not dispose of any waste on site. All waste streams will be temporarily stored on site until they are removed by an appointed waste contractor. The mine has committed to ensuring the following waste storage thresholds are adhered to:

No more than 99 m^3 of general (domestic, non-hazardous) waste will be stored on site at any one time; and no more than 34 m^3 of industrial (hazardous) waste will be stored on site at any one time.

2.7.2 MINE RESIDUE

Mine residue (slurry and discard) will be generated at the proposed wash plant area. Slurry will be routed to a filter press, where the slurry will be dried to a filter cake before being added to the saleable product. During emergencies and maintenance, the slurry will be put into the discard dump or pumped back into the pit. Discard will be disposed of either back into the pit on the site or into a discard dump. Current calculations indicate that discard tonnages will average 542 091 tons per year for the first three years of operation and 203 883 tons per year for the next three years.

2.8 ORGANISATIONAL STRUCTURE OF ACTIVITY

The organisational structure of the Applicant is indicated in Figure 12.

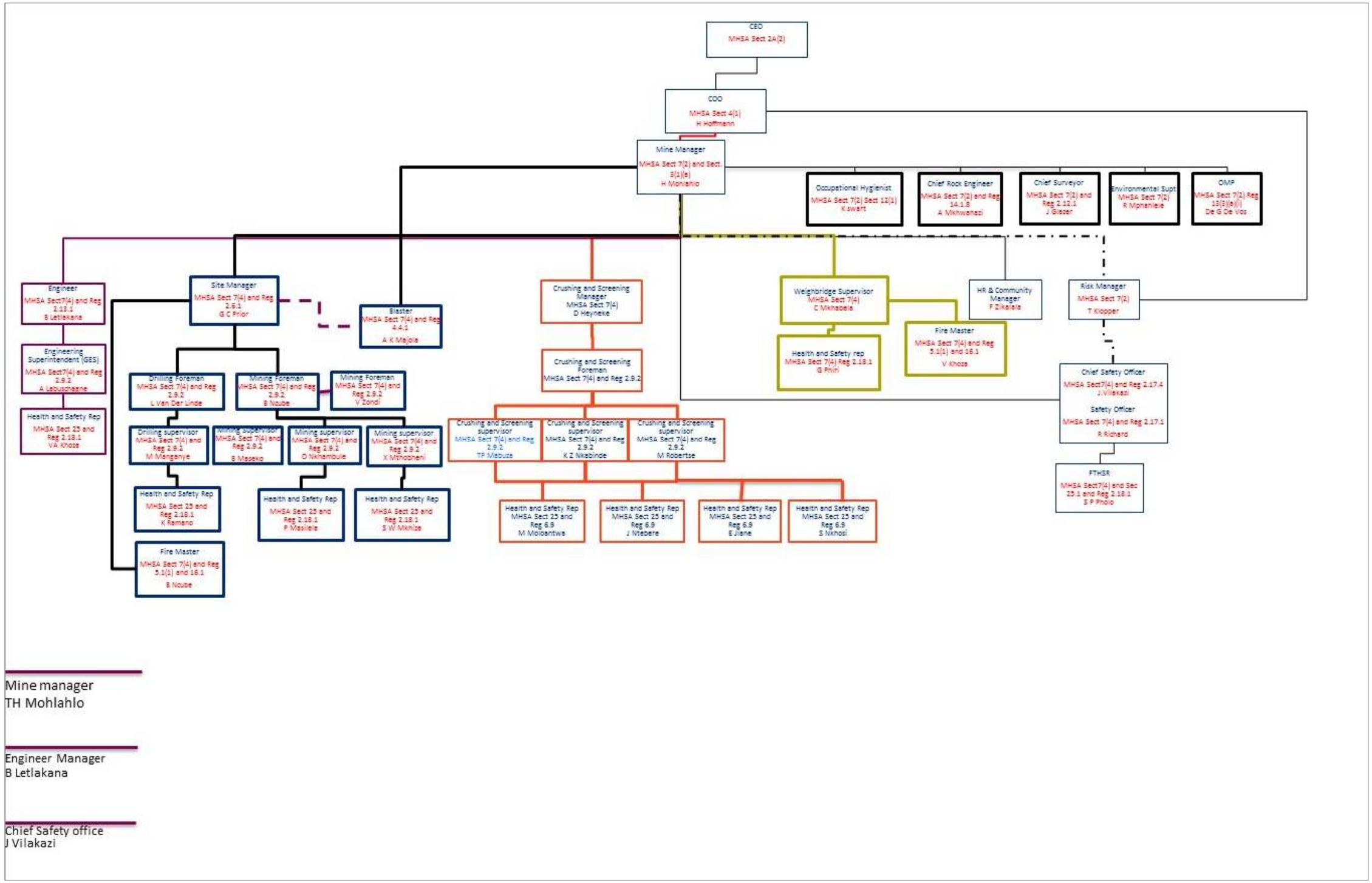


Figure 12: The Applicant's organisational structure

2.9 BUSINESS AND CORPORATE POLICIES

See Figure 13 for the Health, Safety, Environmental and Community policy for Continental Coal.

MBUYELO COAL (Pty) Ltd

HEALTH, SAFETY ENVIRONMENT AND COMMUNITY POLICY DOCUMENT

HSE POLICY

We at Mbuyelo Coal endeavour to be a sustainable organisation by making safety, health, the environment and the community an integral part of our planning and decision-making process. We are actively aware of the impact that our mining activities can have on the people, environment and surrounding communities. In all our day-to-day activities, we expect our employees and service providers to take personal responsibility to embrace safety, health, the environment and the community.

We are committed to documenting, implementing and maintaining our management systems to ensure clarity of purpose and effective application of systems and procedures to enable us to:

- Conduct our business with integrity, respect and care for employees, the environment and the community;
- Identify, assess and manage risk;
- Meet applicable legislation and industry standards;
- Define SHEC objectives and targets and measure progress and compliance
- Lead, develop and motivate our people to respect and adopt this commitment;
- Provide adequate resources to reach our HSEC goals;
- Support the fundamental rights of employees and communities to be safeguarded from unacceptable risk;
- Identify, implement and manage a program to reduce risks related to Fatigue
- Minimise the impact or our operations on the environment through pollution control, conservation and restoration of natural resources; and
- Design and implement processes that result in timeous, cost effective and quality product delivery.

We will engage with local communities to contribute to social development needs through the application of appropriate skills, technologies and resources.

We will regularly review this policy document and our HSEC progress and communicate results to our stakeholders, thereby sharing with them the responsibility of meeting the objectives of this document.

We hold our leaders accountable for HSEC performance at all levels within our organisation. We will be successful when we meet our targets towards the goal of zero harm, and when we are a valued member of the community in which we operate.

H C Hoffmann
Chief Operating Officer

Figure 13: Vlakvarkfontein Health, Safety and Environmental policy

2.9.1 PERSONAL PROTECTIVE EQUIPMENT

The mine personal has:

- 100% compliance – wearing of Personal Protective Equipment (PPE).

2.9.2 CORE VALUES

The following behaviour is against the organizations core values regarding Health and Safety and a zero tolerance approach are used in dealing with them:

- Environmental impacts;
- Unsafe behaviour; and
- Unsafe conditions.

The following are compulsory to ensure the company objectives are met:

- Annual induction training;
- Annual medical examination; and
- Licensing.

2.9.3 HEALTH AND DUST

With regards to health an dust issues, Vlakvarkfontein Colliery applies the following:

- 100% compliance <2mg/m^3 Personal Exposure;
- 100% Treatment of all hypertension cases;
- 100% Treatment of Tuberculosis;
- NIHL cases;
- Good water system and ventilation; and
- Dust control underground (sprays, water, cars, etc.).

2.9.4 SAFETY PROGRAMMES

Vlakvarkfontein Colliery continuously strives to ensure safety in and around the mine through:

- Compliance to legislation;
- Planned Task Observation;
- Planned inspections;
- Contractor Management;
- Incident Recording and close out; and
- Risk Assessment.

2.9.5 COMMUNITY

The Vlakvarkfontein Colliery addresses all community complaints received and keeps records of this.

3 REGULATORY WATER AND WASTE MANAGEMENT FRAMEWORK

The Vlakvarkfontein Colliery has been in operation for several years and as such a number of licenses and authorisations are held by the mine. The following rights, licenses, authorisations and approvals are currently in place and have been considered in the compilation of this report:

Table 7: Existing rights, licenses and authorisations for Vlakvarkfontein Coal Mine

Document	Consultant	Applicable Properties	Reference Number
MPRDA EIA and EMPR (2009)	Geovicon Environmental (Pty) Ltd.	Portion 3, 5 and 13 of Vlakvarkfontein 213 IR	MP 30/5/1/2/3/2/1 (300) EM
IWWMP and Water Use Licence (2011)		Portion 3, 5 and 13 of Vlakvarkfontein 213 IR	4/B20F/AGJ/1131
IWWMP and Water Use Licence Amendment (2014)	Geo Soil and Water CC	Portion 3, 5 and 13 of Vlakvarkfontein 213 IR	4/B20F/AGJ/1131
IWWMP Consolidation (2015)	Geo Soil and Water CC.	Portion 5 and 18 of Vlakvarkfontein 213 IR	03/B20F/AGJ/4858

In addition to the approved authorisations and licenses listed in Table 7, Ntshovelo also wish to amend the approved MR (MP 30/5/1/2/2/112 MR) and EMPR to extend the mining operations within the approved mining right boundary at the Vlakvarkfontein Colliery, located on Portions 5, 13, and 18 of the Farm Vlakvarkfontein 213 IR. The extension of the mining operations will require the relocation and re-establishment of the existing ancillary infrastructure associated with the current mining operations, including the PCD and the administrative structures. It is also proposed to establish a coal processing plant (wash plant). Ntshovelo is required to assess any new environmental impacts associated with the change in the mining programme and area, and to establish appropriate mitigation measures to address the impacts. The EA application was submitted to the DMR on 19 October 2017 and the Scoping Report on 27 November 2017 for adjudication.

3.1 SUMMARY OF ALL WATER USES

A summary of all of the water uses is provided in Section 2.6. Below is a discussion of the existing water uses at the Vlakvarkfontein Colliery, as well as the relevant exemption and the new and proposed water uses to the extension project.

3.2 EXISTING LAWFUL WATER USES

The NWA makes provision for Section 21 Water Uses that could be considered to be Existing Lawful Water Uses, if they comply with the requirements of Section 32 of the NWA (1998), although the declaration of any water uses as Existing Lawful Water Uses is still at the discretion of the DWS.

A person may use water, if the use is

- permissible as a continuation of an existing lawful water use;
- permissible in terms of a general authorisation;
- permissible under Schedule 1; or

- authorised by a licence.

The water uses, as listed in Section 2.6 is considered an entitlement due to the approved WULAs (Licence no.: 03/B20F/AGJ/4858 and 03/B20A/G/4845) for the Vlakvarkfontein Colliery.

3.3 RELEVANT EXEMPTIONS

GN 704 and Regulation 77 of the NWA (Act 36 of 1998) place restrictions on the mining activities for the protection of water resources. Of relevance to the Applicant are the following:

(a) *Section 4a of Government Notice 704 (GN 704) of the South African National Water Act states the following: "No person in control of a mine or activity may locate or place any residue deposit, dam, reservoir, together with any associated structure or any other facility within the 1:100 year flood-line or within a horizontal distance of 100 metres from any watercourse…".*

(b) *Section 4b of Government Notice 704 of the South African National Water Act states the following: "No person in control of a mine or activity may … carry on any underground or opencast mining, prospecting or any other operation or activity under or within the 1:50 year flood-line or within a horizontal distance of 100 metres from any watercourse…"*

(c) *place or dispose of any residue or substance which causes or is likely to cause pollution of a water resource, in the workings of any underground or opencast mine excavation, prospecting diggings, pit or any other excavation;*

PCDs are required as part of the project, therefore, Section 4(a) of GN 704 will apply to the mine. The surface water buffer zone, therefore, is the greater of the 100-year floodline or 100 m from the water course. The floodlines and buffer zones for the tributary of the Wilge River, namely the Klipspruit, are shown in Figure 14.

Figure 14: Buffer zones on the Klipspruit

Vlakvarkfontein Colliery is planning to dispose of the filter cake into pit as is anticipated that the mine water quality of the surrounding aquifers are not expected to be impacted, due to groundwater flowing toward the dewatered mining area indicated that due to the direction of groundwater flow (refer to Section 4.6). Vlakvarkfontein Colliery, therefore, also requires exemption in terms of 4(c) of GN 704.

3.4 GENERALLY AUTHORISED WATER USES

No General Authorisations are applicable to this project.

3.5 NEW WATER USES TO BE LICENSED

A summary of all new and proposed water uses that will be applied for is indicated in Table 8 The completed Water Use Licence Forms will be submitted to the DWS simultaneously with the submission of this IWWMP.

Table 8: New and proposed water uses

Section 21 Water Use	Water Use Name	Description / purpose
Section 21(a)	Borehole	Removal of water for use at mine
Section 21 (c) and (i)	Mining within 500m of a wetland	Loss of delineated wetland due to mining
Section 21 (c) and (i)	Mining infrastructure situated within 500m of a wetland	All mining infrastructure will fall within the 500m buffer
Section 21 (f)	Discharge of water containing waste	Water treated at treatment plant will be released into environment
Section 21 (g)	New PCD	Disposing of water containing waste into PCD
Section 21 (g)	Dust Suppression	Suppression of dust
Section 21 (g)	New ROM Stockpile	Storing of coal product stockpile
Section 21(g)	New Carbonaceous interburden stockpile	Dispose of carbonaceous interburden stockpile
Section 21(g)	Discard disposal	Disposal of discard waste from wash plant
Section 21 (g)	Water Treatment Plant	Treatment of waste water
Section 21(j)	Removal of underground water	Removal of underground water from open pit for safety of people
Section 21 (j)	Removal of water from void	Removal of water in void for the safety of people

3.6 WASTE MANAGEMENT ACTIVITY (NEMWA)

Vlakvarkfontein Colliery currently does not have a NEMWA licence. Section 3.7 provides a detailed description of the waste activities that the mine is applying for.

3.7 WASTE RELATED AUTHORISATIONS

Vlakvarkfontein Colliery is applying for the waste related activities as listed in Table 9 as per the NEMWA.

Table 9: Proposed waste activities in terms of NEMWA for Vlakvarkfontein Colliery

Activity #	Listed Activity Description	Reason for Inclusion
NEMWA listed activities - Government Notice R921		
B1	The storage of hazardous waste in lagoons excluding storage of effluent, wastewater or sewage.	A PCD will be required. The penstock sump would also trigger this activity. .
B4	The treatment of hazardous waste in excess of 1 ton per day calculated as a monthly average; using any form of treatment excluding the treatment of effluent, wastewater or sewage.	Water treatment plant and temporary ablution facilities will be constructed.
B 5	The treatment of hazardous waste in lagoons, excluding the treatment of effluent, wastewater or sewage.	This is applicable to the water treatment plant and oil separators.
B7	The disposal of any quantity of hazardous waste to land.	The construction of residue dumps
B 10	The construction of a facility for a waste management activity listed in Category B of this Schedule (not in isolation to associated waste management activity).	The construction of PCD's and water treatment plant.
B 11	The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right, exploration right or production right in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).	Dumps & stockpiles are residue deposits resulting from activities which require a mining right These include waste rock dumps, the ROM stockpile, product stockpile and any topsoil stockpiles.
C 1	The storage of hazardous waste at a facility that has the capacity to store in excess of 80m^3 of hazardous waste at any one time, excluding the storage of hazardous waste in lagoons or temporary storage of such waste.	Storage of hazardous waste in a PCD.
C 2	The storage of general waste at a facility that has the capacity to store in excess of 100m^3 of general waste at any one time, excluding the storage of waste in lagoons or temporary storage of such waste.	Storage of hazardous waste in a PCD. The capacity of the pollution control dam is 14 000 m^3 The penstock sump will also trigger this activity.

3.8 OTHER AUTHORISATIONS

3.8.1 THE MINERALS AND PETROLEUM RESOURCES DEVELOPMENT ACT

The purpose of the MPRDA is *"to make provision for equitable access to and sustainable development of the nation's mineral and petroleum resources; and to provide for matters connected therewith."* The MPRDA establishes that environmental management principles are relevant and binding to all mining operations. Government Notice R527 of the MPRDA is a comprehensive listing of environmental regulations related to mining. The most relevant Regulations to this project are Regulations 63 and 69, which state that pollution control and waste management principles must be implemented. Where the generation and production of waste at source is not avoidable, it must be disposed of in a responsible and sustainable manner (in compliance with the NEMWA).

Section 37 of the MPRDA confirms that the principles set out in the NEMA apply to all prospecting and mining operations and must be carried out in accordance with the generally accepted principles of sustainable development. Section 38 stipulates that the general objectives of IEM must be applied in accordance with NEMA and this includes the assessment and management of impacts identified as part of the environmental management program process laid out in Section 39.

R527 specifies that the EMPR must include environmental objectives and specific goals for mine closure and must prescribe financial provisions for the rehabilitation or management of negative environmental impacts, which must be reviewed annually (Section 41) R527 also provides principles for mine closure.

The proponent will remain responsible for any environmental liability and the management thereof, until it has been issued with a closure certificate by the DMR (Section 43). R527 allows for four methods of financial provision.

3.8.2 THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT

The mining right for the Vlakvarkfontein Colliery (Ref No: MP 30/5/1/2/2/300 MR) was approved in 4 May 2009. In support of the amendment to the mining right submitted by Ntshovelo, the Applicant is required as to conduct a Scoping Report, EIA /EMP and I&AP consultations that need to be submitted to the DMR for adjudication.

The Scoping Report was submitted to the DMR on 03 November 2016 for adjudication.

Section 24 P of the NEMA requires that an applicant for an environmental authorisation relating to prospecting, mining or production must, before the Minister responsible for mineral resources issues the environmental authorisation, comply with the prescribed financial provision for the rehabilitation, closure and ongoing post decommissioning management of negative environmental impacts. Therefore, the potential environmental liabilities associated with the proposed activity must be quantified and indicate the method of financial provision in line with the NEMA regulations pertaining to the financial provision for prospecting exploration, mining and production, (2015). The financial provision costs in line with DMR guidelines will be presented in the EIA Report. Table 10 indicates the listed activities in terms of the NEMA Regulations that are applicable to the proposed extension of the Vlakvarkfontein Colliery mining area within the existing mining right.

Table 10: Listed activities in terms of the NEMA Regulations

Notice #	Activity #	Description	Triggered by
Activities in terms of NEMA (1998)			
GNR 983	9	*The development of infrastructure exceeding 1 000 metres in length for the bulk transportation of water or storm water—* *(i) with an internal diameter of 0,36 metres or more; or*	Proposed Water Treatment Plant / water pipelines

Notice #	Activity #	Description	Triggered by
		(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 railway line reserve; or* *(b) where such development will occur within an urban area.*	
GNR 983	12	*"The development of—* *(i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or* *(ii) infrastructure or structures with a physical footprint of 100 square metres or more;* *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. "*	PCD

Notice #	Activity #	Description	Triggered by
R 983	13	*The development of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50000 cubic metres or more, unless such storage falls within the ambit of activity 16 in Listing Notice 2 of 2014.*	PCD
R 983	14	*The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres.*	Diesel storage on site up to 100 cubic meters
R 983	19	*"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* *(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."*	Infilling/deposition during upgrade
GNR 983	24	*"The development of a road—* *(i) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or* *(ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;* *but excluding a road—* *(a) which is identified and included in activity 27 in Listing Notice 2 of 2014;* *(b) where the entire road falls within an urban area; or*	Internal haul roads for transporting of coal

Notice #	Activity #	Description	Triggered by
		(c) which is 1 kilometre or shorter."	
GN983	25	*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 2000 cubic metres but less than 15000 cubic metres.*	PCD
GNR 983	27	*"The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for-* *(i) the undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan."*	Open Cast Extension
GN983	28	*Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development:* *(i) will occur inside an urban area, where the total land to be developed is bigger than 5 hectares; or* *(ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare;* *excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes.*	Mining (industrial) development
GN983	31	*The decommissioning of existing facilities, structures or infrastructure for—* *(i) any development and related operation activity or activities listed in this Notice, Listing Notice 2 of 2014 or Listing Notice 3 of 2014;* *(ii) any expansion and related operation activity or activities listed in this Notice, Listing Notice 2 of 2014 or Listing Notice 3 of 2014;* *(iii) …….* *(iv) any phased activity or activities for development and related operation activity or expansion or related operation activities listed in this Notice or Listing Notice 3 of 2014; or* *(v) any activity regardless the time the activity was commenced with, where such activity:*	Decommissioning & relocation of existing facilities

Notice #	Activity #	Description	Triggered by
		(a) is similarly listed to an activity in (i) or (ii) above; and *(b) is still in operation or development is still in progress;* *excluding where—* *(aa) activity 22 of this notice applies; or* *(bb) the decommissioning is covered by part 8 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies.*	
GN983	45	*The expansion of infrastructure for the bulk transportation of water or storm water where the existing infrastructure—* *(i) has an internal diameter of 0,36 metres or more; or* *(ii) has a peak throughput of 120 litres per second or more; and* *(a) where the facility or infrastructure is expanded by more than 1 000 metres in length; or* *(b) where the throughput capacity of the facility or infrastructure will be increased by 10% or more;* *excluding where such expansion—* *(aa) relates to transportation of water or storm water within a road reserve or railway line reserve; or* *(bb) will occur within an urban area.*	Utilization of existing pipelines
GNR 983	46	*The expansion and related operation of infrastructure for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes where the existing infrastructure—* *(i) has an internal diameter of 0,36 metres or more; or* *(ii) has a peak throughput of 120 litres per second or more; and* *(a) where the facility or infrastructure is expanded by more than 1 000 metres in length; or* *(b) where the throughput capacity of the facility or infrastructure will be increased by 10% or more;* *excluding where such expansion—* *(aa) relates to the bulk transportation of sewage, effluent, process water, waste water, return water,*	Possible utilization of existing pipelines

Notice #	Activity #	Description	Triggered by
		industrial discharge or slimes within a road reserve or railway line reserve; or *(bb) will occur within an urban area.*	
GNR 983	48	*The expansion of—* *(i) infrastructure or structures where the physical footprint is expanded by 100 square metres or more; or* *(ii) dams or weirs, where the dam or weir, including infrastructure and water surface area, is expanded by 100 square metres or more;* *where such expansion 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 expansion of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour;* *(bb) where such expansion 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 expansion occurs within an urban area; or* *(ee) where such expansion occurs within existing roads, road reserves or railway line reserves.*	Possible utilization / expansion of existing infrastructure
GNR 983	50	*The expansion of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, where the combined capacity will be increased by 50000 cubic metres or more*	Existing underground penstock area may trigger this
GNR 983	56	*"The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre-* *(i) where the existing reserve is wider than 13,5 meters; or* *(ii) where no reserve exists, where the existing road is wider than 8 metres;*	Internal haul roads for transporting of coal

Notice #	Activity #	Description	Triggered by
		excluding where widening or lengthening occur inside urban areas."	
GNR 11983	67	*Phased activities for all activities—* *(i) listed in this Notice, which commenced on or after the effective date of this Notice or similarly listed in any of the previous NEMA notices, which commenced on or after the effective date of such previous NEMA Notices;* *excluding the following activities listed in this Notice-* *17(i)(a-d); 17(ii)(a-d); 17(iii)(a-d); 17(iv)(a-d); 17(v)(a-d); 20; 21; 22; 24(i); 29; 30; 31; 32;* *34; 54(i)(a-d); 54(ii)(a-d); 54(iii)(a-d); 54(iv)(a-d); 54(v)(a-d); 55; 61; 64; and 65; or* *(ii) listed as activities 5, 7, 8(ii), 11, 13, 16, 27(i) or 27(ii) in Listing Notice 2 of 2014 or similarly listed in any of the previous NEMA notices, which commenced on or after the effective date of such previous NEMA Notices;* *where any phase of the activity was below a threshold but where a combination of the phases, including expansions or extensions, will exceed a specified threshold."*	General mining activities
GNR 984	6	*"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. "*	Possibly triggered if new PCD inflow exceeds 2000 cubic meters / day

Notice #	Activity #	Description	Triggered by
GNR 984	15	*"The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for-* *(i) the undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan."*	The extension of the mining area.
GNR 984	16	*The development of a dam where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5 metres or higher or where the high-water mark of the dam covers an area of 10 hectares or more."*	A PCD will be constructed. The exact size and capacity of the dam will be determined in the EIA phase.
GN 984	17	*"Any activity including the operation of that activity which requires a mining right as contemplated in section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including—* *(a) associated infrastructure, structures and earthworks, directly related to the extraction of a mineral resource; or* *(b) the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing;* *but excluding the secondary processing of a mineral resource, including the smelting, beneficiation, reduction, refining, calcining or gasification of the mineral resource in which case activity 6 in this Notice applies.*	Mining Activities
GN985	12	*The clearance of an area of 300 square meters or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.* *i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004*	All infrastructure and open put extension – site falls within endangered ecosystem

4 PRESENT ENVIRONMENTAL SITUATION

4.1 CLIMATE

The climate is typical of the Highveld, with warm summers and cold winters with occasional severe frosts. Rainfall typically occurs as high intensity short duration thunderstorms. The mean annual temperature is 22.5°C, with recorded extremes of -11°C and 34°C.

Owing to the location of the site, the gentle undulating topography and the non-existence of mountain ranges and ridges, limited localised wind systems (topographically-induced) will be generated. Hence the wind patterns at the mine will typically conform to the regional wind patterns. Wind speed and direction summary for eMalahleni (January 2016 to March 2016) is provided in Table 11.

The mine is situated in the Highveld zone, characterised by summer hailstorms. These hailstorms per annum occur between mid-November and mid-April in the Witbank area. Thunderstorms occur frequently during summer (rainy season) and are usually accompanied by lightning, heavy rain, strong winds and occasional hail. Storms are localised and rainfall can vary markedly over short distances. Frost occurs in the winter months. According to the WRC (1994) the Vlakvarkfontein Colliery is situated in quaternary catchments B20F and B20E, both with Mean Annual Precipitation (MAP) of 670 mm/a.

Table 11: Wind speed and direction summary for eMalahleni (January to December 2016)

Period	Average Wind Speed (m/s)	Dominant Direction
Jan-16	2.99	East
Feb-16	2.88	West
Mar-16	2.48	North and East
Apr-16	2.25	Northwest
May-16	2.37	Northeast
Jun-16	2.18	Northwest
Jul-16	2.77	Southwest
Aug-16	2.81	Northwest
Sep-16	3.30	Northwest
Oct-16	3.74	North and East
Nov-16	3.27	North and Northeast
Dec-16	2.25	West

4.1.1 PRECIPITATION

The annual rainfall and evaporation data was assessed from the WR2005 data set for the artificial water circuits. MAP is representative of the average rainfall that occurs over an area during any given year. The site MAP is estimated at 736 mm. Delmas normally receives about 575 mm of rain per year, while Ogies receives about 569 mm annually. The latest recorded data from the annual dust fallout monitoring report for Vlakvarkfontein Colliery indicate a yearly average of 677.5 mm of rainfall for the eMalahleni area.

4.1.2 EVAPORATION

The mean monthly evaporation for the quaternary catchment B20E is presented in Figure 15. The maximum evaporation occurs during the summer months, from October to January, due to high summer temperatures with the annual average being 839 mm. The site Mean Annual Evaporation (MAE) is estimated at 1 677 mm.

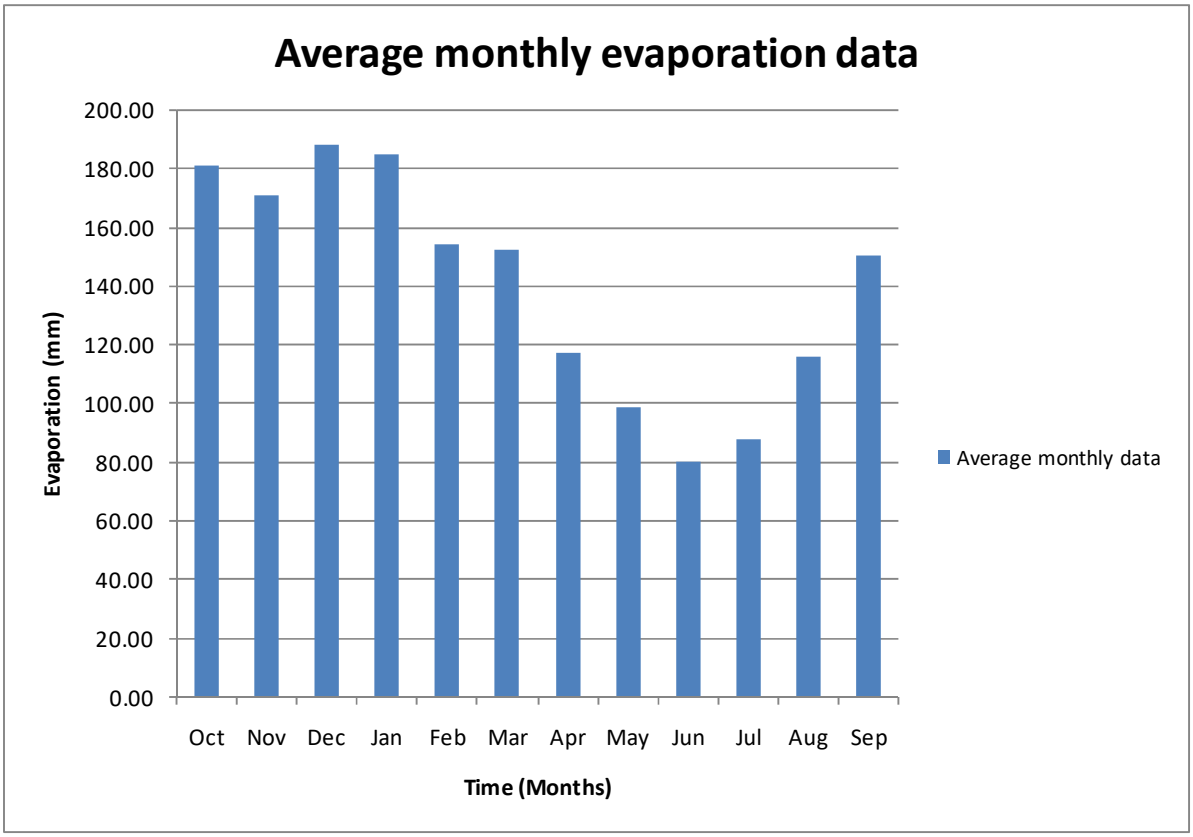


Figure 15: Average Monthly Evaporation

4.1.3 MEAN ANNUAL RUNOFF (MAR)

The size and Mean Annual Runoff (MAR) for the affected sub-catchments, taken as 10% of the annual precipitation, within which the Vlakvarkfontein Colliery occurs is indicated in Table 12 (BEAL,2017).

Table 12: Catchment MAR for sub-catchments within and around the Vlakvarkfontein Colliery

Catchment	Area (km^2)	MAR (10^6m^3)
Leeuwfonteinspruit sub-catchment	70.4	1.1120
Heuwelfonteinspruit sub-catchment	126.2	7.9516
Mining Area catchment	1.21	0.0764

4.2 SURFACE WATER

A surface water study was conducted by BEAL Consulting and Project Management (Pty) Ltd. (BEAL) (refer to Appendix D). The Leeuwfonteinspruit and Heuwelfonteinspruit, which drain the proposed mining area run along the southern and northern boundary of the proposed mine respectively. Both these streams discharge into the Wilge River some kilometres west of the mining area. Both of these streams have their headwaters upstream of the mining area to the east and south east of the mining area. A power station and several opencast and underground mining operations occurs upstream of the proposed mining area.

A number of impoundments have been erected within the affected streams, which are in the form of farm dams, mined out opencast pits, mine pollution control dams and power station water storage dams. Two sub-catchments of the Wilge River (Leeuwfonteinspruit and Heuwelfonteinspruit sub catchments) were identified as being potentially affected by the proposed mining project. These sub-catchments cover an area of approximately 196.6 km^2 (Heuwelfonteinspruit: 70.4 km^2 and Leeuwfonteinspruit: 126.2 km^2) and both discharge into the Wilge River some kilometres west of the proposed mining area. Both sub catchments are typical of the Highveld region with gentle to flattish slopes with scattered pans. The Wilge River catchment measures 4 360 km^2. The mean annual precipitation in this catchment is generally uniform with an average precipitation of approximately 670 mm, varying between 650 mm and 700 mm.

Three streams near the Vlakvarkfontein Colliery are at risk of potentially being impacted on by the mining activities. These include the Wilge River, the Klipspruit and the Kromdraaispruit. The Wilge River flows in a northerly direction past the Vlakvarkfontein Colliery between the Vaal and the Olifants Rivers. Several collieries have been identified upstream and should be considered, when assessing downstream water quality. The Klipspruit flows from a south-easterly to a north-westerly direction to join the Wilge River on the western side of the Vlakvarkfontein Colliery. The Klipspruit passes the closest to the mine and is most likely to be impacted on by the mine. Again, several potential sources of pollution were identified upstream and may contribute to downstream water quality. The Kromdraaispruit flows from an easterly to a westerly direction, approximately 1.4 km to the north of the Vlakvarkfontein Colliery. Similar, to the Wilge River and Klipspruit, upstream activities have been identified, which may impact on the water quality in the downstream aquatic environment. The flow of the Leeufontein, Blesbok and Wilge systems has been modified due to the altered hydrology of these systems. The construction of impoundments within the channels, and also the input of storm water from local developments has also resulted in channel modifications, and erosion and sedimentation of these systems. The water quality of these systems has also been impaired due to the local land uses

4.2.1 WATER MANAGEMENT AREA

According to DWS' water management areas delineations, Vlakvarkfontein Colliery falls within the Olifants water management area (WMA), which is delineated as water management area No, 4, and subsequently falls under the B primary drainage area. The Olifants WMA is divided into four major river catchments i.e. the Elands River, Wilge River, Steelpoort River and Olifants River catchments. The Vlakvarkfontein Colliery falls within the Wilge catchment. Within the Wilge River catchment, the mine occurs within the B20F tertiary drainage region and B20E and B20F quaternary drainage regions, which is drained by the Leeuwfonteinspruit and the Heuwelfonteinspruit. The Leeuwfonteinspruit and the Heuwelfonteinspruit are tributaries of the Wilge River, which eventually confluence with the Olifants River just upstream of the Loskop Dam.

4.2.2 SURFACE WATER HYDROLOGY

The Vlakvarkfontein Colliery is located on the boundary between quaternary catchments B20E and B20F (refer to Figure 16). It is located approximately 6 km west of Kendal and 24 km north east of Delmas. A tributary of the Wilge River (Klipspruit) flows to through the mining rights area (refer to Figure 14). The Klipspruit is a perennial stream and flows generally in a westerly direction through the southern part of the mining rights area, and to the south of the proposed open cast operations.

4.2.3 FLOODLINE DELINEATION

BEAL calculated the floodline for a tributary of the Wilge River to the south of the Vlakvarkfontein mining operations (refer to Appendix D). The 50-year and 100-year floodlines for the stream is indicated in Figure 17.

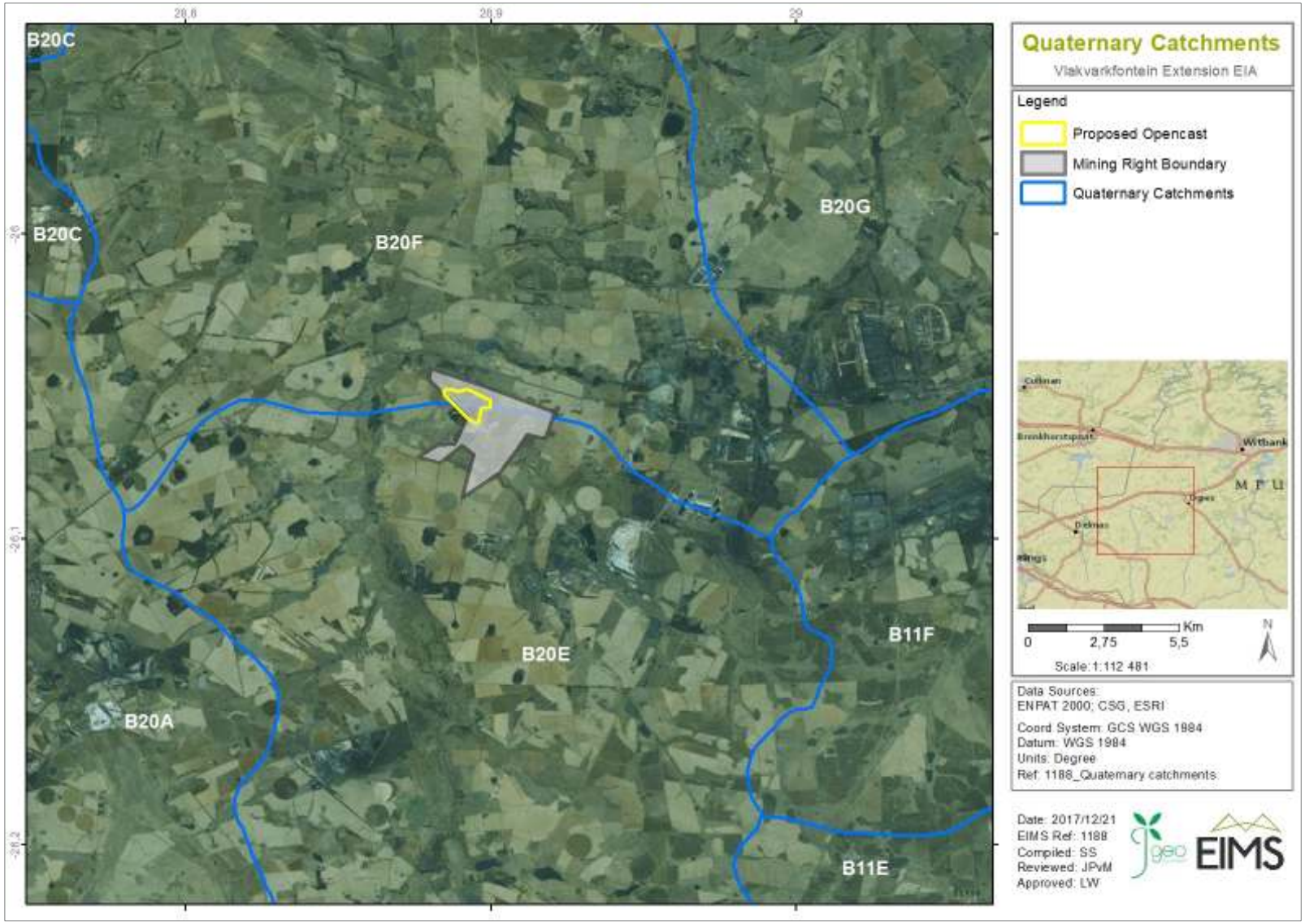


Figure 16: Quaternary catchment for the Vlakvarkfontein Colliery

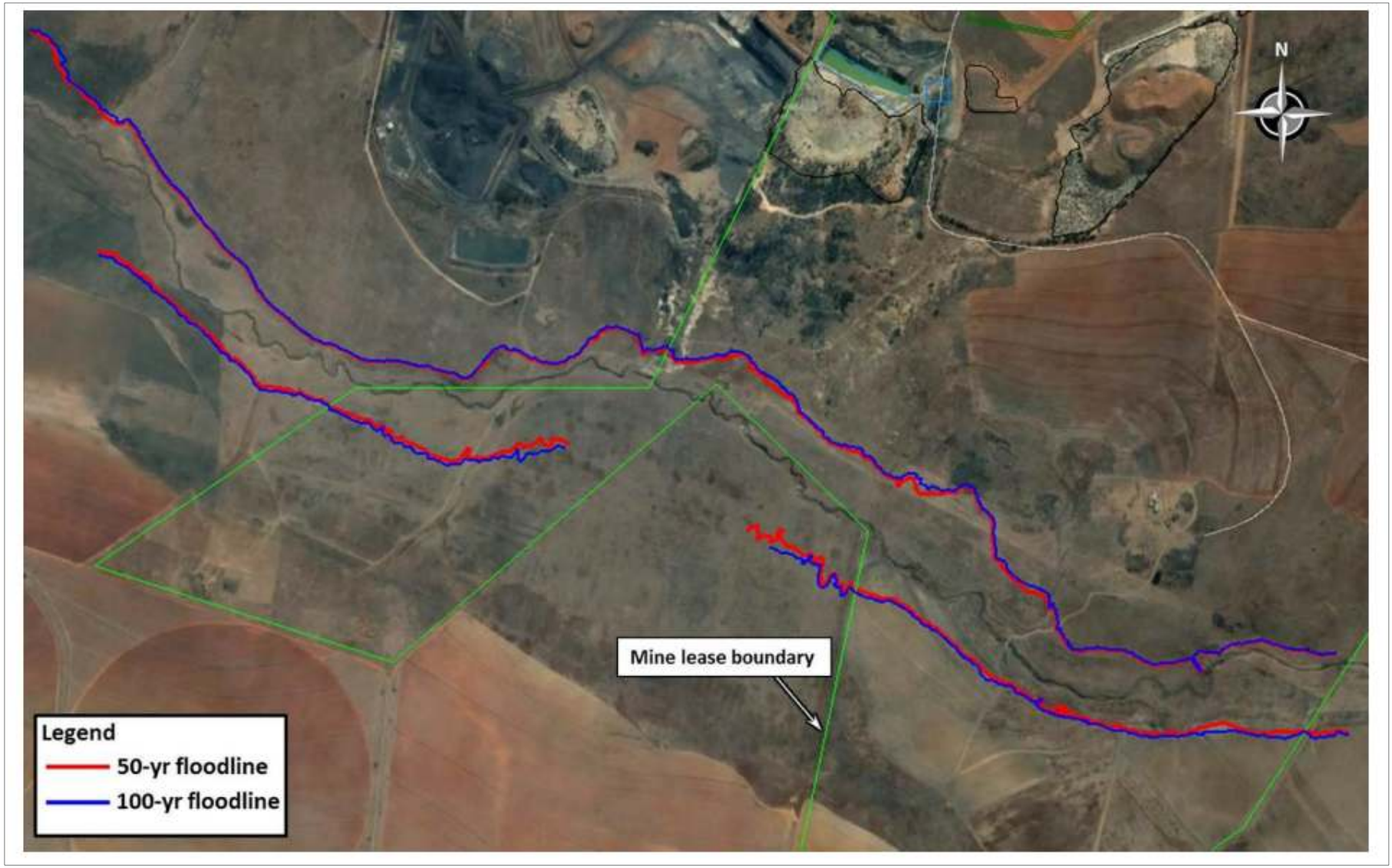


Figure 17: Floodline delineation

4.2.4 SURFACE WATER QUALITY

The surface water quality within the two affected sub-catchments in which the Vlakvarkfontein Colliery is located, has been impacted on by current and previous uses. This includes agricultural practices (cultivation and grazing), mining (current and defunct mining) and power generation activities. Several mines, grazing and cultivated land and an Eskom Power Station are located upstream of the proposed mining area.

In view of the above-mentioned activities, mining activities have potential to impact on the surface water environment. It is, therefore, imperative that the water quality of the water bodies within and around the proposed mining area be monitored. These qualities will be used to determine the current conditions of the surface water environment, which will further be used for comparison purposes with water qualities during mining. This will in turn act as a measuring tool for the efficiency or inefficiency of the management measures to be undertaken during mining.

The surface water quality parameters that are measured at the Vlakvarkfontein Colliery as per the requirements of the WUL include the followings:

- pH @ 25°C;
- Electrical conductivity (EC);
- Total dissolved solids (TDS);
- Total alkalinity;
- Chloride (Cl);
- Sulphate (SO_4);
- Nitrate (NO_3) as N;
- Fluoride (F);
- Calcium (Ca);
- Magnesium (Mg);
- Sodium (Na);
- Potassium (K);
- Aluminium (Al);
- Iron (Fe);
- Manganese (Mn);
- *E.coli* CFU/100ml;
- Total coliform ;
- Total Viable Count; and
- Total suspended solids (TSS).

As Vlakvarkfontein Colliery is an operational mine, a surface water monitoring programme has already been implemented. The water quality is sampled on a monthly basis and the reports are submitted to the DWS on a quarterly basis. The surface water monitoring points for the quarterly report for June to August 2017 are indicated in Figure 18. Refer to Appendix E for the water monitoring report.

Table 13: Surface Monitoring Points (June to August 2017)

Monitoring Point ID	Latitude	Longitude	Frequency	Picture
Klipspruit Upstream	-26.0788	28.91146	Monthly	
Kromdraai Upstream	-26.0432	28.9153	Monthly	
Kromdraai Downstream	-26.035	28.88324	Monthly	
Wilge River upstream	-26.0987	28.85865	Monthly	
Wilge River Downstream	-26.0455	28.868	Monthly	

Monitoring Point ID	Latitude	Longitude	Frequency	Picture
MW-01	-26.0685	28.89101	Monthly	
MW-02	-26.0609	28.8935	Monthly	
Pit-D01	-26.06209	28.91286	Monthly	
Adhoc Sample – Drinking Water	-26,0569	28,8926	Monthly	
(VBH) Tap water	-26,0447	26,8910	Monthly	

The August 2017 quarterly water quality results were compared against the issued WULAs, as well as SANS 241-1: 2015 standards. The results are indicated in Figure 19 and can be summarised as follows:

- The surface water quality results for the second quarter is good at the Vlakvarkfontein Colliery;
- Instream monitoring points located in the Wilge, Kromdraai and Klipspruit River, indicate a good water quality as well.

- The Klipspruit Upstream has an increased concentration of Total Dissolved Solids (973mg/l) and Sulphates (579mg/l) respectively, but only exceeding the Vlakvarkfontein Colliery IWUL standard;.
- The surface water limits were exceeded at dirty water management facilities. However, these facilities are operated and maintained as dirty water systems and there are no discharges at these monitoring points. The following points of exceedances were noted:
    - Workshop PCD and MW02 PCD have highly elevated average concentrations of TDS exceeding point the IWUL and SANS standards;
    - Workshop PCD and MW02 PCD show extremely high concentrations of SO_4. They show non-compliance in term of SANS 241-2015, which state that SO_4 concentration levels must not exceeds 500mg/l. The presence of the determinant is an evident of coal mining activities; this water is pumped into the PCDs from the mining Pit and surface run-offs;
    - Klipspruit Upstream shows high concentration of SO_4 with an average concentration of 579mg/l. It shows non-compliance in term of IWUL, which state that SO_4 concentration level must not exceed 324mg/l;
    - Workshop PCD and MWO2 PCD shows high concentration of Magnesium, 86mg/l and 149mg/l respectively. They show non-compliance in terms of IWUL, which state that Magnesium concentration must not exceed 70mg/l;
    - Workshop PCD and Pit PCD shows high concentration of Manganese. They show noncompliance in term of SANS 241-2015, which state that Manganese concentration levels must not exceed 0,1mg/l; and
    - Workshop PCD show high concentration of Aluminium. It shows non-compliance in term of SANS 241-2015, which state that Aluminium concentration levels must not exceed 0,3mg/l.

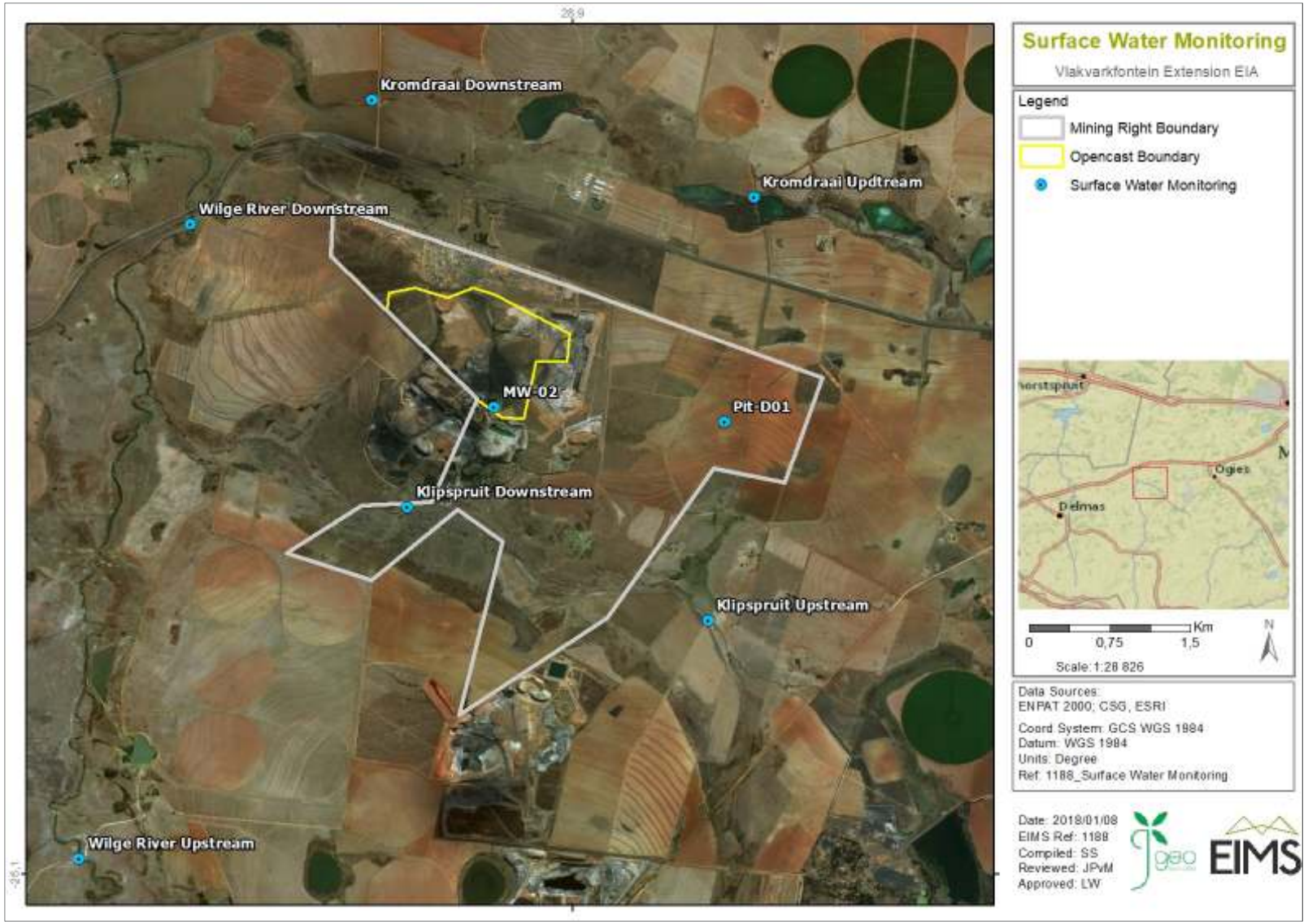


Figure 18: Surface water monitoring points for the Vlakvarkfontein Colliery

Locality	20 - pH	20 - EC	26 - TDS - cal	01 - Alk	02 - Cl	03 - SO4	06 - NO3	08 - F	30 - Ca	30 - Mg	30 - Na	30 - K	31 - Al	31 - Fe	31 - Mn	25 - TSS	60 - Acidity
	pH	mS/m	mg/l	mg CaCO3/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg CaCO3/l
VVF IWUL	6 to 9,0		520		163	324				70			0,1				
SANS 241-2015	5 to 9,7	170	1200		300	500	11	1,5			200		0,3	0,3	0,1		
Wilge U/S	8	39	264	112	14	98	0,4	0,2	35	21	21	4	0,003	<0,004	0,1	-1	13
Wilge D/S	8	67	465	120	15	236	1	0,4	64	33	37	5	0,004	<0,004	0,05	228	22
Kromdraai U/S	8	67	477	100	7	264	1	1	84	34	19	4	0	<0,004	0,03	52	20
Kromdraai D/S	8	62	424	104	11	219	1	1	67	31	23	6	0	<0,004	0,05	27	10
Klipspruit U/S	8	125	973	150	17	579	1	0,5	129	58	91	4	<0,0003	<0,004	0,2	8	18
MW02	7	221	2019	46	4	1415	3	0,4	378	149	12	19	0,01	<0,004	6,9	28	20
PIT D01	7	50	391	9	4	266	3	<0,3	61	24	8	7	0,02	0,1	1,9	171	94
Workshop PCD	5	177	1444	23	6	1019	2	1	231	86	63	14	6	1	12	3720	478

Figure 19: August 2017 surface water quality results for the Vlakvarkfontein Colliery

4.2.5 RESOURCES CLASS AND RIVER HEALTH RECEIVING WATER QUALITY OBJECTIVES AND RESERVE

Ecological classification refers to the determination and categorisation of the integrity of the various selected biophysical attributes of ecosystems compared to the natural or close to natural reference conditions Based on the water resources report the Present Ecological Status (PES) of this reach of the Leeufontein River is a class D or largely modified. The confidence in this classification is low due to the long distance of the considered sub-quaternary reach (32 km). The ecological importance and sensitivity of the river reach was rated as moderate. The defined Default Ecological Category for the river was class C or moderately modified. The current gradient of the considered river reach in proximity to the project area was found to be a class E class. This places the river as a lowland river reach.

4.2.6 SURFACE WATER USER SURVEY

The surface water use within the affected sub-catchment takes place in the form of impoundments such as farm dams. Several perennial and non-perennial pans occur within the sub-catchments but are however far from the proposed mining area. It can thus be concluded that surface water within the sub-catchments especially near the proposed mining area are mainly used for agricultural purposes (livestock watering). It is also likely that the water is utilized by the nearby community for domestic purposes.

4.3 SENSITIVE AREAS SURVEY

A water resource report, including a wetland and aquatic ecology component, was conducted for the proposed extension at the Vlakvarkfontein Colliery by the Biodiversity Company in November 2017(refer to Appendix D).

4.3.1 WETLAND ASSESSMENT

As indicated in Section 4.2, Vlakvarkfontein Colliery is located in the B20F and B20E quaternary catchments within the Olifants Water Management Area (WMA2), Highveld – Lower Ecoregion. Three drainage systems and a single NFEPA wetland are associated with the project area. Water resources include the Leeufontein River, Wilge River, and the Blesbok system which is regarded as a wetland.

One wetland type was identified within the 500 m project assessment boundary, namely a depression, which comprised of two units that are 100 m apart. The vegetation associated with the wetland areas has been cleared for mining operation, and the Katspruit soil form was confirmed for these depressions. According to the DWAF (2005) delineation guidelines, this soil form is indicative of a permanent wetland zone. No other wetlands were identified within the larger 500 m study area.

The Mpumalanga Highveld (MPHG) wetlands dataset was also considered for the proposed expansion, and no systems are located within the proposed expansion footprint Figure 21.

The overall wetland health for the systems was determined to be that of a Largely Modified (D) system (refer to Table 14 for summary of the scores for the wetland present ecological status (PES)). The wetland type had overall Intermediate levels of service, with only some water quality enhancement services showing a moderately high level of benefit. The ecological importance and sensitivity (EIS) and direct human importance for the wetland was rated to be Low (D). The hydrological / functional importance was rated as Moderate (C) (refer to Table 15).

The project is for the proposed expansion of the Vlakvarkfontein Colliery. The expansion of the mining area will result in the loss of the delineated wetlands . Alternatively, should the depressions be avoided, and the surrounding areas be mined, the removal of the stockpiles and subsequent change to the topographical features will remove a source for hydrological inputs which will result in the loss of the wetlands (refer to Figure 20). Additionally, the wetlands are considered to be a result of the mining operation, and are not regarded as natural systems. It is apparent that the loss of these wetlands is unavoidable, and no buffer zone is suitable for either of the above-mentioned options.

The loss of these depressions is not regarded as a fatal flaw for this project. The DWS should be consulted in order to determine the need, if any, for a wetland offset strategy. An artificial wetland has been formed by decant water emanating from one of the defunct underground workings some two to three hundred meters

southwest of the initial box cut. It must, however, be mentioned that the water from the decant point is of very poor quality. A map of all National Freshwater Ecosystem Priority Area (NFEPA) wetlands and rivers in the study area is included in Figure 22. All streams and wetlands occurring in the mining right area should be treated as sensitive landscapes. Existing mining and agricultural activities have also contributed to wetland modifications, which include altered flows caused by compaction and drainage, and also the establishment of alien vegetation within the systems.

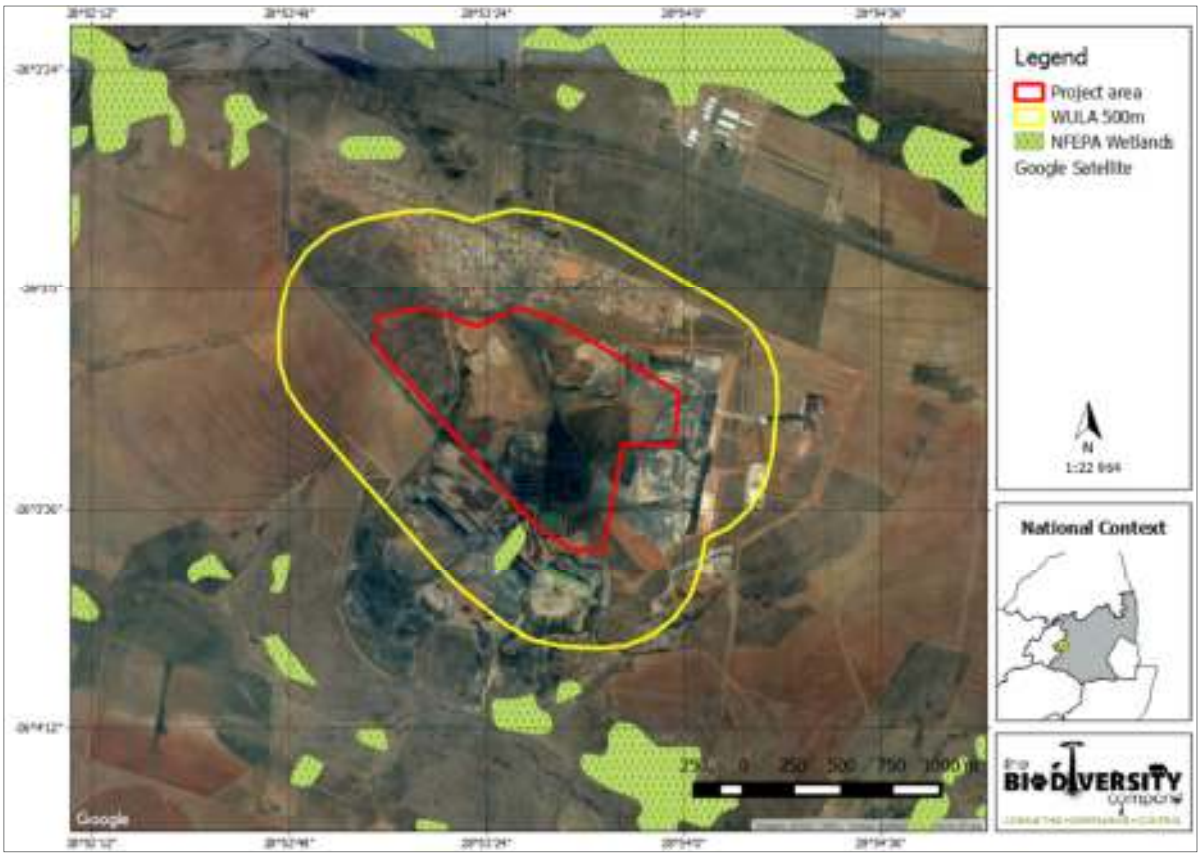


Figure 20: The FEPA wetlands in the project assessment area

Table 14: Summary of the scores for the wetland PES

Wetland	Hydrology		Geomorphology		Vegetation	
	Rating	Score	Rating	Score	Rating	Score
HGM 1	D: Largely Modified	4.0	D: Largely Modified	4.1	F: Seriously Natural	8.6
Overall PES Score	5.4		Overall PES Class		D: Largely Modified	

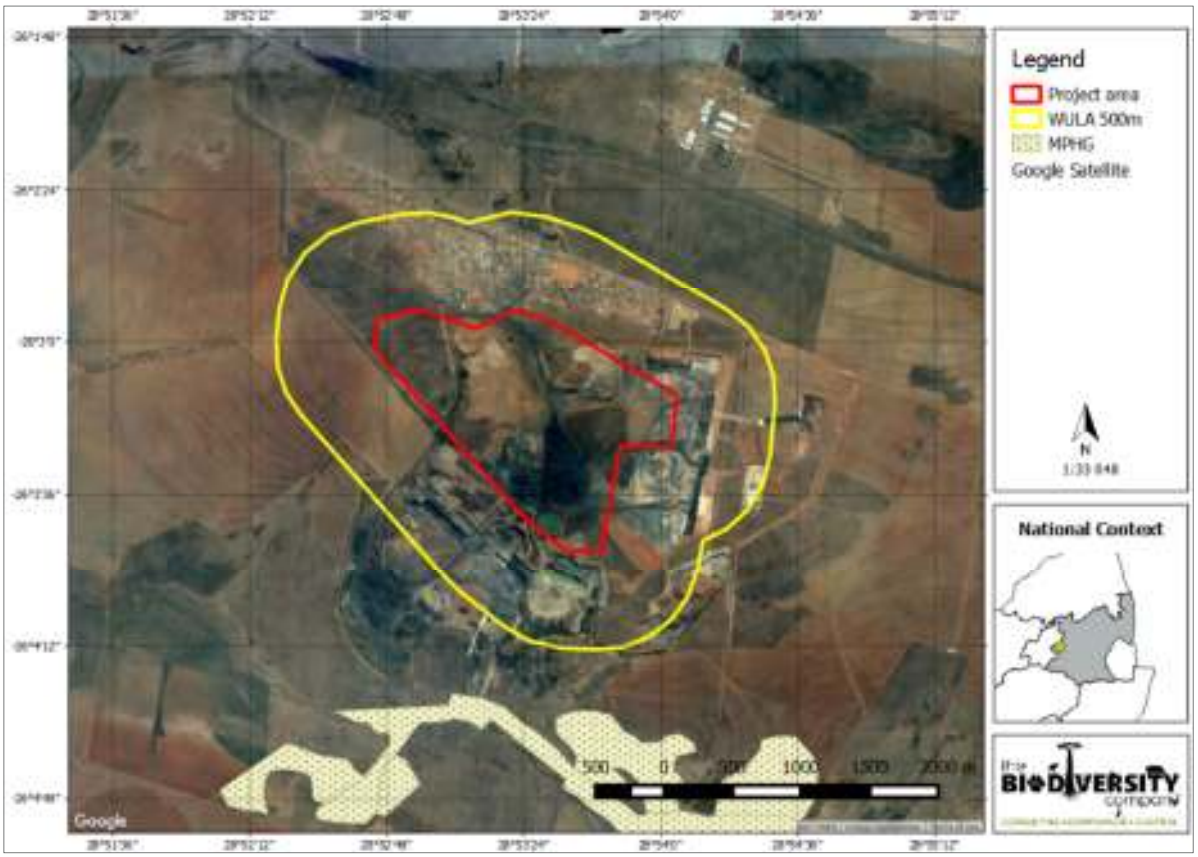
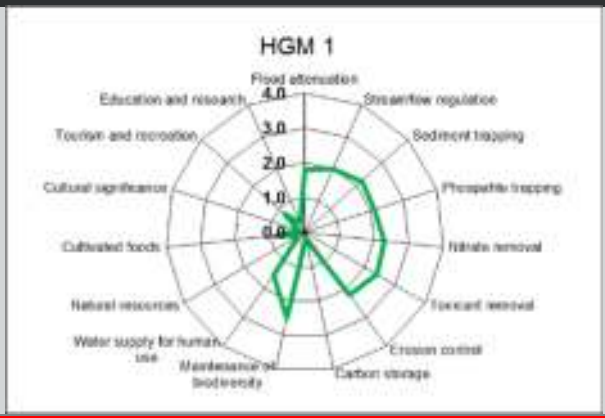


Figure 21: The MPHG wetlands in the project assessment area

Table 15: A summary of the results for the HGM type

	Depression(s)
Description:	The Clovelly and Oakleaf soil forms were identified within the non-wetland areas. The Katspruit form was identified within the depression, this is indicative of a permanent wetland zone. The depression has been formed due to the mining operation, with run-off being directed to the depression area. The vegetation of the depression is not typically characteristic of a wetland, and represents grassland species, with stands of Black Wattle.
Photograph: Overall Wetland	 
Overall Present Ecological State	Largely Modified (D)
Hydrology	Largely Modified
Geomorphology	Largely Modified
Vegetation	Seriously Natural (F)

	Depression(s)
WET-EcoServices description: The following shows services with moderately high levels or higher for: • Phosphate assimilation; • Toxicant assimilation; and • Erosion control.	
EIS	Low (D)
Hydrological/Functional Benefit	Moderate (C)
Direct Human Benefits	Low

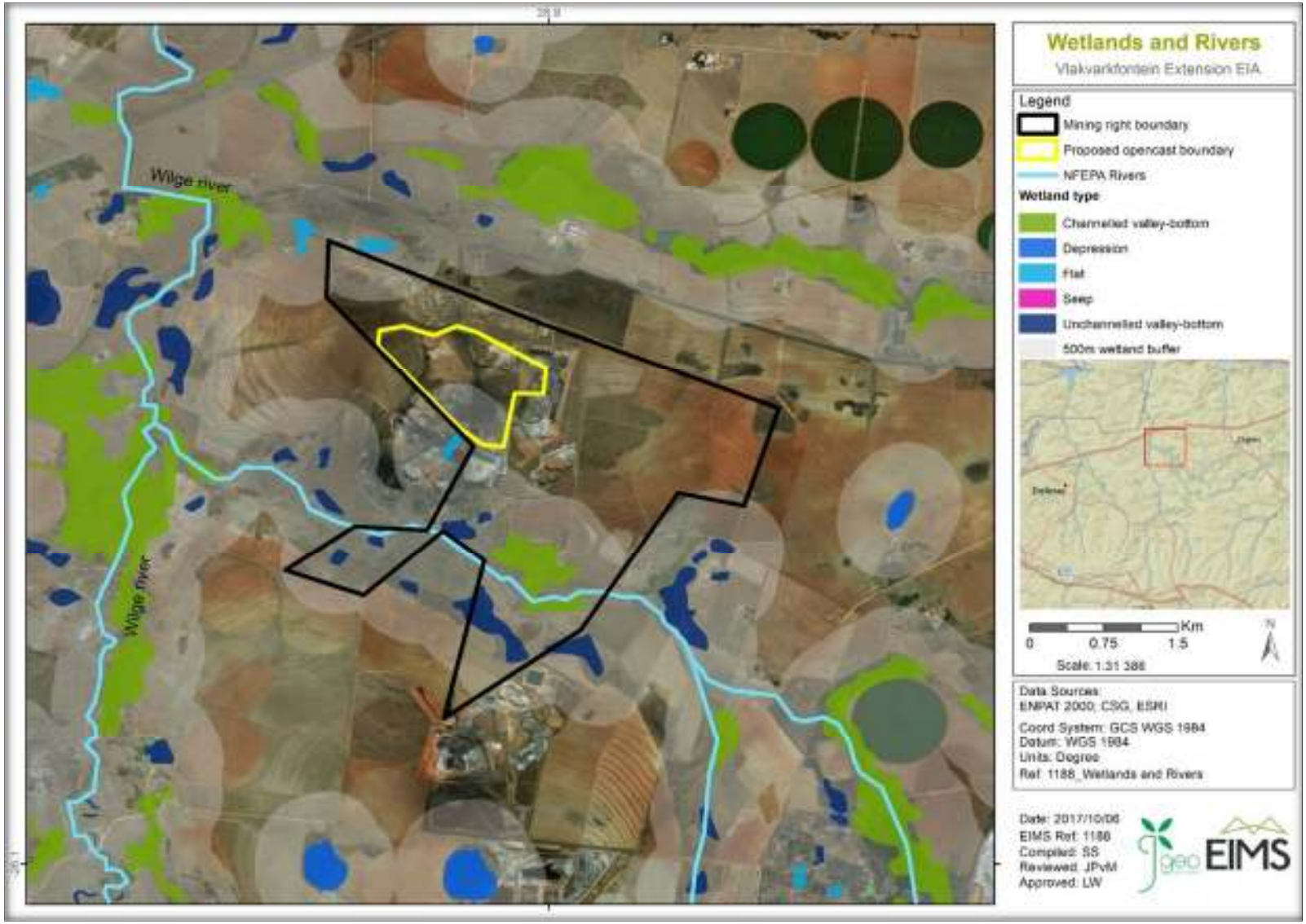


Figure 22: NFEPA wetlands and rivers within the mining right area of the Vlakvarkfontein Colliery

4.3.2 AQUATIC ASSESSMENT

The water quality results for the biomonitoring is discussed in Section 5.10.2. A full discussion is available in the Water Resource Study conducted by the Biodiversity Company (Appendix D). This section only provides a summary of the overall aquatic ecology.

As indicated in Table 16 and Table 17, the results of the PES assessment derived largely modified (class D) conditions of the Leeufontein and Wilge River reaches considered in this assessment. The modified conditions were largely attributed to cumulative habitat and water quality level impacts which have resulted in the modification of instream habitat, invertebrate and fish communities.

Table 16: Present Ecological Status of the Leeufontein reach assessed in the 2017 survey

Aspect Assessed	Ecological Category
Instream Ecological Category	D
Riparian Ecological Category	D
Aquatic Invertebrate Ecological Category	E
Fish Ecological Category	D/E
Ecostatus	D

Table 17: Present Ecological Status of the Wilge River reach assessed in the 2017 survey

Aspect Assessed	Ecological Category
Instream Ecological Category	D
Riparian Ecological Category	D
Aquatic Invertebrate Ecological Category	D
Fish Ecological Category	E
Ecostatus	D

4.4 GROUNDWATER

A groundwater study was conducted by Groundwater Square in November 2017(Refer to Appendix D). The depth of the groundwater table in the study area was determined by means of a hydrocensus conducted as part of the IWWMP update, as well as from exploration boreholes drilled in 2016. From the data obtained, it is evident that the groundwater depth varies across the site, mainly due to topography and heterogeneity of the secondary structures in the bedrock. Groundwater levels varying between 17 m and 30 m below ground level were measured during the exploration survey. The relationship between the topography and static groundwater level can be used to distinguish between boreholes with water levels at rest and boreholes with anomalous groundwater levels due to disturbances such as pumping or local geohydrological heterogeneities.

Groundwater flow should be perpendicular to the above-mentioned contours and inversely proportional to the distance between contours. Groundwater flow is mainly from topographically high to low areas, eventually draining to local streams. Inter-mine flow between the historic underground Seam-4 and Seam-2 workings and neighbouring opencasts to the east (Vlakvarkfontein Colliery-Current Pit) and south (Wescoal), is probably relatively small for the current dewatered mining situation.

Measured groundwater levels in exploration boreholes indicated that the Seam-2 underground workings are flooded, but that the Seam-4 workings are probably 80% to 90% flooded. This was deduced by considering the mine water elevations (as partially reflected by the groundwater level in exploration holes), which varied between 1539.5mamsl and 1540.5mamsl, compared to the maximum height of the Seam-4 coal floor of 1541mamsl (i.e. roof elevation of ±1543.5mamsl). It was estimated that between 160,000 m^3 to 180,000 m^3 water is contained in the Seam-4 workings and 584,000 m^3 in the Seam-2 workings.

4.4.1 AQUIFER CHARACTERISATION

The aquifer within which all impacts of the Vlakvarkfontein Colliery is likely to be confined and is classified as a minor aquifer system. Boundaries were chosen to include the area where the groundwater pollution plume could reasonably be expected to spread and simultaneously be far enough removed from mining boundaries to include the area that could be affected by groundwater abstraction in the mine. To the north and west, streams act as boundaries. Groundwater flow is parallel to the streams and is, therefore, unlikely to cross any streams under normal undisturbed conditions. In the south and south-east, an upstream boundary was chosen due to the fact that drainage in the area is in a north-west direction and it can be expected that the groundwater flow is mainly from topographical high to low areas, eventually draining to local streams.

The following major groundwater aquifers were identified in and around the Vlakvarkfontein Colliery:

- Coal-Bearing Unit

  The coal-bearing unit is the Vryheid Formation, Ecca Group, Karoo Supergroup. The Karoo-Ecca aquifers in the Highveld generally comprise a 1-8m deep upper layer of shallow overburden, followed by a 2m thick clay horizon. Beneath the clay horizon, there exist three aquifers of varying thickness: 1) shallow weathered zone aquifer, 20-35 m thick; 2) deep fractured aquifer, 60-80 m deep; and 3) a deep, non-fractured aquifer, below 80 m.

  The depth of the Karoo-Ecca aquifer within the planned mining area varies from 1642 m, but averages at 35 m. The bottom of the sequence is formed by the 2-seam, with both the 2- and 4- seam being mined within this zone. Water strikes exist at both the top and bottom contacts of both coal seams, although more prolifically on the 4-seam contacts. Due to these similar hydraulic characteristics, the entire depth of the Karoo-Ecca aquifer within the mining zone was considered as the shallow weathered zone aquifer, although the number 2- and 4- coal seams were considered to have a slightly higher hydraulic permeability. Outside of the mining area, the Karoo-Ecca aquifers were considered to be less than 35 m thick due to the dome-shaped topography when compared to the flat number 2- and 4- coal seams.

- Dwyka Sediments

  Sediments of the Dwyka group are situated beneath the Ecca Group, with fresh, non-weathered Tillite lying immediately beneath the 2-seam, which is expected to be at a lower permeability than the uppermost 4 m of this unit.

- Surrounding Geological Units

  The local aquifer system described above is surrounded by various geological units, each with unique hydraulic attributes. Sedimentary Formations of the Transvaal sequence bound the area to the north and east while granitic rocks of the Bushveld Complex bound the area to the west and south. The Ogies dyke (orientation west-east) transects the area some 180 m to the south of the proposed open pit. Furthermore, post-Transvaal basal diabase sill outcrops were identified, as well as some alluvial deposition along the Klipspruit in the south.

It is generally accepted that permeability decreases with depth, with the fresh Dwyka and Dwyka tillites being of a lower permeability than the Karoo-Ecca aquifer. The permeability of the different aquifers typically ranges over several orders of magnitude and no major continuous zones of preferential flow were identified.

4.4.2 GROUNDWATER RECHARGE

The area earmarked for mining has a recharge value of 2.5% of the MAP, which equates to roughly 17.5 mm/a or 4.8 x 10-5 m/d. These values are based on previous hydrogeological assessments from surrounding coal fields, independent calculations and calibration of the numerical groundwater model. Natural chloride concentrations of the aquifers range from 1 mg/l to 4 mg/l, which are very low, and are indicative of a rainfall recharge greater than 10%. However, these values are probably related to the movement of shallow groundwater in the aquifer system. This low residence time can be attributed to the depletion of the mineral resources, which typically retard groundwater flow. The seasonal variation of groundwater levels ranges from 2 m to 4 m probably as a

result of rainfall recharge. Given the shallow nature of mining, it is believed that natural rainfall recharge to the underground workings should be in the order of 5% of mean annual precipitation. This equates to a value of 10,900 m^3/a or 30 m^3/d (based on an area of 311,500 m^2 and rainfall of 700 mm/a). Compared to the volume stored in the underground workings (>750,000m^3, which equates to ±60 times the annual rainfall recharge) this volume will contribute only a small additional volume to the water balance during the time of mining

4.4.3 GROUNDWATER QUALITY

As Vlakvarkfontein Colliery is an existing and operational mine, a groundwater monitoring system has already been implemented. As per the requirements of the exsiting WULAs, the following parameters measured on a quarterly basis:

- pH @ 25°C;
- Electrical conductivity (EC);
- Total dissolved solids (TDS);
- Total alkalinity;
- Chloride (Cl);
- Sulphate (SO_4);
- Nitrate (NO_3) as N;
- Fluoride (F);
- Calcium (Ca);
- Magnesium (Mg);
- Sodium (Na);
- Potassium (K);
- Aluminium (Al);
- Iron (Fe);
- Manganese (Mn);
- *E.coli* CFU/100ml;
- Total coliform ;
- Total Viable Count; and
- Total suspended solids (TSS).

The groundwater monitoring points for August 2017 are indicated in Table 18 and depicted in Figure 24. The monitoring report is attached in Appendix E.

Table 18: August 2017 groundwater monitoring points

Monitoring Point ID	Latitude	Longitude	Frequency	Picture
VBH-02M	-26.0621	28.90239	Quarterly	
VBH-06S	-26.0612	28.89326	Quarterly	
VBH-03M	-26.0647	28.8889	Quarterly	
VBH-9D	-26.05088	28.88716	Quarterly	
VBH-11M	-26.05999	28.89495	Quarterly	

The findings of the quarterly monitoring for August 2017 are indicated in Figure 23 and can be summarized as follows:

- Water quality results were compared against the issued WULAs, as well as the SANS 241:2015;
- The groundwater water quality at Vlakvarkfontein Colliery is very good. The following points of exceedances were noted:
    - VBH-06M shows high concentration of Sulphates, exceeding both standards. An elevated concentration of Total Dissolved was detected at a concentration of 1 115 mg/l, however, this concentration is within the SANS 241:2015 limits. Manganese has a concentration of 1mg/l higher than the expected; and
    - VBH-03M has a good water quality with all variables found within the SANS 241:2015 limits, but some of the variables have increased concentrations. Total Alkalinity is at a concentration of 144 mg/l with Sulphates being 219 mg/l.

Locality	20 - pH	20 - EC	26 - TDS - cal	01 - Alk	02 - Cl	03 - SO4	06 - NO3	08 - F	30 - Ca	30 - Mg	30 - Na	30 - K	31 - Al	31 - Fe	31 - Mn	25 - TSS	60 - Acidity
	pH	mS/m	mg/l	mg CaCO3/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg CaCO3/l
VVF IWUL	6 to 9,0		520		163	324				70			0,1				
SANS 241-2015	5 to 9,7	170	1200		300	500	11	1,5			200		0,3	0,3	0,1		
VBH-02M	6	9	51	26	5	5	2	<0,3	5	5	3	2	0,01	0,2	0,3	15	45
VBH-03M	7	58	448	144	3	219	1	0,3	85	33	11	7	0,01	<0,004	0,2	36	40
VBH-06M	6	132	1115	30	6	765	6	<0,3	188	85	12	13	0,01	<0,004	1	334	116
VBH-9D	7	11	67	47	5	6	1	<0,3	9	4	4	8	<0,002	1	0,4	77	29
VBH-11M	6	28	182	16	3	105	4	<0,3	17	19	5	8	<0,002	<0,004	0,1	35	105

Figure 23: Groundwater quality results for August 2017

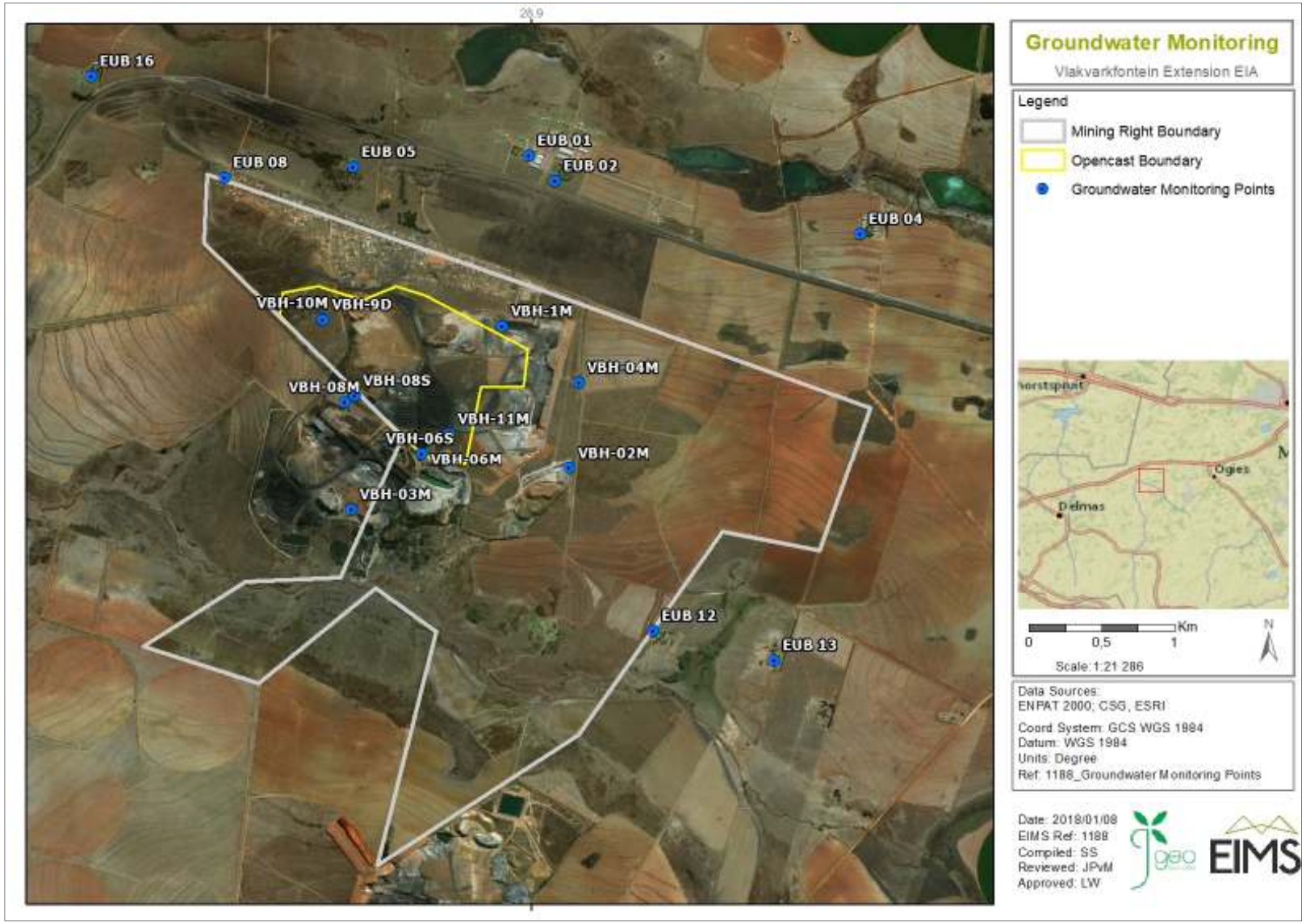


Figure 24: Groundwater monitoring points

4.5 POTENTIAL POLLUTION SOURCE IDENTIFICATION

The main indicator for groundwater contamination is sulphate. During the various stages of geochemical transformation, sulphate will be associated with sodium, calcium and magnesium. TDS or EC, indicates the total salt load. Other contaminant indicators associated with sulphate, are pH levels. When low-pH conditions prevail, increased metals concentrations may manifest, such as iron.

4.6 GROUNDWATER MODEL

Numerical modelling was performed for the pre-mining, operational phase, and post-mining for a period of 100 years after mine closure. Four numerical modelling scenarios (refer to Table 19) were performed for the post-mining situation, to study the impact of placing of coal discard back into the pit, as well as to determine the effect if the barrier pillar with Wescoal is mined.

Table 19: Description of the main groundwater modelling scenarios

Model scenario	Mining included in modelling		Figure	Contamination
	Mine barrier pillar	Place discard into VVF-Pillar Pit	Post-mining groundwater levels	SO_4 plumes
Scenario-1	No	No	Figure 26	Figure 30
Scenario-2	Yes	No	Figure 27	Figure 31
Scenario-3	No	Yes	Figure 26	Figure 29 Figure 32
Scenario-4	Yes	Yes	Figure 27	Figure 33

The results of the model indicate that prior to mining, the groundwater flow was radially outward from the coal resource area to the north, east and south. Along the eastern boundaries of the coal resource, the groundwater flow was from east, in a westward direction toward the resource. Around the southern regions, the groundwater flow was predominantly to the south.

Due to the current contaminated situation inside the proposed pillar mining area, mining of the Vlakvarkfontein Colliery Pillar Pit does not constitute a loss of a groundwater resource. During mining, groundwater flow will be towards mining, resulting in the following groundwater impacts:

- A dewatering cone will develop around the Vlakvarkfontein Colliery Pillar Pit; expanding on the current dewatering cone:
    - The dewatering cone will gradually expand in the shallow weathered zone aquifer, with a maximum impact zone as indicated in Figure 25:
        - During mining, groundwater levels in the immediate vicinity of the pits will be influenced the most, typically limited to 200 m from the pit perimeter for the first few years (2 to 4 years), and gradually expanding over time;
        - During the early stages of dewatering the biggest groundwater level drawdown effect will be observed at the pit boundary, depending on the pit floor depth below the groundwater table (≤30m);
        - Eventually, the drawdown at 400 m will typically not be distinguishable from seasonal groundwater trends, and only applies to areas where the pit floors are deepest below the natural groundwater table;
- The village drinking water supply is likely to be impacted;
- In view of the fact that Wescoal has been mining to the south of the pillar area, the additional mining of the pillar project will not have an increased effect on the base flow to the Klipspruit (i.e. a positive effect in the sense that contamination to the Klipspruit will be prevented for prolonged period);

- Storage of underground mine water:
    - There will be insufficient space to store all water pumped from the historical underground areas. Management measures will include a combination of treat-and-discharge, in-pit storage, PCD storage, as well as early utilisation of this water in the plant;
    - A maximum in-pit storage level of 1 525 mamsl in Vlakvarkfontein Colliery-current pit is recommended at this stage, to prevent decant during the operational phase; whilst mining is progressing in the eastern regions of the Vlakvarkfontein Colliery -Pillar Pit:
        - In-pit storage of this water, is unlikely to have an impact on local groundwater levels and groundwater quality;
        - The fact that the barrier pillar between the current Vlakvarkfontein Colliery Pit and the Pillar area will only be mined during the final stages of mining, may provide an opportunity for in-pit water storage of water contained in the flooded historical mined-out underground areas;
- No decant will occur during mining, unless excessive volumes of water are stored in-pit;
- Groundwater inflow:
    - Due to the shared mining boundaries with Vlakvarkfontein Colliery-Current Pit and Wescoal, the current mine water balance cannot simply be extrapolated in relation to the size of the final pit;
    - Direct rainfall recharge to mine-out voids/backfill/rehab needs to be factored in for the total pit water balance;
    - The mine may experience a water deficit during prolonged dry rainfall spells (as experienced periodically to date); and
    - Evaporation, can have a significant impact on the mine water balance during certain times of the year, and can potentially reduce the rainfall recharge component by 50% to 100% during dry summer rainfall periods; thus, also exceeding the groundwater inflow component.
- During the mining phase, the anticipated mine water quality of the surrounding aquifers are not expected to be impacted, due to groundwater flowing toward the dewatered mining area, which will also be applicable if discard and filter cake is stored in-pit;
- Operational phase water quality of the Vlakvarkfontein Colliery-pillar pit is likely to be worse than the current Vlakvarkfontein Colliery pit, due to:
    - Mine water in the rehabilitated historic opencast areas, to the west of the underground areas, is highly contaminated where (pH probably ranges from <3 to 4.5 and sulphate concentrations exceed 3 000 mg/l); and
    - Based on mine water samples that were collected from exploration boreholes during November 2016, mine water in the Seam-2 workings currently has a pH of <5.4, and mine water in the Seam-4 workings has a pH of ±3 (sulphate concentrations probably range between 800 mg/l and 1500 mg/l).

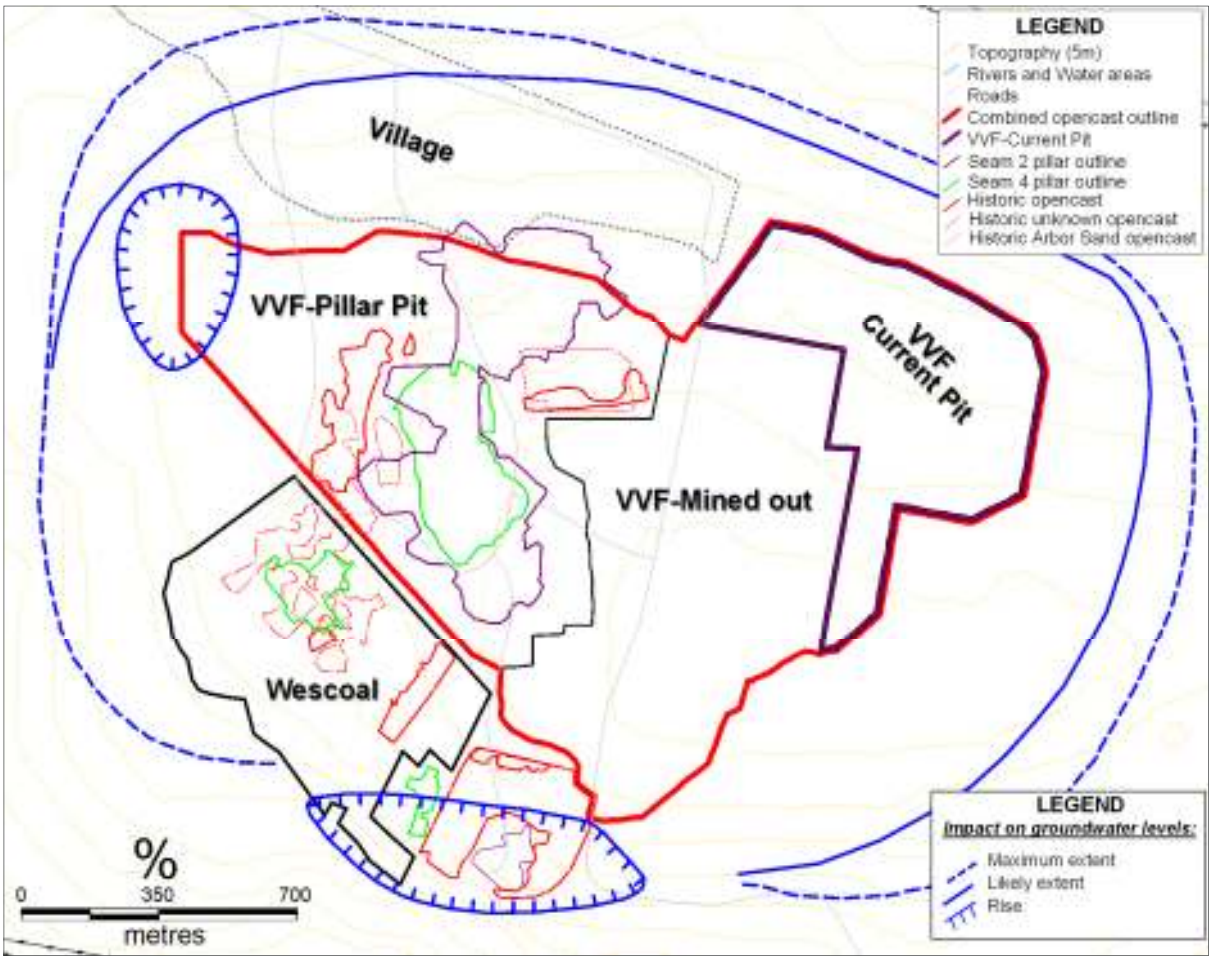


Figure 25: Groundwater levels impact zones during mining and post-mining

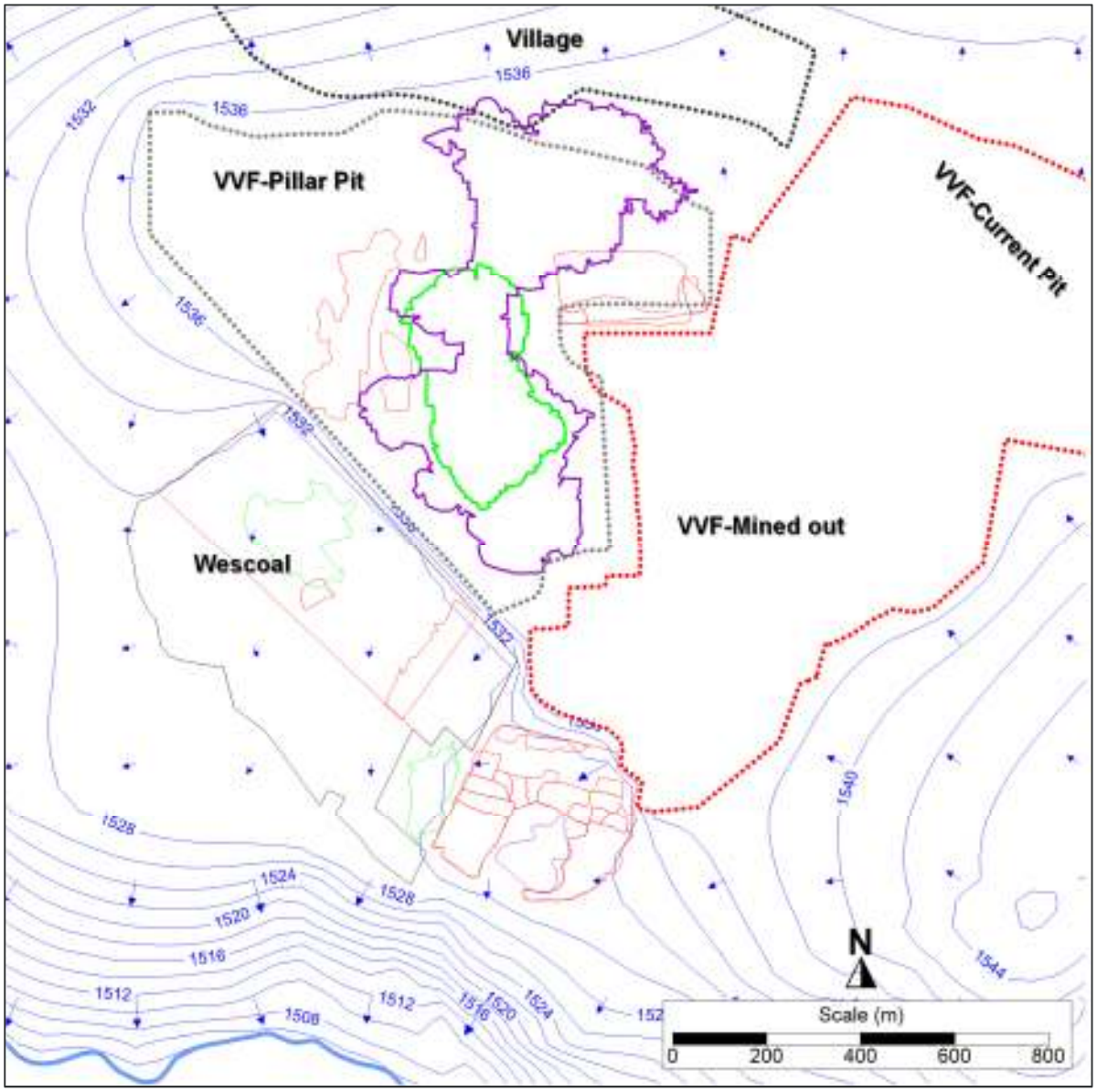


Figure 26: Scenario-1 and Scenario-3 (Vlavarkfontein Colliery-Current Pit and VVF-Pillar Pit mined as one opencast): Steady state post-mining groundwater levels (mamsl) and flow directions

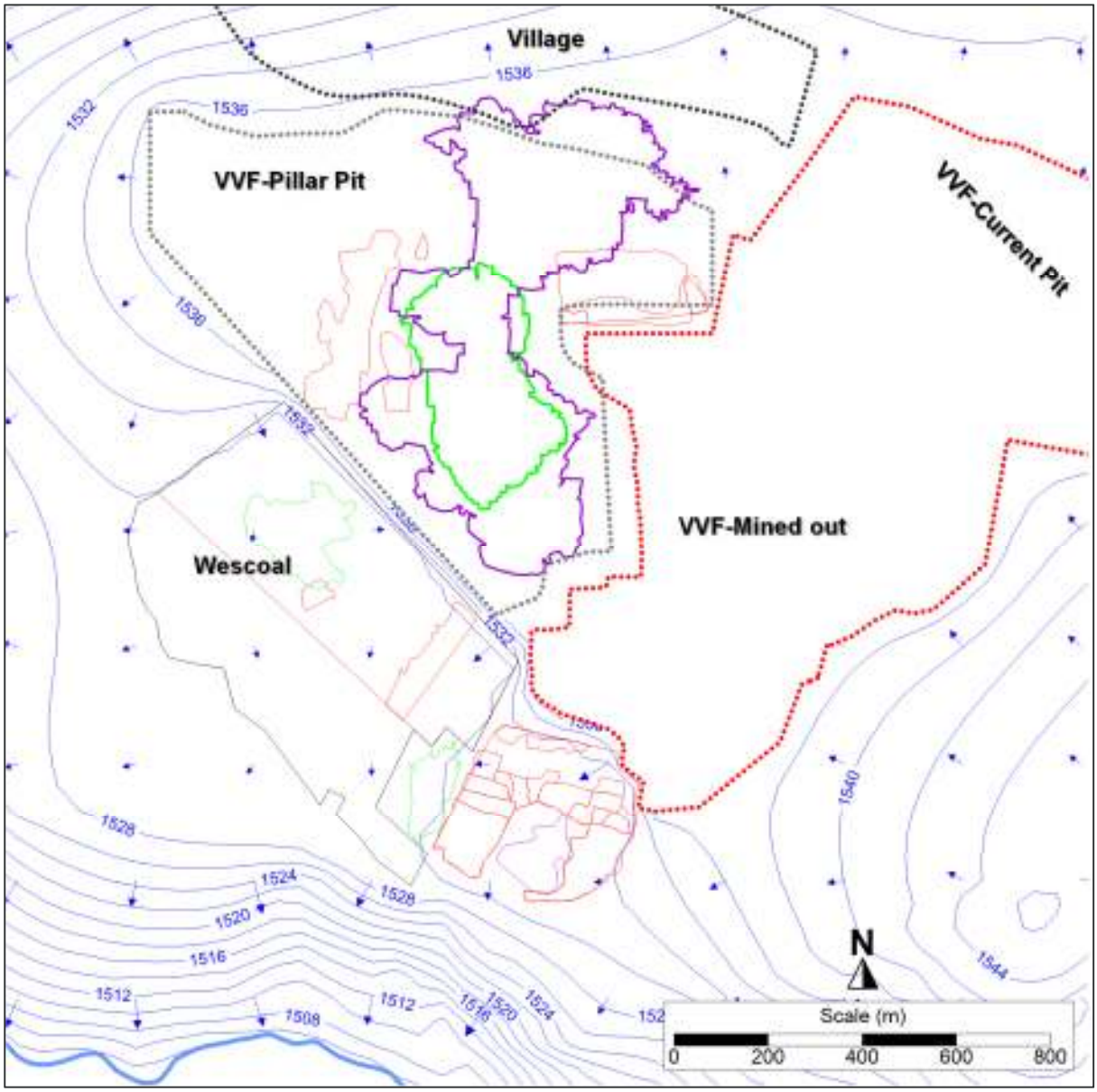


Figure 27: Scenario-2 and Scenario-4 (Vlakvarkfontein-Current Pit, VVF-Pillar Pit and Wescoal Pit forming one opencast after mining of barrier pillar): Steady state post-mining groundwater levels (mamsl) and flow directions

Prior to mining at the Vlakvarkfontein Colliery, decant was observed in two areas as indicated in Figure 28. The main-decant-zone-east is located directly south of the Vlakvarkfontein Colliery-Current Pit where historical opencast mining and Seam-2 underground mining by Sterling-TVL was undertaken. The main-decant-zone-west is located between poplar trees, south of the Wescoal Pit, west of main-decant-zone-east, south of historical opencast and Seam-4 underground mining by Sterling-TVL.

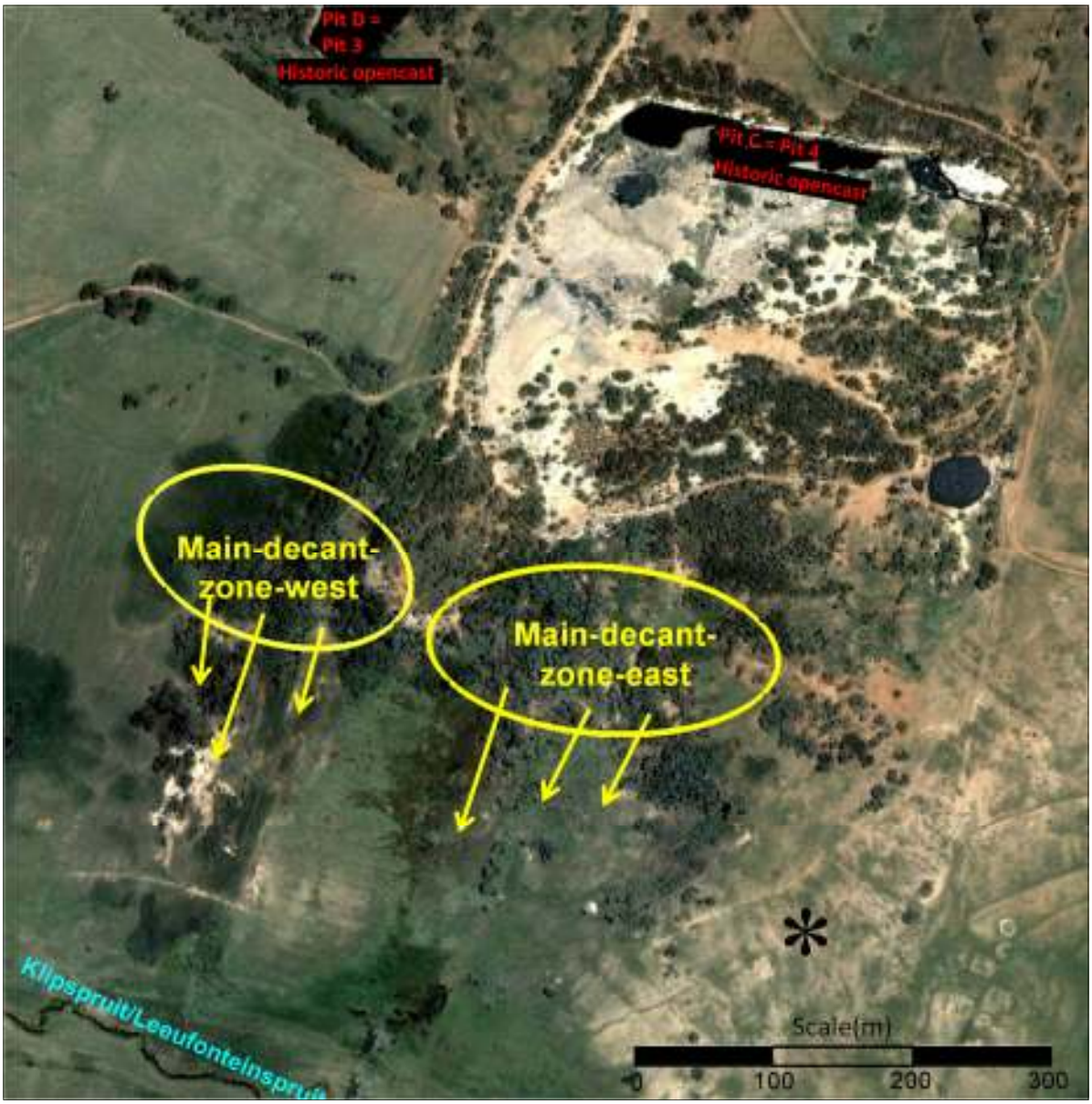


Figure 28: Main decant zone prior to mining at the Vlakvarkfontein Colliery, 2009

Post-mining flooding of all opencasts are likely to occur within 30 years after the cessation of mining; but influenced by the volume of water stored in-pit at the end of mining. All indications are that the combined Vlakvarkfontein Colliery-Current Pit and Vlakvarkfontein Colliery-Pillar Pit will flood to a level of 1538 mamsl. If the barrier pillar with Wescoal is mined the final level will be 5 m deeper.

Post-mining flooding of all opencasts are likely to occur within 30 years after the cessation of mining; but will be influenced by the volume of water stored in-pit at the end of mining. All indications are that the combined Vlakvarkfontein Colliery-Current Pit and Vlakvarkfontein Colliery-Pillar Pit will flood to a level of 1538 mamsl. If the barrier pillar with Wescoal is mined the final level will be 5 m deeper.

The following differences in groundwater flow characteristics are emphasized for the mining scenarios after the cessation of mining:

- Historical mining (i.e. prior to Vlakvarkfontein Colliery mining) did not alter groundwater flow directions significantly; the most significant effect being that:
    - Higher recharge to opencast regions resulted in slightly faster groundwater flow (i.e. higher seepage/decant volumes) in the main decant zones;

- AMD generation in opencasts and the southern underground regions, however, contaminated the groundwater system to the south;

- The expected effect of Vlakvarkfontein Colliery-Current Pit and Vlakvarkfontein Colliery-Pillar Pit:
  - Additional recharge to the rehabilitated opencast will increase the decant volumes (and salt load) to the two decant areas (south);
  - Additional groundwater flow toward the pit could also be expected at the eastern pit perimeter, due to lower groundwater levels in the opencast;
  - As groundwater levels inside the pit will be lower than the original pre-mining levels over most of the area, the surrounding aquifers will remain dewatered to a certain extent:
    - The likely zone of influence is indicated in Figure 25;
    - The village drinking water supply is likely to be impacted;
    - Along the north-western corner of the Vlakvarkfontein Colliery-Pillar Pit, and south of the Vlakvarkfontein Colliery-Current Pit, groundwater levels are likely to be higher than pre-mining. However, this does not indicate that decant will occur;
- The expected effect of Vlakvarkfontein Colliery-Current Pit and Vlakvarkfontein Colliery-Pillar Pit, and mining of the barrier pillar with the Wescoal pit:
  - The final in-pit groundwater level is expected to be at 5 m to 8 m lower than the decant level of 1838 mamsl, if the barrier pillar is not
  - Given the steeper groundwater gradients around the pit, slightly higher groundwater flow toward the pit will occur, compared to a scenario where the barrier pillar is not mined;
  - The likely zone of influence will not be worse than indicated in Figure 25 (i.e. the village drinking water supply is likely to be impacted);
- Even if the Vlakvarkfontein Colliery-Pillar Pit is not mined, the addition of the Wescoal opencast will have altered groundwater flow as far as 500 m north of the opencast due to the large area where preferential flow can occur in historical opencast and underground regions:
  - Groundwater flow directions and velocities around the south-western and southern regions of the Vlakvarkfontein Colliery-Current opencast will be altered toward the southwest (i.e. toward Wescoal);
  - Even groundwater flow which would have been to the south from the southern Vlakvarkfontein Colliery-Current Pit boundary, will be attracted to the Wescoal opencast due to the difference in groundwater elevations;
  - Consequently, a significant portion of decant that would have taken place to the Main-decant-zone-east (i.e. directly south of the Vlakvarkfontein Colliery-Current Pit), is expected to change course to the Main-decant-zone-west south of the Wescoal Pit (between the poplar trees, west of Main-decant-zone-east);
- The 2013 numerical groundwater model investigated the effect that a barrier wall would have on the post-mining decant situation (installed to heights of 1535 mamsl and 1540 mamsl):
  - Smaller groundwater inflows into the Vlakvarkfontein Colliery opencast will occur if the top elevation of the barrier wall is 1540 mamsl compared to 1535 mamsl (i.e. higher post-mining groundwater levels in the Vlakvarkfontein Colliery opencast will result in smaller inflows into the pit);

- Assuming it does not leak (i.e. installed to below the pit floor), the barrier wall will reduce groundwater flow velocities to the south significantly;

- The following relates to the efficiency of the barrier wall:
    - The mean annual recharge to the Vlakvarkfontein Colliery pit at 10% of MAP is estimated at 255m^3/d (3L/s), which is very small compared to the water that can leak through a crack;
    - The Dwyka tillite formation below the pit floor is known to have higher hydraulic conductivity values at depths <30m (the eastern portion of the pit floor along the southern border of the Vlakvarkfontein Colliery pit is relatively shallow – this is also a region where there is only a 9 m barrier pillar [with blasting fractures] between Vlakvarkfontein Colliery-Current Pit and the historical opencast), therefore, potentially leaking contaminated mine water to the decant areas where it will have to be controlled/treated; and
    - Groundwater studies in the surrounding geological/hydrogeological environment have identified the preferential flow zones and high yielding fractures on geological contact below the Karoo aquifers.

In view of the groundwater flow directions, contamination plumes will potentially spread towards the north-west of the Vlakvarkfontein Colliery-Pillar Pit, and to the south. Smaller plumes will extend north of Vlakvarkfontein Colliery-Current Pit and southwest of Wescoal. Groundwater flow from the east will be towards the Vlakvarkfontein Colliery opencast, and no plume is expected to develop in this direction.

Due to historical opencast/underground mining and acid mine drainage (AMD) decant (pH of 2.8 to 3.2; SO_4 of 1000mg/L to 1500mg/L), the groundwater plume to the south will develop into an aquifer which has already been contaminated. Decant to surface has historically drained overland towards the Klipspruit (also known as the Leeuwfonteinspruit), as will be the most-likely situation during the post Vlakvarkfontein Colliery mining. It is therefore not possible to depict the spread of a contamination plume to the south, but it was calculated as if aquifers were unimpacted. It is, however, important to note that the highest decant seepage zone elevations ranged between 1535 mamsl and 1538 mamsl, south of the Vlakvarkfontein Colliery-Current Pit, where the AMD contamination plume is believed was forced to surface against the relatively impermeable granite rock. The AMD decant then flowed overland to the Leeuwfonteinspruit (1505 mamsl to 1509mamsl). This area south of the Vlakvarkfontein Colliery-Current Pit, will again serve as a natural decant area after the cessation of mining. South of the Vlakvarkfontein Colliery-Pillar Pit, these decant elevations are probably lower by approximately 5m to 8m.

The contaminant contribution from Vlakvarkfontein Colliery-Pillar Pit will be smaller than the extreme AMD conditions that currently exist (prior to mining) in the western-most historical opencasts that were rehabilitated/ backfilled by DWA in 2006 (pH of 3 to 5; SO_4 of 3000 mg/L to 4600 mg/L). The worst water quality observed in boreholes VBH-8M/S are attributed to historical mining and the 2006 backfilling of opencast void by waste material. Underground mine water samples were collected from exploration boreholes during November 2016. Mine water in the Seam-2 workings currently has a pH of <5.4, and mine water in the Seam-4 workings has a pH of ±3. Sulphate concentrations probably range between 800mg/L and 1500 mg/L).

The following additional comments relate to the post-mining groundwater contamination:

- Groundwater quality trends:
    - pH levels lowering from 6 to 4 over the first 30 years, followed by a further drop to pH 3.5 to 4.5 over the long-term (100 years);
    - Post-closure evolution stages in AMD are summarised in Table 7.9 of the hydrogeological report attached in Appendix D;
    - Geochemical trends for various scenarios/pits are summarised in Figure 7.10 the hydrogeological report attached in Appendix D;

- Not all decant will occur at the pit perimeter as sub-surface decant (i.e. the formation of a groundwater contamination plume) will occur primarily to the northwest and south (i.e. in the direction of groundwater flow) and some of this water will decant to surface before the final in-pit water level is reached;
- The spread of groundwater contamination will be influenced by the low hydraulic conductivity of the hard rock (0.04m/d), rock porosity (relatively high for this course-grained aquifer; >0.08), and groundwater gradients;
- Assuming the barrier pillar with the Wescoal pit is not mined, and discard is backfilled into the Vlakvarkfontein Colliery-Pillar Pit:
    - The groundwater SO_4 contamination plume indicated in Figure 29 is, therefore, the expected worst-case outcome after 100 years (see development of contamination plume after 20 years, 30 years, 50 years and 100 years);
    - Figure 30 to Figure 33 depict the concentrations after 100 years for all four modelling scenarios;
    - As can be seen in Figure 30 and Figure 32, there is very little difference in the spread of groundwater contamination plumes for scenario where the Vlakvarkfontein Colliery-Pillar Pit contains no discard, compared to when discard is placed back into the pit sufficiently deep below the final in-pit groundwater level;
- If the barrier pillar with the Wescoal pit is mined (Scenario-2 and Scenario-4):
    - The spread of groundwater contamination to the northwest will be restricted as indicated in Figure 31 and Figure 33, due to the lower in-pit post-mining mine water level; resulting in smaller groundwater gradients to the northwest;
    - The disadvantage of the scenario is that additional decant will occur directly to surface, especially along the south-eastern boundary of Wescoal (discussed in following paragraphs);
    - (The applicable modelling scenario assumed that if discard is placed back into the pit, when the pillar is mined, there will be enough space, sufficiently deep below the long-term in-pit mine water level);
- In-pit groundwater quality will vary over time as various minerals are depleted from the rock and rehabilitated backfill material. Water quality will vary in terms of pH and several anions/cations. SO_4 will be the most-important contamination indicator;
- This study concluded that SO_4 concentrations will eventually on average be at 2100mg/l after 100 years, if discard is deposited in the Vlakvarkfontein Colliery-Pillar Pit, and slightly better (2000mg/l) if no discard is placed in the pit. There will be a 300mg/L difference in concentrations for discard backfill into the pit compared to no discard, will occur during the first 30years while the mine is flooding (2000mg/l compared 1700mg/l).
- A comparison of Scenario-3 (Figure 32), with the other three scenarios, after 100 years, are provided in Figure 30, Figure 31 and Figure 33;
- Figure 34 serve as a summary of the potential post-mining groundwater quality impacts, indicating the following:
    - If the Wescoal pillar is not mined (scenario-1 and scenario-3) – likely and maximum impacts zones;
    - If the Wescoal pillar is mined (scenario-2 and scenario-4) – maximum impact zone.

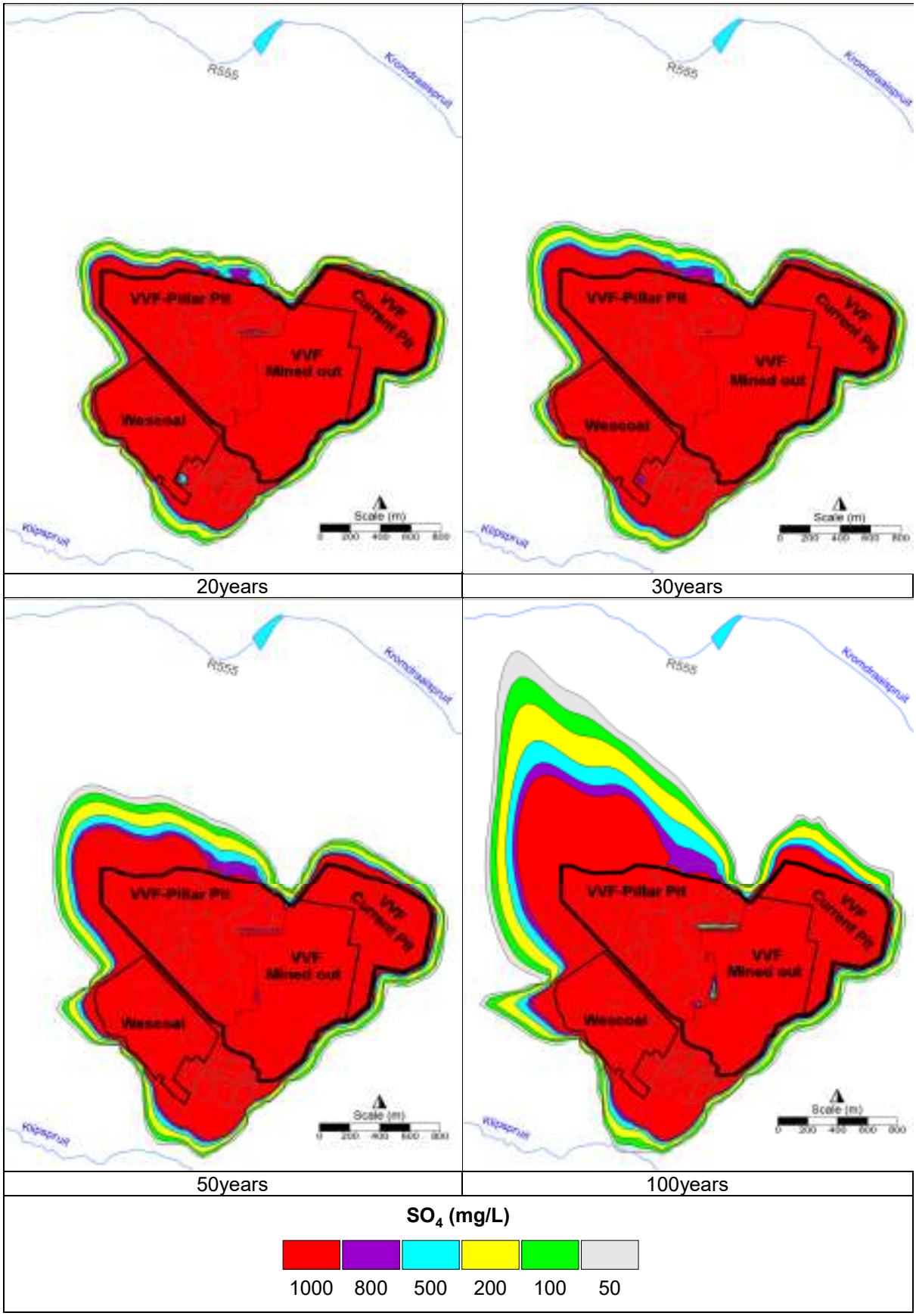


Figure 29: Place discard into Vlakvarkfontein Colliery-Pillar Pit, do not mine barrier pillar with Wescoal): Vlakvarkfontein Colliery opencast SO_4 contamination plume 20/30/50/100 years after the cessation of mining

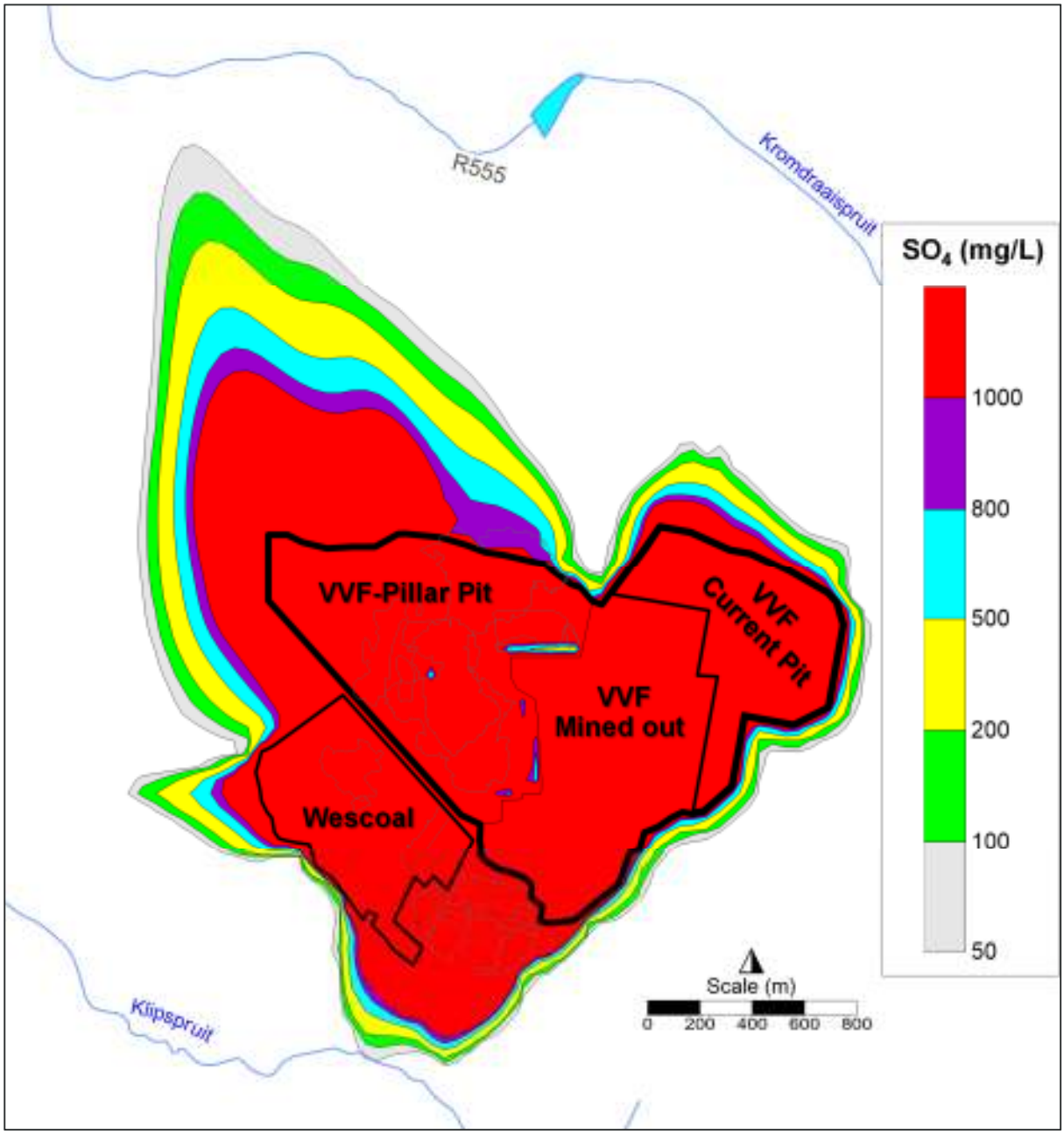


Figure 30: Scenario-1 (no discard, do not mine barrier pillar with Wescoal): Vlakvarkfontein Coliery opencast SO_4 contamination plume 100 years after the cessation of mining

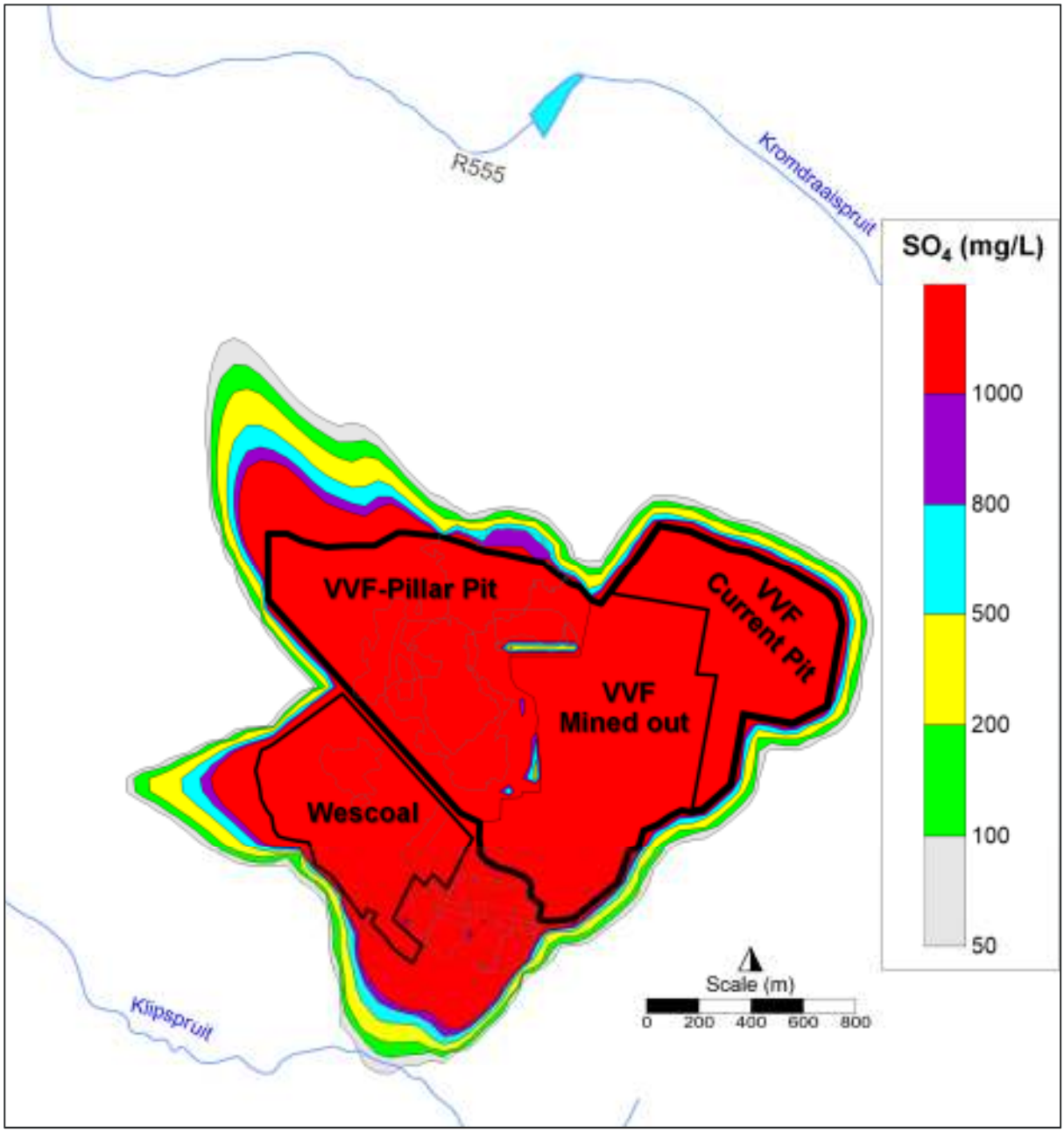


Figure 31: Scenario-2 (no discard, mine barrier pillar with Wescoal): Vlavarkfontein Colliery opencast SO_4 contamination plume 100 years after the cessation of mining

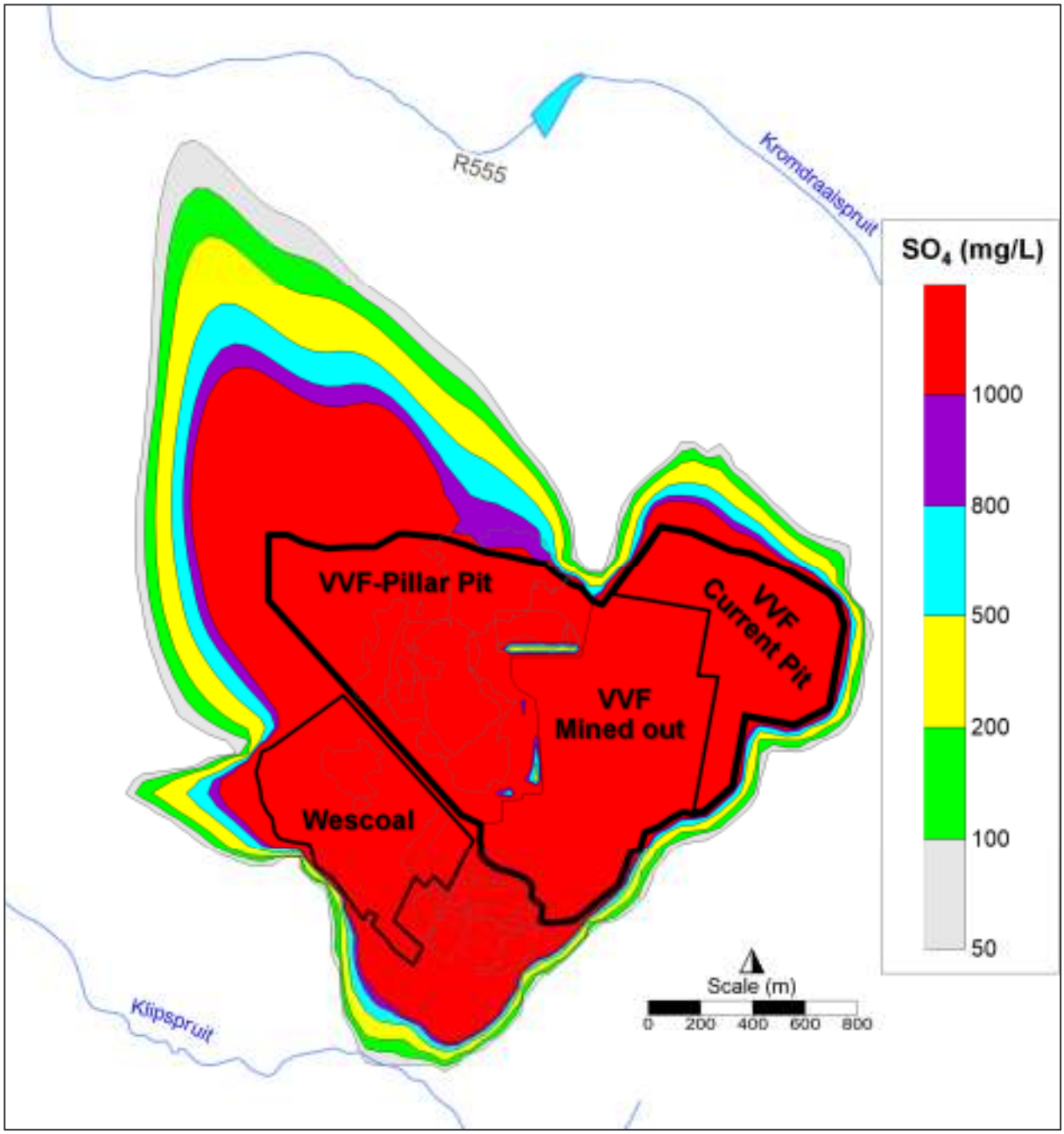


Figure 32: Scenario-3 (place discard into Vlakvarkfontein Colliery-Pillar Pit, do not mine barrier pillar with Wescoal): Vlakvarkfontein Colliery opencast SO_4 contamination plume 100 years after the cessation of mining

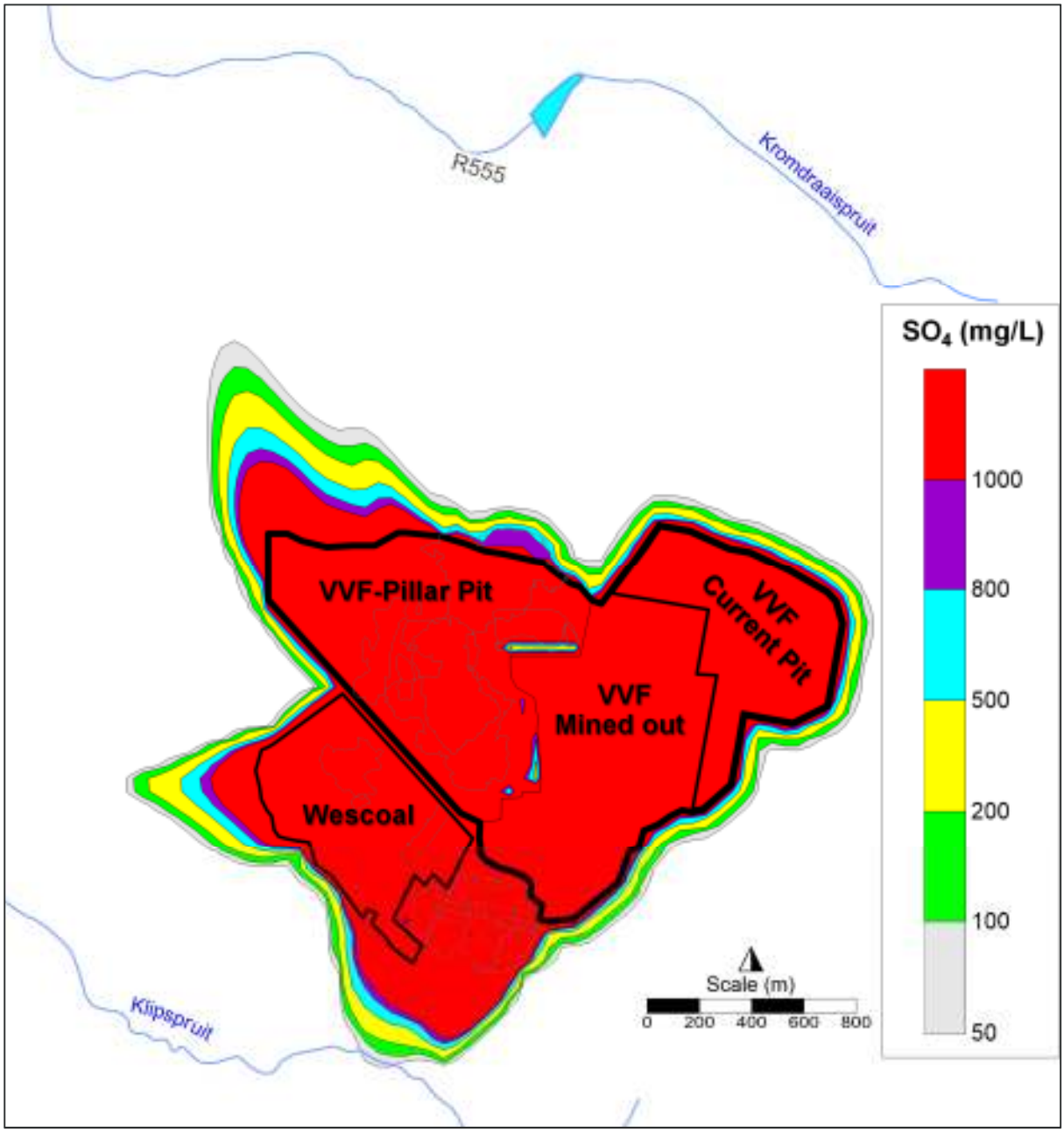


Figure 33: Scenario-4 (place discard into Vlakvarkfontein Colliery-Pillar Pit, mine barrier pillar with Wescoal): Vlakvarkfontein Colliery opencast SO_4 contamination plume 100 years after the cessation of mining

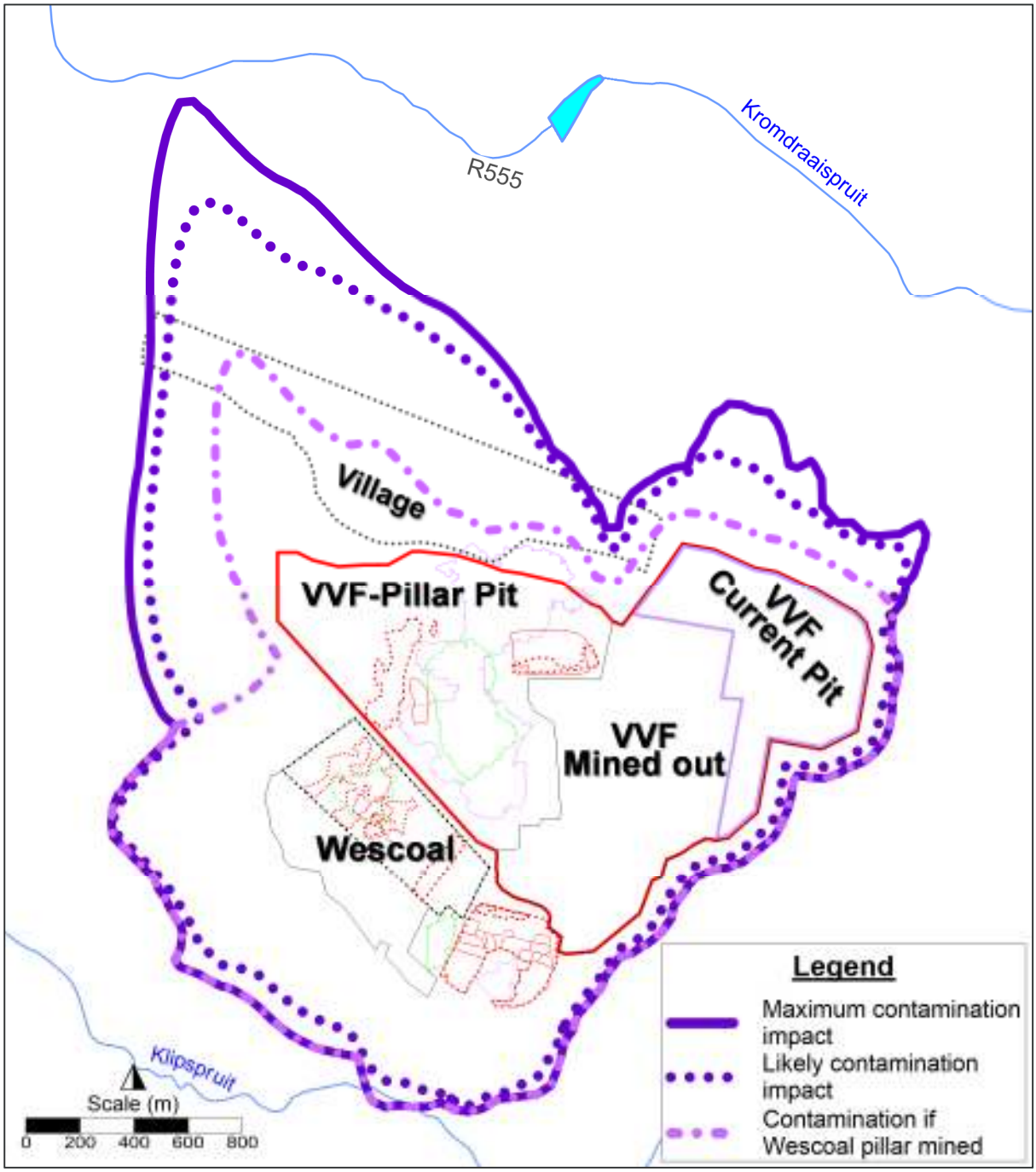


Figure 34: Groundwater quality impact zones – post-mining

A decant zone analysis was performed for Scenario-3 (discard backfill into Vlakvarkfontein Colliery-Pillar Pit, and no mining of Wescoal barrier pillar), through identifying 23 possible decant areas (depicted in Figure 35– the important zones where most decant was/will be expected are highlighted) where groundwater pressures may be above the surface topography. The following aspects are important for the post-mining environment:

- The following areas were considered:
    - Directly downstream/south of mining;
    - Adjacent to the Klipspruit (also known as the Leeuwfonteinspruit) in the south;
    - Central regions of the potential decant zone;

- The two historical decant zones do not necessarily correlate exactly with the 23 possible decant zones (e.g. Main-decant-zone-east coincides with portions of zones 18, 19 and 22);
- Figure 35 graphically depicts the important decant zones where long-term (100 years) most decant can be expected for Scenario-3 (discard backfill into the Vlakvarkfontein Colliery-Pillar Pit, no mining of barrier pillar):
    - For simplification, zones which will decant very small volumes and/or only uncontaminated natural groundwater base-flow, are not indicated);
    - Decant volumes, concentrations and salt load for scenario-3 are provided in Table 7.10 and Figures 7.16 A-C of the hydrogeology report attached in Appendix D;
    - The post-mining steady-state decant volumes to these individual zones, for the other three modelling scenarios, are also summarised in Table 7.10 of the hydrogeology report attached in Appendix D; i.e. serving as a comparison of the volumes and concentrations for each modelling scenario in these areas;
- If the groundwater contamination plumes are compared to the decant analysis, it is clear that decant will have by far the most critical impact on the surface water environment.

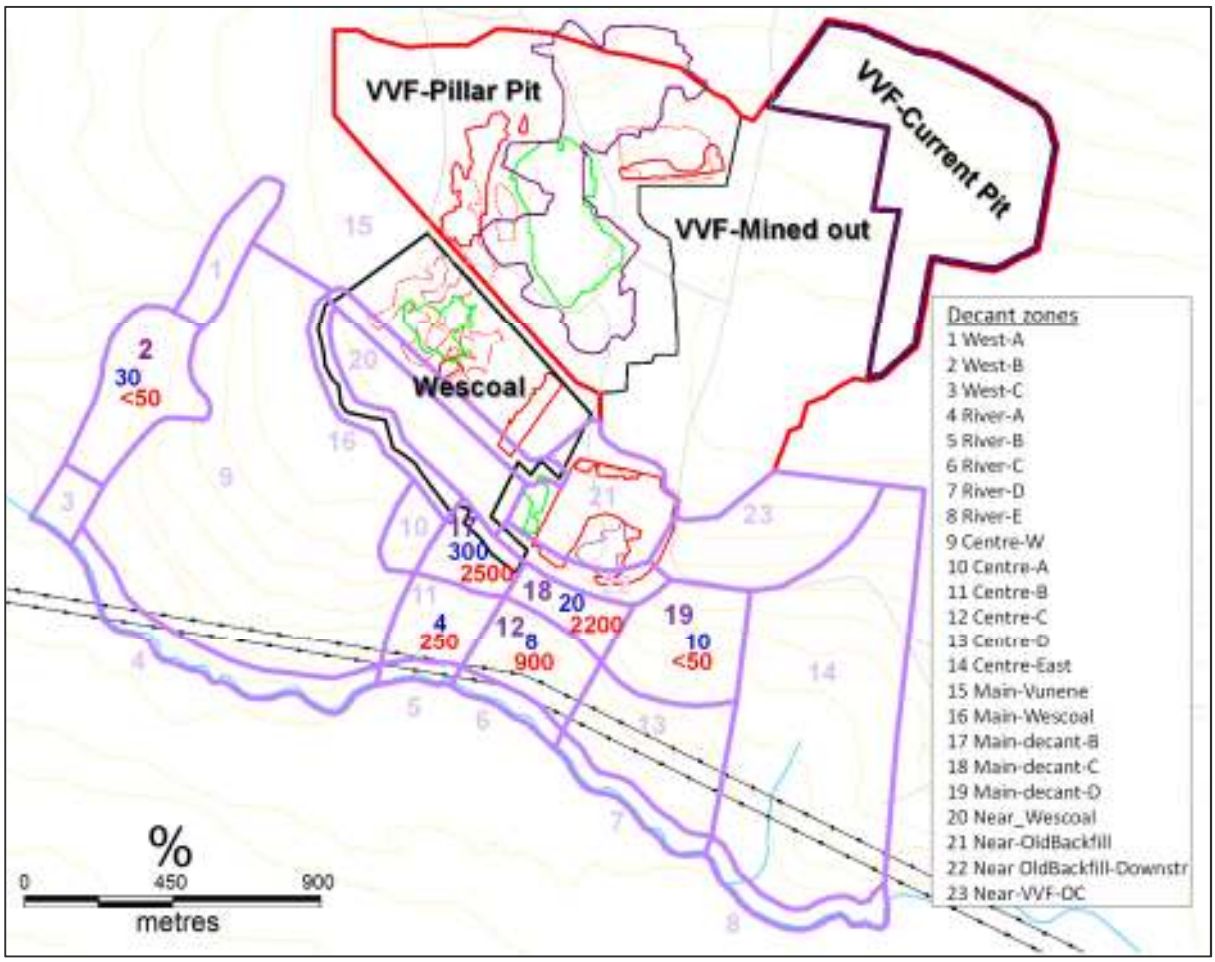


Figure 35: Scenario-3 (place discard into Vlavarkfontein Colliery-Pillar Pit, do not mine barrier pillar with Wescoal): Potential decant zones during the pre-mining situation and various post-mining scenarios

4.7 HYDRO-CENSUS

Hydrocensus information of external groundwater users within a 1 km radius of the Vlakvarkfontein Colliery layout has been obtained. A total of 18 boreholes including 1 exploration borehole, 2 dug-wells, 2 fountains and

1 mine water decant point were surveyed. A summary of the hydro-census is indicated in Figure 36 and Table 20.

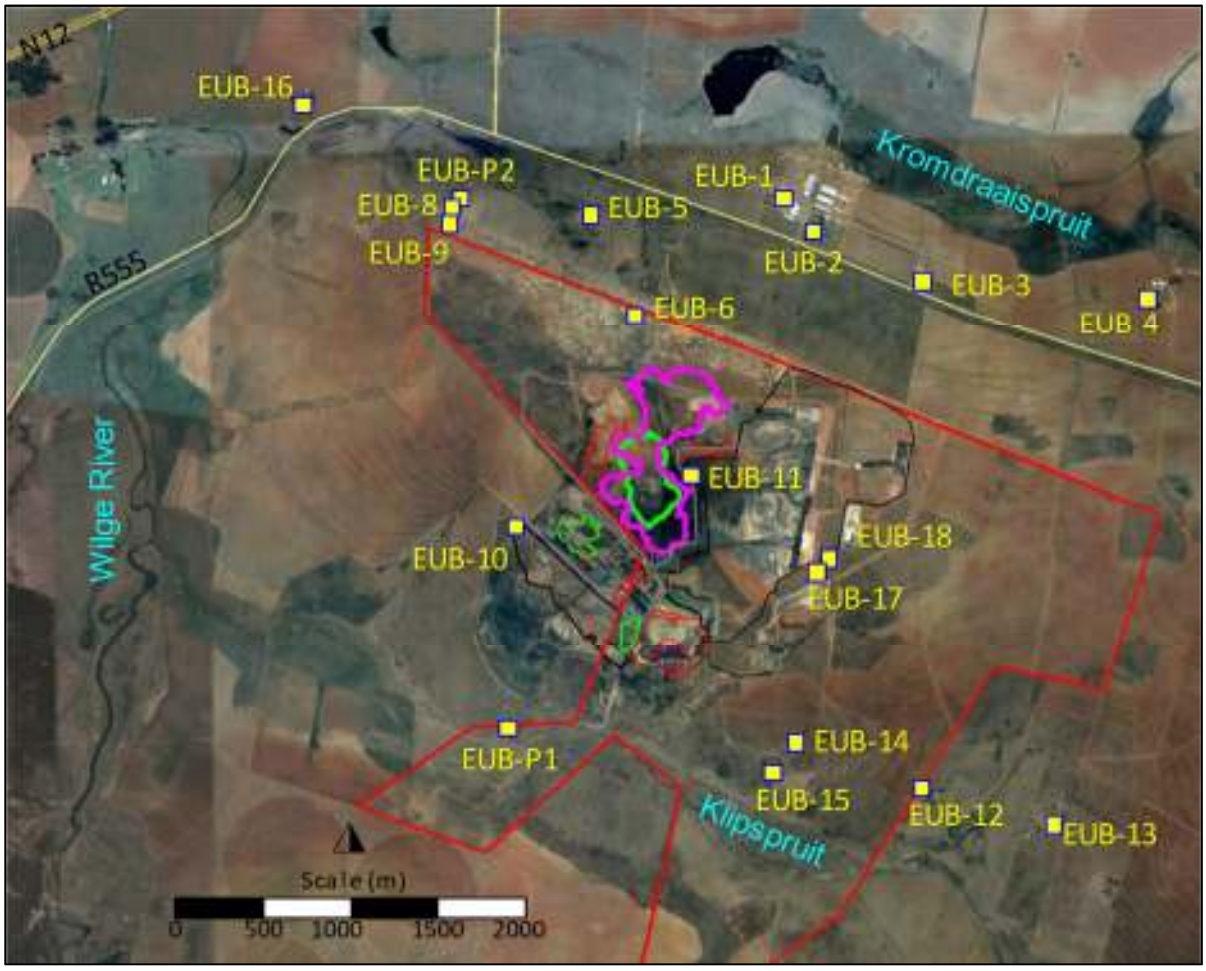


Figure 36: External users identified by Groundwater Square (Ref: GW2_069, 2009), depicted against an August 2016 Google Earth aerial photograph

Table 20: Hydro-census survey data

Farm Name	Occupant Owner	P.O. Box	Telephone	Ha Irrigation	Crops	Irrigation Kl/month	Drinking l/day	Recreational	Dams	Bridges
RE Boschpoort 211 IR and Ptn 3 Vandyksput 214 IR	Truter Boerdery Trust	Box 621, Ogies		20	Wheat, Maize	200	12 000	N	N	N
Ptn 2 Nooitgedacht 564 JR	J.P. Joubert	Box 55. Ogies	0823882590	50	Maize	200	45 000	Fishing	N	Y
Ptn 3 Witpoort 563 JR	H.S, Pienaar	P.O. Box 8269 Die Heuwel, 1042	0825766678	30	Maize	Unsure		N		Y
Ptn 10 Witpoort 563 JR	Nobody home									
Ptn 6 Witpoort 563 JR	Nobody home									
Ptn 8 Witpoort 563 JR	S.H. Boshoff	Box 1799, Bronkhorstspruit, 1020	0139325645	20	Maize	Unsure			N	N
Ptn 13 Witpoort 563 JR	S.H. Boshoff	Box 1799, Bronkhorstspruit, 1020	0139325645	20	Maize	Unsure	40 000	N	N	N
Ptn 7 Bossemanskraal 538 JR	Nobody home									
Ptn 6 Bossemnaskraal 538 JR	Nobody home									
Ptn 5 Kortfontein 530 JR	Harry & Jeanette Short	P.O. Box 355 Bronkhorstspruit, 1020	0827718746 0827775175	N			N	N	N	N
Ptn 11 Onverwacht 532 JR	Len Ditchfield	P.O. Box 1769 Bronkhorstspruit 1020	0825779260 0139327500	20	Pasture	400	80 000	N	Y, 4	N
Ptn 10 Onverwacht 532 JR	Peter Glintzr	P.O. Box 280 Bronkhorstspruit, 1020	0828315944	30	Maize	1250	5000	N	N	N

Farm Name	Occupant Owner	P.O. Box	Telephone	Ha Irrigation	Crops	Irrigation Kl/month	Drinking l/day	Recreational	Dams	Bridges
Ptn 20 Onverwacht 532 JR	M.S. Venter	P.O. Box 153 Bronkorstspruit, 1020	0139324444 0845131606	30	Pumpkins	Unsure	3000	N	N	Y
Ptn 17 Onverwacht 532 JR	H.F.C. Venter	P.O. Box 193, Bronkhorstspruit, 1020	0139325529 0792981638	20	Pumpkins	Unsure	1000	N	N	Y
Ptn 15 Onverwacht 532 JR	Nobody home									
Portion 15 Onverwacht 532 JR	L. Adlam	P.O. Box 2368, Bronkhorstspruit, 1020	0834177464	20	Green fields (grazing)	Unsure	15 000	N	N	Y
Ptn 13 Witpoort 563 JR	Andre van Vuuren	P.O. Box 5009, Bronkhorstspruit, 1021	0721226247	30	Lucerne	Unsure	Unsure – watering of game	Fishing	Y	N
			Total:	**290**						

4.8 SOCIO-ECONOMIC ENVIRONMENT

The Vlakvarkfontein Coal Mine is situated in the Victor Khanye Municipality area. The area within which the mine is situated is called Arbor (local name taken from the nearby Arbor siding). The population density in the local area where Vlakvarkfontein Colliery is located is limited to residents of the Arbor settlement, as well as farmers and their workers. The area of influence includes the Nkangala District Municipality and the greater Victor Khanye Local Municipality as well as the eMalahleni Local Municipality. The most affected stakeholders are the adjacent commercial farmers and more directly, the Arbor Community (BEAl, 2017).

The Arbor community is located adjacent to the mine. The mine owns the land on which the Arbor community reside. There are about 300 households that occupy this land, but this is expanding continually. It is unclear exactly how long the community has been occupying the land. There have been riots and violent protests in the past, and the relationship between the mine and the community has been volatile. The Centre for Environmental Rights (CER), the Human Rights Commission (HRC) and the DMR have been involved by the community, and there are significant sensitivities around community relations and impacts. Since Ntshovelo Mining has taken over the operations, an effort has been made to improve relationships between the mine and the Arbor community. This has resulted in frequent meetings between the mine and the community, represented by the Steering Committee and the Forum. The Vlakvarkfontein Colliery is an existing mine situated in an area with complex social dynamics. The community is already exposed to a number of social and environmental impacts from different sources. The Arbor community is a poor community with high levels of illiteracy. They have tried to use external parties such as the DMR, CER and Human Rights Commission to assist them with improving the situation. Despite this, not much has changed in the community, and the community remains divided. The relationship between the mine and the community is tense. Some community members welcome the presence of the mine and the attempts of the mine to improve relationships. Others do not want the mine as a neighbour, and view the mine as a hostile presence. The Arbor community is neglected in terms of services from the Vlakvarkfontein Colliery, and some community members feel they are left to their own devices to try and better their situation (BEAL,2017).

4.8.1 DEMOGRAPHICS AND EMPLOYMENT STATISTICS

In 2011, the total population of the Victor Khanye Local Municipality was 75 452 people and in 2001 it was 56 335. This indicates a gradual increase taking place in the municipality (Victor Khanye IDP 2016/2017). The unemployment level has been reduced from 28.2% to 21.6% in terms of Global insight figures this reduction is as a results of an increase in investments in our local economy. The employment situation is expected to improve over the medium term with additional jobs expected in the mining sector. The latest statistic reflects that the employment level in the Victor Khanye Local Municipality is currently at 28. 9%. Based on the 2016 definition of Economically Active Population (EAP) of 30,415 the unemployment rate is reflected at 21.6%, this represents an overall gain in employment compared to 2011. This figure is high when we consider the economic activity in the area, but obviously impacted by the migration influx of job seekers. Leading industries in employment comprise of trade (18.7%), agriculture (18.2%) and community services contributing (14.3%). However, the former two sectors are experiencing a decline in employment in the last few years whilst community services has increased and mining as an employer has grown and now contributes 12.7%.

4.8.2 Mining and Industry

The local economy is relatively diversified with the largest sector, in terms of output as well as proportional contribution being the trade sector. The growing sector is trade sector followed by the agriculture sector and the mining sector. During recent years the total output of the agriculture sector experienced significant levels of growth while the mining and minerals sector declined. Mining activities are concentrated mainly on coal and silica. As mentioned, about 3 million metric tons of coal and 2 million metric tons of silica are mined annually in the municipality. The main mining areas are around Delmas in the centre of the municipal area, and also in the far north-eastern corner of the municipal area. Importantly, there is a growing urgency to establish an equitable and realistic trade-off that maximizes the provincial benefits from mining and energy sectors while mitigating any environmental impacts. According to the MPGDS, the mining, petrochemicals, steel and forestry sectors are

dominated by a few global-level companies, with relatively few job opportunities being created due to their intensive capital nature (Victor-Khanye IDP).

4.8.3 Transportation, Infrastructure and Traffic

The social infrastructure within the area surrounding the proposed mine, including the Arbor informal settlement is limited to farm stalls, isolated farm shops and farm schools. The Arbor informal settlement has a public primary school which used to be a farm school. No formal water supply is available in the immediate vicinity of Vlakvarkfontein Colliery. Water is obtained from groundwater boreholes and surface water dams for domestic and agricultural use. The entire rural area is serviced with electricity from an Eskom supply network. Power to Vlakvarkfontein Colliery will be sourced from a power line that runs along the eastern boundary of the mining area.

5 ANALYSIS AND CHARACTERISATION OF THE WATER USE ACTIVITY

The following section describes the activity, its associated processes and infrastructure in more detail.

5.1 SITE DELINEATION AND CHARACTERISATION

Vlakvarkfontein Colliery is an existing coal mine located 30 km north east of Delmas, and approximately 15 km south west of Ogies, Mpumalanga Province. The mine has two existing WULAs (Licence no.: 03/B20F/AGJ/4858 and 03/B20A/G/4845), but is planning to extend its mining operations within the existing mining right boundary. The proposed new mining operations will necessitate the relocation and re-establishment of the existing ancillary infrastructure associated with the current mining operations, including the Pollution Control Dam (PCD) and the administrative structures. A new WUL application for the relevant water uses that will be triggered due to the proposed extension project needs to be undertaken. The Vlakvarkfontein Colliery is located on the boundary between quaternary catchments B20E and B20F. A tributary of the Wilge River (Klipspruit) flows to through the mining rights area. The Leeuwfonteinspruit and the Heuwelfonteinspruit are tributaries of the Wilge River, which eventually confluence with the Olifants River just upstream of the Loskop Dam.

5.2 WATER AND WASTE MANAGEMENT

The Vlakvarkfontein Colliery will continue to require water in the form of both potable and bulk water for the wash plant and dust suppression.

5.3 POTABLE WATER SUPPLY

Potable water supply to the Vlakvarkfontein Colliery is obtained via an existing borehole. The borehole is located on Portion 5 of the farm Vlakvarkfontein 213 IR. Potable water will continue to be obtained from boreholes and from the water treated at the water treatment plant, if required. As such, potable water will be made available for the required 300 people on site at a rate of ~50 litres per day per person.

5.4 PROCESS WATER

Water will be recycled onsite as far as possible. The mine extension will include a proposed water treatment plant. The Vlakvarkfontein Colliery requires a fair amount of water for dust suppression and for the processing plant. Process water needs can be supplied directly from the pit or PCD and subject to applicable water use licences may be used for dust suppression. An offtake (Gooseneck) facility will be situated at the PCD dam. Water from the water treatment plant or from the PCD dam will be pumped to the processing plant's process water tank from where it will be utilised. Process water will be further used for wash bay consumption.

5.5 SOLID WASTE MANAGEMENT

5.5.1 DOMESTIC AND INDUSTRIAL WASTE

Domestic waste is mostly generated at the mine offices and change houses, while industrial waste is generated during mining activities (although the majority of industrial waste is classed as hazardous).

The domestic and non-hazardous industrial waste stream comprises of typical constituents as paper, empty cans, glass, non-contaminated containers (steel and plastic), scrap metal, non-contaminated builder's rubble, piping and tubing (plastic, metal and rubber) and wood cut-offs. These wastes are separated at source and then transferred to a central temporary holding facility comprising of skips.

The mine will ensure that:

- Waste is separated at source and removed to the temporary storage facility on a daily basis;
- Waste skips containing paper and plastic are sufficiently covered to prevent windblown waste;
- Skips will not be allowed to overtop / be overfilled. Skips will be cleared by the appointed contractor on a monthly basis or sooner if it is noted that the waste skips are full;
- A licensed waste contractor is appointed for the supply and removal of skips. The waste contractor must supply the mine with safe disposal certificates of all materials which the mine will keep on record;
- It is recommended that the appointed waste contractor has a recycling subdivision or, if not, that a separate recycling contractor is appointed to ensure that all potentially recyclable materials are not unduly disposed of;
- The temporary waste storage area will be contained within the mine's dirty water catchment and will be underlain by a concrete slab;
- The temporary waste storage area will be surrounded by a fence to catch windblown litter;
- No waste will be disposed of on site;
- The mine will obtain a commitment from the appointed waste contractors that sufficient capacity is available to ensure that no emergency situations are encountered where waste cannot be removed;
- The waste contractor will keep a record of the volumes of waste removed from site;
- If any scrap metal is to be sold, a licensed scrap dealer will remove the scrap metal. This scrap metal must be removed immediately following purchase. Waste will not be allowed to accumulate beyond the capacity of the facility and any scrap metal which is not collected will be removed by the appointed waste contractor; and
- Any contractors involved with the removal, purchase or recycling of waste must be able to produce the necessary licences required under the NEMWA.

5.5.2 HAZARDOUS INDUSTRIAL WASTE

The majority of industrial waste produced during mining activities is likely to be hazardous and will include used oil, degreasers, lubricants and containers, contaminated by or used in the conveyance or storage of any of oil, degreasers or lubricants. These substances will be separately stored in designated and sealed drums at the location on site where the waste is generated and once full, conveyed to a central temporary storage point on site for removal by an appointed contractor. The mine will ensure that:

- All drums of hazardous waste yet to be transferred to the temporary storage facility will be kept within steel drip trays;

- No drums are to be left open. Once the material has been transferred to the drum it is to be immediately sealed;
- Once 90 % full, the drums are to be immediately transferred to the designated temporary hazardous waste storage facility;
- During the conveyance of hazardous waste drums, all covers must be firmly sealed and the drums must be lashed securely to the relevant trolley or vehicle used in the transport to the temporary hazardous storage facility;
- The temporary hazardous waste storage facility will be constructed upon a concrete slab and be bunded with an oil trap to collect any spills;
- The temporary hazardous waste storage facility will be located within the mine's dirty water catchment;
- The temporary hazardous waste storage facility will be fenced-off and located separately to the temporary general waste storage facility to ensure that general waste does not become contaminated by the hazardous waste;
- Full drums contained within the temporary hazardous waste storage facility will be regularly removed by an appointed hazardous waste contractor. The facility will be cleared of full drums on a monthly basis or sooner if necessary;
- Drums will not be allowed to overtop / be overfilled;
- The waste contractor must supply the mine with safe disposal certificates of all materials which the mine will keep on record;
- No hazardous waste will be disposed of on site;
- The mine will obtain a commitment from the appointed waste contractors that sufficient capacity is available to ensure that no emergency situations are encountered where waste cannot be removed;
- The waste contractor will keep a record of the volumes of waste removed from site;
- Any contractors involved with the removal must be able to produce the necessary licences required under the NEMWA; and
- The mine will maintain a supply of spill-kits on site for application to any spillages which may occur outside of the bunded areas.

5.6 STORM WATER

BEAL has compiled a storm water management plan (SWMP) for the proposed Vlakvarkfontein Colliery (refer to Appendix F). The purpose of a SWMP is the following:

- To confine any unpolluted water to a clean water system, away from any dirty area;
- To design, construct, maintain and operate any clean water system at the mine or activity so that it is not likely to spill into any dirty water system more than once in 50 years;
- To collect the water arising within any dirty area, including water seeping from mining operations, outcrops or any other activity, into a dirty water system;
- To design, construct, maintain and operate any dirty water system at the mine or activity so that it is not likely to spill into any clean water system more than once in 50 years; and
- To design, construct, maintain and operate any dam or tailings dam that forms part of a dirty water system to have a minimum freeboard of 0.8 m above full supply level, unless otherwise specified in terms of Chapter 12 of the NWA;
- To design, construct and maintain all water systems in such a manner as to guarantee the serviceability of such conveyances for flows up to and including those arising as a result of the maximum flood with an average period of recurrence of once in 50 years.

The proposed SWMP includes the following aspects:

- The pollution control dam has been designed to contain dirty storm water generated on the site, as well as the operational dewatering from the opencast mine. The capacity of the pollution control dam is 14 000 m^3;
- Upfront dewatering volumes have been calculated by Groundwater Square and indicate that approximately 750 000 m^3 of water will need to be dewatered prior to mining. Some of this water can be stored in the transfer sump but the remainder will need to be treated and released. The mine will determine how far in advance upfront dewatering will commence. This timing will determine the size of the water treatment plant required; and
- The storm water channels are relatively small, since the proposed colliery is located close to local watersheds and internal catchments are small.

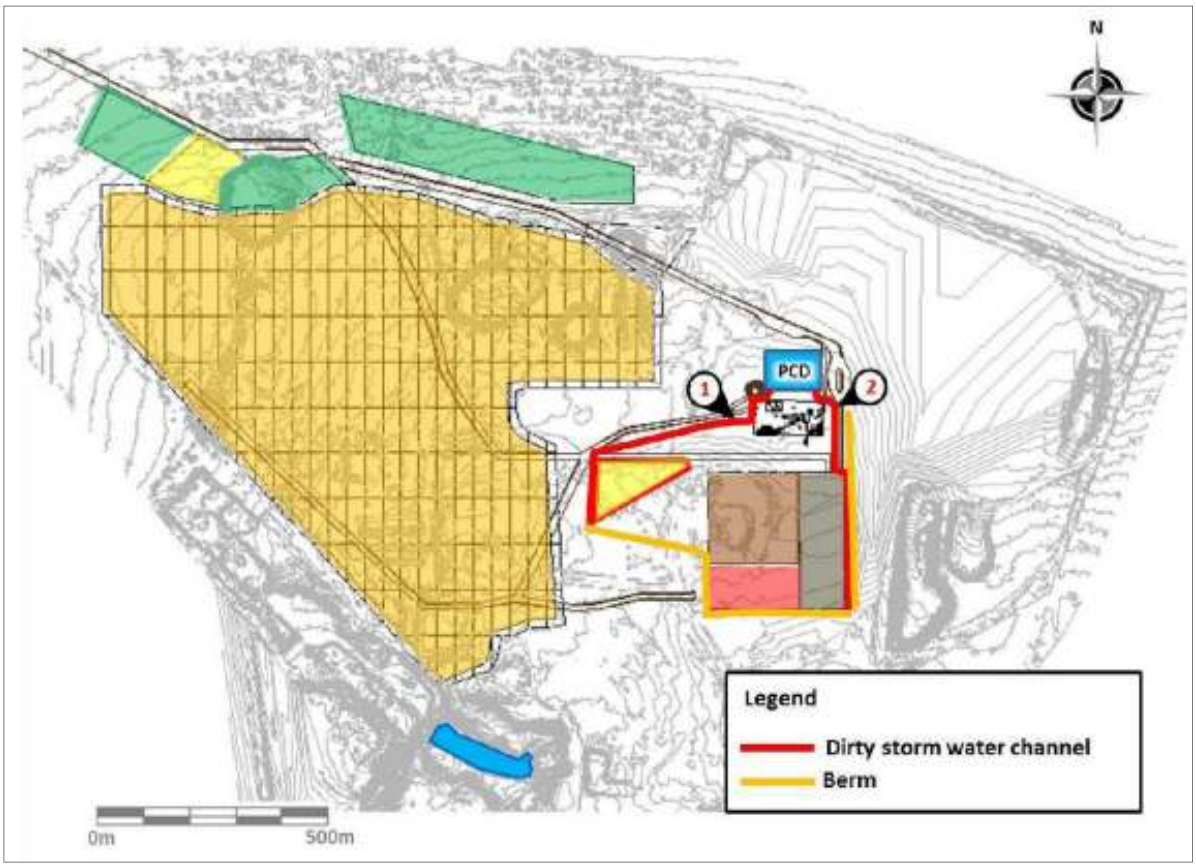


Figure 37: Storm water channels for Vlakvarkfontein Colliery

5.7 WATER AND SALT BALANCE

The WB for the Vlakvarkfontein Colliery was determined by BEAL. It is a static water balance. The WB represents average flows between facilities and along hydrological interfaces. Being a static WB showing average flows, peak flows cannot be accounted for. The Mpumalanga Highveld has distinct wet and dry seasons. Over 94% of Vlakvarkfontein Colliery's MAR between September and April inclusively. Over 77% of the area's MAE occurs in this period. For this reason, the WB was divided into a wet season and a dry season water balance. The wet season WB represents the period 1 September to 30 April. The rest of the year is included in the dry season WB. The wet season WB is represented in Figure 38 and the dry season WB is represented in Figure 39. The water balance is a deficit water balance on average, with the plant demand exceeding storm water inflows into the pollution control dam.

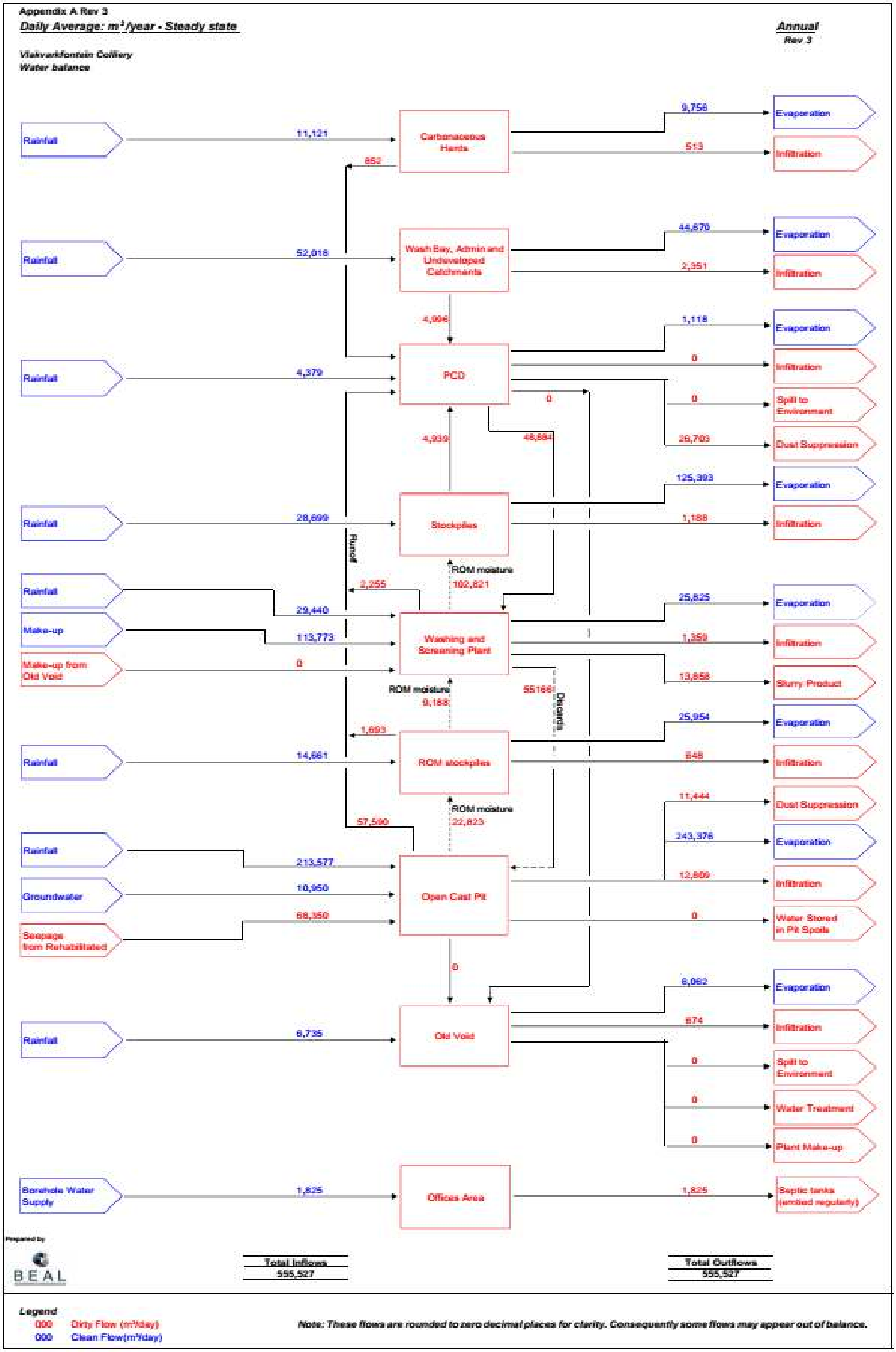


Figure 38: Water Balance for wet season

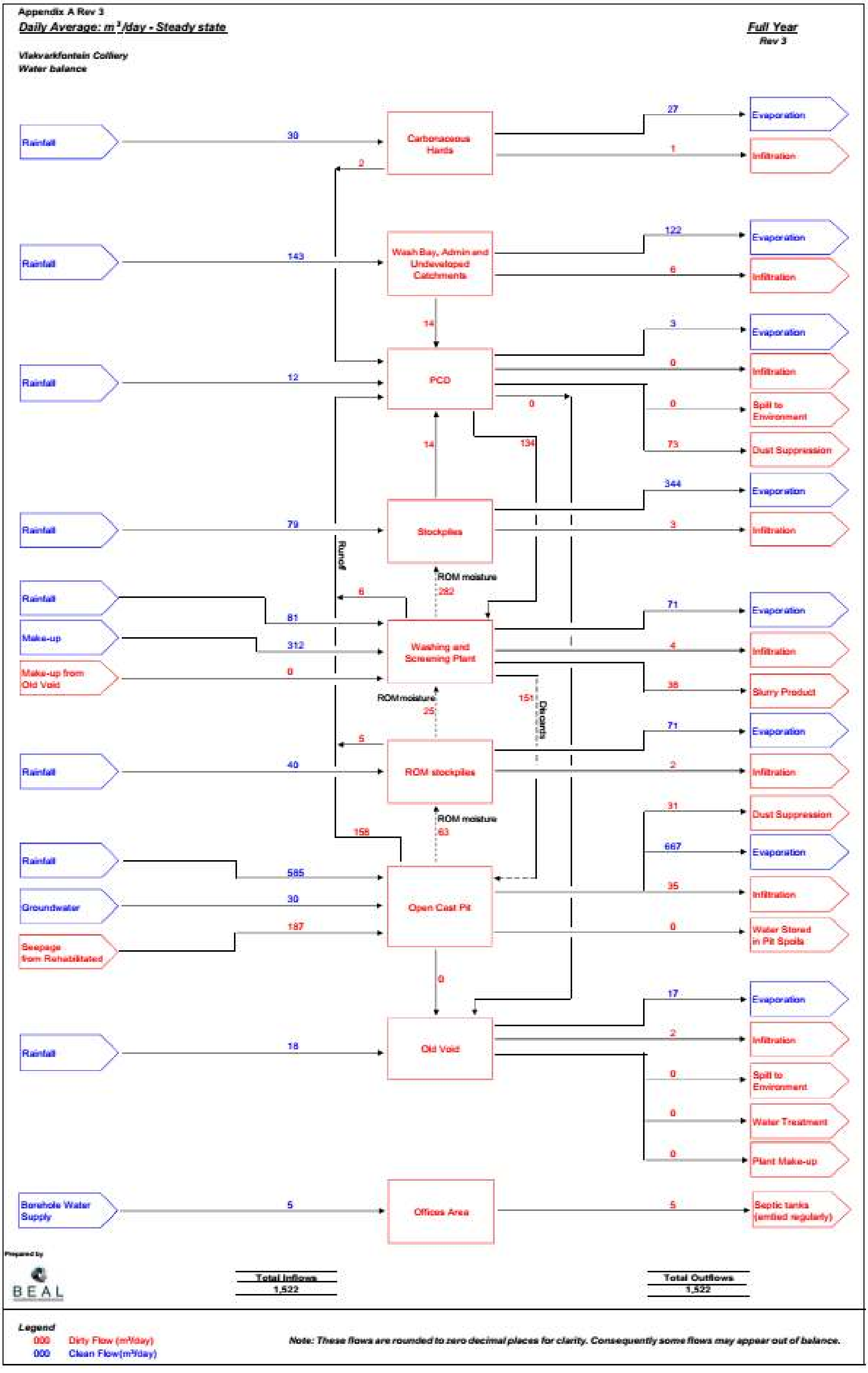


Figure 39: Water Balance for the dry season

The salt balance is a conservative mass balance. It provides average total dissolved solids (TDS) loads that are transported with inflows, outflows and inter-facility flows from the water balance. TDS was used as it is a good representation of sulphates and other pollutants in the water. TDS can be modelled conservatively. The salt balance is likely to be typical of a coal mining operation, with salts being generated mainly from the on-site coal and carbonaceous material. The salts are diluted and transported into the water circuits. Salts are lost from the system when discharges occur or when water is transported off the site. These include moisture transported off site with the coal product, dust suppression, and discharges to the environment should they occur. The salt balance (Figure 40) shows that this water contains pollution levels common to coal mining activities.

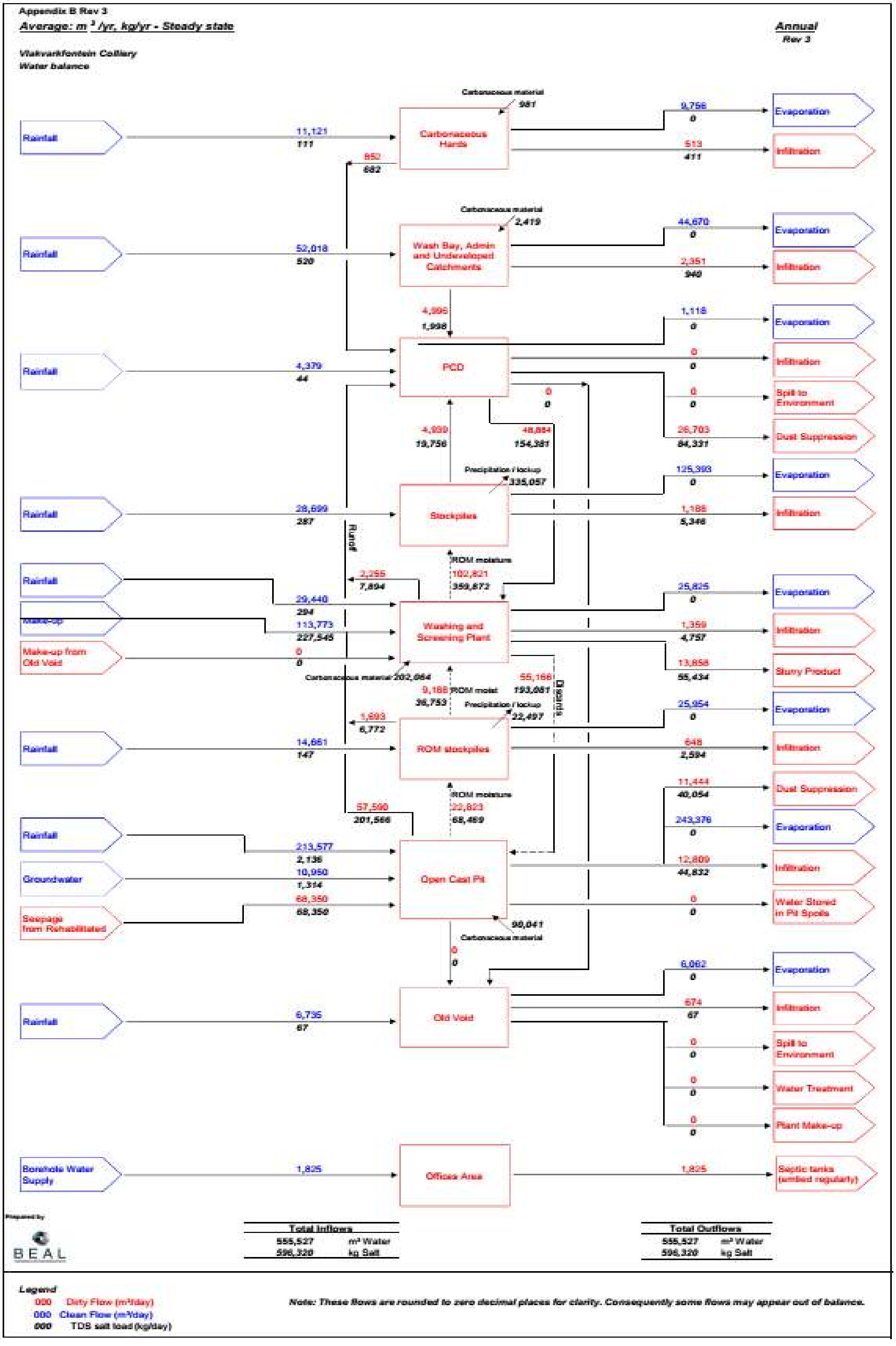


Figure 40: Salt balance for the Vlakvarkfontein Colliery

5.8 GROUNDWATER

Refer to Section 4.3.2, as well as Section 5.10.3. The Hydrogeological Study is attached in Appendix D.

5.9 OPERATIONAL MANAGEMENT

The operational management of the activities in terms of the water and waste management are detailed in the following sections. This included the organisational structure, competence training and awareness and the internal and external communication.

5.9.1 ORGANISATIONAL STRUCTURE

The organizational structure for the Applicant is presented in Section 2.8 above and the sections 5.9.2 to 5.9.5 below includes a discussion of resources and competencies, as well as the internal and external communication processes that are implemented by the Applicant.

5.9.2 RESOURCES AND COMPETENCE

The success of environmental management is dependent upon the commitment of the organization, at all levels, to environmental excellence. Commitment to this IWWMP will benefit both the organization's business success and the community in which it operates. This commitment requires that the organization provide the necessary resources for employee training, reference material and reporting procedures. Senior executives and line managers will be held responsible and accountable for the health and safety of personnel while on duty, as well as the environmental impacts caused by mining activities. The mine will conduct its operations responsibly and with due care and regard to the impact on the environment. It is the policy of the Applicant to strive to eliminate the adverse environmental effects of all its activities and take an active role in raising the environmental awareness and responsibility of all employees, suppliers, contractors and customers.

To achieve and surpass this objective, the company endeavours to:

- Conduct all its activities in an environmentally responsible manner;
- Conform to all relevant legislation as a minimum standard;
- Ensure that all its operations have appropriate policies, procedures and facilities so that such standards can be met;
- Promote environmental awareness by continuous training, motivation and leading by example;
- Implement effective environmental management and reporting systems at all operations, that encompasses auditing, monitoring and decisive intervention;
- Conduct regular review of conformance to requirements and achievement of objectives at Board level;
- Use raw materials and resources prudently;
- Promote the recycling of used and waste materials;
- Apply the principles of continuous improvement to environmental performance;
- Develop and maintain positive relationships with all affected and interested parties, governmental departments, environmental agencies and the public; and
- Participate in environmental governance.

5.9.3 EDUCATION AND TRAINING

Training and environmental awareness is an integral part of environmental management of a mine. The mine must ensure that all relevant employees are trained and capable of carrying out their duties in an environmentally responsible and compliant manner, and are capable of complying with the relevant

environmental requirements. Environmental Awareness at Vlakvarkfontein Colliery is addressed and conducted by means of two (2) main components:

- Training; and
- Communication.

Environmental awareness training at the mine will be attended to during induction for new employees and in refresher courses for ex-leave employees by means of an audio visual environmental awareness video. Apart from own employees, the operation also make use of numerous contractors to undertake different components of their mining activities. Each contractor will be responsible for its own environmental awareness training for its employees.

The principles to be adhered to by the mine and the contractors are based on the following:

- Environmental awareness is addressed at top management level;
- Workers receive awareness training on all environmental and SHE procedures;
- Training aids includes the use of photographs, posters and live demonstrations;
- The workers whose jobs have the greatest potential for environmental impact are identified and receive specific training in impact prevention and remediation; and
- Records are kept of environmental awareness training and all new employees receive induction before they are allowed to work on site.

5.9.4 INTERNAL AND EXTERNAL COMMUNICATION

The Public Participation Process (PPP) is a requirement of several pieces of South African Legislation. The aim of public participation is to ensure that all relevant interested and affected parties (I&AP's) are meaningfully notified, consulted and their opinions considered during the course of the project. The methodology applied to the PPP, must be one of openness, transparency and collaboration between the EAP and I&AP's. All documentation pertaining to the IWWMP will be made available to the public for comment in accordance with the relevant regulations. All comments received will be included in the IWWMP to be submitted to the DWS for adjudication, as well as in the Public Participation Report that will be attached as an Appendix to the IWWMP.

5.9.4.1 INTERNAL COMMUNICATION

The following channels will be used to communicate pertinent environmental information to the appropriate levels.

- E-mails;
- Posters;
- Management briefs;
- Management meetings;
- SHE meetings;
- Site meetings; and
- Notice boards.

5.9.4.2 EXTERNAL COMMUNICATION

Social impacts already start in the planning phase of a project and as such it is imperative to start with stakeholder engagement as early in the process as possible. A stakeholder engagement plan will assist Vlakvarkfontein Colliery to outline their approach towards communicating in the most efficient way possible

with stakeholders throughout the life of the project. Such a plan cannot be considered a once off activity and should be updated on a yearly basis to ensure that it stays relevant and to capture new information. Stakeholders must provide input in the Stakeholder Engagement Plan.

The Vlakvarkfontein Colliery Stakeholder Engagement Plan should have the following objectives:

- To identify and assess the processes and/or mechanisms that will improve the communication between local communities, the wider community and the mine;
- To improve relations between the mine's staff and the people living in the local communities (Arbor and commercial farmers);
- To provide a guideline for the dissemination of information crucial to the local communities in a timely, respectful and efficient manner; and
- To provide a format for the timely recollection of information from the local communities in such a way that the communities are included in the decision making process.

The Stakeholder Engagement Plan should be compiled in line with International Finance Corporation (IFC) Guidelines and should consist of the following components:

- Stakeholder Identification and Analysis: time should be invested in identifying and prioritizing stakeholders and assessing their interests and concerns;
- Information Disclosure: information must be communicated to stakeholders early in the decision-making process in ways that are meaningful and accessible, and this communication should be continued throughout the life of the project;
- Stakeholder Consultation: each consultation process should be planned out, consultation should be inclusive, the process should be documented and follow-up should be communicated;
- Negotiation and Partnerships: add value to mitigation or project benefits by forming strategic partnerships and for controversial and complex issues, enter into good faith negotiations that satisfy the interest of all parties;
- Grievance Management: accessible and responsive means for stakeholders to raise concerns and grievances about the project must be established throughout the life of the project;
- Stakeholder Involvement in Project Monitoring: directly affected stakeholders must be involved in monitoring project impacts, mitigation and benefits. External monitors must be involved where they can enhance transparency and credibility;
- Reporting to Stakeholders: report back to stakeholders on environmental, social and economic performance, both those consulted and those with more general interests in the project and parent company;
- Management Functions: sufficient capacity within the company must be built and maintained to manage processes of stakeholder engagement, track commitments and report on progress; and
- It is of critical importance that stakeholder engagement takes place in each phase of the project cycle and it must be noted that the approach will differ according to each phase. The stakeholder analysis done in Section 6 of this report must inform the stakeholder engagement strategy.

5.9.5 AWARENESS RAISING

All employees and contractors have to undergo environmental and awareness training, which broadens the base of people that acts as custodians of the environment. The mine supports the comprehensive set of policies, standards and guidelines that the company applies for the various facets of the business, amongst which are:

- Safety, health, environment and risk, quality and community;

- Equity in employment;
- Information Systems;
- Compliance with the law; and
- Relationships with Governments.

The Applicant has established and maintains procedures for the internal communication between the various levels and functions of the operation. Environmental incidents are reported by either employees or I&APs via two distinct routes:

- Incident reporting directly to the surface environmental officer: I&AP's or employees report directly to the surface environmental officer, who then reports to the technical services manager who finally reports to the general manager; and
- Incident reporting to the respective head of department: Any incident is reported by an I&AP or an employee to the employees' respective head of department, who in turns reports to the technical services manager. The technical services manager reports to the surface environmental officer and general manager respectively. Grievance Mechanism

In accordance with international good practice Vlakvarkfontein Colliery should establish a specific mechanism for dealing with grievances. A grievance is a complaint or concern raised by an individual or organisation that judges that they have been adversely affected by the project during any stage of its development. Grievances may take the form of specific complaints for actual damages or injury, general concerns about project activities, incidents and impacts, or perceived impacts. The International Finance Corporation (IFC) standards require Grievance Mechanisms to provide a structured way of receiving and resolving grievances. Complaints should be addressed promptly using an understandable and transparent process that is culturally appropriate and readily acceptable to all segments of affected communities, and is at no cost and without retribution. The mechanism should be appropriate to the scale of impacts and risks presented by a project and beneficial for both the company and stakeholders. The mechanism must not impede access to other judicial or administrative remedies.

The grievance mechanism should be based on the following principles:

- Transparency and fairness;
- Accessibility and cultural appropriateness;
- Openness and communication regularity;
- Written records;
- Dialogue and site visits; and
- Timely resolution.

Based on the principles described above, the grievance mechanism process involves four stages:

- Receiving and recording the grievance;
- Acknowledgement and registration;
- Site inspection and investigation; and
- Response.

5.10 MONITORING AND CONTROL

Several environmental impacts will require on-going monitoring during various phases of the proposed project. The purpose of monitoring is not merely to collect data, but to provide information necessary to make informed decisions on managing and mitigating potential impacts. Monitoring, therefore, serves the following functions

- Serve as early warning system to detect any potential negative impacts;
- To provide information to feedback into management controls to avoid, prevent or minimise potential negative impacts;
- Provide quantitative data that can serve as evidence for the presence of negative impacts or the lack thereof; and
- Allows for trending, modelling and prediction of future conditions or potential impacts.

5.10.1 SURFACE WATER MONITORING

The design and implementation of the surface water monitoring network will be undertaken in accordance with the Best Practice Guidelines G3: Water Monitoring Systems (DWAF, 2006). The aim of the surface water monitoring network is to assist with overall water management including but not limited to the following:

- Pollution prevention;
- Assess the performance of pollution prevention; and
- Develop a more holistic understanding of current, baseline water quality on site and the changes that result from mining activities.

As discussed in Section 4.2.4, Vlakvarkfontein Colliery has an existing monitoring programme, as per the requirements of the existing WULAs (Licence no.: 03/B20F/AGJ/4858 and 03/B20A/G/4845).

5.10.2 BIOMONITORING

Biomonitoring is conducted at the Vlakvarkfontein Colliery as per the requirements of the WULAs during the summer and the winter (Refer to Appendix G). The biomonitoring is currently conducted at 5 sampling points:

- Three are located on the Leeufontein River, upstream and downstream of the Vlakvarkfontein Colliery;
- A single site is located on the Wilge River, and
- A single site on the Blesbok system, which is classified as a wetland system.

The location of these biomonitoring site are discussed in Table **21** and indicated in Figure **41**.

Table 21: Biomonitoring points

Site Name	GPS Co-ordinates	Site Description	Photos
Vlak1	26° 4'31.04"S 28°54'18.44"E	Site Vlak1 is situated on the Leeufontein River, a tributary of the Wilge River. Vlak1 is situated upstream of the mining operation. The site is characterized by deep slow moving waters over muddy substrate with marginal vegetation. Surrounded by agricultural land.	

Site Name	GPS Co-ordinates	Site Description	Photos
			Downstream low flow.  Upstream Low flow.
Vlak2	26° 4'29.51"S 28°53'50.19"E	Site Vlak2 is situated on the Leeufontein River, a tributary of the Wilge River. Vlak2 is situated adjacent to Vlakvarkfontein Colliery. Vlak2 was characterised by slow moving waters over rocky and sandy substrate. A large pool is present upstream of the level crossing. Surrounded by agricultural land. Coal dust was noted in the sediment.	 Upstream low flow.  Downstream low flow.
Vlak3	26° 4'9.55"S 28°53'10.39"E	Site Vlak3 is situated on the Leeufontein River, a tributary of the Wilge River. Vlak3 is situated downstream of Vlakvarkfontein Colliery. This site was predominantly slow moving waters over scattered stones with sandy and muddy substrate. A small amount of algae was present during the high flow survey. White precipitate noted on the rocks.	 Upstream low flow.

Site Name	GPS Co-ordinates	Site Description	Photos
			 Downstream low flow.
Vlak4	26° 2'46.16"S 28°52'3.63"E	Site Vlak4 is situated on the Wilge River, downstream of Leeufontein River confluence. Site Vlak4 had slow moving waters over sandy and rocky substrate. A large amount of algae and aquatic vegetation was observed during the high flow period. Some bank undercutting and sedimentation was present during the high flow. White precipitate noted on the rocks.	 Upstream low flow.  Downstream low flow.
Vlak5	26° 2'6.04"S 28°53'1.28"E	Site Vlak5 is situated on the Blesbok River, a tributary of the Wilge River. Vlak5 is situated downstream of Vlakvarkfontein Colliery. During the high flow, heavy sedimentation from the poorly maintained dirt road inundated the channel, suffocating much of the habitat. The recent low flow showed reconstruction of the channel. ONLY *in situ* water quality is carried out at this site.	 Upstream low flow.

Site Name	GPS Co-ordinates	Site Description	Photos
			 Downstream low flow.

In situ water quality analyses was conducted at all sites assessed during August 2015 (low flow), January 2016 (high flow) and July 2016 (low flow) surveys. The results of the survey are presented in Figure 42.

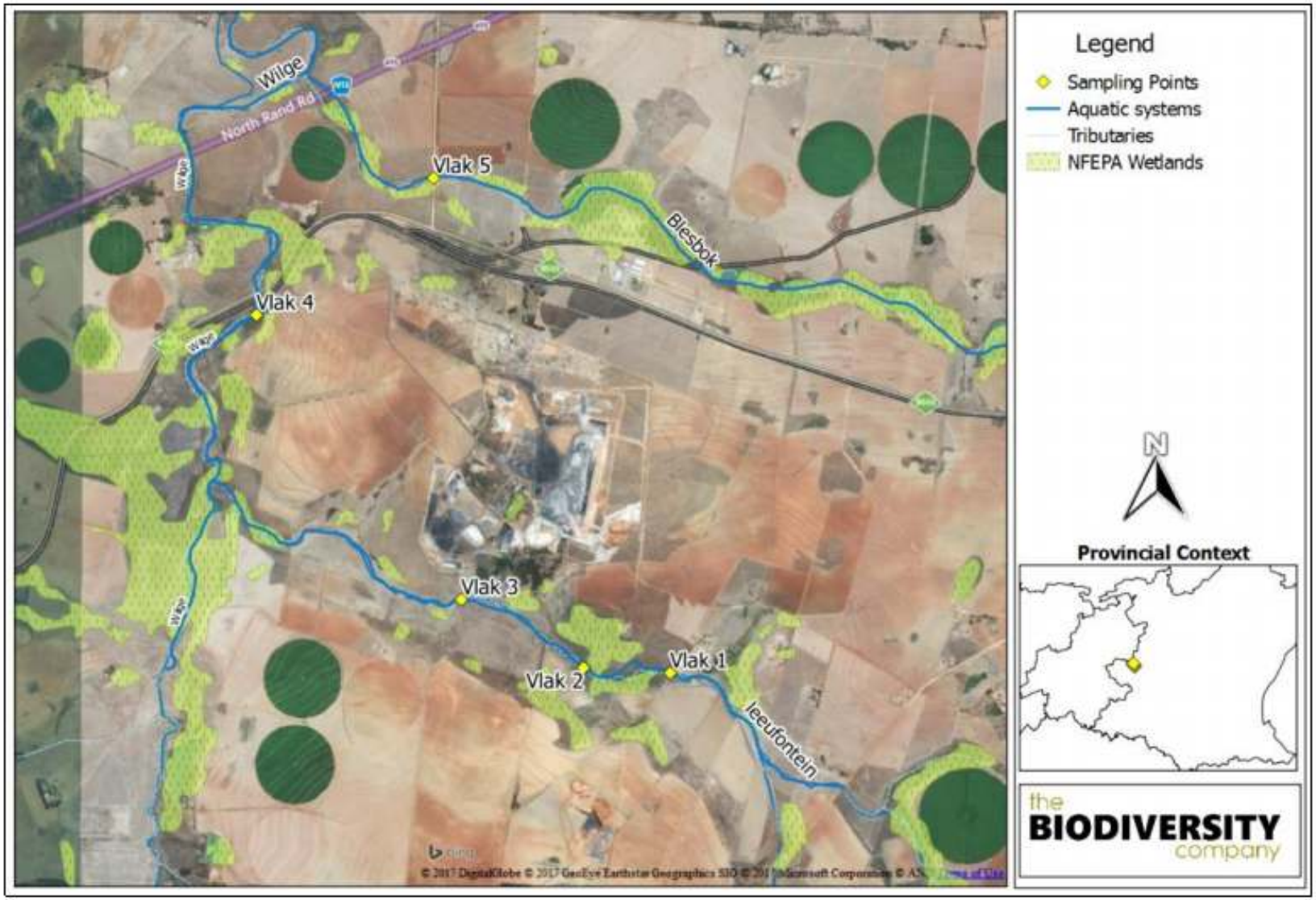


Figure 41: Biomonitoring points at the Vlakvarkfontein Colliery

Site	pH	Conductivity (µS/cm)	DO (mg/l)	DO Saturation (%)	Temperature (°C)
TWQR*	**6.5-9.0**	**<700**	**>5.00**	**>80**	**5-30**
Low Flow 2015					
Vlak1	**6.01**	**906**	8.25	110.6	21.3
Vlak2	**6.31**	**821**	5.89	**73.9**	17.1
Vlak3	**6.42**	**882**	6.87	90.1	19.5
Vlak4	**6.49**	**1017**	7.73	106.8	22.4
Vlak5	6.62	331	7.01	93.6	20.3
High Flow 2016					
Vlak1	7.60	**1173**	**4.40**	**60.2**	22.6
Vlak2	7.78	**1123**	5.11	86.1	22.2
Vlak3	8.33	**915**	7.47	109.0	23.9
Vlak4	8.89	**1075**	5.84	96.8	29.1
Vlak5	7.28	197.4	**3.01**	**54.2**	**34.7**
Low Flow 2016					
Vlak1	8.65	**1109**	8.60	105.7	11.7
Vlak2	7.85	**1038**	9.75	98.3	10.5
Vlak3	8.73	**1010**	9.34	109.6	13
Vlak4	8.58	**980**	7.62	101.5	14.8
Vlak5	8.14	380	8.18	100.3	15.1

*Levels exceeding recommended guideline levels (DWAF, 1996) are indicated in red.

Figure 42: In situ water quality results for the Vlakvarkfontein Colliery sites

The Leeufontein River, Wilge River and Blesbok River reaches assessed are in a poor condition. The water quality and habitat have shown little to no improvement with a decline in water quality at sites Vlak1 to Vlak5 from previous biomonitoring survey conditions negatively impacting on the aquatic biota. Water quality showed conductivity continuing at elevated levels due to salt in the systems. It is unlikely that water quality issues stem entirely from Vlakvarkfontein Colliery, but may be attributed from a combination of impacts within the catchments.

The specialist has recommended that the biomonitoring programme be continued, and consider the proposed expansion project. An aquatic biomonitoring programme is an essential management tool. The monitoring programme should be designed to enable the detection of potential negative impacts brought about by the proposed project. Table 22 highlights some important aspects to monitor in reference to aquatic biota for the duration of the programme.

Table 22: Aquatic and wetland ecology monitoring plan

Location	Monitoring objectives	Frequency of monitoring	Parameters to be monitored
Current sites used in this study.	Overall Aquatic PES	Bi-annual	Standard River Ecosystem Monitoring Programme (Ecostatus) methods
Current sites used in this study.	Determine if water quality deterioration is occurring.	Bi-annual	SASS5 and ASPT scores should not decrease as and be related to mining activities.
Current sites used in this study.	Determine if water/habitat quality deterioration is occurring.	Bi-annual	Monitor for presence of fish.

5.10.3 GROUNDWATER MONITORING

As Vlakvarkfontein Colliery is an existing coal mine, a groundwater monitoring programme has already been implemented, as per the requirements of the guidelines documented in Best Practice Guideline G3 Water Monitoring Systems (2007) available from the DWS. A monitoring plan is necessary due to the following reasons:

- Accurate and reliable data forms a key component of many environmental management actions;
- Water monitoring is a legal requirement;
- The most common environmental management actions require data and thus the objectives of water monitoring include the following:
    - Development of environmental and water management plans based on impact and incident monitoring (facilitate in decision-making, serve as early warning to indicate remedial measures or that actions are required in certain areas) for the mine and region;
    - Generation of baseline/background data before project implementation;
    - Identification of sources of pollution and extent of pollution (legal implications or liabilities associated with the risks of contamination moving off site);
    - Monitoring of water usage by different users (control of cost and maximising of water reuse);
    - Calibration and verification of various prediction and assessment models (planning for decommissioning and closure);
    - Evaluation and auditing of the success of implemented management actions (ISO 14000, compliance monitoring);
    - Assessment of compliance with set standards and legislation (EMPs, water use licenses); and
    - Assessment of impact on receiving water environment.

Effective groundwater monitoring systems on a mine consist of the following components:

- Groundwater quality monitoring system;
- Groundwater flow monitoring system; and
- Data and information management system.

When designing the monitoring system, the following issues should also be taken into consideration:

- Potential or actual water use;

- Aquifer or catchment vulnerability;
- Toxicity of chemicals;
- Potential for seepage or releases;
- Quantities and frequency of release to the environment (point and non-point); and
- Management measures in place to minimise risk.

The groundwater monitoring points that were measured in August 2017, as well as the parameters that are currently measured in terms of water quality are indicated in Section 4.4.3. The geohydrological report conducted for the Vlakvarkfontein Colliery extension project recommends additional groundwater monitoring points as indicated in Table 23 and depicted in Figure 43.

Table 23: Proposed additional monitoring points, to be drilled during November 2017

Borehole Number	Description / Location	Longitude	Latitude
VBH-12M	Southern decant area	28.8935	-26.0682
VBH-13M	In-between historical Opencast and underground	28.8936	-26.0549
VBH-14M	Barrier pillar with Wescoal	28.8920	-26.0598
VBH-15M	Northern potential decant area	28.9079	-26.0538

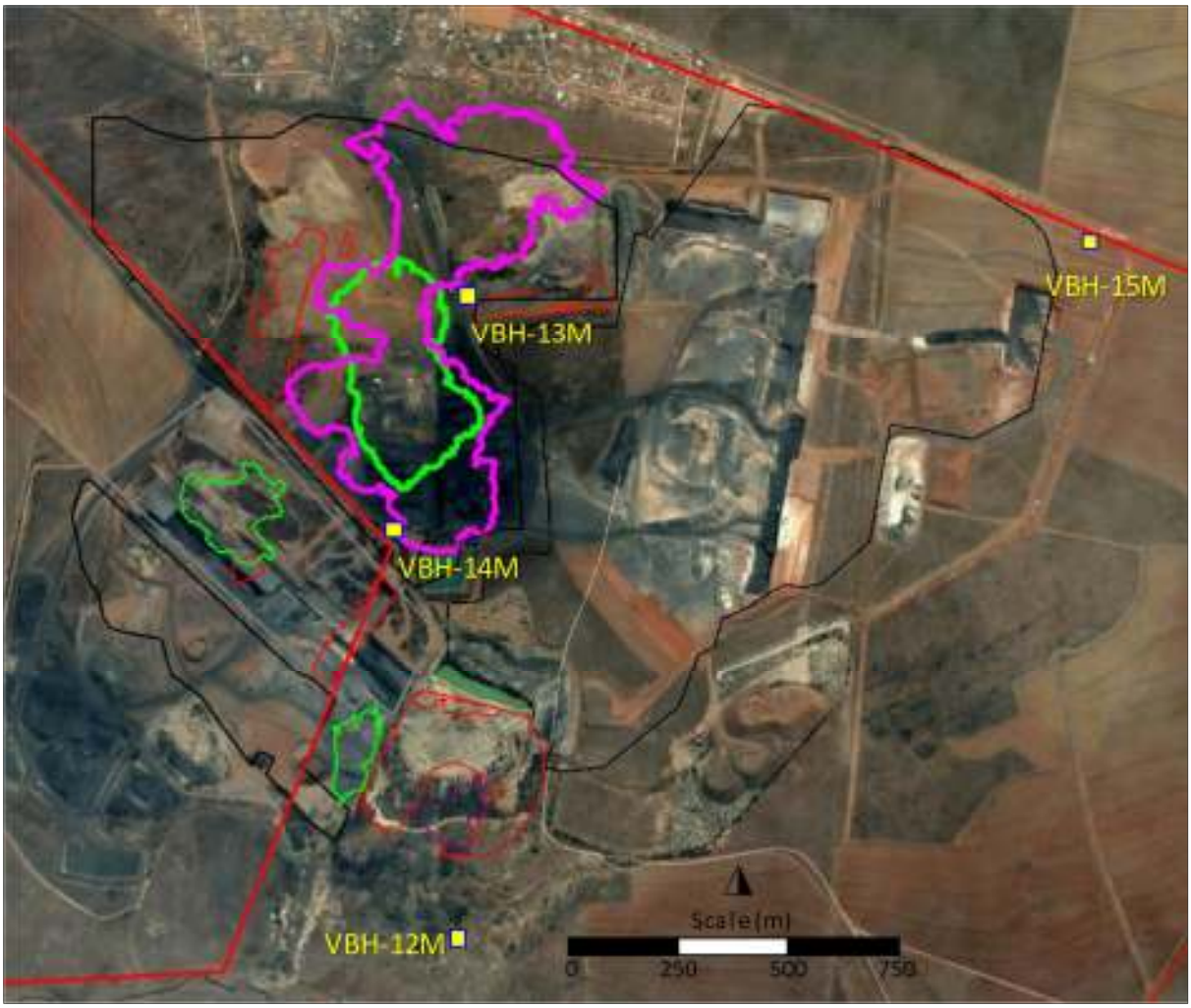


Figure 43: Proposed additional groundwater monitoring boreholes

5.10.4 WASTE MONITORING

The Applicant will develop and implement a waste management plan, which complies with the principles of the NEMWA and provides a mechanism for the effective management of waste throughout the LoM. This plan has to ensure that the appropriate management of all solid waste, including construction debris (cement bags, wrapping material, timber, cans, wire, nails, etc.), waste and surplus food, food packaging, organic waste, etc. The objectives of a waste monitoring programme are to identify and sufficiently manage waste related impacts through:

- Avoiding and minimising waste;
- Reducing and recycling waste; and
- The prevention of pollution.

Solid waste must be monitored in accordance with the waste management conditions detailed below:

- The Applicant shall develop and maintain a hazardous substance register for all hazardous materials that shall be kept on site. Material Safety Data Sheets (MSDS) must be available on site at the point of use and readily accessible for all hazardous substances stored;
- All equipment must be inspected regularly (daily) to ensure that it is in good working condition, clean, and free from leaks of oil, petrol, diesel, hydraulic fluid and contaminating compounds;

- Daily inspections shall be carried out to ensure such spill prevention measures are in place and remain effective;
- The Applicant shall maintain a waste register which shall be used to track all waste removed from site. Proof of appropriate waste disposal shall be kept on file at the site for auditing purposes.

5.10.5 STORM WATER MANAGEMENT STRUCTURES

Storm water structures (channels, silt traps, dirty water containment facilities and energy dissipaters) should be monitored every year in September, before the rainy season begins, for any blockages or breaches. They should further be monitored immediately after every storm event during the rainy season. Should blockages or breaches occur, immediate action should be undertaken to remove debris and / or repair breaches. Monitoring should be undertaken by the onsite Environmental Control Officer (ECO) or maintenance manager. Inspections should be recorded and should include the following:

- Date of inspection;
- Rainfall amount received;
- Photographs of blockages and / or breaches witnessed;
- What action were taken to fix issues and amount of time taken to address issues; and
- Photographs post action taken.

The inspection reports should be presented to the DWS.

5.11 RISK ASSESSMENT / BEST PRACTICE ASSESSMENT

An impact/risk assessment was undertaken for this IWWMP. This section deals with the identification of risks/impacts and their mitigation measures. The following prediction and evaluation of impacts is based on the mining activities conducted at the project area.

The first stage of impact assessment is the identification of environmental activities, aspects and impacts. The receptors and resources are also identified, which allows for an understanding of the impact pathway and assessment of the sensitivity to change.

The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The values for the likelihood and consequence (severity, spatial scope and duration) of the impact are then used to determine whether mitigation is necessary.

The following criteria have been used to describe magnitude and significance of impacts in a systematic manner:

Extent or spatial scale of the impact;

- Intensity or severity of the impact;
- Duration of the impact;
- Mitigatory potential;
- Acceptability;
- Degree of certainty; and
- Impact Magnitude/Significance.

Describing the impacts in terms of the above criteria, provides a consistent and systematic basis for the comparison and application of scoring impacts. The rating for each criterion is provided in Table 24.

Table 24: Criterion for Risk assessment

Rating	Comment
Impact criteria: Intensity or severity of the impact	
High:	Disturbance of pristine areas that have important conservation value.
	Destruction of rare or endangered species.
Medium:	Disturbance of areas that have potential conservation value or are of use as a resource.
	Complete change in species occurrence or variety.
Low:	Disturbance of degraded areas that little conservation value.
	Minor change in species occurrence or variety.
Impact criteria: Duration of the impact	
High (Long term) **(more than 15 years)**	Permanent
	Beyond decommissioning
	Long term (more than 15 years)
Medium (Medium term) (5 to 15 years)	Reversible over time
	Lifespan of the project
	Medium term (5-15 years)
Low (Short term) (0 to 5 years)	Quickly reversible
	Less than the project lifespan
	Short term (0-5 years)
Mitigatory potential	
High:	High potential to mitigate negative impacts to the level of insignificant effects
Medium:	Potential to mitigate negative impacts. However, the implementation of mitigation measures may still not prevent some negative effects.
Low:	Little or no mechanism to mitigate negative impacts.
Acceptability	
High (Unacceptable)	Abandon project in part or in its entirety

Rating	Comment
	Redesign project to remove impact or avoid impact
Medium (Manageable)	With regulatory controls
	With project proponent's commitments
Low (Acceptable)	No risk to public health
Degree of certainty	
Definite	More than 90% sure of a particular fact. Substantial supportive data exist to verify the assessment.
Probable	Over 70% sure of a particular fact, or of the likelihood of that impact occurring.
Possible:	Only over 40% sure of a particular fact, or of the likelihood of an impact occurring.
Unsure	Less than 40% sure of a particular fact, or the likelihood of an impact occurring.
Categories for the rating of impact magnitude and significance	
High	Of the highest order possible within the bounds of impacts that could occur. In the case of adverse impacts, there is no possible mitigation that could offset the impact, or mitigation is difficult, expensive, time- consuming or a combination of these. Social, cultural and economic activities or communities are disrupted to such an extent that these come to a halt. In the case of beneficial impacts, the impact is of a substantial order within the bounds of impacts that could occur.
Medium	Impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur. In the case of adverse impacts, mitigation is both feasible and fairly easily possible. Social, cultural and economic activities of communities are changed, but can be continued (albeit in a different form). Modification of the project design or alternative action may be required. In the case of beneficial impacts, other means of achieving this benefit are about equal in time, cost and effort.
Low	Impact is of a low order and therefore likely to have a little real effect. In the case of adverse impacts, mitigation is either easily achieved or little will be required, or both. Social, cultural and economic activities of communities can continue unchanged. In the case of beneficial impacts, alternative means of achieving this benefit are likely to be easier, cheaper, more effective and less time-consuming.
No impact	Zero impact.

The impact assessment is available in Appendix N. The section below discusses the various impacts and mitigation measures.

5.11.1 IMPACTS ON SURFACE WATER

The following impacts on the hydrological resources within the study area were identified and assessed for the various project phases (planning and design, construction, operation, decommissioning, and rehabilitation and closure). No impacts on hydrology have been identified that will occur during the Planning and Design Phases. Below are the identified impacts on hydrological resources for the construction, operation, and rehabilitation and closure phases identified during scoping, as well as their impact rating.

A) Impacts due to topsoil stripping

During the construction phase, topsoil from all facility footprints will be stripped and stockpiled for future use. This may result in the following impacts:

- Areas that have been stripped of vegetation and topsoil will be prone to erosion. This could lead to increased suspended solids being deposited into the Klipspruit and the Kromdraaispruit; and
- The topsoil stockpiles will be prone to erosion prior to being vegetated. Natural re-vegetation will likely take more than one season to completely cover the stockpiles. The resultant erosion could lead to increased suspended solids being deposited into the Kromdraaispruit.

The affected areas will be relatively small. Erosion impacts will be short term and will cease once the facilities are constructed and the topsoil stockpile is vegetated.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Impacts due to topsoil stripping	Construction	-11.25	-8.75	-11.67

Proposed Mitigation

Mitigation of the impacts should include the following:

- Areas that are stripped should be optimised to limit unnecessary stripping;
- Storm water from upslope of the stripped areas should be diverted around these areas to limit the amount of storm water flowing over these areas;
- The timing of the topsoil stripping should be optimised to limit the time between stripping and construction/deposition. Where practical constraints exist and areas need to be left stripped for long periods, contour ploughing or ripping could reduce run-off and hence reduce erosion;
- Dry season construction is preferable; and
- Hydro seeding of topsoil stockpiles is recommended to speed up vegetation cover. An appropriate seed mix should be designed by a vegetation specialist.

B) Surface Water Contamination during Construction

During the construction phase, a significant number of vehicles will be driving around the site. In addition to this, fuels are stored on site and chemicals are used during normal construction activities. This may result in the following impacts:

- If the construction vehicles are poorly maintained, oil spills could cause pollution if washed off roads by storm water;
- Vehicle wash bays are a common source of hydrocarbon pollutants;
- Leaks from fuel depots could result in surface water pollution; and

- Spillage and unsafe storage of chemicals could result in surface water contamination.

The affected areas will be the entire construction site. Spillage impacts will be short term and will cease after the completion of construction. If soils have become contaminated, this will leach out over a prolonged period.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Construction related pollution	Construction	-6.75	-4.50	-6.75

Proposed Mitigation

Mitigation of the impacts should include the following:

- All construction vehicles should be well maintained and inspected for hydrocarbon leaks weekly;
- Wash bay discharge water should flow through an oil separator;
- Fuel depots and refuelling areas should be bunded;
- Chemicals should be stored in a central secure area; and
- Regular toolbox talks on the responsible handling of chemicals should be undertaken.

C) Contaminated Water Discharge

Prior to mining, the old underground workings must be dewatered. This water will be treated to discharge quality standards and discharged into the Klipspruit. This may result in the following impacts:

- Flows in the Klipspruit will be increased and will experience a relatively constant inflow of good quality water. The volume of water is not currently known and this will depend largely on how early the mine starts dewatering; and
- Dry season impacts will be higher than wet season impacts. These will be positive impacts.

During operation some areas of the proposed colliery should be considered as dirty areas. These areas typically include the product and ROM stockpiles, the carbonaceous hards stockpiles, the dried slurry storage areas, and the open cast workings. Storm water and seepage generated from these areas will likely be contaminated and have a detrimental effect on the water quality in the Klipspruit and the Kromdraaispruit. These impacts will be most acute during the dry season when stream flows are low.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Contaminated water discharge (wet season)	Construction	11.50	11.5	15.00
Contaminated water discharge (dry season)	Construction	12.5	.12.50	16.67
Contaminated water discharge	Operation	-17.50	-5.50	-7.33

Proposed Mitigation

The proposed colliery must have an undertaking to comply with Government Notice 704 of the South African National Water Act. This act limits discharges of contaminated water from mining related activities to less than

once in 50 years on average. Contaminated water should be reused or treated to adequate discharge standards prior to release.

Should a legal discharge occur as a result of extreme rainfall conditions, the Klipspruit and the Kromdraaispruit should have sufficient capacity to dilute poor quality spillage water. The impacts from extreme rainfall conditions should be low and will last for a short duration. Impacts resulting from negligence or mismanagement could be more severe. The severity of the impacts would be related to the volume and quality of water that is spilled. Impacts relating to small spillages would probably be relatively low to moderate and would be short in duration. Impacts relating to large spillages would be high. The effects would be short to medium term.

Mitigation of the impacts must include the following:

- Shallow seepage and contaminated storm water run-off must be collected and routed to lined pollution control dams. The pollution control dams must be sized in accordance with GN 704 of the NWA;
- Pollution control dam water levels must be constantly monitored. Steps and procedures must be put in place to manage situations where excess water builds up in the pollution control dams. This could include pumping to the transfer sump;
- Pollution control dams must be operated empty as far as practicable and cannot fulfil the same role as water storage dams, unless specifically designed to fulfil both purposes; and
- Water reuse from the pollution control dams should be maximised.

D) Loss of catchment yield

During the operational phase, storm water generated from the open pits, overburden stockpiles and surrounding areas considered as dirty, will be collected in the dirty water system. This water would have contributed to the flow in the Klipspruit and the Kromdraaispruit. The loss of catchment yield will result in a negligible reduction in flow in the catchment of the Klipspruit. The loss of flow in the Kromdraaispruit will be moderate.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Loss of catchment yield	Operation	-17.50	-15.50	-20.00

Proposed Mitigation

- As is best practice, dirty areas must be minimised. This will have the dual benefit of smaller dirty water management systems and reduction in catchment yield loss;
- This must include the separation of overburden stockpiles into topsoil, softs (uncontaminated) and hards (contaminated); and
- The open cast operations must be rehabilitated to return as much storm water to the environment as possible.

E) Impacts due to Washbays and Workshops

Organic and nutrient pollution may result from the wash bays and workshop areas. These areas should be bunded and all water should be contained, collected and routed to an appropriate treatment facility. Impacts are likely to be low and will last during the life of the mine.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Contamination from washbays and workshops	Operation	-4.00	-2.00	-2.67

Proposed Mitigation

- All drains that collect the wash water and storm water must be maintained regularly. These should be free of debris and silt;
- All diversion canals, trenches and conduits must be designed to convey run-off from a 50-year design storm; and
- The wash bays and workshops must be equipped with oil separators to remove hydrocarbons from wash down water.

E) Impacts due to Burst Water Pipes

Water pipes will transport polluted water between the pollution control dams and the washing plant as well as between other facilities on the proposed colliery. If any of these pipes burst, significant quantities of poor quality water could be pumped into the environment.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Burst water pipes	Operation	-10.00	-6.00	-8.00

Proposed Mitigation

- Pipe lines should be subjected to frequent patrols. An efficient system of reporting should be available to allow the immediate tripping of pumps;
- Where practical, pipelines should be installed within dirty areas; and
- The wash bays and workshops must be equipped with oil separators to remove hydrocarbons from wash down water.

F) Impacts due Pollution from Vehicles

During the operational phase a significant number of vehicles will be driving around the site. In addition to this, fuels are stored on site and chemicals are used during normal operational activities. This may result in the following impacts:

- If the mining vehicles are poorly maintained hydrocarbon spills could cause pollution if washed off roads by storm water;
- Vehicle wash bays are a common source of hydrocarbon pollutants; and
- Leaks from fuel depots could result in surface water pollution.
- Spillage and unsafe storage of chemicals could result in surface water contamination.

The affected areas will be the entire mining area. Impacts will be medium term and will cease after the cessation of mining. If soils have become contaminated, this will leach out over a prolonged period.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Vehicle fleet impacts	Operation	-6.75	-4.50	-6.00

Proposed Mitigation

- All mining vehicles should be well maintained and inspected for hydrocarbon leaks weekly.
- Wash bay discharge water should flow through an oil separator.
- Fuel depots and refuelling areas should be bunded.
- Chemicals should be stored in a central secure area. Regular training on the responsible handling of chemicals should be undertaken. If contract mining is being used, responsible handling of chemicals and vehicle maintenance should be a key performance objective of the mining contractor.

G) Impacts due to Removal of Infrastructure

During the decommissioning phase, most impacts will be associated with the removal of surface infrastructure, final closure of the open cast workings and removal and rehabilitation of the ROM and product stockpiles and other dirty areas. Haul roads will be removed, as will berms and diversion trenches.

During this process, short term impacts will be moderate, as heavy earth-moving machinery will disturb large areas. Previously vegetated areas may be disturbed which will increase erosion potential. These short term impacts will give way to long term benefits.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Removal of infrastructure	Decommissioning	-12.50	-10.00	-13.33

Proposed Mitigation

Apart from due diligence care while performing decommissioning tasks, no mitigation is necessary. Due diligence care includes the following:

- Plant should be well maintained to ensure that hydrocarbon spills are minimised;
- Existing roads should be used where possible; and
- New disturbed areas should be minimised.

H) Post-closure Decant impacts

For the surface water impact assessment, a conservative approach is followed and it is assumed that decant may occur from the rehabilitated open cast workings. After the colliery is closed, contaminated water management becomes passive. Groundwater inflows and recharge through the rehabilitated spoils may create decant from the open cast workings. This decant will be driven by rainfall recharge through the surface and groundwater inflows. The decant water quality is likely to be poor and will contaminate the Klipspruit and the Kromdraaispruit. Decant flows will likely be seasonal and volumes will be dependent on the quality of rehabilitation done and the degree of surface subsidence. Poor rehabilitation will increase the decant volumes. The water quality is likely to remain poor in the long term (>20 years). Eventually as pollutants are leached out of the workings, the seepage water quality will improve.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Decant from pit	Closure and rehab	-20.00	-18.75	-25.00

Proposed Mitigation

- Surface subsidence that creates ponding should be avoided;
- During the rollover mining, contaminated spoils should be placed at the base of the open cast pit where they can be permanently flooded. The uncontaminated spoils should be placed in the top horizons of the rehabilitated backfill; and
- Should passive mitigation measures not be suitable, active alternatives can be considered such as some form of treatment, prior to release.

5.11.2 IMPACTS ON WETLANDS

One wetland type was identified within the 500 m project assessment boundary, namely a depression, which comprised of two units. No other wetlands were identified within the larger 500 m study area. The overall wetland health for the systems was determined to be that of a largely modified system. The wetland type had overall Intermediate levels of service, with only some water quality enhancement services showing a moderately high level of benefit. The EIS and direct human importance for the wetlands was rated to be Low. The hydrological / functional importance was rated as moderate. The expansion of the mining area will result in the loss of the delineated wetlands. Alternatively, should the depressions be avoided, and the surrounding areas be mined, the removal of the stockpiles and subsequent change to the topographical features will remove a source for hydrological inputs which will result in the loss of the wetlands. Additionally, the wetlands are considered to be a result of the mining operation, and are not regarded as natural systems. It is apparent that the loss of these wetlands is unavoidable, and no buffer zone is suitable for either of the above-mentioned options. The loss of these depressions is not regarded as a fatal flaw for this project.

Owing to the fact that the Leeuspruit, Blesbok and Wilge systems are in excess of 500 m from the proposed expansion area, the focus for the impact assessment were the delineated depressions. These systems are regarded as artificial systems and largely a result of the mining activities, but despite this, these systems do provide some level of ecological service, particularly with regards to water quality enhancement. The most notable impact is the expectant loss some water resources, the delineated depressions in particular. The significance of the loss if regarded as high, and the loss of wetlands is avoidable due to the nature of the project. It is worth mentioning that the loss of the wetlands is regarded as permissible for this project, owing to the fact that these wetlands are a result of the current mining operation, and are therefore classified as artificial systems. Thus there is no preference to assign a buffer to these areas and avoid disturbances to these systems, because as the landscape changes to accommodate the rest of the proposed expansion, the hydrological inputs to these wetlands will be lost as a result, no significant risks are posed to the local water resources by the proposed expansion of the Vlakvarkfontein Colliery.

A) Loss of Water Resources

The loss of wetlands is expected for the mining of the entire footprint area, and also by avoiding these systems and changing the topography of the area. The significance of the loss if regarded as high, and because avoidance is not possible for this project, mitigation has not been considered and the significance remains high.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Loss of Water Resources	Construction and Operation	-16.25	-16.25	-21.67

Proposed Mitigation

The loss of wetland is unavoidable, and the only mitigation would be to avoid the wetland area. However, changes to the topography will likely also result in the loss of the wetland due to hydrological changes. The DWS should be consulted for an offset strategy to determine the need thereof. An artificial wetland must be considered for any possible decant post closure.

B) Altered Hydrological Regime

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Altered Regime	Construction	-16.25	-16.25	-21.67
	Operation	-9.00	-5.50	-7.33

Proposed Mitigation

- Compile a suitable SWMP. The SWMP should incorporate "soft" engineering measures as much as possible, limiting the use of artificial materials. These measures may include grassy swales, bio-retention ponds / depressions filled with aquatic vegetation or the use of vegetation to dissipate flows at discharge locations;
- Storm water channels and preferential flow paths should be filled with aggregate and/or logs (branches included) to dissipate and slow flows limiting erosion;
- Rehabilitation of old workings must be re-profiled to the natural topography; and
- Stockpiles must be sloped to limit the run-off velocity of the area.

C) Water Quality Impacts

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Water Quality Impacts	Construction	-16.25	-16.25	-21.67
	Operation	-9.00	-5.50	-7.33
	Closure and rehab	-9.00	-5.50	-7.33

Proposed Mitigation

- Separate clean and dirty water, continue with surface water and biomonitoring programmes.

- Compile a suitable storm water management plan.
- All chemicals and toxicants during construction must be stored in bunded areas.
- All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site.
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping".
- Adequate sanitary facilities and ablutions must be provided for all personnel throughout the project area, Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems.
- All waste generated on-site must be adequately managed. Separation and recycling of different waste materials should be supported.

D) Erosion and Sedimentation of Water Resources

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Erosion and Sedimentation	Construction	-7.50	-5.00	-6.67
	Operation	-9.00	-5.50	-7.33

Proposed Mitigation

- Compile a suitable SWMP;
- Construct cut-off berms downslope of working areas, demarcate footprint areas to be cleared to avoid unnecessary clearing;
- Exposed areas must be ripped and vegetated to increase surface roughness, create energy dissipation at discharge areas to prevent scouring;
- Temporary and permanent erosion control methods may include silt fences, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed areas, erosion mats, and mulching;
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping";
- Adequate sanitary facilities and ablutions must be provided for all personnel throughout the project area, Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems; and
- All waste generated on-site must be adequately managed. Separation and recycling of different waste materials should be supported.

E) Establishment of Weeds and Alien or Invasive Species

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Alien invasion	Construction	-6.75	-4.00	-5.33
	Operation	-6.75	-4.50	-6.00

Proposed Mitigation

- An alien invasive plant management plan needs to be compiled and implemented prior to construction to control and prevent the spread of invasive aliens; and
- Clean vehicles on-site (and prioritise vehicles gaining access from surrounding areas).

5.11.3 IMPACTS ON GROUNDWATER

The following impacts on the geohydrological resources within the study area were identified and assessed for the various project phases. Below are the identified impacts on geohydrological resources for the construction, operational, and rehabilitation and closure phases identified during the EIA, as well as their impact rating according to the methodology described above.

The hydrogeology of the study area has been studied in detailed since 2009. Three important numerical groundwater flow and contaminant transport modelling studies have been performed. During each study, detailed geochemical laboratory testing and geochemical trend modelling were performed, to predict long-term post-mining mine water quality trends. Prior to mining, groundwater flow was radially outward from the coal resource area to the north, east and south. Along the eastern extremities of the coal resource, groundwater flow was from east, in a westward direction toward the resource. Most importantly groundwater flow, in the most critical impact area, around the southern regions, was predominantly to the south.

Vlakvarkfontein Colliery-Pillar Pit mining will impact on the local village groundwater supply through dewatering of the local aquifers. Over the long-term, a groundwater contamination plume is likely to spread in the direction of the village. By mining the barrier pillar, the potential contamination impact on the local village can be reduced. A decision in this regard will have to be taken soon after the commencement of mining of the Vlakvarkfontein Colliery-Pillar Pit. Currently, the main impacts relate to the dewatering of the local aquifer surrounding the current mining of Vlakvarkfontein Colliery-Current Pit. The historical decant toward the Klipspruit dried up within two years of mining. Due to groundwater flow being toward the mining area, groundwater contamination has not spread

If mining continues in the Vlakvarkfontein Colliery-Pillar Pit to form one pit with the Vlakvarkfontein Colliery-Current Pit, dewatering of the local aquifers will expand. Mining will impact on the local village groundwater supply through dewatering of the local aquifers. Groundwater contamination from the opencast pit should not impact on the local groundwater supply. Groundwater contamination may occur through AMD toe seepages, if a discard dump is placed on surface.

Post-mining flooding of all opencasts are likely to occur within 30 years after the cessation of mining; but influenced by the volume of water stored in-pit at the end of mining. All indications are that the combined Vlakvarkfontein Colliery-Current Pit and Vlakvarkfontein Colliery-Pillar Pit will flood to a level of 1538 mamsl. If the barrier pillar with Wescoal is mined the final level will be 5m deeper.

Due to the current contaminated situation inside the proposed pillar mining area, mining of the Vlakvarkfontein Colliery-Pillar Pit does not constitute a loss of a groundwater resource. During mining, groundwater flow will be toward mining, resulting in the following groundwater impacts:

- A dewatering cone will develop around the Vlakvarkfontein Colliery-Pillar Pit; expanding on the current dewatering cone;
- The dewatering cone will gradually expand in the shallow weathered zone aquifer: during mining, groundwater levels in the immediate vicinity of the pits will be influenced most, typically limited to 200m from the pit perimeter for the first few years, gradually expanding over time;
- During the early stages of dewatering the biggest groundwater level drawdown effect will be observed at the Pit boundary, depending on the Pit floor depth below the groundwater table (≤30m);
- Eventually, the drawdown at 400 m will typically not be distinguishable from seasonal groundwater trends, and only applies to areas where the Pit floors are deepest below the natural groundwater table; and
- The village drinking water supply is likely to be impacted.

In view of the fact that Wescoal has been mining to the south of the pillar area, the additional mining of the pillar project will not have an increased effect on the base flow to the Klipspruit (i.e. a positive effect in the sense that contamination to the Klipspruit will be prevented for prolonged period).

There will be insufficient space to store all water pumped from the historical underground areas. A maximum in-pit storage level of 1525 mamsl in Vlakvarkfontein Colliery-Current Pit is recommended at this stage, to prevent decant during the operational phase; whilst mining is progressing in the eastern regions of the Vlakvarkfontein Colliery-Pillar Pit. In-pit storage of this water, is unlikely to have an impact on local groundwater levels and groundwater quality and the fact that the barrier pillar between the current Vlakvarkfontein Colliery Pit and the Pillar area will only be mined during the final stages of mining, may provide an opportunity for in-pit water storage of water contained in the flooded historical mined-out underground areas. No decant will occur during mining, unless excessive volumes of water stored in-pit however direct rainfall recharge to mine-out voids/backfill/rehab needs to be factored in for the total pit water balance.

Post-Mining Impacts

In view of the groundwater flow directions, contamination plumes will potentially spread towards the northwest of the Vlakvarkfontein Colliery-Pillar Pit, and to the south. Smaller plumes will extend north of Vlakvarkfontein Colliery-Current Pit and southwest of *Wescoal*. Groundwater flow from the east will be towards the Vlakvarkfontein Colliery opencast, and no plume is expected to develop in this direction.

Due to historical opencast/underground mining and AMD decant (pH of 2.8 to 3.2; SO_4 of 1000 mg/L to 1500 mg/L), the groundwater plume to the south will develop into an aquifer which has already been contaminated. Decant to surface has historically drained overland towards the Klipspruit (also known as the Leeuwfonteinspruit), as will be the most-likely situation during the post Vlakvarkfontein Colliery mining. It is therefore not possible to depict the spread of a contamination plume to the south, but it was calculated as if aquifers were unimpacted. It is, however, important to note that the highest decant seepage zone elevations ranged between 1535 mamsl and 1538 mamsl, south of the Vlakvarkfontein Colliery-Current Pit, where the AMD contamination plume is believed was forced to surface against the relatively impermeable granite rock. The AMD decant then flowed overland to the Leeuwfonteinspruit (1505 mamsl to 1509 mamsl). This area south of the Vlakvarkfontein Colliery-Current Pit, will again serve as a natural decant area after the cessation of mining. South of the Vlakvarkfontein Colliery-Pillar Pit, these decant elevations are probably lower by approximately 5 m to 8 m.

All geochemical scenarios (mine water with-and-without discard, and for the discard dump) indicated pH levels lowering from 6 to 4 over the first 30 years, followed by a further drop to pH 3.5 to 4.5 over the long-term (100years). Geochemical trends for various scenarios/pits are summarised in the groundwater report (Appendix D). If the groundwater contamination plumes are compared to the decant analysis, it is clear that decant will have by far the most critical impact on the surface water environment.

A) Impacts on Groundwater Quality

Most groundwater contamination and related impacts will occur during operation, decommissioning and closure phases.

Impact	Alternative	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Impacts on groundwater quality (contamination, AMD etc.)	P2a, P2b	Operation	-4.50	-3.00	-3.50
	P3a	Operation	-4.50	-4.50	-5.25
	P3b	Operation	-15.00	-11.00	-12.83
	P3d	Operation	-9.00	-6.75	-7.88
	P4a	Operation	-7.50	-6.50	-8.67
	P4b	Operation	-6.75	-6.00	-8.00
	P2a, P2b, P3a	Decommissioning	-3.00	-2.00	-2.33
	P3b	Decommissioning	-12.50	-9.00	-10.50
	P3d	Decommissioning	-7.00	-5.25	-6.13
	P4a	Decommissioning	-6.00	-5.50	-7.33
	P4b	Decommissioning	-6.75	-4.00	-5.33
	P2a, P2b P3a, P3b	Rehab and Closure	-4.50	-3.00	-3.50
	P3b	Rehab and Closure	-15.0	-11.0	-12.83
	P3d	Rehab and Closure	-9.00	-6.75	-7.88
	P4a	Rehab and Closure	-12.00	-11.00	-14.67
	P4b	Rehab and Closure	-6.75	-6.00	-8.00

P2a - Stockpile filter cake for use as non-select product

P2b – Disposal of filter cake

P3a – Disposal of plant waste rock to surface facility located in on old rehabilitated area

P3b – Disposal of plant waste rock to surface facility located on unmined area

P3d – Disposal of waste rocks and filter cake to pit

P4a – Pump-treat-discharge of underground water

P4b – Pump-store-treat-discharge underground water

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Contamination of Groundwater (i.e. chemicals, fuel, waste, sedimentation)	Construction Operation Rehabilitation and Closure	-15.00	-9.75	-13.00

Proposed Mitigation

During the operational phase the most-important mitigation measures relate to:

- Groundwater monitoring.
- The placement of discard material:
    - If discard is placed on undisturbed/uncontaminated ground, a liner system will be required to prevent the contamination of the local groundwater system, and toe seepages should be collected (numerical modelling can confirm that, due to the short duration of mining, the liner system does not necessarily have to be designed for zero infiltration):
        - Any seepages and rainfall runoff originating from stockpiles should be identified and captured/diverted to the dirty water system;
        - Dirty water should be removed as quickly as possible to reduce the driving mechanism for contaminant migration;
    - If the dump is placed on rehabilitated mining areas without a liner system, the discard seepage water will mix with pit water and pumped out if necessary;
    - If the discard is paced in mined-out areas – the preferred option – it should be placed sufficiently deep below the long-term decant elevation (e.g. 10 m);
- In line with pollution prevention and minimisation strategies, the following principles should apply if filter cake material is stored on-site as non-select product:
    - Source reduction through general site maintenance:
        - Product should be moved off-site as quickly to prevent continuous seepages from occurring;
        - The site should be maintained to be free draining. Where relevant, areas should be compacted/shaped;
        - Rainfall runoff should be separated into clean and dirty water (rainfall falling on the site should be allowed to drain quickly/freely, and contaminated water should then be captured in the mine dirty water system and re-used where possible);
        - Clean upstream rainfall water runoff should be diverted around the site;
    - Treatment:

        - Unless monitoring indicates otherwise, treatment is not required/recommended at this stage;
    - Secure disposal:
        - All dirty water collected on the site should be re-used or stored during operation;

- The preparation of the in-pit overburden-backfill material to limit the post-mining impact (i.e. adhering to the principles of source reduction, treatment and secure disposal):
    - The geochemical assessment indicated that the addition of lime in the backfill will reduce the long-term postmining groundwater quality impact, though improving the anticipated low-pH conditions and lowering sulphate and metal concentrations (a decision in this regard will have to be taken);
- The storage of contaminated operational mine water:
    - This water will be pumped to surface water dams where it can be reused;
    - In-pit water storage in low-lying areas may also be pursued;
    - Cognisance should be taken of highly contaminated mine water in the rehabilitated historic opencast areas, to the west of the underground areas, where (pH probably ranges from <3 to 4.5 and sulphate concentrations exceed 3000 mg/L);
- Contaminated mine water, contained in historical Seam-2 and Seam-4 underground areas, will have to be pumped out prior to reaching these areas, as mining progresses from the west:
    - Because the Seam-4 and Seam-2 underground workings are probably interconnected (e.g. through boreholes or ramps), the Seam-4 mine workings should therefore be pumped first;
    - Cognisance should be taken of pillar failure, which can result in sudden water inrushes from areas where water was stored in underground dams during the 1940s historical mining phase;
    - Based on preliminary discussions:
        - A portion of the water will be treated and released into the Klipspruit;
        - The coal processing plant will require water;
        - The remainder of the water will be stored in-pit in the penstock area, and in the lined pollution control dams;
- A decision on the benefits of mining the barrier pillar between Vlakvarkfontein Colliery-Pillar Pit and Wescoal needs to be taken soon after the commencement of mining in the Vlakvarkfontein Colliery-Pillar Pit.

Penstock/Sump

An in-pit penstock/sump was constructed in the south of the Vlakvarkfontein Colliery-Current Pit, which can be utilised to pump mine water to surface from this low-lying region of the pit.

The sump can also constitute a possible long-term/post-mining water management option; where mine water is pumped from the rehabilitated backfill to reduce seepage to the south.

AMD Prevention

AMD can be reduced through the addition of calcitic lime to the backfill material (to buffer pH) or treating decant water. In terms of cost and volume, the required tonnage of calcitic lime to be added to the entire pit would be impracticable in terms of cost and volume. Target areas may include where discard is placed in the pits.

One option that should be pursued, is the placement of coal-fire station fly ash on top of the backfilled opencast. However, detailed research is required to investigate, especially, the geochemistry and water balance of such a scenario. Due to the long-term benefits of flushing acid-generating minerals from backfill material, this option should be carefully evaluated in terms of the potential impact on the local surface water environment and ecosystem. One aspect to consider is that water should first flow through the ash (e.g. rainfall recharge) before entering acid generating material, such as backfill. If decant water is treated in this way, it is advisable not to use ash, unless properly researched, but rather add calcitic lime.

SA National Development Plan

Water will remain a critical component of the National Development Plan initiative of the South African Government, as it can stimulate economic growth. Local farmers have been utilising the local surface water environment for decades to irrigate crops. The irrigation infrastructure consists of the river system, purpose build canals and -dams, as well as pump stations.

The Vlakvarkfontein Colliery opencast (and surrounding mining environment) can potentially be incorporated into this system to store water for long periods, from where it can be utilised for irrigation; obviously ensuring that the water is of acceptable quality. It can potentially be beneficial for future generations, thus stimulating job creation in the local surroundings. Detailed planning and research is required.

Decant Prevention Measures

In-pit evaporation from a final void or large enough in-pit-shaped evaporation can minimise the opencast water balance. Such a design is not currently planned. If such a design is pursued, it should account for rainfall that would fall directly on the evaporation area and the rainfall deficit that occurs on an annual basis.

A fundamental design criteria of in-pit evaporation areas, relates to the slopes above- and below the anticipated in-pit groundwater level. The slopes would be steeper above the groundwater level to minimise rainfall run-off. The slopes below the anticipated groundwater would be more gradual to optimise evaporation and evapotranspiration by plants, to account for the fluctuating in-pit groundwater levels on a seasonal basis. In practice, it will be very difficult to construct a large in-pit evaporation area.

B) Impacts on Groundwater Quantity

In view of the fact that Wescoal has been mining to the south of the pillar area the additional mining of the pillar project will not have an increased effect on the base flow to the Klipspruit (i.e. a positive effect in the sense that contamination to the Klipspruit will be prevented for prolonged period).

Impact	Alternative	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Impacts on groundwater quantity due to dewatering	P2a, P3d, P4a	Operation	3.00	1.50	1.75
	P2b	Operation	4.50	1.50	1.75
	P3a	Operation	3.00	1.50	1.75
	P3b	Operation	7.50	4.00	4.67
	P4b. P3a	Operation	2.00	1.00	1.17
	P2b	Decommissioning	3.00	1.00	1.17
	P3b	Decommissioning	6.00	3.00	3.50

Impact	Alternative	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
	P4a	Decommissioning	-10.0	-9.00	-12.00
	P4b	Decommissioning	-6.75	-4.00	-5.33
	P2a, P3a, P3d	Rehab and Closure	3.00	1.50	1.75
	P2b	Rehab and Closure	4.50	1.50	1.75
	P3b	Rehab and Closure	7.50	4.00	4.67
	P4a	Rehab and Closure	-12.00	-11.00	-14.67
	P4b	Rehab and Closure	-8.25	-5.00	-6,67

5.12 ISSUES AND RESPONSES FROM PUBLIC CONSULTATION PROCESS

A PPP is being undertaken for the Applicant. I&AP's will be provided opportunities throughout the process to provide comment and thereby participate in the PPP. I&AP's will be afforded an opportunity to review and comment on the draft IWWMP. The draft IWWMP will be made available to all registered I&AP for a period of 60 days from the 7 March 2018 until 13 May 2018. The Public Participation Report describing the PPP for this WUL application shall be attached as Appendix H to this IWWMP on completion of the public review and comment period.

5.13 MATTERS REQUIRING ATTENTION / PROBLEM STATEMENT

The following matters require attention:

- The proposed SWMP needs to be implemented;
- The additional recommended groundwater monitoring boreholes need to be added to the monitoring plan; and
- The groundwater model needs to be updated on an annual basis.

5.14 ASSESSMENT OF LEVEL OF CONFIDENCE OF INFORMATION

5.14.1 WETLANDS

The assessment undertaken by the specialist included the following assumptions and limitations:

- The GPS used for wetland delineations is accurate to within five meters. Therefore, the wetland delineation plotted digitally may be offset by at least five meters to either side.
- Wetland systems identified at desktop level within 500 m of the project area were considered for the identification and desktop delineation, with wetland areas within the project area being the focus for ground truthing.

5.14.2 SURFACE WATER

The assessment undertaken by the specialist included the following assumptions and limitations:

- The floodlines are based on the survey data provided by the mine. The accuracy of the survey data cannot be verified. It is assumed that the survey data provided is a true reflection of the topography within the study area. The accuracy of the floodlines is dependent on the accuracy of the survey data; and
- The 100 m buffer zones are measured from the stream centreline.

In terms of the surface water impact assessment the following assumptions and limitations apply:

- The impact assessment and rating are undertaken on the basis that the current opencast operations will be completed prior to mining the proposed open cast pit;
- The existing void is assumed to be able to be used for dirty water storage as a buffer dam; and
- The impact assessment and ratings assume that storm water management will be in line with the storm water management plan.

5.14.3 GROUNDWATER

The following main assumptions applied to groundwater study:

- Data and information were presumed sufficiently accurate:
    - Where relevant, datasets (e.g. hydraulic testing, water monitoring, surface topography and aquifer geometry) from previous groundwater studies were used;
    - The basis of the impact assessments, were field studies (e.g. hydrocensus, hydrogeological drilling, geophysical surveys, pump testing and groundwater monitoring) conducted by Groundwater Square at the Vlakvarkfontein Colliery over the past decade; and these were supplemented in this study by the drilling of four additional monitoring holes, and the collection of various water/geochemical samples;
    - Project consultants ECMA, GeoSoilWater, GEMECS, CCIC, and EIMS supplied the following information (through discussions, spreadsheets, presentations and electronic CAD drawings):
        - Latest mining scheduling and life-of-mine plans;
        - Infrastructure layout and design;
        - Geological model of coal seams;
        - Groundwater monitoring database;
        - Bulking factor of rehabilitated backfill material;
    - During several visits to the Vlakvarkfontein Colliery, the current water situation was discussed with mine personal and mentioned project consultants; providing valuable insight into the future mine water balance;
    - The life-of-mine of neighbouring Wescoal mining company was determined from Google Earth aerial photographs and mining plans provided in the past by Wescoal;
- Inter-mine flow calculations with adjacent Wescoal, assumed certain design criteria for barrier pillars (width and depth) parameters, as well as hydraulic aquifer parameters not severely altered by blasting;
- Aquifer parameters of geological units:

- Although aquifer parameters vary over orders of magnitude over short distances (e.g. fracture flow compared to flow through the solid portions of the rock matrix), the values utilised in the groundwater model for similar geological units of similar depths, will be representative of groundwater flow over distances applicable to typical mining impacts;
- Where aquifer information was judged to be incomplete (i.e. hydraulic aquifer parameters of geological units within the numerical groundwater model domain, other than Karoo Ecca rock, within which coal mining is taking place), knowledge of Mpumalanga coal fields was applied;
- Visual inspection of borehole cores retrieved during exploration drilling of the Selons River Formation to the south, indicated a very low hydraulic conductivity;
- The Ogies dykes Ogies dyke was assumed non-weathered and non-fractured below 5 m deep;

- The existing and proposed pit areas are devoid of major geological structures, such as faults and dykes;
- Conceptually, the groundwater flow field is well understood;
- The extent of historic underground mining, was based on historical mine maps. This will have no bearing on the post-mining groundwater flow impact assessment as the whole area will be mined;
- The current interaction of mining with the surrounding aquifers will continue as the mine expands to the north and west into the pillar area;
- Geochemical evaluation:
  - Geochemical samples were representative of the backfilled spoils, mined coal seams and the complete litho-stratigraphical profile; and
  - Given the scientific integrity of the geochemical modelling considerations and technique, geochemical trend predictions are therefore within an acceptable range of accuracy.

The following limitations applied to the study:

- Rainfall seasonality will influence the mine water balance, and the compounding effect of sequential wet or dry rainfall periods may result in much larger than average decant for such extreme wet periods, and zero decant during extreme droughts. An indication of “relatively” wet and dry cycles were provided in the groundwater report, but it is not possible to provide for extreme events, such as 100/1000 year extremes;
- The sequence of mining will affect the mine water balance; especially relevant with regard to the storage of mine water from the historical underground workings;
- No accurate data exists of how much groundwater has been pumped from the boreholes which supply the local village; and
- It is very important to perform groundwater level and groundwater quality monitoring, to verify modelling predictions, and timeously correct assumptions in the unlikely event that the groundwater system behaves differently to expectations.

6 WATER AND WASTE MANAGEMENT

The following section describes water and waste aspects at the Applicants project area, as well as the related operational processes.

6.1 WATER AND WASTE MANAGEMENT PHILOSOPHY

The general principle of water management is the recognition that water is a scarce resource. This in turn leads to the other principles, such as water use minimisation (water conservation) or reuse of water and pollution

prevention or the limitation of pollution of water. The Vlakvarkfontein Colliery also has a "Water Conservation, Demand and Supply Strategy" (WCDSS) in place to ensure the efficient use of water activities (refer to Appendix M).

Water that exceeds the quality, as set by DWS shall not be released from site, with the exception of emergency conditions, but it must be reused, thus reducing the quantity of intake of clean water. The Applicant will endeavour to:

- Continually seeking ways to improve its performance in terms of consumption, and water related impacts;
- Reduce consumption of clean water;
- Implement pollution prevention at source;
- Maximise, recycling and reuse of dirty storm water and process water;
- Implementation of process water treatment to facilitate reuse; and
- Collect, contain dirty storm water and process water on site for preferential use as process water.

The hierarchical management approach comprises the implementation of best practice measures to minimise water consumption and reduce impacts on water resources, by:

- Implementing measures to ensure compliance with relevant water and waste legislation and with other standards to which the organisation subscribes;
- Proactively identifying and implement actions that are required to achieve the water and waste related objectives;
- Implement these actions in an open and transparent manner;
- Implement on-going water and waste related monitoring to support legal compliance;
- Continually seeking ways to improve the performance of water and waste management systems, process and objectives; and
- Encourage open and transparent communication with regulatory authorities and other interested and affected parties within the context of the National Water Resource Strategy and Local Catchment Management Strategies.

6.2 STRATEGIES

6.2.1 SURFACE WATER

The general principle of water management is the recognition that is a scarce resource. This principal is guided by water use minimisation (water conservation) or re-use of water and pollution prevention or the limitation of pollution of water.

The goal of the Applicant is to minimise water consumption, impacts to the environment, running costs and to achieve environmental legal compliance, whilst maintaining adequate water supply as not to compromise the mining operations and supply of coal to industry. The following objectives are, therefore, set for the project:

- Water conservation by minimising water use. Water is reused wherever possible;
- Prevention of water pollution where possible;
- Minimise impacts on water resources and receiving water environment;
- Achieve and maintain legal compliance;

- Continuous mining operation to supply market need; and
- Production of quality coal for industry.

In order to achieve the above objectives, the Applicant is committed to uphold the following broad commitments:

- All water that can remain unpolluted will be kept separate and dirty water areas will be minimised;
- The use of water resources for processing and mining activities will constantly be evaluated to ensure that their use is optimised;
- No water will be discharged unless authorised by the DWS, especially water that exceeds the catchments water quality objectives, as set out by the National Authority, with the exception of emergency conditions if safety should demand so; and
- Dirty water catchments will be minimised and kept separate from clean catchments and all water contained here shall be re-used as far as possible, thus reducing the quality or raw water extracted;

All the relevant principles contained in DWA's Best Practice Guidelines (BPG) will be utilised to guide mine design and management practices. The Applicant will also ensure compliance with GNR 704 of the NWA, and is applying for the relevant exemption indicated in Section 3.3 above.

6.2.2 WETLANDS AND AQUATIC ECOLOGY

Management actions should consider that the main impacts of the development are likely to be to water quality, as well as water quantity (flows) within receiving watercourses. As such, the main objectives for management are:

- To take all reasonable measures to prevent any disturbance, damage or impact to aquatic ecosystems outside of mining footprint;
- Minimise and prevent disturbance to wetlands and watercourses;
- Prevent impacts to water quality;
- Prevent and minimise erosion and sedimentation;
- Prevent flow changes in receiving watercourses;
- Effective bio-monitoring programme be implemented as soon as possible to assess and mitigate negative impacts on aquatic ecosystems;
- Manage biodiversity; and
- On-going rehabilitation.

6.2.3 GROUNDWATER

Refer to Section 4.3.2 above and Section 5.8

6.2.4 WASTE

The following waste management strategies will be implemented:

- The waste management plan will ensure the appropriate management of all solid waste, including construction debris (cement bags, wrapping material, timber, cans, wire, nails, etc.), waste and surplus food, food packaging, organic waste etc;
- The Mine and Contractor(s) will comply with the environmental management principles referenced in the NEMA. In respect of waste management, the 'cradle-to-grave' principle in particular must be adhered to so as to ensure accountability for correct waste handling, storage and disposal;

- The waste management system will provide for adequate waste storage (in the form of waste skips and bins with lids), waste separation for recycling, and frequent removal of non-recyclable waste for permanent disposal at an appropriately licensed waste disposal facility. No waste material is to be disposed of on site. Under no circumstances may there be any burial of waste underground or on the site;
- Waste will be separated into reusable, recyclable and non-recyclable waste, and shall be further separated as follows:
    - Hazardous waste, consisting of substances that may be harmful to the receiving environment, and, therefore, require precautionary measures when handled. Examples include (but not limited to) oil, paint, diesel.
    - General waste, consisting of non-hazardous substances and substances that cannot be recycled. Examples include (but are not limited to) construction rubble, excess construction materials that cannot be reused.
    - Recyclable waste, (where volumes are sufficient to make recycling feasible) will preferably be deposited in separate bins. Recyclable material includes paper, tins and glass.
- The mine will implement a waste removal regime that ensures waste containers do not exceed their capacity before being removed from site for disposal;
- Environmental awareness training given to workers on site will include appropriate waste management practices to be implemented on site;
- Particular caution is to be exercised with regards to handling of hazardous waste, to ensure that it does not spill or leak from the waste collection containers. Refuse must also be protected from rain, which may cause pollutants to leach out;
- Littering will be strictly prohibited. The site shall remain in a neat and tidy condition at all times. If required, the Applicant shall make use of regular litter patrols to remove litter and ensure the site remains clean, neat and tidy; and
- The mine will maintain a waste register which shall be used to track all waste removed from site. Proof of appropriate waste disposal shall be kept on file at the site for auditing purposes.

6.3 PERFORMANCE OBJECTIVES / GOALS

The Applicant has an Occupational Health, Safety and Environmental Policy in place, which outlines the mine's commitment towards environmental management and which provides the framework for all environmental activities on the mine. The policy is aimed at achieving excellence and ensuring continual improvement in the mine's endeavour to create a sustainable environment. There is a continual process of reviewing to assess the impacts of the mine's activities on the environment. The performance objectives are summarised in Table 25 below.

Table 25: Performance objective for the Applicant

Item:	Performance objective:
Process Water:	Required water quality standard
	Re-use and recycling of process water
	Accurate water balance (hour meter flows)
Ground Water:	Prevent deterioration of ground water quality
	Prevent aquifer contamination

Item:	Performance objective:
Storm / Surface Water:	Clean and dirty water separation
	Diversion of clean storm water runoff around the mine area
	Collection and containment of contaminated water
Waste:	Ensure legal proper disposal of waste at registered sites
	Minimize waste generation
	Re-use of recycle if possible
	Ensure proper storage before disposal to prevent pollution of environment

6.4 MEASURES TO ACHIEVE AND SUSTAIN PERFORMANCE OBJECTIVES

The IWWMP action plan identifies measures to achieve the water and waste related objectives. Refer to Section 6.6 below.

6.5 OPTION ANALYSIS AND MOTIVATION FOR IMPLEMENTATION OF PREFERRED OPTIONS

The most important aspects considered during the EIA phase of the project were :

- Post-mining decant;
- Where to place coal discard; and
- The potential impacts on external groundwater users' drinking water.

These aspects were investigated through numerical groundwater modelling. The results of the modelling are discussed in Section 4.6 and in the hydrogeological study (Appendix D).

There is a clear advantage in placing coal discard into the Vlakvarkfontein Colliery-Pillar Pit below the long-term in-pit mine water level. If a discard dump is placed on surface, it will require decant management measures, including engineered liner and capping systems. Toe seepages at the discard dump is expected to have sulphate concentrations >5000 mg/L over the long-term problem. This will have to be managed. The proposed alternative of placing discard back into the pillar area below the long-term in-pit water table, will generate slightly higher in sulphate concentrations (2000 mg/L to 1700 mg/L; i.e. 300 mg/L difference) over the first 30 years, where after the difference will be smaller.

The south-eastern corner of the Wescoal pit will form the main decant zone. If the barrier pillar between the Wescoal pit and the Vlakvarkfontein Colliery-Pillar Pit is mined, the in-pit groundwater level will be at least 5m lower, and more water will decant at the mentioned main decant area. The applicable modelling scenario assumed that if discard is placed back into the pit, when the pillar is mined, if there will be enough space, sufficiently deep, below the long-term in-pit mine water level.

Vlakvarkfontein Colliery-Pillar Pit mining will impact on the local village groundwater supply through dewatering of the local aquifers. Over the long-term, a groundwater contamination plume is likely to spread in the direction of the village. By mining the barrier pillar, the potential contamination impact on the local village can be reduced. A decision in this regard will have to be taken soon after the commencement of mining of the Vlakvarkfontein Colliery-Pillar Pit.

One option that should be pursued to mitigate the effects of AMD, is the placement of coal-fire station fly ash on top of the backfilled opencast. However, detailed research is required to investigate the geochemistry and water balance of such a scenario. Due to the long-term benefits of flushing acid-generating minerals from backfill material, this option should be carefully evaluated in terms of the potential impact on the local surface water

environment and ecosystem. One aspect to consider is that water should first flow through the ash (e.g. rainfall recharge) before entering acid generating material, such as backfill. If decant water is treated in this way, it is advisable not to use ash, unless properly researched, but rather add calcitic lime.

In terms of the wetland assessment (refer to Appendix D), one wetland type was identified through the wetland and aquatic ecology assessment within the 500 m project assessment boundary, namely a depression, which comprised of two units. No other wetlands were identified within the larger 500 m study area. The overall wetland health for the systems was determined to be that of a largely modified system. The wetland type had overall 'Intermediate levels of service', with only some water quality enhancement services showing a moderately high level of benefit. The direct human importance for the wetlands was rated to be low. The hydrological / functional importance was rated as moderate.

The project is for the proposed expansion of the Vlakvarkfontein Colliery. The expansion of the mining area will result in the loss of the delineated wetlands. Alternatively, should the depressions be avoided, and the surrounding areas be mined, the removal of the stockpiles and subsequent change to the topographical features will remove a source for hydrological inputs which will result in the loss of the wetlands. Additionally, the wetlands are considered to be a result of the mining operation, and are not regarded as natural systems. It is apparent that the loss of these wetlands is unavoidable, and no buffer zone is suitable for either of the above-mentioned options. The loss of these depressions is not regarded as a fatal flaw for this project. The DWS should be consulted in order to determine the need, if any, for a wetland offset strategy.

The most notable impact is the expectant loss some water resources, the delineated depressions in particular. The significance of the loss if regarded as high, and the loss of wetlands is avoidable due to the nature of the project. It is worth mentioning that the loss of the wetlands is regarded as permissible for this project, owing to the fact that these wetlands are a result of the current mining operation, and are therefore classified as artificial systems. Therefore, there is no preference to assign a buffer to these areas and avoid disturbances to these systems, because as the landscape changes to accommodate the rest of the proposed expansion, the hydrological inputs to these wetlands will be lost as a result.

6.6 IWWMP ACTION PLAN

This part of the IWWMP details the actions that will be taken to ensure that the objectives and measures set out in Section 6.3 and Section 6.4 above, as well as the commitments made throughout the rest of this document, are achieved. The main purpose of this section of the IWWMP is to identify the direct actions to be taken by the mine, as well as to allocate responsibility for the implementation of these actions and set a target in terms of the timeline(s) within which the actions will be achieved. The action plan included in Table 26 focuses on the measures that will be implemented during the construction, operational and decommissioning phases of the mine.

Table 26: IWWMP action plan

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
STAFF AND MANAGEMENT AWARENESS					
Staff awareness program and training	Risk mitigation	The Applicant must inform its employees of risk associated with their operations and make sure that all employees are trained prior to undertaking any activity associated with their operations. Ensure that the Contractor and key personnel are aware of the relevant provisions of the EMPR, sensitive environmental features and agreements made with individual landowners and/or land users.	Permanent/ Continuous	• Reducing in incidents and identified risks	Management • EMPR
ii.) Appoint Contractors Environmental Officer (CEO)	Oversee and enforce EMPR.	The Applicant's management to assign a team that will monitor EMPR implementation and compliance by the employees. Enforcement should be applied to those employees that are not complying.	Permanent/ continuous	• Management satisfied with CEO performance based on EMPR implementation	Management • EMPR • Compliance checklists • Audit reports
SITE OPERATION					
Water for human consumption	Water and soil pollution, health	Water for human consumption shall be available at the site offices and at other convenient locations on site. All drinking water must be from a legal source and comply with	Weekly monitoring of waste and effluent	• Adequate quantities of potable water,	Management • EMPR

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
		recognised standards for potable use. The Applicant shall comply with the provisions of the NWA and its Regulations pertaining to the abstraction of water from rivers and streams and the use thereof. All effluent from the office shall be collected and disposed of properly, (e.g. chemical toilets should be emptied). If this is not feasible (due to the construction duration or other difficulties), all effluent water from the camp / office sites shall be disposed of in a properly designed and constructed system, situated so as not to adversely affect water sources (streams, rivers, pans dams etc). Only domestic type wastewater shall be allowed to enter this drain. The effluent system should comply with provisions of the NWA.	removal/ disposal	• Proper effluent disposal	• Compliance checklists
Sewage	Soil and water pollution; Waste disposal	Ensure that the sewage plant is working.	Weekly monitoring of sewage facilities, maintenance and disposal	• Adequate and operation sewage treatment/disposal	Management • EMPR • Compliance checklists

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
Waste Management	Soil and water pollution; Waste disposal	Where practically possible, general waste on-site must be reused or recycled. Bins and containers must be available on-site for collection, separation, and storage of waste streams (such as wood, metals, general refuse etc.).	Weekly monitoring of waste clean-up	• No waste or litter accumulation on site	Management • EMPR • Compliance checklists
Solid Waste	Soil and water pollution; Waste disposal	A refuse control system shall be established for the collection and removal of refuse. Bins and containers must be available on-site for collection, separation, and storage of waste (such as wood, metals, general refuse etc.). Solid waste shall be stored within a designated area that is covered, utilising plastic wheelie bins for collection and disposal. Disposal of solid waste shall be at a DWS licensed landfill site or at a site approved by DWS in the event that an existing operating landfill site is not within reasonable distance from the site. No waste shall be burned or buried at or near the site offices, or anywhere else on the site.	Weekly monitoring	• No waste or litter accumulation on site • Proof of disposal certificates. • No burning of waste.	Management • EMPR • Compliance checklists
Wastewater	Soil and water pollution;	The Applicant shall comply with the provisions of the NWA and its Regulations pertaining to the storage and reuse of wastewater collected on site.	Monthly monitoring	• No ground and water contamination	Management • EMPR • Compliance checklists

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
		Wastewater collection ponds should be lined and in compliance with the NEMWA and other legal requirements.			
Litter	Soil and water pollution; Waste disposal	No littering by construction workers shall be allowed. During the construction and operation period, the facilities shall be maintained in a neat and tidy condition and the site shall be kept free of litter. Measures shall be taken to reduce the potential for litter and negligent behaviour with regard to the disposal of all refuse. At all places of work the contractor shall provide litter collection facilities for later safe disposal at approved sites.	Bi weekly monitoring	• No waste or litter accumulation on site • Proof of disposal certificates. • Availability and maintenance of litter / refuse collection facilities. • No burning of waste.	Management • EMPR • Compliance checklists
Hazardous waste	Soil and water pollution Waste disposal	Hazardous waste such oils etc. shall be disposed of in a DWS approved landfill site. Any spillage shall be attended to immediately and affected areas shall be promptly reinstated to the satisfaction of the engineer.	Weekly monitoring	• No spillages or direct disposal. • No waste or litter accumulation on site • Proof of disposal certificates. • Proof of reinstatement following any spillages.	Management • EMPR • Compliance checklists

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
				• No burning of waste.	
Control at the workshop	Soil and water pollution; Waste disposal	Management and maintenance of plant and machinery will be strictly monitored according to the subsections below, regardless whether it is serviced on the site (i.e. at the place of construction activity or at a formalised workshop). All maintenance, including washing and refuelling of plant on site shall take place at designated locations at the workshop area. All machinery servicing areas shall be bunded.	Monthly monitoring	• Random visual inspection during site visits.	Management • EMPR • Compliance checklists
Hazardous Material Storage	Soil and water pollution Waste disposal	Petrochemicals, oils and identified hazardous substances shall only be stored under controlled conditions. All hazardous materials shall be stored in a secured, appointed area that is fenced and has restricted entry. The Applicant should ensure that they keep proof that relevant authorisation to store such substances has been obtained from the relevant authority. In addition, hazard signs indicating the nature of the stored materials shall be displayed on the storage facility or containment structure. Before containment or storage facilities can be erected the Applicant should ensure that preventative measures are put in place to mitigate against pollution of the	Weekly monitoring	• No hazardous waste accumulation on site • Proof of disposal certificates. • No burning of waste. • Suitable and adequate hazardous substance storage areas. • Proof of submission and approval from the Employers Environmental	Management • EMPR • Compliance checklists

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
		surrounding environment from leaks or spillage. The preferred method shall be a concrete floor that is bunded. Any deviation from the method will require proof from the relevant authority that the alternative method proposed is acceptable to that authority. The proposals shall also indicate the emergency procedures in the event of misuse or spillage that will negatively affect an individual or the environment.		Manager/Environmental Officer.	
Fuel and Gas Storage	Soil and water pollution; Waste disposal	Fuel shall be stored in a secure area in a steel tank supplied and maintained by the fuel suppliers. An adequate bund wall, at least 110% of the volume stored, shall be provided for fuel and diesel areas to accommodate any leakage spillage or overflow of these substances. The area inside the bund wall shall be lined with an impervious lining to prevent infiltration of the fuel into the soil. Any leakage, spillage or overflow of fuel shall be attended to immediately. Gas welding cylinders and LPG cylinders shall be stored in a secure, well-ventilated area. Storage of hazardous substances must comply with construction regulations under the OHSA.	Weekly monitoring	• Inspect bunded area for leaks / drainage • Proof of disposal certificates. • No burning of waste.	Management • EMPR • Compliance checklists

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
Oil and Lubricant Waste	Soil and water pollution; Waste disposal	Used oil, lubricants and cleaning materials from the maintenance of vehicles and machinery shall be collected in a holding tank and sent back to the supplier. Oils collected in this manner, shall be retained in a safe holding tank and removed from site by a specialist oil recycling company for disposal at approved waste disposal sites for toxic/hazardous materials. Oil collected by a mobile servicing unit shall be stored in the service unit's sludge tank and discharged into the safe holding tank for collection by the specialist oil recycling company. All used filter materials shall be stored in a secure bin for disposal off site. Any contaminated soil shall be removed and replaced. Soils contaminated by oils and lubricants shall be collected and disposed of at a facility designated by the local authority to accept contaminated materials.	Weekly monitoring	• Inspect bunded area for leaks / drainage • Proof of disposal certificates. • No burning of waste.	Management • EMPR • Compliance checklists
Soil and Stockpile Management	Soil erosion	Topsoil shall be removed from all areas where physical disturbance of the surface will occur and shall be stored and adequately protected. The Applicant will provide for the stripping and stockpiling of topsoil from the site for later re-use. Topsoil is considered to be the natural soil	Monthly monitoring	• Visual inspection of stockpiles	Management • EMPR • Compliance checklists

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
		covering, including all the vegetation and organic matter. Depth may vary at each site. The areas to be cleared of topsoil shall include the storage areas. All topsoil stockpiles and windrows shall be maintained throughout the contract period in a weed-free condition. Weeds appearing on the stockpiled or windrowed topsoil shall be removed by hand. Soils contaminated by hazardous substances shall be disposed of at an approved DWS waste disposal site. The topsoil stockpiles shall be stored, shaped and sited in such a way that they do not interfere with the flow of water to cause damming or erosion, or itself be eroded by the action of water. Stockpiles of topsoil shall not exceed a height of 2m, and if they are to be left for longer than 6 months, shall be analysed, and if necessary, fertility improved before replacement. Stockpiles shall be protected against infestation by weeds. The Applicant shall ensure that no topsoil is lost due to erosion – either by wind or water. Areas to be top-soiled and grassed shall be done so systematically to allow for quick cover and reduction in the chance of heavy topsoil losses due to unusual weather patterns.			

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
Drainage / Storm water Management	Soil erosion /storm water management	The quality, quantity and flow direction of any surface water runoff shall be established with the aid of a qualified engineer prior to disturbing any area for construction purposes. Cognisance shall be taken of these aspects and incorporated into the planning of all construction activities. Before a site is developed or expanded, it shall be established how this development or expansion will affect the drainage pattern. No water source shall be polluted in any way due to proposed development. No wastewater may run freely into any of the surrounding environment or neighbouring properties. The contractor shall implement the storm water design in accordance with the approved Storm Water Management Plan. The Applicant and Contractor(s) shall ensure compliance with the requirements of the NWA and GN 704. All areas susceptible to erosion shall be protected by ensuring that there is no undue soil erosion resultant from construction and/or mining activities. Berms shall be constructed where necessary to direct all runoff into the storm water system. Care must be taken to avoid scouring and erosion and suitable	Weekly monitoring	• Visual inspection, no excessive soil erosion or sedimentation.	Management • EMPR • Compliance checklists

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
		measures should be placed in areas where runoff concentrates, in order to detain the sediment load and slow down the runoff. All erosion damage shall be repaired as soon as possible as directed by the Environmental Representative. Consideration shall be given to the placement of silt traps or barriers where the soils are of a dispersive nature or where toxic fluids are used in the construction process. The silt traps must be large enough to contain runoff so that they function properly under heavy rain conditions.			
Stockpiles	Soil erosion Visual impact Noise	No construction and operation related activities including stockpiling, temporary storage areas, temporary and permanent access routes, and temporary working areas are to take place within the area beyond the demarcated site boundary. The Applicant shall plan their activities so that materials in so far as possible, can be transported directly to, and placed at, the point where they will be used. The areas for the stockpiling of excavated and imported material shall be indicated and demarcated on the site plan, together with the contractor's proposed	Weekly monitoring	• Visual inspection, no excessive dust	Management • EMPR • Compliance checklists

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
		measures for prevention, containment and rehabilitation against environmental damage. The areas chosen shall have no naturally occurring indigenous trees and shrubs present that may be damaged during operations. Care shall be taken to preserve all vegetation in the immediate area of these temporary stockpiles. During the life of the stockpiles the contractor shall at all times ensure that they are: • Positioned and sloped to create the least visual impact; • Structurally sound and present no safety risk; • Constructed and maintained so as to avoid erosion of the material and contamination of surrounding environment; and Kept free from all alien/undesirable vegetation. After construction, any areas no longer required for operation shall be re-instated to its original condition. No foreign material generated / deposited during construction shall remain on site. Areas affected by stockpiling shall be landscaped, top soiled, grassed and maintained until closure from the Environmental Advisor and the relevant National Authority is received.			

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
		In all cases, Environmental Advisor shall approve the areas for stockpiling and disposal of construction rubble before any operation commences and shall approve their clause only when they have been satisfactorily rehabilitated.			
Spillages	Soil & water pollution	Watercourses such as streams, rivers, dams, etc. shall be protected from direct or indirect spillage of pollutants such as refuse, garbage, cement, concrete, sewage, chemicals, fuels, oils, aggregate, wash water, and organic materials. In the event of a spillage, the Applicant should arrange for professional service providers to clear the affected area. All spills must be dealt with as per the Emergency Response Procedure. Should water downstream of the spill be polluted, and fauna and flora show signs of deterioration or death, specialist hydrological or ecological advice will be sought for appropriate treatment and remedial procedures to be followed.	Weekly monitoring	• Visual inspection	Management • EMPR • Compliance checklists

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
Areas of Specific Importance	• Loss of populations of threatened plant species • Loss of habitat of threatened animal species • Loss of indigenous natural vegetation (primarily grassland) • Erosion and siltation due to change in runoff and drainage patterns • Establishment and spread of declared weeds and alien invader plants. • Noise impacts on local residents	Any area, as determined and identified as sensitive or of special interest within the site (e.g. wetlands) shall be treated according to the express instructions contained in these specifications or the approved EMPR. The overriding principle is that such defined areas requiring protection shall not be changed. • No unnecessary vegetation clearing will be allowed in natural vegetation areas.	Weekly monitoring	• No vegetation has been unnecessary removed, (photo graphic evidence)	Management • EMPR • Compliance checklists

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
Dust Control	Nuisance pollution	Dust caused by strong winds and operational activities shall be controlled by means of water spray vehicles. Exposed soils and material stockpiles shall be protected against wind erosion. The location of stockpiles shall take into consideration the prevailing wind directions and locations of sensitive receptors A dust monitoring system needs to be put in place to ensure that dust falls within the acceptable limits as per the ambient air quality standards	Monthly monitoring	• Routine observation, no complaints from residents	Management • EMPR • Compliance checklists
Alien Vegetation	Habitat destruction	The Applicant shall establish an on-going monitoring programme to detect and quantify any alien species that may become established and identify the problem species (as per Conservation of Agricultural Resources Act and Biodiversity Act). The Applicant shall be held responsible for the removal of alien vegetation within the boundary of the site disturbed during construction. This includes, for example, service roads, stockpile areas, and wherever	Monthly monitoring	• Visual inspection, vegetation removal record by contractor, no unnecessary vegetation clearing	Management • EMPR • Compliance checklists

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
		material generated for or from construction has been stored temporarily.			
DECOMMISSIONING PHASE					
Decommissioning	Decommissioning and rehabilitation	Any additional licensing or permitting requirements must be identified prior to any decommissioning activities commence. Prior to the decommissioning a detailed decommissioning plan must be prepared. This plan should aim to follow the waste management hierarchy (reuse, recycle, reduce and dispose) in order to prevent unnecessary wastes. All waste which require disposal must be disposed of at a suitably licenced facility. An inventory of infrastructure and wastes together with the ultimate destination (e.g. recycler, waste disposal) should be kept for future records. A rehabilitation plan must be prepared by a suitably qualified specialist. The sites must be rehabilitated to the pre-construction condition or alternatively to align with the surrounding land-uses at the time. The rehabilitated site must be protected from future erosion.	Weekly	• Routine check for EMPR availability and awareness.	Management • EMPR • Compliance checklists

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
Decommissioning	Decommissioning and rehabilitation	The area where the site offices are placed will require rehabilitation at the end of the contract. All construction material, including concrete slabs shall be removed from the site on completion of the contract, to the Applicants satisfaction.	Weekly	• Routine check for EMPR availability and awareness.	Management • EMPR • Compliance checklists
Decommissioning	Decommissioning and rehabilitation	Any disturbed areas should be rehabilitated with natural vegetation endemic to the area as soon as possible after decommissioning.	Weekly	• Routine check for EMPR availability and awareness.	Management • EMPR • Compliance checklists

6.7 MONITORING AND CONTROL

In order to determine the impact of the facility on the surface and groundwater regimes, monitoring systems have been implemented, by which data can be continually gathered and analysed, with corrective action being taken as required.

6.8 MONITORING OF CHANGE IN BASELINE INFORMATION

The results of the monitoring plan will be submitted to the relevant DWS directorates, as well as other government departments as required in terms of management objectives, action plan and applicable legislation and other legislative requirements.

6.8.1.1 SURFACE WATER MONITORING

As detailed in Section 5.10.1 above surface water monitoring is currently undertaken at Vlakvarkfontein Colliery. The Applicant will need to amend the surface water monitoring to ensure that it is in line with any conditions specified in the amended WUL.

6.8.1.2 BIOMONITORING

As detailed in Section 5.10.2 above biomonitoring is currently undertaken at Vlakvarkfontein Colliery. The Applicant will need to amend the surface water monitoring to ensure that it is in line with any conditions specified in the amended WUL.

6.8.1.3 GROUNDWATER MONITORING

As detailed in Section 5.10.3, groundwater monitoring is currently undertaken at Vlakvarkfontein Colliery. The groundwater monitoring plan should be amended as proposed by the Hydrogeologist (refer to Section 5.10.3 and Appendix D).

6.9 AUDIT AND REPORT ON PERFORMANCE

The WUL and other applicable authorisations require that regular formal audits be undertaken in order to assess the compliance with, amongst others, the WUL and IWWMP. As such, the applicant will cater for this requirement through regular internal and external audits in line with the frequency required by the WUL (usually on an at least an annual basis) and the other applicable authorisations. The EMP performance audit conducted in July 2017 is attached in Appendix I.

6.10 AUDIT AND REPORT ON RELEVANCE OF IWWMP ACTION PLAN

The existing WULAs requires that the efficacy of the measures proposed as part of the action plan be reviewed and updated where required. As such, the IWWMP action plan will be reviewed and updated in line with the frequency required by the WUL and the other applicable authorisations. A copy of the last WUL audit report is attached in Appendix O.

7 CONCLUSION

7.1 REGULATORY STATUS OF ACTIVITY

Vlakvarkfontein Colliery has two approved WULAs (Licence no.: 03/B20F/AGJ/4858 and 03/B20A/G/4845) approved by the DWS. The mine also has an existing Mining Right (MP 30/51/2/2/300 MR) approved by the DMR. The mine has applied for environmental authorisation in terms of the NEMA regulations, as well as certain waste activities in terms of the NEMWA regulations (refer to Section 3.7 and Section 3.8). The EA process is still ongoing.

7.2 STATEMENT OF WATER USES REQUIRING AUTHORISATION, DISPENSING WITH LICENCENCING REQUIREMENT AND POSSIBLE EXEMPTION FROM REGULATION

In terms of the NWA, it is an offence to pollute any water resources to render it unfit for the propagation of fish and aquatic life, including rainwater, seawater, and subterranean water. An application for the exemption of the provision of GNR 704 is required for the PCD as Section 4a of GN 704 will apply. Details of these water uses are presented in Section 3.5.

The subsections below provide contextualisation of the activities with respect to Section 27 of the NWA.

7.2.1 SECTION 27(1)(A) EXISTING LAWFUL WATER USES

As the mine has existing WULAs (Licence no.: 03/B20F/AGJ/4858 and 03/B20A/G/4845), all the activities licenced in terms of these WULAs are considered to be existing lawful water uses.

7.2.2 SECTION 27 (1)(B) THE NEED TO REDRESS THE RESULTS OF PAST RACIAL AND GENDER DISCRIMINATION

Vlakvarkfontein Colliery has an approved Social and Labour Plan (SLP) (refer to Appendix J) that among other items ensures community investment in a Lavender farm.

An addendum to the SLP has been prepared, stipulating human resources development, local economic development, and processes pertaining to management of downscaling and retrenchment.

As part of the Human Resources Development Programme (HRDP), the following plans have been developed:

- Skills Development Plan: This plan considers business requirements, career aspirations, provision of portable/transferable skills, and training required by the new labour force. The Vlakvarkfontein Colliery is committed to providing its employees with the opportunity to become functionally literate and numerate. Adult Basic Education and Training (ABET) will be made available. In addition, the following portable skills will be developed amongst the employees – basic welding, driver's license, computer literacy, carpentry, basic electrical course and basic mechanics course.
- Mentorship Plan: This plan is aimed at facilitating developmental needs, and specifically the transference of skills, knowledge and competency to Historically Disadvantaged South Africans (HDSAs), including women. The Mentorship Plan will assist in the identification, training and assessment of both mentors and protégés.
- Learnership Plan / Internship: The aim is to provide necessary support and assistance for identified employees to complete their qualifications. One internship and two learnership positions will be made available for employees each year. One bursary per year will also be made available within fields identified to have a skills shortage. Potential candidates must reside within the Delmas Local Municipality.
- Employment Equity Plan: the recruitment and development of staff will aim to secure 10 % of the employment for women, to participate in the core functioning of mining and not only in the administration and support services. In addition, NMR commits to 40 % of HSDAs in top and middle management positions.

7.2.3 SECTION 27 (1)(C) EFFICIENT AND BENEFICIAL USE OF WATER IN THE PUBLIC INTEREST

The concept of "public interest" is a very complex one. Under the Water Act, permits were issued to users provided that they used the water beneficially. The use was considered beneficial if the mine was going to make a profit. Under the NWA, public interest goes much wider. The fact that the mine has to undertake a public participation process, and the public's opinion is to be elicited, means that, at least, the public opinion can be gauged by the response and the comments and concerns received.

As public trustee of the water resources, the DWS must ensure that the water is protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner for the benefit of all users. The Minister, through the DWS has to ensure that the water is allocated equitably and used beneficially in the public interest, while promoting environmental values.

The beneficial use of the water is derived for the social and economic benefits resulting from the mining activity. Water will be used optimally to ensure minimum wastage. The water use will be undertaken, managed and controlled in such a way to ensure that pollution of the water resources is minimised and avoided. Social and economic development will be facilitated, which will ensure that the use of the water resource will be of benefit to the local communities. Goods and services will be sourced from local businesses as far as possible, to enhance the economic benefits of the project.

A public participation process relating to the water use application has been undertaken and all the identified impacts can be mitigated taking the other water users into consideration. The public consultation process will be on-going throughout the life of mine.

The uses of water is in the public interest because no significant volumes of water is used in the mining activities. Existing contaminated water is removed from the general surface and groundwater systems during operation (to ensure safe and efficient mining), thereby removing this pollution source. As part of the mine's progressive rehabilitation plan, acid mine drainage will be minimised or prevented from occurring. Once the mine is no longer operational, groundwater levels will return to those of pre-mining, but are expected to have a better water quality. The contaminated decant currently occurring in the south will be managed according to the rehabilitation plan, and should contaminated water again decant, this water will be filtered via an artificial wetland prior to entering the Klipspruit. While the mine itself requires no water resources, there is a requirement for potable water. This water is obtained from an existing borehole (un-used) and is pumped at a reasonable rate.

7.2.4 SECTION 27 (1)(D) THE SOCIO-ECONOMIC IMPACT OF THE WATER USE OR USES IF AUTHORISED OR OF THE FAILURE TO AUTHORISE THE WATER USE OR USES

Compliance to the NWA will be adhered to with the approval of the WUL. Mining of the coal at Vlakvarkfontein Colliery will ensure the provision of employment and continued short- to long-term employment, and positive economic benefits to the local community.

Vlakvarkfontein Colliery also has two approved WULAs (Licence No.: 03/B20F/AGJ/4858 and 03/B20A/G/4845) and water uses are already authorized. The water uses (pumping of groundwater to ensure safe and efficient mining; storage/disposal of contaminated water within a pollution control dam; use of this contaminated water for dust suppression; management of runoff over waste rock stockpiles; and the abstraction of potable water for use by the mine employees) being applied for by Vlakvarkfontein Colliery are integral to the mining operation. The socio-economic impact of approved water uses includes:

- The provision of employment (albeit limited) to some of the local community;
- The opportunity to provide goods and services to the mine;
- The investment in portable/transferable skills and greater employment opportunities resulting from learnerships, mentorships and bursaries;

- The ultimate (in 10 to 12 years) provision of cleaner groundwater and the prevention of ongoing contamination of surface water (should the recommended mitigation measures be implemented); and
- The immediate management of local dangers on the site, in terms of fencing off dangerous roads and open voids, and minimising hazardous and illegal abstraction of coal.

7.2.5 SECTION 27 (1)(E) ANY CATCHMENT MANAGEMENT STRATEGY APPLICABLE TO THE RELEVANT WATER RESOURCES

The Olifants WMA falls within the Limpopo River Basin, which is shared by South Africa, Botswana, Zimbabwe and Mozambique. As the Olifants River flows directly from South Africa into Mozambique, where it joins the Limpopo River, developments in South Africa can directly impact upon Mozambique.

Of particular importance in this respect is Massingire Dam in Mozambique, located immediately downstream of the border with South Africa, and with the total catchment area of the dam falling within South Africa. Issues related to the management of the Limpopo River below the Olifants confluence, however, can have bearing on all the basin states of the Limpopo.

Joint utilisation of the water resources of the Olifants River is facilitated through the bilateral Joint Water Commission between South Africa and Mozambique. International cooperation with respect to the use and management of the watercourses in the Limpopo River Basin, is overseen by the Limpopo Permanent Technical Committee with membership by South Africa, Botswana, Zimbabwe and Mozambique (Olifants WMA - Overview of Water Resources Availability and Utilisation, 2003).

Discussions have been held between Mozambique and South Africa as far back as 1971 with the development of the Massingire Agreement of 1971. This agreement dealt specifically with the building of the Massingire Dam. Mozambique is proposing to raise the Massingire Dam. The principles of the Helsinki Rules were used prior to 2000 to guide the relations between South Africa and neighbouring states. In 1995, the SADC countries established the 1995 Protocol dealing with Shared Watercourse Systems. The 1995 Protocol was repealed in September 2003 and replaced with the 2000 Protocol which is now used to guide management and development on Shared Watercourse Systems (Olifants WMA – ISP, 2004).

7.2.6 SECTION 27 (1)(F) THE LIKELY EFFECT OF THE WATER USE TO BE AUTHORISED ON THE WATER RESOURCE AND ON OTHER WATER USERS

The main potential impacts identified include (Refer to Section 5.11 for a detailed description of the potential impacts):

- Surface water: water quality may decrease due to contaminated water discharge; loss of catchment yield during operation, and decant during decommissioning may impact surface water quality;
- Wetlands: Loss of wetlands due to mining, decreased water quality and as altered hydrological regime may occur; and
- Groundwater: groundwater quality may be impacted on due to AMD formation and contamination of groundwater, while the groundwater quantity may decrease due to dewatering.

All of these potential impacts will require mitigation, which is further addressed in the IWWMP action plan (Section 6.6 above).

7.2.7 SECTION 27 (1)(G) THE CLASS AND THE RESOURCE QUALITY OBJECTIVES OF THE WATER RESOURCE

In terms of Section 16 of the NWA, the Minister of DWS, must determine the reserve for the river system before any license can be issued. The Reserve consists of two parts, namely, the basic human needs and the ecological reserve, which must be determined for all or part of any significant water resource. The desktop PES of this reach of the Leeufontein River is a class D or largely modified. The confidence in this classification is low due to the long distance of the considered SQR (32 km). The ecological importance and sensitivity of the river reach was rated as moderate. The defined Default Ecological Category for the river was Class C or moderately modified. The current gradient of the considered river reach in proximity to the project area was found to be a class E

geoclass. This places the river as a lowland river reach. The desktop information pertaining to the B20E-1290 sub quaternary reach is indicated in Table 27.

Table 27: The desktop information pertaining to the B20E-1290 sub quaternary reach

Component/Catchment	Leeufontein (B20E-1290)
Present Ecological Status	Largely Modified (Class D)
Ecological Importance Class	Moderate
Ecological Sensitivity	Moderate
Default Ecological Category	Moderately Modified (Class C)

As indicated in Table 28, the desktop PES of this reach of the Wilge River is a class C or moderately modified. The confidence in this classification is low due to the long distance of the considered SQR (44 km). The ecological importance and sensitivity of the river reach was rated as high and very high respectively. The defined Default Ecological Category for the river was class A or natural. The current gradient of the considered river reach in proximity to the project area was found to be a class D geoclass. This places the river as a lowland river reach.

Table 28: The desktop information peratining to the B20F-1150 sub quaternary reach

Component/Catchment	Wilge (B20F-1150)
Present Ecological Status	Moderately Modified (Class C)
Ecological Importance Class	High
Ecological Sensitivity	Very high
Default Ecological Category	Largely Natural (Class A)

7.2.8 SECTION 27 (1)(H) INVESTMENT ALREADY MADE AND TO BE MADE BY THE WATER USER IN RESPECT OF THE WATER USE IN QUESTION

Vlakvarkfontein Colliery has invested significantly in their mining and processing activities in terms of coal production with the project initiating financial benefit to both the surrounding areas as well as the existing workers that depend on the mining operations for their livelihood. The mine has also invested in various specialist studies and a public participation process for the WUL Application, as well as the EIA process. Furthermore, the mine invested in the compilation of a WCDSS (Refer to Appendix M) to ensure efficient water use activities.

7.2.9 SECTION 27 (1)(I) THE STRATEGIC IMPORTANCE OF THE WATER USE TO BE AUTHORISED

The strategic importance of the water uses to be authorised includes:

- Securing jobs and additional job creation in future;
- Contingency of training programmes provided to employees and external learner-ship programmes to improve skills base;
- Support to local economy and national economy with purchasing of services and goods;
- Continued production of coal for ESKOM; and
- Contingency of LED projects in conjunction with local municipality to the benefit and growth of local community.

7.2.10 SECTION 27 (1)(J) THE QUALITY OF WATER IN THE WATER RESOURCE WHICH MAY BE REQUIRED FOR THE RESERVE AND FOR MEETING INTERNATIONAL OBLIGATIONS

Vlakvarkfontein Colliery has been in operation from 2010. The mine has two approved WULAs (Licence no.: 03/B20F/AGJ/4858 and 03/B20A/G/4845) issued by the DWS. No reserve determination is required for this application.

7.2.11 SECTION 27 (1) (K) THE PROBABLE DURATION OF ANY UNDERTAKING FOR WHICH A WATER USE IS TO BE AUTHORISED

The Vlakvarkfontein Colliery extension project with increase the LOM for a period of 10 years. It is, therefore, proposed that the licence be issued for a period of at least twenty (20) years due to the long-term water management measures that are required to be put in place.

7.3 KEY COMMITMENTS

The Applicant is committed to implementing and reviewing the IWWMP action plan included into this document (Refer to 6.6 above).

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