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Eloff Mining Company (Pty) Ltd

Integrated Water Use License Application (IWULA) and Integrated Water and Waste Management Plan (IWWMP)

Report

Version – Public Review

11 June 2019

Eloff Mining Company (Pty) Ltd

Eloff Phase 3 Project

GCS Project Number: 17-1030



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Integrated Water Use License Application (IWULA) and Integrated Water and Waste Management Plan (IWWMP)

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EXECUTIVE SUMMARY

Activity Background

The Eloff Mining Company (Pty) Ltd has a mining right situated in the Magisterial District of Delmas. Eloff Mining Company (Pty) Ltd is 51% and 49% owned by Ndalamo Resources (100% black owned) and Universal Coal, respectively.

Eloff Mining Company (Pty) Ltd.'s mining right adjoins Universal Coal's existing Kangala Colliery operation. Upon granting of mining right, Kangala's life of mine was 10 years. However, due to Eskom's demand for coal supply over the years, Kangala had to supply more coal tonnages than what was agreed between the Mine and Eskom. Consequently, the life of mine was reduced to 6 – 7 years. The current mine plan indicates that Kangala will run out of coal in quarter 4 of 2019. The plan to extend Kangala's life of mine has always been to extend the current operation into the adjacent Eloff Mining Company (Pty) Ltd mining right area through a consolidation of mining activities.

Eloff Mining Company (Pty) Ltd intends to provide the coal required by Eskom with the addition of the new opencast mine, Eloff Phase 3 Project. The Eloff Phase 3 Project mining area is located 6km south-west of the town Delmas and 8.5km south-east of the town of Eloff in the Mpumalanga Province; and approximately 65km due east of Johannesburg. The mine is situated within the Victor Kanye Local Municipality.

From 2018 to 2019, all the Run of Mine (ROM) coal will be produced from Kangala only. Production from the Eloff Phase 3 Project is planned to commence in Quarter 4 of 2019, and this will be the last year that coal will be produced from Kangala. The proposed expansion operation will involve the exploitation of thermal coal contained within the Witbank Coal Fields using the truck and shovel opencast mining method. Coal mined from the opencast will be trucked to the existing Kangala Colliery for processing at the plant. Discard generated from the processing will be disposed of on the existing discard dump. The total estimated ROM and Product production for Kangala is 3 700 000 and 2 400 000 tonnes respectively per annum, and the total estimated ROM production at the Eloff Phase 3 Project will remain the same. Kangala produces a low ash, high energy, and low Sulphur thermal coal for local market such as Eskom, with a proportion of the coal product exported.

Authorised Water Uses: Kangala Colliery

In terms of legislative requirements, Universal Coal's Kangala Colliery was issued a Water Use Licence (WUL) (Licence No**. 04/B20A/ABCGIJ/1506**) on the 25th of May 2012 by the Department of Water and Sanitation (DWS). The IWUL was issued in terms of Chapter 4 of the National Water Act, 1998 (Act No. 36 of 1998) (NWA), with an amendment issued on the 8th

of April 2013 and the 5th of August 2016 (Licence no: **03/B20A/A/A/4683**). The following water uses have been authorised for the existing Kangala Colliery in terms of Section 21 of the NWA:

- Section 21(a) – Taking water from a water resource;
- Section 21(b) – Storing of water;
- Section 21(c) – Impeding or diverting the flow of water in a watercourse;
- Section 21(g) – Disposing of waste in a manner which may detrimentally impact on a water resource;
- Section 21(i) – Altering the bed, banks, course or characteristics of a watercourse; and
- Section 21(j) – Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.

New Water Uses to be Licenced: Eloff Phase 3 Project

The following water uses are triggered in terms of Section 21 of the NWA as a result of the proposed Eloff Phase 3 Project:

- Section 21(c) – Impeding or diverting the flow of water in a watercourse;
- Section 21(g) – Disposing of waste in a manner which may detrimentally impact on a water resource;
- Section 21(i) – Altering the bed, banks, course or characteristics of a watercourse; and
- Section 21(j) – Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.

Impact Assessment

Sensitive Areas

The most notable impact on sensitive areas is the expectant loss of some water resources, the delineated wetlands in particular. The loss of wetlands is expected for the mining of the opencast area. **It must be noted that the waste stockpiles will be located at the existing Kangala Colliery and will no longer form part of this application.** However, the assessment was done with the waste stockpiles potentially being located for the Eloff Phase 3 Project area.

A number of aspects were considered for the construction phase of the project. The majority of these aspects are not expected to have a direct impact (or risk) on the delineated wetland areas. The moderate risks are expected for the clearing of vegetation and excavations of the channel. If recommended mitigation measures are implemented, these risks will be reduced to a low risk.

A number of moderate risks are expected for the operational phase of the project, with the significance of the majority of these risks being reduced to a low risk should the prescribed mitigation measures be implemented. A number of these risks are carried through from the construction phase of the project, and this emphasises the need and importance to have these risks managed and mitigated from the onset of the project. The most notable risks posed during the operational phase of the project area are the actual opencast mining methods, which will result in the loss of wetland area, and the altered topography which will have an effect on the hydrology of the catchment. These two aspects are considered to pose a high risk, and there is no mitigation available for the mining of wetlands.

Groundwater

The proposed new mining activities are an expansion of the already existing Kangala Colliery and only include additional opencast excavation (access to the opencast cut and removal of overburden) and sub soil and top soil stockpiling. **It should be noted that the groundwater study was done with waste stockpiles forming part of the Eloff Phase 3 Project. However, the waste stockpiles will be located at the existing Kangala Colliery and so a conservative approach has been taken.** All existing Kangala mining and related infrastructure will be utilised throughout the life of mine and have already been included and approved in previous EMP and EIA studies. The impact on the groundwater system is seen as insignificant due to the short duration of this phase. No additional support and processing infrastructure will be constructed for this project.

The planned opencast mining (pit floor) is expected to intersect the local groundwater table from year one, resulting in groundwater influx and therefore necessitating pit dewatering. The mining depth varies between approximately 18 and 58 metres below the groundwater table, with the average being more or less 37 metres. The pit dewatering will result in the partial dewatering of the aquifer, a lowering of the surrounding groundwater levels and the formation of a groundwater depression cone.

Surface water

The following impacts have been identified: Sedimentation of downstream drainage/watercourses; Hydrocarbon fuel spillage; Reduction of catchment yield; Flooding of proposed infrastructures; Pollution of downstream watercourse; and Siltation of water resources. The significance of the impacts during the construction and operational phase will be reduced to a low risk if the prescribed mitigation measures are implemented.

Integrated Water and Waste Management Plan:

This document serves as the technical report for submission to the DWS for the authorisation of water uses triggered by the proposed expansion project. As there are waste related uses associated with the proposed development, this report has been structured in line with the approved Integrated Water and Waste Management Plan (IWWMP) Operational Guideline compiled by the DWS.

This IWWMP document includes the operations proposed to be undertaken at the Eloff Phase 3 Project. The main purpose of this IWWMP is to consolidate all the various site-specific activities such as water balances, storm water management, water reuse, water conservation, waste minimization and recycling into a simple implementable management plan.

The IWWMP is therefore a living document that will be revised and updated throughout the life of the operations and as per the IWUL conditions to accommodate additional information and improved technologies. These will ensure that water and waste management is continually optimised and adapted to the changing needs of the mine and the Water Management Area (WMA).

Information		Included? (Yes/No)	Relevant section of IWWMP Report
Evaluate to determine if the following aspects are addressed in the FINAL / BRIEF APPLICATION (IWWMP) REPORT:			
Introduction			
1.1	Activity Background	Yes	1.1
1.2	Contact Detail	Yes	1.2
1.3	Regional setting and location of activity	Yes	1.3
1.4	Property description	Yes	1.4
1.5	Purpose of IWWMP	Yes	1.5
Conceptualisation of activity			
2.1	Description of activity	Yes	2.1
2.2	Extent of activity	Yes	2.2
2.3	Key activity related processes and products	Yes	2.3
2.4	Activity life description	Yes	2.4
2.5	Activity infrastructure description	Yes	2.5
2.6	Key water uses and waste streams	Yes	2.6
2.7	Organisational structure of activity	Yes	2.7
2.8	Business and corporate policies	Yes	2.8
Regulatory water and waste management framework			
3.1	Summary of all water uses	Yes	3.1
3.2	Existing lawful water uses	Yes	3.2
3.3	Relevant exemptions	Yes	3.3
3.4	Generally authorized water uses	Yes	3.4
3.5	New water uses to be licensed	Yes	3.5
3.6	Waste management activities (NEMWA)	Yes	3.6
3.7	Waste related authorizations	Yes	3.7
3.8	Other authorizations (EIAs, EMPs, RODs, Regulations)	Yes	3.8
Present Environmental Situation			
4.1	Climate	Yes	4.1
4.1.1	Regional Climate	Yes	4.1.1
4.1.2	Rainfall	Yes	4.1.2

Information		Included? (Yes/No)	Relevant section of IWWMP Report
4.1.3	Evaporation	Yes	4.1.3
4.2	Surface Water	Yes	4.2
4.2.1	Water Management Area	Yes	4.2.1
4.2.2	Surface Water Hydrology	Yes	4.2.2
4.2.3	Surface Water Quality	Yes	4.2.3
4.2.4	Mean Annual Runoff (MAR)	Yes	4.2.4
4.2.5	Resource Class and River Health	Yes	4.2.5
4.2.6	Receiving Water Quality Objectives and Reserve	Yes	4.2.6
4.2.7	Surface Water User Survey	Yes	4.2.7
4.2.8	Sensitive Areas Survey	Yes	4.2.8
4.3	Groundwater	Yes	4.3
4.3.1	Aquifer Characterisation	Yes	4.3.1
4.3.2	Groundwater Quality	Yes	4.3.3
4.3.3	Hydro-census	Yes	4.3.4
4.3.4	Potential Pollution Source Identification	Yes	4.3.5
4.3.5	Groundwater Model	Yes	4.3.6
4.4	Socio-economic environment	Yes	4.4
Analyses and characterisation of activity			
5.1	Site delineation for characterisation	Yes	5.1
5.2	Water and waste management	Yes	5.2
5.2.1	Process water	Yes	5.2.1
5.2.2	Storm water	Yes	5.2.2
5.2.3	Groundwater	Yes	5.2.3
5.2.4	Waste	Yes	5.2.4
5.3	Operational Management	Yes	5.3
5.3.1	Organisational structure	Yes	5.3.1
5.3.2	Resources and competence	Yes	5.3.2
5.3.3	Education and training	Yes	5.3.3

Information	Included? (Yes/No)	Relevant section of IWWMP Report
5.3.4 Internal and external communication	Yes	5.3.4
5.3.5 Awareness raising	Yes	5.3.5
5.4 Monitoring and control	Yes	5.4
5.4.1 Surface water monitoring	Yes	5.4.1
5.4.2 Groundwater monitoring	Yes	5.4.2
5.4.3 Bio monitoring	Yes	5.4.3
5.4.4 Waste monitoring	Yes	5.4.4
5.5 Risk assessment / Best Practice Assessment	Yes	5.5
5.6 Issues and responses from public consultation process	Yes	5.6
5.7 Matters requiring attention / problem statement	Yes	5.7
5.8 Assessment of level and confidence of information	Yes	5.8
Water and waste management		
6.1 Water and waste management philosophy (process water, storm water, groundwater, waste)	Yes	6.1
6.2 Strategies (process water, storm water, groundwater and waste)	Yes	6.2
6.3 Performance objectives / goals	Yes	6.3
6.4 Measures to achieve and sustain performance objectives	Yes	6.4
6.5 Option analyses and motivation for implementation of preferred options (Optional)	Yes	6.5
6.6 IWWMP action plan	Yes	6.6
6.7 Control and monitoring	Yes	6.7
6.7.1 Monitoring of change in baseline (environment) information (surface water, groundwater and bio-monitoring)	Yes	6.7.1
6.7.2 Audit and report on performance measures	Yes	6.7.2
6.7.3 Audit and report on relevance of IWWMP action plan	Yes	6.7.3
Conclusion		
7.1 Regulatory status of activity	Yes	7.1
7.2 Statement on water uses requiring authorization, dispensing with licensing requirement and possible exemption from regulations	Yes	7.2
7.3 Section 27 motivation	Yes	7.4
7.4 Proposed licence conditions	Yes	7.5

Information	Included? (Yes/No)	Relevant section of IWWMP Report
References		
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1 INTRODUCTION

1.1 Activity Background

Eloff Mining Company (Pty) Ltd intends to expand the existing Kangala Colliery with the addition of the new opencast mine, Eloff Phase 3 Project. Eloff Phase 3 Project is located 6km south-west of the town Delmas and 8.5km south-east of the town of Eloff in the Mpumalanga Province; and approximately 65km due east of Johannesburg. The mine is situated within the Victor Kanye Local Municipality.

The project area is located in the Delmas Coalfield. This coalfield can be sub-divided into three palaeo domains, namely:

- In the east is the Devon Basin;
- In the centre the Vischkuil Basin; and
- In the west the Springs Basin (also referred to as the Grootvlei Palaeo-valley).

The Eloff Phase 3 Project is located in the north-east of the Vischkuil Basin. The R42 provincial road crosses through the centre of the Eloff Phase 3 Project area in a north-east to south-west direction. The R555 provincial road runs along the north western boundary of the Eloff Phase 3 Project area.

The existing Kangala Colliery coal handling and processing plant (CHPP) is situated on the Kangala Mining Right area and is 3.2km from the R42 provincial road. The Kangala mine development commenced in May 2013, and first saleable coal was delivered in April 2014. Kangala's Mining Right (Ref. No. **MP 30//5/1/2/2/429 MR**) was granted on the 3rd of May 2012 by the Department of Mineral Resources (DMR) Mpumalanga Regional Office in terms of Section 23(1) of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA). The existing mining operation involves the exploitation of thermal coal contained in the Witbank Coal Fields using the truck and shovel opencast mining method, coal processing plant, and discard and slurry disposal facility. The total estimated ROM and Product production for Kangala is 3 700 000 and 2 400 000 tonnes respectively per annum, and the total estimated ROM production at the Eloff Phase 3 Project will remain the same. Kangala produces a low ash, high energy, and low Sulphur thermal coal for local market such as Eskom, with a proportion of the coal product exported.

The existing Kangala CHPP will be up-sized during 2019 to accept the increased production planned from 2019. The Eloff Phase 3 Project ROM coal will be hauled to the up-sized CHPP at Kangala Colliery for beneficiation.

Current mining activities at Kangala include opencast mining. A large pollution control dam (PCD) was constructed to address stormwater management around Kangala. A crushing, screening and washing plant is in operation for the processing of coal destined for the domestic markets and small portion to export market. A RoM Stockpile and product stockpiles are located at Kangala as well as a discard facility to store the discard coal separated during the washing plant process.

Universal Coal is the registered surface owner of Portion 1 of the farm Wolvenfontein 244 IR. Universal Coal also has a grant of servitude agreement in place with the Kallie-Madel Trust, who is the registered surface owner of the Remaining Extent of Portion 2 of the farm Wolvenfontein 244 IR.

In terms of the Water Use Authorisation, Kangala holds a Water Use Licence (Licence No. **04/B20A/ABCGIJ/1506**) granted on the 25th of May 2012 by the Department of Water and Sanitation (DWS) in terms of chapter 4 of the National Water Act, 1998 (Act No. 36 of 1998) (NWA), with its amendments issued on the 8th of April 2013 and 5th of August 2016 (Licence no: **03/B20A/A/A/4683**).

The mine is currently authorised by the Department of Water and Sanitation (DWS) to undertake the following water use activities on portion 1 and remaining extent of portion 2 of the farm Wolvenfontein 244 IR in terms of section 21 of the NWA:

- Section 21 (a) taking water from a water resources (groundwater abstraction borehole and opencast workings);
- Section 21 (b) storage of water (pressed steel tank- for domestic use)
- Section 21 (c) and (i) impeding or diverting the flow of water in a watercourse and altering the bed, banks, course or characteristics of a watercourse (upgrading of road crossing over a wetland and infrastructure with 500 m for the wetland);
- Section 21 (g) disposing of waste in a manner which may detrimentally impact on a water resource (sewage treatment facility, pollution control dam, and discard facility);
- Section 21 (j) removing of water found underground for the efficient continuation of an activity or for the safety of people (dewatering from the opencast workings).

Eloff Mining Company (Pty) Ltd's mining right adjoins Universal Coal's existing Kangala Colliery operation. Upon granting of mining right, Kangala's life of mine was 10 years. However, due to Eskom's demand for coal supply over the years, Kangala had to supply more coal tonnages than what was agreed between the Mine and Eskom. Consequently, the life of mine was reduced to 6 – 7 years. The current mine plan indicates that Kangala will run out

of coal in quarter 4 of 2019. The plan to extend Kangala's life of mine has always been to extend the current operation into the adjacent Eloff Mining Company (Pty) Ltd mining right area through a consolidation of mining activities.

The Eloff Phase 3 Project mine falls within the Delmas Coalfield of South Africa and is situated close to Leeuwpan and Mbuyelo Coal, which are operating coal mines. Eloff Mining Company Pty Ltd is the applicant for the Eloff Phase 3 Project mining right and is 100 percent owned by Universal Coal plc which is an Australian Securities Exchange-listed company.

1.2 Contact Details

Eloff Mining Company (Pty) Ltd is the applicant for this IWULA. Refer to Table 1.1 for the contact details of the applicant as well as the details of the consultant compiling this application.

Table 1.1: Contact Details

Item	Company Contact Details
Applicant	
Company Name	Eloff Mining Company (Pty) Ltd
Telephone Number	012 460 0805
Contact Person	Minah Moabi
Contact Person Mobile Number	076 431 3968
Email Address	m.moabi@universalcoal.com
Postal Address	PO Box 2423, Brooklyn Square, Pretoria, 0075
Physical Address	467 Fehrsen Street, Cnr Muckleneuk Brooklyn, Pretoria, 0181
Environmental Consultant	
Company Name	GCS Water and Environment (Pty) Ltd
Telephone Number	011 803 5726
Contact Person	Kate Cain
Email Address	kate@gcs-sa.biz
Postal Address	PO Box 2597 Rivonia 2128
Physical Address	63 Wessel Road Rivonia 2128

1.3 Regional Setting and Location of Activity

1.3.1 Regional Setting

The proposed project site is located 6km south-west of the town Delmas and 8.5km south-east of the town of Eloff in the Mpumalanga Province and approximately 65km due east of Johannesburg. Refer to Figure 1.1 for a map showing the locality of the project area.

1.3.2 Magisterial District and Local Municipality

The expansion area is situated in the south-western parts of Mpumalanga Province within ward 7 of the Victor Kanye Local Municipality which is under the jurisdiction of the Nkangala District Municipality (Figure 1.1).

1.4 Property Description

The proposed project site is located on portions on farm Strydpan 243 (Refer to Table 1.2 and Figure 1.2 for the farm portion descriptions). The Eloff Phase 3 Project will be over a total area of 856.815Ha.

Table 1.2: Property Details

Property Description	Size of property (ha)	Title deed No.	Property owner
Strydpan 243 IR Ptn 14	64.29577	T41791/1984	Eloff Mining Co Pty Ltd
Strydpan 243 IR Ptn 15	64.2525	T41791/1984	Eloff Mining Co Pty Ltd
Strydpan 243 IR Ptn 16	64.14852	T41791/1984	Eloff Mining Co Pty Ltd
Strydpan 243 IR Ptn 18	64.0748	T41791/1984	Eloff Mining Co Pty Ltd
Strydpan 243 IR Ptn 19	64.02477	T41791/1984	Eloff Mining Co Pty Ltd
Strydpan 243 IR Ptn 20	64.13398	T41791/1984	Eloff Mining Co Pty Ltd
Strydpan 243 IR Ptn 22	64.2289	T41791/1984	Eloff Mining Co Pty Ltd
Strydpan 243 IR Ptn 23	64.28106	T41791/1984	Eloff Mining Co Pty Ltd
Strydpan 243 IR Ptn 24	64.11705	T41791/1984	Eloff Mining Co Pty Ltd
Strydpan 243 IR Ptn 59	6.898564	T41791/1984	Eloff Mining Co Pty Ltd
Total	**856.8157**		

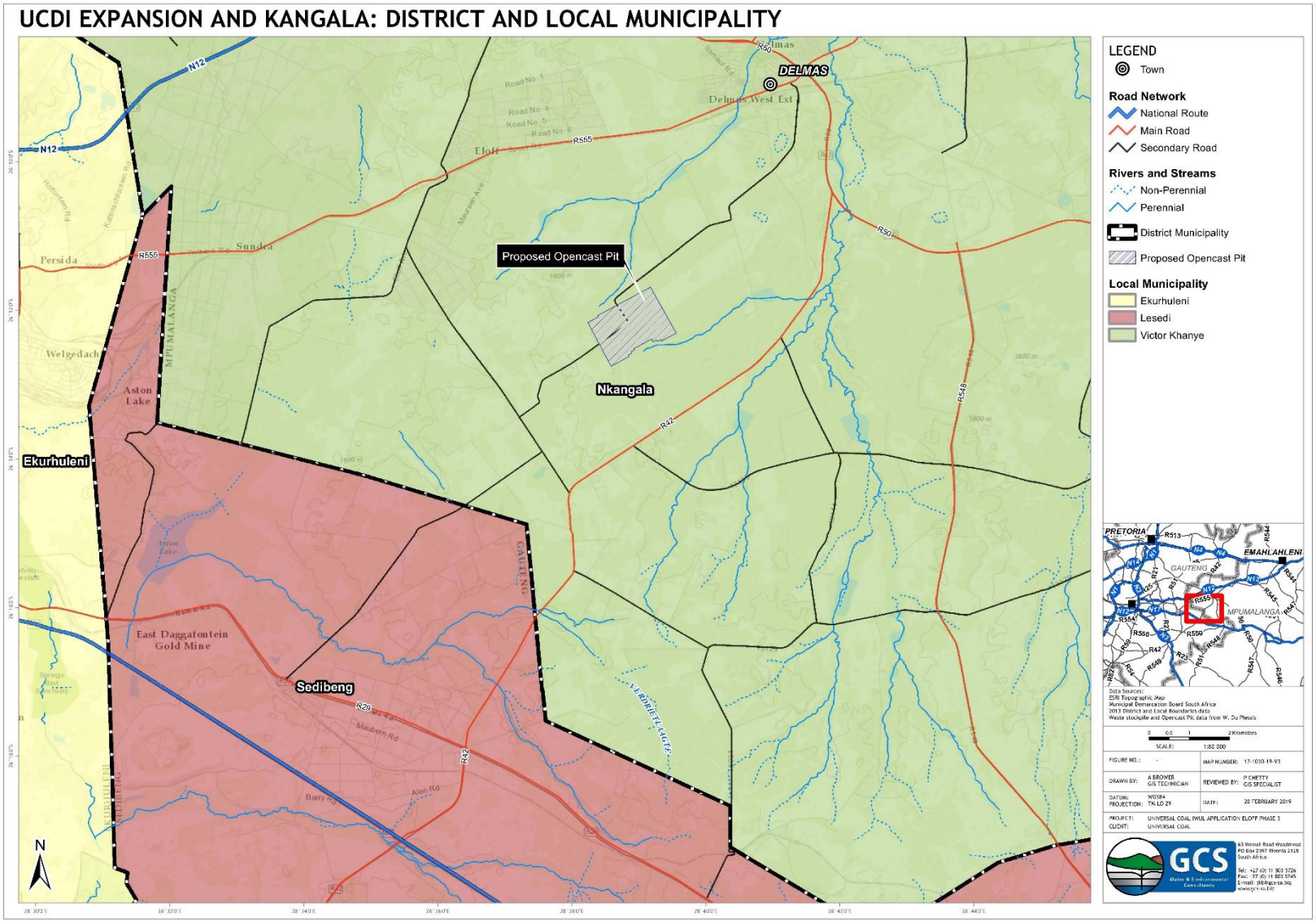


Figure 1.1: District and Local Municipality

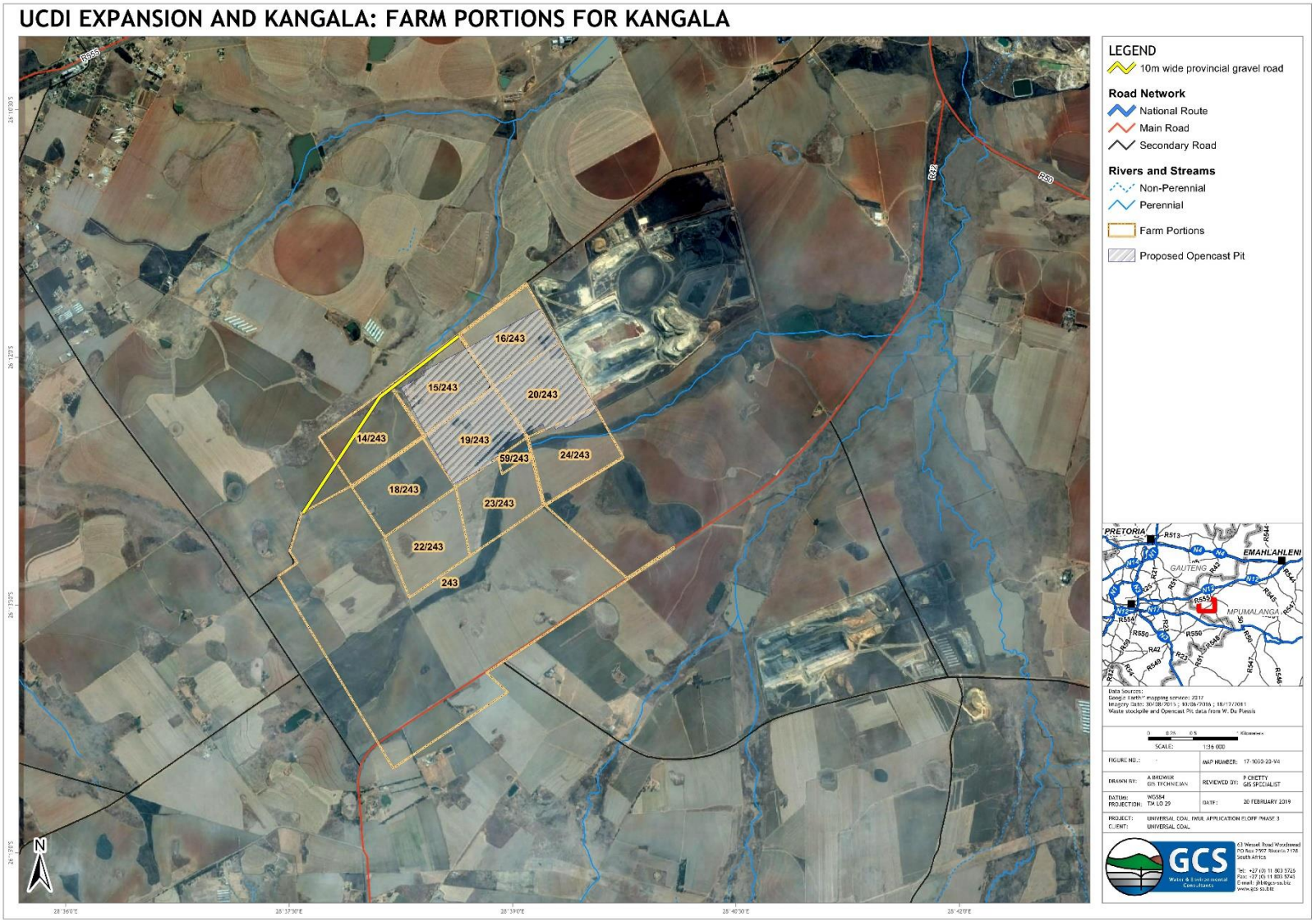


Figure 1.2: Eloff Phase 3 Project properties

1.5 Purpose of the IWWMP

This document serves as the technical report to motivate the authorisation of the water uses triggered by the proposed Eloff Phase 3 Project.

As there are waste related uses associated with the proposed development, this report has been structured in line with the approved Integrated Water and Waste Management Plan (IWWMP) Operational Guideline compiled by the DWS.

The purpose of the IWWMP includes:

- Compilation of a site specific, implementable, management plan addressing all the identified water use and waste management relates aspects of a specific activity, in order to meet set goals and objectives in accordance with Integrated Water Resource Management (IWRM) principles;
- Provision of a management plan to guide the 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 the IWWMP Guideline as compiled by the DWS, to enable DWS to make a 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 contents of the IWWMP;
- Standardisation of the format of supporting documentation which DWS requires during the 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 DWS requires to enable them to evaluate the supporting documentation to make a decision on authorising a water use; and;
- Ensuring that a consistent approach is adopted by DWS and the various Regional Offices and Catchment Management Agencies (CMA) with regards to IWWMPs.

The IWWMP also strives to show the DWS that the selected management measures included into the IWWMPs action plan adhere to the SMART concept which refers to:

- S – Sustainable;
- M – Measureable;
- A – Achievable;
- R – Resources Allocated; and
- T – Timeframe Specific.

2 CONCEPTUALISATION OF THE ACTIVITY

2.1 Description of the Activity

The existing Kangala Colliery currently exploiting bituminous coal reserves from the No. 2 and No. 4 seams of the Vryheid Geological Formation (Witbank Coal Field) within the Ecca Group. The Eloff Phase 3 Project resource area (which lies directly adjacent to the existing colliery as depicted in Figure 2.1) has a favourable strip ratio for opencast mining (MWP, 2018). The total coal resource at Kangala will continue to be mined by opencast mining methods. Similarly, at the Eloff Phase 3 Project, the total resource will be mined by opencast mining methods. This ensures the maximum extraction of these two resource areas (MWP, 2018).

The current opencast pits at Kangala will be mined up to Q4 2019 and mining operations will start at the Eloff Phase 3 Project in Q4 2019, with the establishment of the box cut. As the production at Kangala ramps down, the production at the Eloff Phase 3 Project will ramp up and by financial year 2020, the total production will be from the Eloff Phase 3 Project.

The Eloff Phase 3 Project has a ROM reserve of 41.17Mt in the current planned mining area. The total Eloff Phase 3 Project area contains 784.11 gross tonnes in situ (GTIS). Currently only 44.95 Mt of the total GTIS have been converted to ROM reserves through a detailed mining plan with a balance of 739.16Mt. The balance of the GTIS will be included in the next phase of mine planning. Based on the ROM and product production schedule, Eskom and Kusile Power Station products can be produced for 10 years at ~ 430 000tpm (MWP, 2018). The mining schedule for the opencast was designed to allow for a continuation of the current steady-state production and a sharp ramp-down of production at the end of the Project life.

From 2018 to 2019, all the ROM coal will be produced from Kangala only. Production from the Eloff Phase 3 Project will commence in 2019, and this will be the last year that coal will be produced from Kangala. Due to the multiple seams planned to be mined and the wide range of raw qualities, the following product options are planned (MWP, 2018):

- Eskom:
    - A 19.5 Megajoules per kilogram (MJ/kg) calorific value (CV) product; and
    - This product will be produced from all the seams mined.
- Eskom Kusile:
    - A 19.0 MJ/kg CV product; and
    - Kusile Power Station coal quality specifications are generally lower than what Eskom expects for Khutala and other power stations.

The raw coal qualities at Kangala are similar to those at the Eloff Phase 3 Project resource. The MM Seam at Kangala produces an export product at washing yields above 70 % but no export products are currently planned to be produced from the Eloff Phase 3 Project.

2.1.1 Mining Method

Based on the business philosophy of Eloff Mining Company Pty Ltd, the opencast mining operations will be outsourced. The opencast mining contractors apply standard truck and shovel mining methods based on a strip mining design and layout (MWP, 2018).

The mining method that has been applied since the start of mining operations at Kangala is standard truck and shovel strip mining, which is described as follows (MWP, 2018):

- The topsoil is removed by truck and shovel and stored at the designated area;
- Thereafter, the softs will be removed by truck and shovel and stored at the designated material stockpiles;
- Next, cast blasting of the hard overburden material will be employed;
- Roll-over dozing of the hard overburden material will follow, where practical;
- Truck and shovel mining techniques are then applied to remove the hard overburden material in order to expose the various coal seams;
- Finally, the coal seams will be excavated by truck and shovel mining techniques; and
- Any parting or interburden material between the coal seams will be drilled and blasted before being removed by the truck and shovel technique.

The process is repeated on a strip-by-strip basis. Material (apart from the topsoil) will then be rolled-over into the void created by the removal of the waste and coal in the previous bench, with the hard overburden and parting/ interburden forming the base, followed by the softs, levelled, and finally topsoil will be placed and seeded.

2.2 Extent of the Activity

The IWWMP is developed to cover the project sites entire area of operations in order to manage all water and waste issues on site. Refer to Figure 2.1 for a map indicating the extent of the proposed Eloff Phase 3 Project.

The project site is located on farm portions mentioned in Section 1.4. The total footprint of the Eloff Phase 3 Project mine will be approximately 856Ha. The boundary coordinates for the combined project area (existing Kangala Colliery and the Eloff Phase 3 Project area) are provided in Table 2.1.

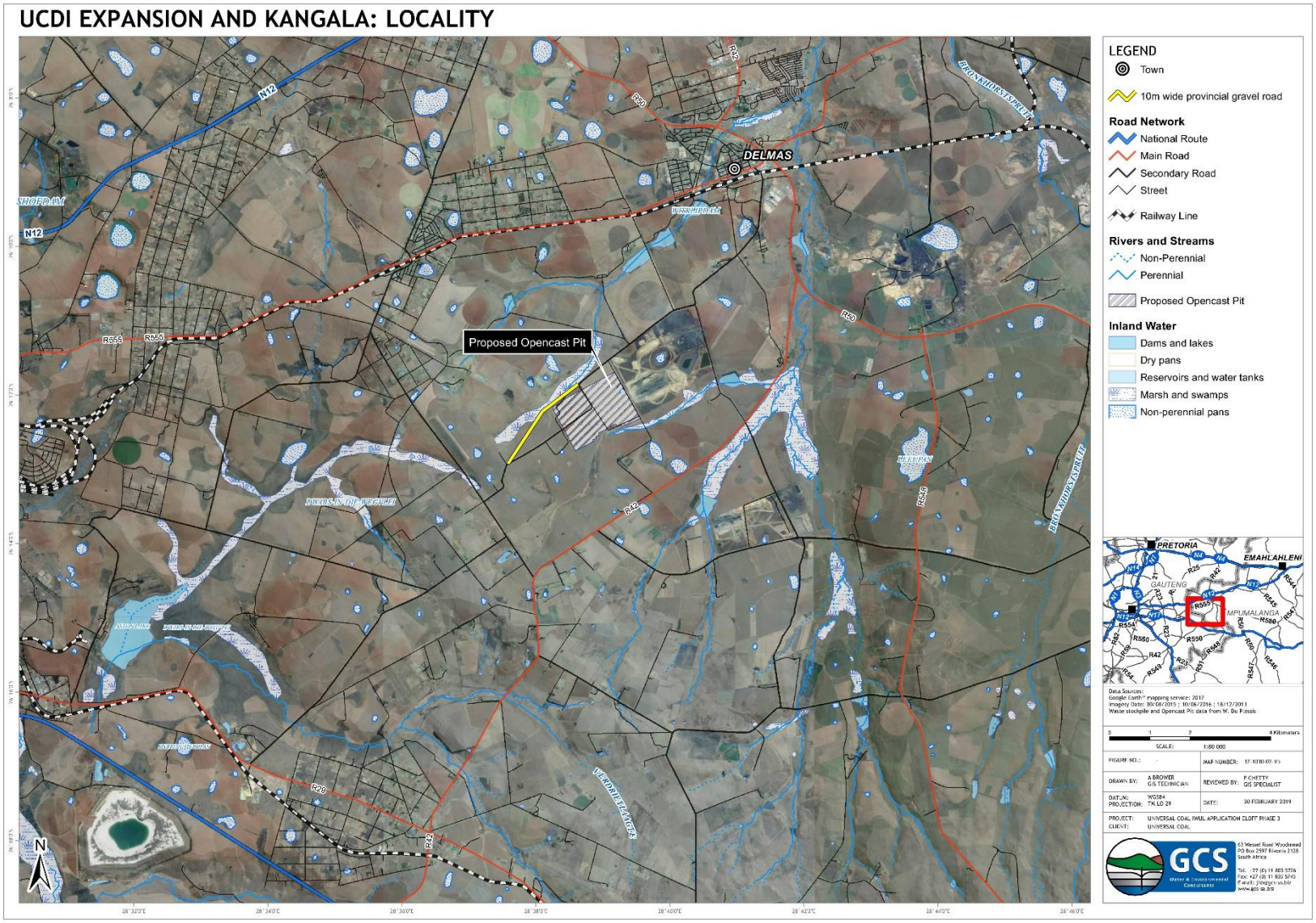


Figure 2.1: The Eloff Phase 3 Project locality

Table 2.1: Eloff Phase 3 Project Boundary Coordinates

Code	Co-Ordinates (Metres) Lo 29 (WGS84)	
	Y	X
A	+ 43 849.50	+ 2 897 359.03
B	+ 42 794.57	+ 2 896 837.96
C	+42 040.48	+ 2 897 005.25
D	+41 908.49	+ 2 898 565.17
E	+40 541.30	+ 2 899 936.56
F	+ 39 736.55	+ 2 897 836.58
G	+ 36 626.88	+ 2 899 597.06
H	+ 34 814.10	+ 2 898 225.88
J	+ 32 536.45	+ 2 902 300.87
K	+ 32 373.89	+ 2 904 039.51
L	+ 32 542.31	+ 2 905 155.84
M	+ 33 401.01	+ 2 908 047.37
N	+ 32 662.29	+ 2 909 487.92
P	+ 32 671.84	+ 2 911 421.29
Q	+ 37 278.75	+ 2 909 291.06
R	+ 37 455.21	+ 2 907 407.37
S	+ 37 736.67	+ 2 904 403.30
T	+ 41 767.02	+ 2 903 190.91
U	+ 43 546.05	+ 2 902 739.39
V	+ 43 297.03	+ 2 901 758.18
W	+ 44 578.47	+ 2 901 432.93
X	+ 44 083.71	+ 2 899 483.36
Y	+ 43 522.28	+ 2 899 154.61
Z	+ 43 991.00	+ 2 897 810.11
A1	+ 43 841.36	+ 2 897 788.44
B1	+ 43 864.34	+ 2 897 634.31
C1	+ 43 803.12	+ 2 897 629.15
D1	+34 546.22	+ 2 903 244.12

2.3 Key Activity Related Processes and Products

The Eloff Phase 3 Project will do opencast mining with standard truck and shovel mining methods based on a strip mining design and layout. The mining operation will begin with the creation of a cut with the first coal being produced by September 2020. The topsoil, soft overburden, and hard overburden from the box cut will be taken and stored at Kangala. On

completion of the box cut, mining will continue on a roll-over basis, placing the next strips overburden back into the previous strip.

All the coal extracted at the Eloff Phase 3 Project will be trucked and processed at the Kangala CHPP ("Plant"). The CHPP has two processing streams, namely:

- Stream One has the capacity to screen and crush 350 ROM tonnes per hour (tph) for the sale of a raw product; and
- Stream Two consists of a pre-screening and crushing section and a DMS washing section that can process 300 ROM tph.

At 6,480 operating hours per annum, the CHPP can process 4.2 million ROM tpa. The annual ROM production is planned to be increased to between 5.0 and 6.0 million ROM tpa from 2019. The current CHPP will be upsized during 2019 to cater for the increased ROM tonnes. Negotiations with Eskom indicate that this market requires ~ 200 000 tonnes per month (tpm) of a 19.5 MJ/kg CV product for Eskom and ~ 230 000 tonnes per month of a 19.0 MJ/kg product for Kusile Power station.

2.4 Activity Life Description

The Eloff Phase 3 Project opencast production will start in 2019, which is the last year that coal will be produced from the Kangala opencast and continue up to 2028 when the reserves in the current Eloff Phase 3 Project area are estimated to be depleted. From 2020, all production will be from the Eloff Phase 3 Project while an Eskom 19.5 MJ/kg CV product and a Kusile Power Station 19.0 MJ/kg product will be produced. The mining schedule can be seen in Figure 2.2 below:

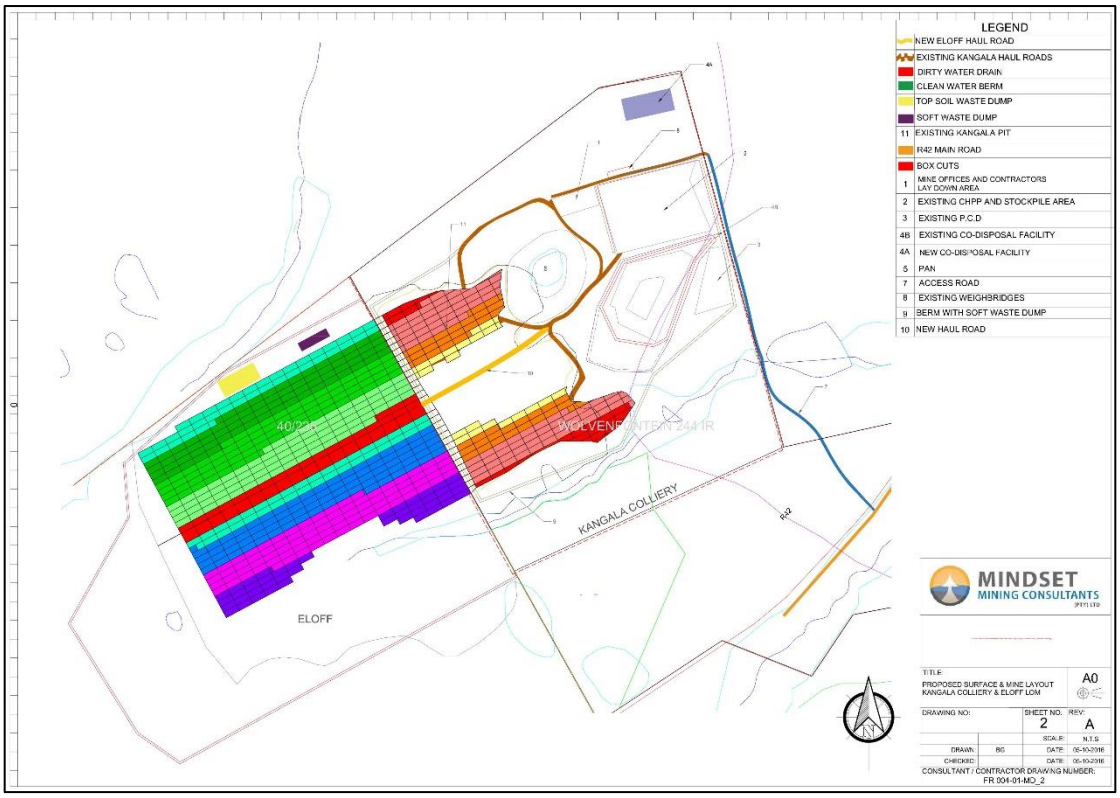


Figure 2.2: Mining Schedule

2.5 Activity Infrastructure Description

2.5.1 Kangala Colliery Mining Infrastructure

The Eloff Phase 3 Project mine will apply opencast mining only and the infrastructure is based on servicing an opencast mine. The following infrastructure has been established for the opencast mining operations at Kangala:

- Pit access ramps;
- Haul roads, at the opencast pit and to the CHPP;
- Waste dump areas for topsoil, soft overburden, and hard overburden (includes interburden);
- ROM stockpiles for each of the seams at the CHPP;
- Product stockpiles;
- Clean water cut-off canals around the:
    - ROM stockpile area, including crushing;
    - Contractors laydown area;
    - Along the haul roads; and
    - Around the waste dumps.
- Dirty water catchment drains at the:
    - ROM stockpile area, including crushing;

    - Contractors laydown area; and
    - Along the haul roads.
- In-pit sumps for water management;
- Pollution Control Dam (PCD);
- Piping system for water management;
- Mining contractor's laydown area (compacted pads for the purpose of placing and/ or assembling offices, workshops, diesel farm, etc.);
- Waste management facility pad;
- Access road from the R42 road to the opencast mining area;
- Weighbridge facility;
- Potable water supply point/tank;
- Bio Disc sewage plant;
- A power supply point to the opencast contractor's laydown area; and
- Three steel water containment.

The ROM coal from the Eloff Phase 3 Project will be transported by the opencast haul trucks to the tipping point at the CHPP.

2.5.2 CHPP Infrastructure

The Kangala CHPP consists of two processes:

- Crush and Screen: High-quality raw coal, from the MBC1 and MBC2 Seams, are directly crushed and screened to the final Eskom product; and
- Dense medium separation (DMS) plant:
    - Lower raw quality coal is crushed, screened, and then washed to produce a higher grade coal that can be blended with the raw product to produce the final Eskom product.

The following infrastructure exists at the CHPP area:

- Power supply;
- Potable water supply;
- Raw make-up water supply;
- Offices;
- Workshops;
- Stores;
- Change house;
- Access roads;
- Access road to the Eskom and export product stockpiles;

- Weighbridges;
- Product stockpiles;
- Conveyor belts; and
- ROM and Products stockpiles.

There is an existing discard dump to the east of the CHPP. The discard produced is hauled by road to this discard dump for placement and compaction. Run-off water drains have been constructed around this discard dump for managing the polluted run-off water. The existing Kangala CHPP will be up-sized during 2019 to ensure the higher ROM production from 2019 can be processed.

2.5.3 Eloff Phase 3 Project Mining Infrastructure

The mining infrastructure that needs to be established to enable the production operations at the Eloff Phase 3 Project area is the following:

- Opencast pit;
- Haul road to the tipping point at the CHPP;
- Stormwater canals channelled into the pit;
- Sumps in the Pit for water management; and
- Piping system to the existing PCD.

The required surface infrastructure such as offices, stores facility, workshops, and change houses already exists at Kangala and thus does not need to be replicated for the operations at the Eloff Phase 3 Project area.

2.5.4 Power Supply

There is an existing power supply of 3.5 megavolt amperes (MVA) from Eskom at Kangala. The power is supplied at 11 kilovolts (kV) and is transformed from 11 kV to 1,000 volts (V) and 400 V through the installation of a substation. No power supply will be required at the Eloff Phase 3 Project area, as only mining will be conducted there. When, and if, pumping of water is required, it will be performed by diesel pumps. The existing power supply is adequate for the life of the Eloff Phase 3 Project.

2.5.5 Fuel and Lube Facilities

At the opencast contractor's laydown area at Kangala, the following facilities have been established by the contractor:

- Diesel bay area;
- Wash bay area with a silt trap and oil separator;
- Oil, gas, and chemical store;

- Workshop; and
- Waste management slab for the placing of the necessary waste disposal bins.

Each facility is designed to ensure that water contaminated with hazardous fluids, diesel and other lubricants used on site, is captured and channeled to the oil separation plant for purification prior to being pumped to the existing Pollution Control Dam (PCD). The oil recovered from the purification process will be stored in oil containers and disposed of according to the Waste Management Plan.

The Eloff Phase 3 Project will utilise the existing fuel and lubrication facilities at Kangala Colliery. The facilities are maintained within the care and maintenance strategy of the Kangala complex to ensure operational readiness for when the Eloff Phase 3 Project opencast mining commences. At the CHPP area complex, the fuel and lube facilities have also been established.

2.5.6 Access Roads

The Eloff Phase 3 Project area is well served by paved provincial roads. The main road serving the area is the R42 paved road, which runs south-east of the proposed Eloff Phase 3 Project area. This road links to the towns of Delmas and Nigel and crosses the N17 highway with on and off ramps to this highway. The R42 also links with the N12 Johannesburg to Witbank highway.

There is an existing access road to Kangala and the CHPP area. The access road includes roads to the various product stockpiles, the mine office complex, and to the contractors' laydown area. The road weighbridges required for weighing the product coal loaded for road transport to the respective markets have been installed at the main gate leading into the Kangala mine. Based on the roads that serve the Eloff Phase 3 Project area and the existing access road to Kangala, only one community access road will need to be diverted. Refer to Figure 2.1 for the proposed new access road.

2.6 Key Water Uses and Waste Streams

2.6.1 Water Uses

The Kangala operation has an approved IWUL. This application aims to apply for a water use licence to cover the Eloff Phase 3 Project opencast pit and haul roads.

During operations at Kangala, 35m^3/hr volume of water is required in order to run the mine and process the coal, as well as for domestic use. Water is currently being sourced from boreholes on the site which is being stored in a clean water storage dam with a capacity of 1

000m^3. The Kangala Colliery is a holder of Water Use Licence (**04/B20A/A/4683**) for the operation granted by the DWS in terms of the National Water Act, 1998 (Act No. 36 of 1998).

The water uses that require authorisation in terms of Section 21 of the NWA are as follows:

- Section 21(c) – Impeding or diverting the flow of water in a watercourse;
- Section 21(g) – Disposing of waste in a manner which may detrimentally impact on a water resource;
- Section 21(i) – Altering the bed, banks, course or characteristics of a watercourse; and
- Section 21(j) – Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.

The Eloff Phase 3 Project will make use of the Kangala PCD, which is already licenced. The water removed from the mine workings, return flows from the sewage treatment plant is disposed of into a PCD. The authorised volumes to be disposed of into the PCD is approximately 56 067.74m^3 per day (672 812.88m^3/a). The water collected in the PCD will be reused in the processing plant and for dust suppression.

Table 2.2: Eloff Phase 3 Project Water Uses

Water Uses - Eloff Project					
Section 21(c) and (i)					
Water Use No.	**Description**	**Co-ordinates**	**Property**	**Capacity (m^3)**	**Applicable Volume (m^3/a)**
1	Access road within 500m of HGM 1 (channelled valley bottom wetland) and watercourse	Start 26°11'52.98"S 28°38'38.68"E End 26°12'56.85"S 28°37'37.08"E	Portion 13 of Farm Strydpan 243 Portion 14 of Farm Strydpan 243 Portion 15 of Farm Strydpan 243	Not Applicable	Not Applicable
2	Activities within 500m of HGM 3 (Depression)	26°13'9.53"S 28°38'19.50"E	Portion 22 of Farm Strydpan 243	Not Applicable	Not Applicable
3	Mining through Seep (HGM 4) as a result of opencast pit	26°11'58.22"S 28°39'18.02"E	Portion 16 of Farm Strydpan 243	Not Applicable	Not Applicable
4	Mining through Depression (HGM 3) as a result of opencast pit and opencast within 500m of HGM 3	26°12'23.69"S 28°38'36.84"E	Portion 19 of Farm Strydpan 243	Not Applicable	Not Applicable

5	Watercourse located within 100m/1:100 year floodline of the open pit.	Start 26°12'27.72"S 28°39'32.97"E End 26°12'52.32"S 28°38'53.48"E	Portion 59 of Farm Strydpan 243 Portion 24 of Farm Strydpan 243	Not Applicable	Not Applicable
6	Watercourse located within 100m/1:100 year floodline of open pit.	Start 26°12'0.34"S 28°38'28.96"E End 26°12'11.82"S 28°38'13.99"E	Portion 15 of Farm Strydpan 243	Not Applicable	Not Applicable
Section 21(g)					
Water Use No.	**Description**	**Co-ordinates**	**Property**	**Capacity (m^3)**	**Applicable Volume (m^3/a)**
7	Dust Suppression	26°12'13.62"S 28°38'53.05"E	Portion 19 of Farm Strydpan 243	Not Applicable	128 373
Section 21(j)					
Water Use No.	**Description**	**Co-ordinates**	**Property**	**Capacity (m^3)**	**Applicable Volume (m^3/a)**
8	Removing, discharging or disposing of water found underground	26°11'48.96"S 28°39'12.64"E	Portion 15, 16, 19 and 20 of the Farm Strydpan 243	Not Applicable	1 690 140

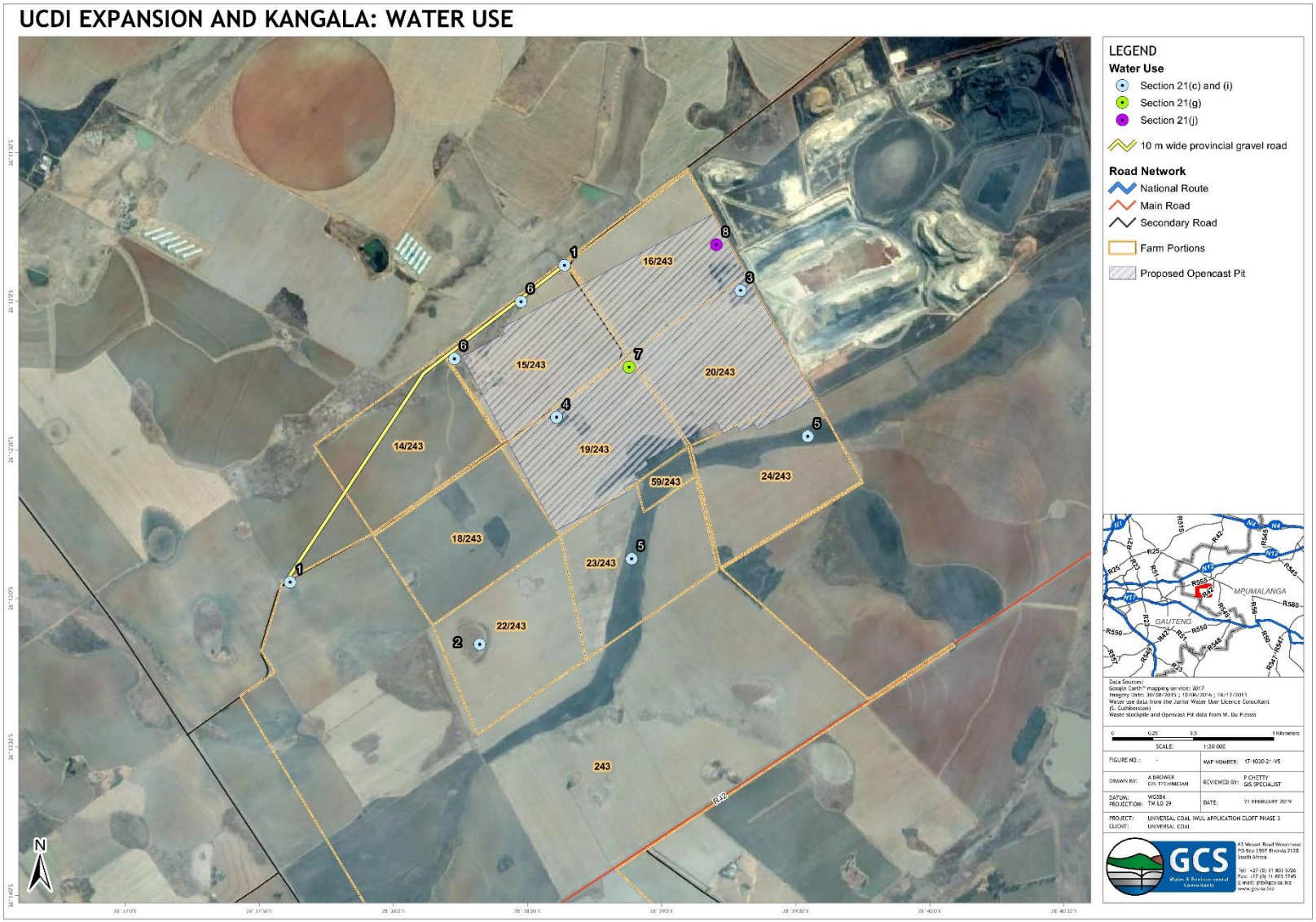


Figure 2.3: Eloff Phase 3 Project Water Uses

2.6.2 Waste Streams

Kangala has all the required waste licence approvals and waste sites. The Eloff Phase 3 Project opencast operations will utilise the same waste licence approvals and waste sites as currently used by Kangala.

The waste dump areas will make use of the existing waste dump area at Kangala. The topsoil dump, a soft material dump, and a waste rock dump will also be located at Kangala. Some of the soft material will be used to construct a berm around the opencast pit to prevent clean rainwater from entering the pit and to direct the surface rain water into the surrounding waterways (MWP, 2018).

Dirty water cut-off drains will also be constructed around the pit to prevent polluted water from being released from the mining area. The waste dumps, berms, and cut-off drains are shown in Figure 2.4.

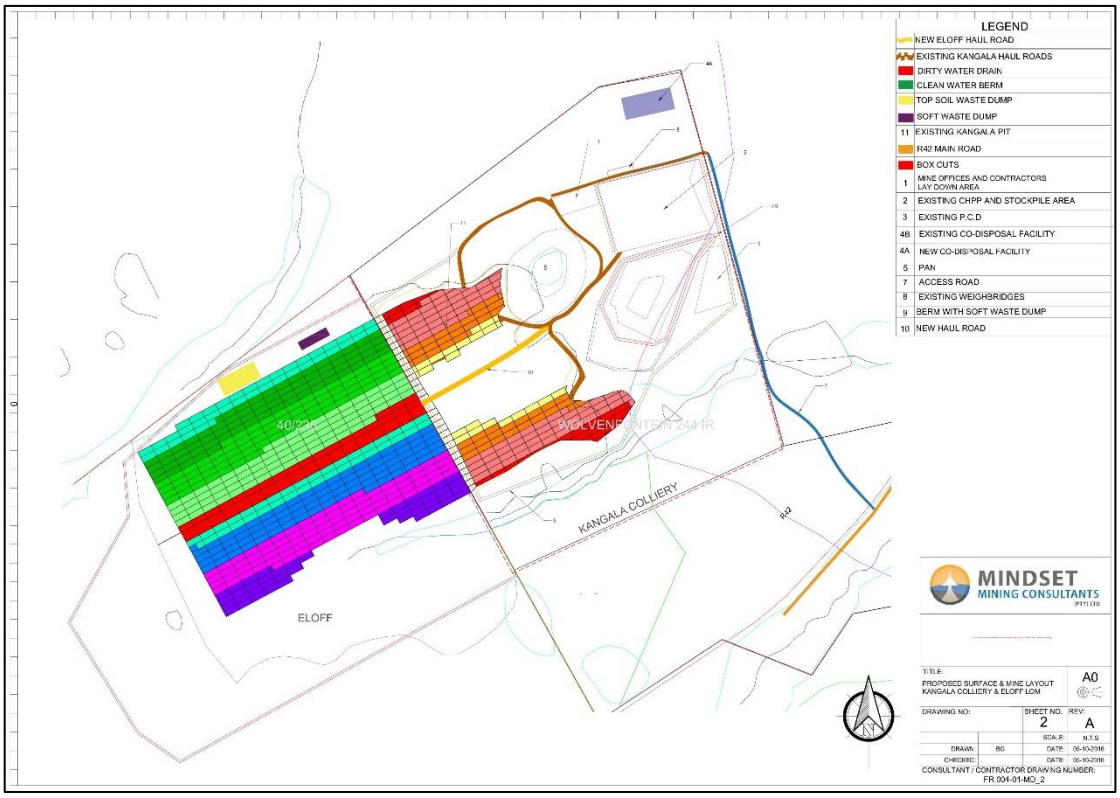


Figure 2.4: Mine Infrastructure

Sumps will be created in the pit to collect all dirty water and the water from the sumps will be pumped to the Kangala PCD from where it will be used for dust suppression.

The following waste streams are generated at Kangala Colliery:

- General domestic waste (e.g. food waste, papers, plastics, glass, cans, and garden waste);
- Spend oil and grease from the mine workshop, as well as hydrocarbon containers
- Coal discard waste;
- Scrap waste (scrap metals and empty chemical containers);
- Wood waste (packaging material); and
- Other waste material such as fluorescent tubes, old batteries, and waste paints.

2.7 Organisational Structure of Activity

Kangala has been an operating mine since 2013. The Eloff Phase 3 Project will be the life extension of Kangala from 2019/2020 when the coal reserves at Kangala are depleted.

The business model adopted by Eloff Mining Company Pty Ltd is based on utilising a number of outsourced services level contracts covering the entire operation of the mine from mining to product logistics, with Eloff Mining Company Pty Ltd providing sufficient financial and human resources to ensure that:

- The mine maintains its license to operate;
- Business objectives are met; and
- Facilities and services that fall between or across contracts are provided for by Eloff Mining Company Pty Ltd

Eloff Mining Company Pty Ltd.'s Head Office will assist the Eloff Phase 3 Project in the form of human resources, industrial relations, public relations, as well as in a legal and financial capacity. The cost of providing this service will partially be recovered as a management fee charged to the Mine.

Approximately 720 personnel will be retain their jobs at the Mine, either on a full-time or part-time basis. Figure 2.5 illustrates the proposed mine organisational structure, reporting lines, and primary and secondary service level contracts employed.

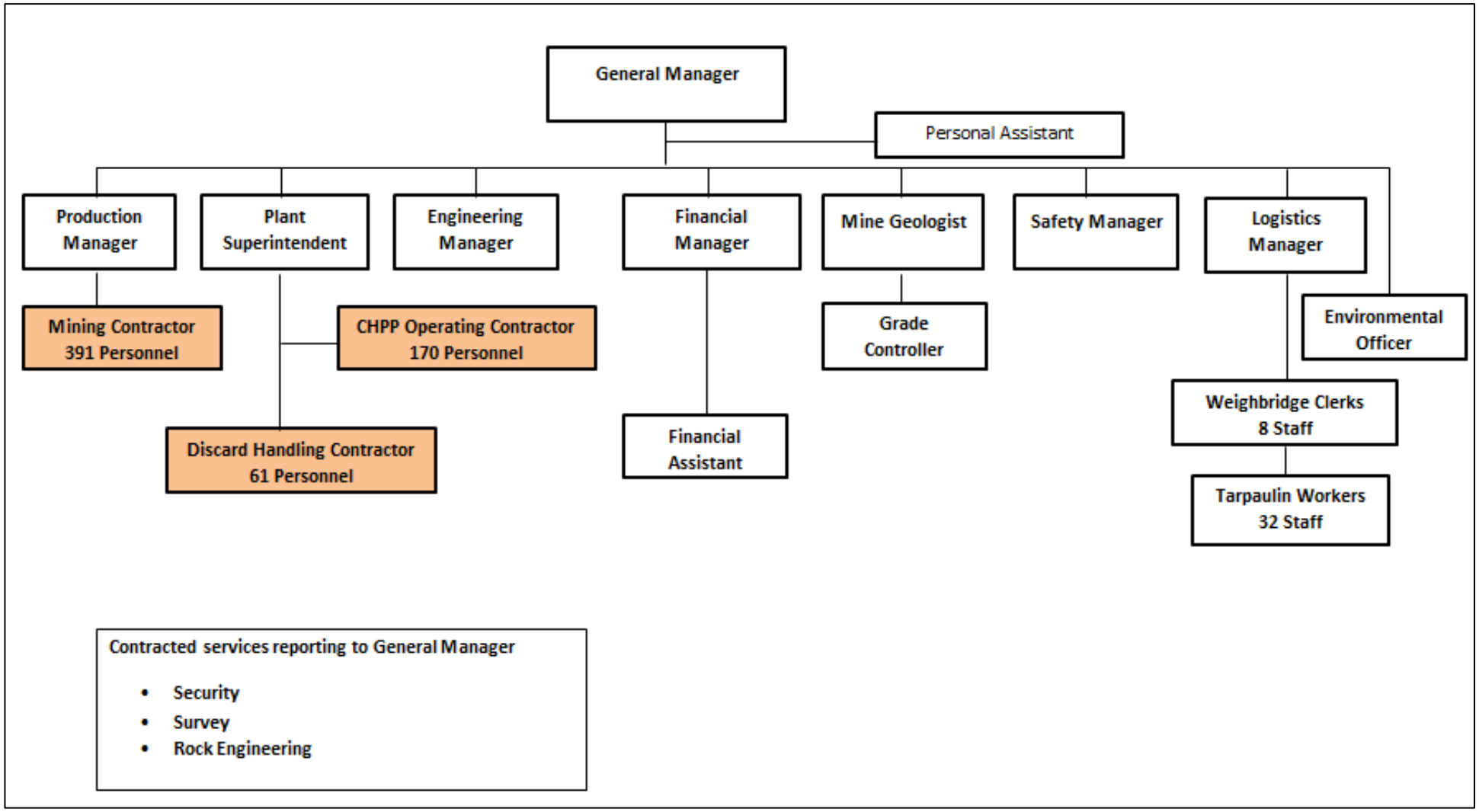


Figure 2.5: Proposed Mine Organisational Structure

2.8 Business and Corporate Policies

Eloff Mining Company Pty Ltd is committed to the safety and protection of its employees and the environment (Figure 2.6). This mine has developed and implemented the following policies at Kangala Colliery. Furthermore, the mine has a signed occupational health, safety, and environment commitment statement as shown below:

Safety and Health

The safety and health of employees and contractors are a priority for Eloff Mining Company Pty Ltd and appropriate risk management systems exist for all production sites. Employees are provided with appropriate and on-going training and protective gear to prevent injuries and health risks. It has been established that the greatest future threat to the workforce will continue to be that of HIV/ AIDS – Eloff Mining Company Pty Ltd have implemented a comprehensive AIDS awareness programmes including on-going workforce education and training, voluntary HIV counselling and testing and primary care wellness programmes.

Environmental Risk Management Policy

Eloff Mining Company Pty Ltd takes a proactive approach towards environmental management and prior to mining activities, all environmental impacts are identified and environmental management plans (EMP) developed. The EMP is developed to address the negative environmental impacts, which could arise from the exploration phase, during mining and at mine closure.

The main environmental aspects of Eloff Mining Company Pty Ltd.'s operations relates to water management, land/biodiversity management, waste management (hazardous materials), air quality management, energy consumption and greenhouse gas emissions. Eloff Mining Company Pty Ltd.'s goal is to go beyond compliance with environmental statutory requirements.

Environmental objectives and targets are being developed to provide clear benchmarks against which to measure the improvement and success of our environmental programmes over time.

Environmental monitoring reviews which include inspections, risk assessments, internal and independent audits and the processing and analyses of environmental data are conducted regularly to assess and generate mitigation plans to manage the impacts of mining activities on the environment.

Kangala Colliery has been granted all relevant environmental licenses to operate, i.e. Environmental Management Plans in terms of the MPRDA, 2002 (Act No. 28 of 2002) and Integrated Water Use Licenses in terms of the National Water Act, 1998 (Act No. 36 of 1998), and Waste Licenses in terms of the National Environmental Waste Act, 2008 (Act No. 59 of 2008).

universal
Coal and Energy Holdings
South Africa (Pty) Ltd

OCCUPATIONAL HEALTH, SAFETY AND ENVIRONMENTAL COMMITMENT

Our Vision – Zero harm is achievable

When extracting and processing coal at our various operations, we at **Universal Coal Energy Holdings South Africa (Pty) Ltd** (UCEHSA) aspire to Zero Harm to people, our host communities and the environment as much as operationally practicable. We are committed to introduce and sustain a healthy and safe working environment, by operating in an environmentally and socially responsible manner, focused on share price while adding value to all stakeholders.

Principles

- A zero tolerance approach will save lives and protect the environment
- Be responsible and accountable
- Embrace the culture of learning from previous incidents
- Respect and protect the culture, beliefs and heritage of the communities in which we operate
- Simple, Non-negotiable standards and rules

Our Policy

Central to UCEHSA's goal of zero harm is our commitment to develop, implement and maintain Occupational Health, Safety and Environmental Management Systems that drive continual improvement and to ensure we:

Utilize Occupational Health, Safety and Environmental Management systems, based on International standards - OHSAS 18001 and ISO 14001 requirements to achieve improved SHE performance and ultimately prevent injury, ill health and pollution associated with coal mining activities.

Never limit the essential resources needed to demonstrate the leadership and commitment of Management, necessary for the SHE management system to be successful and to achieve improved SHE performance.

Identify, assess and prioritise the Occupational Health, Safety and Environmental risks associated with current and planned future operations, and to set appropriate objectives, targets and management programmes to manage these risks

Value our partnership with the community, to ensure sustainable community development to enhance economic benefits from our operation and contribute to improving quality of life within the community;

Engage regularly, openly and honestly with government, non-governmental organizations and the community, taking their views and concerns into account in our decision-making;

Responsibly train employees to a standard where they can work in an environmentally responsible way, participate and recognise hazards relating to their task and to be able to respond and effectively manage any incident or emergency situation.

Strictly comply with all applicable Health, Safety and Environmental legislation and go beyond legal compliance in managing our risks/impacts with the inclusion of sustainability principles set by commercial requirements and stakeholder expectations, such as the Equator Principles, OHSAS 18001 and ISO 14001 requirements and other requirements

Avoid, and where this is not possible minimise adverse impacts on the unique ecological and landscape features of the region, through conserving natural resources, reducing green house gases, reducing waste and preventing pollution to air, water and land.

Lead by example, Line Management is responsible and will be held accountable for the implementation of this policy and all employees, including contractors and visitors will contribute to the Policy through responsible safe behaviour.

TONY WEBER
UNIVERSAL COAL CEO

10/04/2015
DATE

This policy will be reviewed at appropriate intervals and revised whenever necessary to ensure that it remains relevant and appropriate to UCEHSA. UCEHSA will make this policy available for interested parties on request.

10 April 2015

Figure 2.6: Universal Coal's Policy

3 REGULATORY WATER AND WASTE MANAGEMENT FRAMEWORK

3.1 Summary of all Water Uses

Refer to Table 2.2 for the summary of water uses at the Eloff Phase 3 Project.

3.2 Existing Lawful Water Uses

Existing Lawful Water Use (ELWU) is defined in Section 32 of the National Water Act 1998, (Act No. 36 of 1998) (NWA) as any water use which has taken place at any time during a period of two years immediately before the date of commencement of the NWA or which has been declared an existing lawful water use under Section 33 and which was authorised by or under any law which was in force immediately before the date of commencement of the NWA.

There are no existing lawful water uses taking place on the property. All water uses proposed to take place are being applied for as part of the IWULA and will be authorised in terms of a Water Use License issued by the DWS.

3.3 Relevant Exemptions

The Minister of Water and Sanitation is responsible for the protection, use, development, conservation, management and control of the water resources of South Africa on a sustainable basis. The requirements prescribed in terms of the regulations must be seen as minimum requirements to fulfil this goal.

In order for the Eloff Phase 3 Project operations to meet the requirements of sustainable water use, the following exemptions are requested as part of the IWULA:

- Exemption from Government Notice No. 704 (GN 704), Regulation 4 (Restriction on locality) which is required in terms of mining within 100 meter horizontal distance from a watercourse which requires an exemption in terms of regulation (a) (Table 3.1).

Table 3.1: Regulation 704 Compliance

GN704	Condition	Eloff Mining Company Pty Ltd
1	Definitions	Will Comply
2 (1)	Notify DWS of the intention to operate a new mine or conduct any new activity at least 14 days prior to start of operation or activity	Will Comply
2 (2) a	Submit to DWS a copy of all EMPR amendments	Will Comply
2 (2) b	Notify DWS in writing 14 days prior to temporary or permanent cessation of operation, or resumption of operation	Will Comply
2 (2) c	Notify DWS by fastest means possible of any emergency incident or potential emergency incident involving a water resource by providing the following information: date/time, description, source of pollution and impact on water resource and relevant users, and remedial action taken. Notification on new mine or new activity ; "Activity" includes --	Will Comply
2(2)(c)(a)	any mining related process on the mine including the operation of washing plants, mineral processing facilities, mineral refineries and extraction plants, and	Will Comply
2(2)(c)(b)	the operation and the use of mineral loading and off-loading zones, transport facilities and mineral storage yards, whether situated at the mine or not;	Will Comply
2(2)(c)(b)(i)	in which any substance is stockpiled, stored, accumulated or transported for use in such process; or	Will Comply
2(2)(c)(b)(ii)	out of which process any residue is derived, stored, stockpiled, accumulated, dumped, disposed of or transported,	Will Comply
2 (2) d	Within 14 days of such incident report in writing to DWA measures taken to correct and prevent recurrence of such incident (notify of emergency incidents)	Will Comply
4	Minister may authorise exemption from requirements of Regulations 4, 5, 6, 7, 8, 10 or 11	Will Comply
4 a	Locate or place any residue deposit, dam, reservoir, together with any associated structure within 1:100 year flood-line or within a horizontal distance of 100m of a watercourse or borehole, excluding boreholes drilled specifically to monitor the pollution of ground water, or on ground likely to become water-logged, undermined, unstable or cracked	Will Comply
4 b	**No opencast mining, prospecting or any other operation or activity under or within the 1:50 year flood-line or within a horizontal distance of 100m from any watercourse**	**Exemption Requested**

GN704	Condition	Eloff Mining Company Pty Ltd
4 c	No placement or disposal of any residue or substance, which causes or is likely to cause pollution of a water resource, in the underground workings or opencast excavation.	Will Comply
4 d	Locate any sanitary convenience, fuel depots, reservoir or depots for any substance which causes or is likely to cause pollution within the 1:50 year flood line of any watercourse	Will comply
5	May not use any residue or substance which causes or is likely to cause pollution of water resource for the construction of any dam or other impoundment or any embankment, road or railway or for any other purpose which is likely to cause pollution of a water resource	Will comply
6 a	Any unpolluted water must be confined to a clean water system, away from any dirty area	Will Comply
6 b	Clean water systems must be designed, constructed, maintained and operated so that it is not likely to spill into any dirty water system more than once in 50 years	Will Comply
6 c	Water arising within any dirty area must be collected, including water seeping from mining operations, outcrops or any other activity, into a dirty water system	Will Comply
6 d	Any dirty water systems must be designed, constructed, maintained and operated so that it is not likely to spill into any clean water system more than once in 50 years	Will Comply
6 e	Dams and tailings dams which form part of the dirty water system must be designed, constructed, maintained and operated with a minimum freeboard of 0.8 m above full supply level, unless otherwise agreed with DWS with respect to the dam safety regulations	Will Comply
6 f	Water systems shall be designed, constructed and maintained 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.	Will Comply
7 a	Prevent water containing waste or any substance which causes or is likely to cause pollution of water resource from entering any water resource, either by natural flow or by seepage and retain or collect such water for use, reuse, evaporation or for purification and disposal	Will Comply
7 b	Design, modify, locate, construct and maintain all water systems, including residue deposits, in any area so as to prevent the pollution of any water resource through the operation or use thereof	Will Comply
7 c	Cause effective measures to be taken to minimise the flow of any surface water or floodwater into mine workings	Will Comply

GN704	Condition	Eloff Mining Company Pty Ltd
7 d	Design, modify, construct, maintain and use any dam or any residue deposit or stockpile used for the disposal or storage of mineral slimes, so that the water or waste therein will not result in the failure thereof or impair its stability	Will Comply
7 e	Prevent the erosion or leaching of materials from any residue deposit or stockpile and contain material or substances so eroded or leached in by providing suitable barrier dams, evaporation dams or any other effective measures to prevent this material or substance from entering and polluting any water resources	Will Comply
7 f	Ensure that water used in any process at the mine is recycled as far as practicable, and any facility, sump, pumping installation, catchment dam or other impoundment used for recycling water is of adequate design and capacity to prevent the spillage, seepage or release of water containing waste at any time	Will Comply
7 g	Keep any water system free from any matter or obstruction which may affect the efficiency thereof	Will Comply
7 h	Cause all domestic waste which cannot be disposed of in a municipal system to be disposed of in terms of the Act.	Will Comply
8 a	Any impoundment or dam containing any poisonous, toxic or injurious substance must be effectively fenced-off to restrict access thereto, and must have warning notice boards at prominent locations to warn persons of the hazardous contents thereof	Will Comply
8 b	Access control in any area used for stockpiling or disposal of any residue or substance which causes, has caused or is likely to cause pollution of water resource is required to protect any measures taken in terms of this regulation	Will Comply
8 c	The mine shall not allow the area contemplated in 8 a) and b) above to be used for any other purpose, if such use causes or is likely to cause pollution of a water resource	Will Comply
8 d	The mine must protect any existing pollution control measures or replace any measures deleteriously affected, damaged or destroyed by the removing or reclaiming of materials from any residue deposit or stockpile, and must establish additional measures for the prevention of pollution of a water resource which might occur, is occurring or has occurred as a result of such operations	Will Comply
9	On decommissioning, to ensure remediation of the affected water resource due to the mining activity	Will Comply
10	Winning sand and alluvial minerals from a watercourse	Not Applicable
11 a	To ensure all coal residue deposits are compacted to prevent spontaneous combustion and minimise infiltration of water	Will Comply
11 b	To ensure rehabilitation of coal residue deposits concurrent with mining	Will Comply

GN704	Condition	Eloff Mining Company Pty Ltd
12 (1)	DWS may, after consultation with the DMR and DEAT, require a technical investigation or inspection of pollution prevention measures or any potential damage to the in stream or riparian habitat	Will Comply
12 (2)	Such investigation must be conducted and reported on as prescribed by DWA within a specified time period	Will Comply
12 (3)	The mine must inform DWA of the expertise and qualifications of the persons who are to conduct the investigation or inspection prior to commencement of the work	Will Comply
12 (4)	DWS may require a programme of implementation to prevent or rectify any pollution of a water resource of damage to in stream/riparian habitat as recommended in the above inspections/investigations	Will Comply
12 (5)	DWS may require a compliance monitoring network to monitor the programme of implementation in Regulation 12 (4)	Will Comply
12 (6)	Subject to Chapter 4 of the Act, the mine must submit plans, specifications and design reports by the approved professional person to DWS not later than 60 days prior to commencement of activities in relation to: surface dams for impounding waste, water containing waste or slurry; implementation of pollution control measures at residue deposits or stockpiles; and implementation of any water control measures at any residue deposit or stockpiles	Will Comply
13	The mining company must support the mine manager with the means and afford him/her every facility required to enable the mine manager to comply with these provisions	Will Comply
14	Offences and penalties	Not applicable
15	Repeal of regulations	Not applicable
16	Commencement	Not applicable

3.4 Generally Authorised Water Uses

All water uses that are being applied for are being done so as part of this IWULA and not a General Authorisation. Thus, there are no general authorisations applicable to the Eloff Phase 3 Project.

3.5 New Water Uses to be Licensed

No water use activities have been authorised yet for Eloff Phase 3 Project, this document serves to apply for an IWUL. Refer to Section 2.6.1 for a summary of all of the water uses applicable to the Expansion project area. All of these water uses require authorisation in terms of an IWUL issued by the DWS.

3.6 Waste Management Activities (NEM: WA)

The National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM:WA) fundamentally reformed the law regulating waste management, and for the first time provides a coherent and integrated legislative framework addressing all the steps in the waste management hierarchy. The objectives of the NEM:WA are to protect health, well-being and the environment by providing reasonable measures for, inter alia, remediating land where contamination presents, or may present, a significant risk of harm to health or the environment. The objectives of the NEM: WA are structured around the steps in the waste management hierarchy, which is the overall approach that informs waste management in South Africa. The waste management hierarchy consists of options for waste management during the lifecycle of waste, arranged in descending order of priority; i.e. waste avoidance, reduction, re-use, recycling, recovery, treatment, and safe disposal as a last resort.

NEMA, as previously mentioned, introduced a number of additional guiding principles into South African environmental legislation, including the life-cycle approach to waste management, producer responsibility, the precautionary principle and the polluter pays principle (i.e. the sustainability principles as contained in Section 2 of NEMA). Section 5(2) of the NEM: WA stipulates that the Act should be interpreted and guided in accordance with these sustainability principles. The NEM: WA, furthermore, echoes the duty of care provision, in terms of Section 28 of NEMA, by obliging holders of waste to take reasonable measures to implement the waste management hierarchy. Section 16(1) of the NEM: WA provides that:
"A holder of waste must, within the holder's power, take all reasonable measures to –

a) Avoid the generation of waste and where such generation cannot be avoided, to minimise the toxicity and amounts of waste that are generated;
b) Reduce, re-use, recycle and recover waste;
c) Where waste must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner;

d) Manage the waste in such a manner that it does not endanger health or the environment or cause a nuisance through noise, odour or visual impacts;
e) Prevent any employee or any person under his or her supervision from contravening this Act; and
f) Prevent the waste from being used for an unauthorised purpose."

While the NEM: WA creates a comprehensive legal framework for waste management, its provisions will be meaningless without measures to monitor and, where necessary, enforce compliance. Compliance monitoring is supported by a range of reporting provisions contained in the NEM:WA. In addition to compliance reports for waste management licences and norms and standards, the NEM: WA has provisions for annual performance reports on the implementation of provincial and local Integrated Waste Management Plans. Industry Waste Management Plans are subject to review at intervals to be determined by the authority that mandated the plan. Furthermore, Environmental Management Inspectors and Waste Management Officers can request a Waste Impact Report where they suspect a contravention of the Act, licence conditions or exemption conditions.

The NEM: WA provides for a licensing regime specific to waste management activities. It replaces the historical system of permits issued in terms of the repealed Section 20 of the ECA. Transitional arrangements allow existing permits granted in terms of ECA to be regarded as licences in terms of the NEM: WA until the Minister requires a licence application as per the NEM: WA category of the waste management activity (i.e. category A or B). The NEM: WA waste management categories determine the environmental assessment procedure (which is the equivalent of the NEMA EIA regulations' requirements) required to obtain a licence.

Category A activities require a BA process to be undertaken, whilst Category B activities require a S&EIR process to be undertaken.

The recently amended legislation concerning EIAs makes reference to the development of norms and standards which may guide EIA applications and Environmental Authorisations in the future. The production of appropriate norms and standards for specific forms of developments is ongoing and it is anticipated that this will eventually provide the opportunity to further streamline the EIA procedures in relation to particular forms of developments. Depending on the location of developments, it is important to note that applicable Norms and Standards are no different from regulations in law in that they are both equally binding.

3.7 Waste Related Authorisations

Kangala has all of the required waste licence approvals and waste sites. The Eloff Phase 3 Project will utilise the same waste licence approvals and waste sites as currently used by Kangala.

Kangala Colliery is the holder of a Waste Management License (**License No.: 12/9/11/L445/6**) for treatment of sewage and construction of the sewage treatment plant on portion 1 and the RE of portion 2 of the farm Wolvenfontein 244 IR. The license was granted by the National Department of Environmental Affairs (DEA) on the 27th of June 2012, in terms of section 49 (1) (a) of the National Environmental Management Waste Act, 2008 (Act No. 59 of 2008) (NEMWA).

3.8 Other Authorisations (EIAs, EMPs, RODs, Regulations)

Kangala is the holder of a Mining Right (Ref. No.: **MP30/5/1/2/2/429 MR**) for the existing Kangala Colliery granted by the Department of Mineral Resources Mpumalanga Regional Office in terms of Section 23 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA).

In terms of legislative requirements, Universal Coal was issued a Water Use Licence (WUL) (Licence No. **04/B20A/ABCGIJ/1506**) on the 25th of May 2012 by the Department of Water and Sanitation (DWS). The WUL was issued in terms of Chapter 4 of the National Water Act, 1998 (Act No. 36 of 1998) (NWA), with an amendment issued on the 8th of April 2013 and the 5th of August 2016 (Licence no: **03/B20A/A/A/4683**). The following water uses have been authorised for the existing Kangala Colliery in terms of Section 21 of the NWA:

- Section 21(a) – Taking water from a water resource;
- Section 21(b) – Storing of water;
- Section 21(c) – Impeding or diverting the flow of water in a watercourse;
- Section 21(g) – Disposing of waste in a manner which may detrimentally impact on a water resource;
- Section 21(i) – Altering the bed, banks, course or characteristics of a watercourse; and
- Section 21(j) – Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.

3.9 Legislation

3.9.1 Constitution of South Africa, 1996 (Act No.108 of 1996)

The Constitution of the Republic of South Africa, 1996 (Act No.108 of 1996) compels all to ensure the fundamental rights of all citizens. Section 24 of the act states the following:

Everyone has the right:

a) To an environment that is not harmful to their health or wellbeing, and

b) To have an environment protected for the benefit of present and future generations through reasonable legislative and other measures that-

I. Prevent pollution and ecological degradation;

I. Promote conservation; and

II. Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

The environmental legislation promulgated since the constitution has given legal effect to this section of the Constitution.

3.9.2 National Environmental Management Act, 1998 (Act No. 107 of 1998)

The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) is South Africa's overarching framework for environmental legislation. The NEMA sets out the principles of Integrated Environmental Management (IEM). The NEMA aims to promote sustainable development, with wide-ranging implications for national, provincial, and local government. Included amongst the key principles is that all development must be environmentally, economically and socially sustainable and that environmental management must place people and their needs at the forefront, and equitably serve their physical, developmental, psychological, cultural and social interest.

The NEMA is the environmental framework legislation promulgated to replace the Environmental Conservation Act, 1989 (Act No. 73 of 1989), and ensure that the environmental rights contemplated in Section 24 of the Constitution are realised. NEMA sets out:

- the fundamental principles that need to be incorporated in the environmental decision making process;
- the principles that are necessary to achieve sustainable development;
- provides for duty of care to prevent, control and rehabilitate the effect of significant pollution and environmental degradation; and
- it allows for the prosecution of environmental crimes.

The NEMA provides for the identification of activities, which will impact the environment. These activities were promulgated in terms of Regulations 982, 983, 984 and 985, published 4 December 2014 and require environmental authorisation.

The impacts of the listed activities must be investigated, assessed and reported to the competent authority before authorisation to commence with such listed activities can be granted.

3.9.3 The Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)

Granting of permission to mine or prospect, among others, is conditional on an environmental management programme and plan being submitted and accepted by the relevant government authority. Section 43 is one of the most important provisions as it deals with the responsibility for any environmental liability, pollution or ecological degradation until the issue of the closure certificate. In terms of Section 43 of the MPRDA, the holder of a prospecting, mining right or permit remains responsible for any environmental liability, until a closure certificate has been issued. Section 43(1) states:

"The holder of a prospecting right, mining right, retention permit, mining permit, or previous holder of an old order right or previous owner of works that has ceased to exist, remains responsible for any environmental liability, pollution, ecological degradation, the pumping and treatment of extraneous water, compliance to the conditions of the environmental authorisation and the management and sustainable closure thereof…"

These holders will remain responsible "***...until the Minister has issued a closure certificate in terms of this Act to the holder or owner concerned."***

However, in terms of NEMA, Section 24R, the abovementioned holders will remain liable even if a closure certificate was issued in terms of the MPRDA. Section 24R(1) states that:

"... remain responsible for any environmental liability, pollution or ecological degradation, the pumping and treatment of polluted or extraneous water, the management and sustainable closure thereof notwithstanding the issuing of a closure certificate by the Minister responsible for mineral resources in terms of the Mineral and Petroleum Resources Development Act, 2002, to the holder or owner concerned."

It is important to note, that environmental liability will not necessarily cease or fall away by the issuing of a closure certificate. In addition to the broader liability provisions above, Section 45 provides that the relevant authority may direct a mine to undertake remedial measures where:

"...any prospecting, mining, reconnaissance or production operations cause or results in ecological degradation, pollution or environmental damage which may be harmful to the health or well-being of anyone and requires urgent remedial measures."

Where the mine fails to take these measures, the relevant authority will act on its behalf and then recover costs incurred from the mine. If the mine fails to compensate the authority, the latter is empowered to seize and sell the mine's property to recover the costs. The mine will thus remain financially liable for the rehabilitation, even if it chooses to ignore the government directive.

3.9.4 The National Water Act, 1998 (Act No.36 of 1998)

The purpose of the National Water Act, 1998 (Act No. 36 of 1998) (NWA) is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled. Sections 40 and 42 of NWA provides for the responsible authority to request public participation and an assessment of the likely effect of the proposed licence the protection, use, development, conservation, management and control of the water resource.

The NWA defines 11 consumptive and non-consumptive water uses in terms of Section 21 of the NWA:

- Section 21(a): Taking water from a water resource;
- Section 21(b): Storing water;
- Section 21(c): Impeding or diverting the flow of water in a watercourse;
- Section 21(d): Engaging in a stream flow reduction activity;
- Section 21(e): Engaging in a controlled activity: irrigation of any land with waste or water containing waste;
- Section 21(f): Discharging waste or water containing waste into a water resource through a pipe, canal, sewer or other conduit
- Section 21(g): Disposing of waste in a manner which may detrimentally impact on a water resource;
- Section 21(h): Disposing in any manner of water which contains waste from, or which has been heated in any industrial or power generation process;
- Section 21(i): Altering the bed, banks, course or characteristics of a watercourse;
- Section 21(j): Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people;
- Section 21(k): Using water for recreational purposes.

Water uses that are not permissible in terms of Schedule 1 of the NWA need to be authorised under a tiered authorisation system as a General Authorisation in terms of the General

Authorisations as published under section 39 of the NWA or as a water use licence, as provided for in terms of section 21 of the NWA.

The authorisation system allows for the "Reserve" and provides for public consultation processes in the establishment of strategies and decision making and guarantees the right to appeal against such decision.

Section 27 of the NWA specifies that the following factors regarding water use authorisation be taken into consideration:

- the efficient and beneficial use of water in the public interest;
- the socio-economic impact of the decision whether or not to issue a licence;
- alignment with the catchment management strategy;
- the impact of the water use and possible resource directed measures; and
- investments made by the applicant in respect of the water use in question.

Section 26(1) of the NWA states:

- Subject to subsection (4), the Minister may make regulations:
    - (a) limiting or restricting the purpose, manner or extent of water use;
    - (b)requiring that the use of water from a water resource be monitored, measured and recorded;
    - (c) requiring that any water use be registered with the responsible authority;
    - (d) prescribing the outcome or effect which must be achieved by the installation and operation of any water work;
    - (e) regulating the design, construction, installation, operation and maintenance of any water work, where it is necessary or desirable to monitor any water use or to protect a water resource;
    - (f) requiring qualification for and registration of persons authorised to design, construct, install, operate and maintain any water work, in order to protect the public and to safeguard human life and property;
    - (g) regulating or prohibiting any activity in order to protect a water resource or instream or riparian habitat;
    - (h) prescribing waste standards which specify the quantity, quality and temperature of waste which may be discharged or deposited into or allowed to enter a water resource;
    - (i) prescribing the outcome or effect which must be achieved through management practices for the treatment of waste, or any elements of waste, before it is discharged or deposited into or allowed to enter a water resource;

- (j) requiring the waste discharged or deposited into or allowed to enter a water resource be monitored and analysed, and prescribing methods for such monitoring and analysis;
- (k) prescribing procedural requirements for license applications;
- (l) relating to transactions in respect of authorisations to use water, including but not limited to:
  - (i) the circumstances under which a transaction may be permitted;
  - (ii)the conditions subject to which a transaction may take place; and
  - (iii) the procedure to deal with a transaction;
- (m) prescribing methods for making a volumetric determination of water to be ascribed to a stream flow reduction activity for the purpose of water use allocation and the imposition of charges;
- (n) prescribing procedures for the allocation of water by means of public tender or auction; and
- (o) prescribing:
  - (i) procedures for obtaining; and
  - (ii) the required contents of, assessments of the likely effect which any proposed licence may have on the quality of the water resource in question.

4 PRESENT ENVIRONMENTAL SITUATION

4.1 Climate

The project area falls within the Highveld climatic zone, which consists of moderate summer rainfall with cold winters. Effectively three seasons, namely a cool dry season from May to mid-August, a hot dry season from mid-August to about October and a hot wet season from about November to April.

The monthly distribution of average daily maximum temperatures shows that the average mid-day temperature for Delmas ranges from 16°C in June to 25°C in January. The region is the coldest during July.

4.1.1 Regional Climate

The Eloff Phase 3 Project lies within the summer rainfall region of South Africa, which is characterised by showers and thunderstorms. Approximately 90 percent of the Mean Annual Precipitation (MAP) occurs within the six month period between October and March, with only five percent of the MAP occurring between April and September.

4.1.2 Rainfall

The rainfall data was extracted from two sources: The Daily Rainfall Extraction Utility program and Water Resources of South Africa 2005 Study (WR2005). A summary of the six nearest rainfall stations, together with the monthly rainfall obtained from WR2005 is shown below in Table 4.1.

Table 4.1: Summary of monthly rainfall

Months	Rietfontein 0476737 W	Vlakplaas 0477494 W	Strydpan 0477224 W	Droogefontein 0477191 W	Delmas (POL) 0477309 W	Rietkuil 0477459 W	WR2005
January	114	118	117	111	118	114	118
February	94	90	101	100	96	86	90
March	81	76	82	81	85	90	84
April	42	34	44	40	41	41	40
May	19	16	17	15	19	18	17
June	6	5	6	6	6	7	7
July	7	5	7	6	6	6	5
August	7	8	11	7	8	6	6
September	24	21	24	21	22	20	19
October	57	61	60	63	67	63	66
November	106	104	106	102	102	103	105
December	117	98	108	112	106	117	109
MAP (mm)	**674**	**637**	**682**	**664**	**676**	**671**	**669**

Based on the above estimations it is observed that the MAP ranges between 637mm to 669mm, with the average MAP of the six nearest stations estimated to be 671mm. The MAP obtained from the WR2005 study for quaternary catchment B20A is slightly conservative (669mm) when compared to the six stations and is therefore selected as the adopted MAP for the project area.

4.1.3 Evaporation

Monthly evaporation data was obtained from the Water Resources of South Africa manual, (WR2005, 2009). Evaporation was calculated using a Symons pan, which is a square shaped containment, filled with water and buried below the natural ground level as indicated in Figure 4.1. Change in water level because of evaporation losses is then measured daily and recorded.

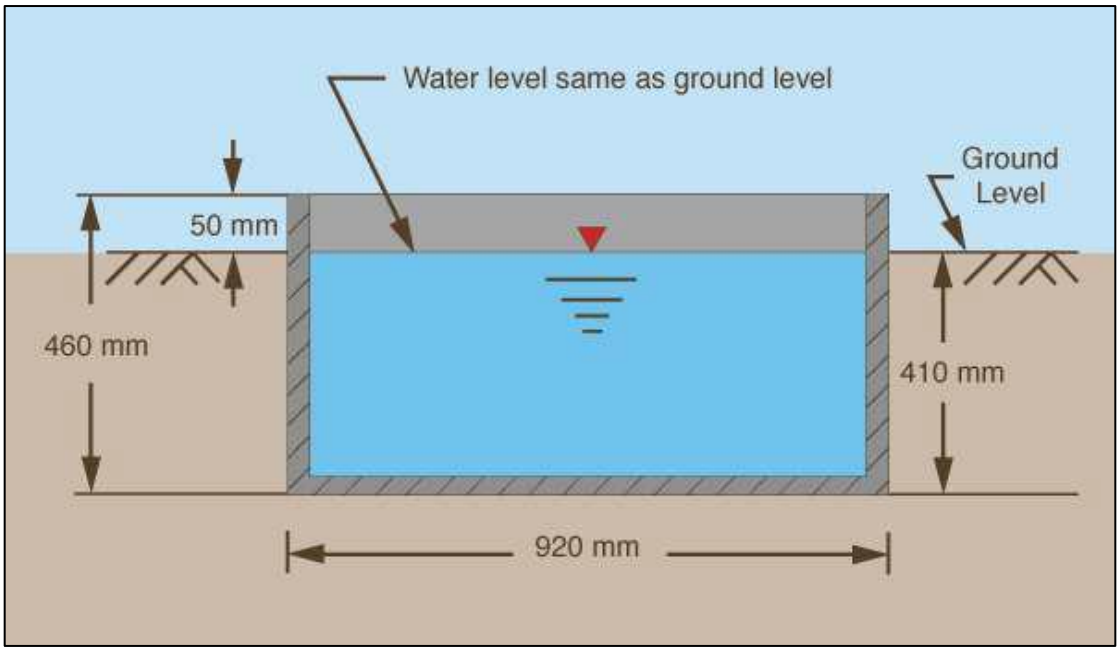


Figure 4.1: Symons Pan

High evaporation rates are experienced between the months of October to March but decrease, with peak monthly evaporation of 153mm occurring in December. Lower evaporation occurs between the months of May to August and range from 67mm to 92mm. It is observed that throughout the year, evaporation rates exceeds the monthly rainfall, resulting in a negative climatic water balance. Table 4.2 provides a summary of the adopted evaporation for the project site.

Table 4.2: Summary of evaporation data

Months	Symons Pan Evaporation (mm)	Lake Evaporation Factor	Lake Evaporation (mm)
January	182	0.84	152
February	151	0.88	133
March	149	0.88	131
April	115	0.88	101
May	97	0.87	84
June	79	0.85	67
July	86	0.83	71
August	114	0.81	92
September	148	0.81	119
October	178	0.81	144
November	168	0.82	138
December	185	0.83	153
Total	**1650**		**1387**

4.2 Surface Water

Information contained in this section has been sourced from the Hydrology Investigation for the project area. The full Hydrological report is attached as Annexure A. It must be noted that the hydrological study included the waste stockpiles, however, the waste stockpiles will be located at the existing Kangala Colliery and will no longer be located the Eloff Phase 3 Project.

4.2.1 Water Management Area

The Eloff Phase 3 Project falls within Quaternary Catchment B20A (Bronkhorstspruit Catchment) of the Upper Olifants WMA (Figure 4.2) and has a net mean annual runoff (MAR) of 25.60 million cubic meters (mcm) which is based on the (WR2012, 2015). The catchment covers an area of approximately 574.300 km^2. The Bronkhorstspruit Catchment is bordered on the north by Osspruit Catchment (B20C), to the north-east by Wilge River Catchment (B20F), on the east and south-east by Kromdraaispruit and Wilge River Catchment (B20E) and to the west is bordered by the Koffiespruit Catchment (B20B).

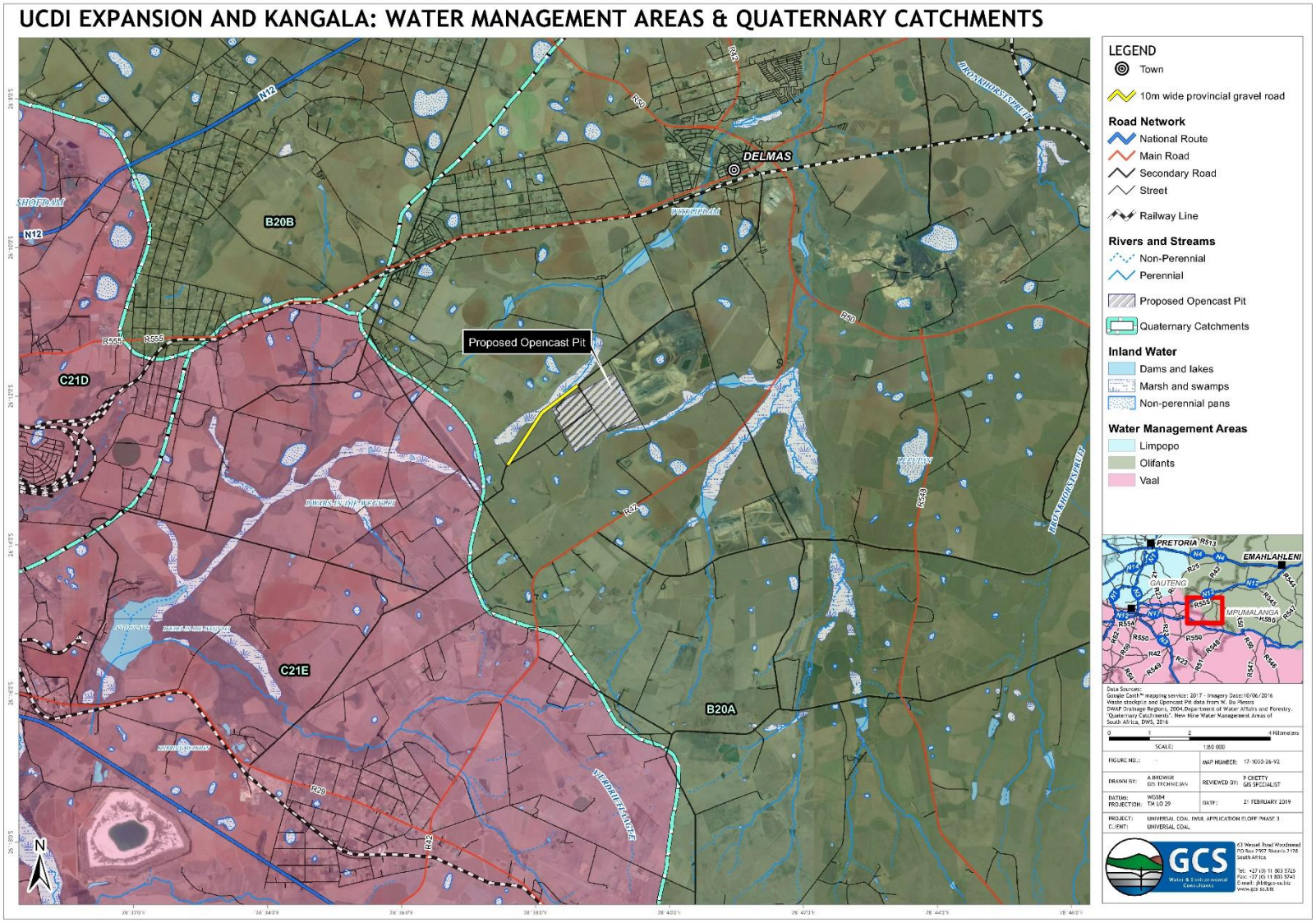


Figure 4.2: Eloff Phase 3 Project WMA and Quaternary Catchments

4.2.2 Surface Water Hydrology

The Bronkhorstspruit River is the most important watercourse in the catchment. Numerous hydro-geomorphic units (wetlands) exist within the mining area such as the valley bottom wetland, which straddles the RE of Portion 2 of the farm Wolvenfontein 244 IR. These watercourses form a tributary of the Bronkhorstspruit approximately 13km north and north-east from the site.

The Bronkhorstspruit River has its headwaters at the B20A quaternary catchment, and eventually flows into the Wilge River further downstream, which joins the larger Olifants River. The Olifants River then flows eastwards into Mozambique. The project area is located on the joint upstream boundary of the Olifants WMA and quaternary catchment B20A. All runoff emanating from the upstream boundary of the project area contributes to flow in the downstream tributaries of the Bronkhorstspruit.

Average elevations at the upstream boundary of quaternary catchment B20A range from 1 600 meters above mean sea level (mamsl) to 1 690 mamsl and decreases to between 1 570 – 1 590 mamsl further downstream at the banks of the downstream tributaries. Average slopes range between 1% and 3 % and is characterised as flat. The hydrological setting of the project site is indicated in Figure 4.3.

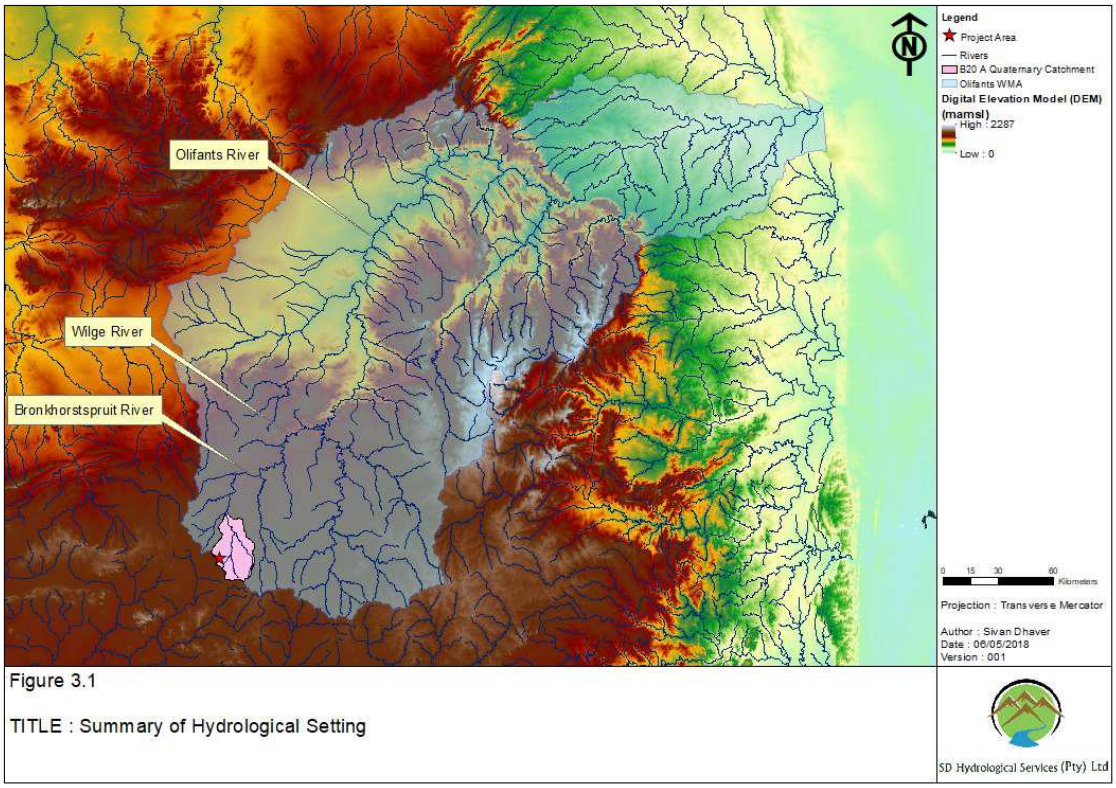


Figure 4.3: Surface Hydrological Map of the Project Area

4.2.2.1 Flood Hydrology

The design storm rainfall depths were obtained from the design rainfall software (Smithers and Schulze, 2002). The programme is able to extract the storm rainfall depths for various recurrence intervals for the six closest rainfall stations as shown below in Table 4.3.

Table 4.3: Summary of six closest SAWS stations as per the design rainfall software

Station Name	SAWS Number	Distance (Km)	Record length (Years)	Mean Annual Precipitation (mm)	Altitude (mamsl)
STRYDPAN	0477224 W	2.5	46	683	1603
DROOGEFONTEIN	0477191 W	5.1	61	664	1617
DELMAS (POL)	0477309 W	10.5	92	661	1555
RIETKUIL	0477459 W	16.1	41	658	1555
VLAKPLAAS	0477494 W	16.3	26	662	1578
RIETFONTEIN	0476737 W	17.0	48	702	1580

It should be noted that the MAP obtained for the six closest stations above, differ from the MAP of the same stations obtained using the Daily Rainfall Extraction Utility. The reason is, due to the extension of the existing record as a result of patched data being taken into account.

The summary of the rainfall depths for the 5 minute duration up to the 1 day storm duration for various recurrence intervals are shown below in Table 4.4, and will be used in the calculation of peak flows for all catchments required in the development of the floodline assessment study.

Table 4.4: Summary of storm rainfall depths

Duration	Rainfall Depth (mm)						
(m/h/d)	1:2 year	1:5 year	1:10 year	1:20 year	1:50 year	1:100 year	1:200 year
5 m	9.8	13	15.3	17.6	20.8	23.3	25.9
10 m	14.5	19.3	22.7	26.2	30.9	34.6	38.6
15 m	18.3	24.4	28.7	33	39	43.7	48.6
30 m	23.2	30.9	36.3	41.8	49.3	55.3	61.6
45 m	26.6	35.4	41.7	48	56.6	63.5	70.7
1 h	29.4	39.1	46	52.9	62.5	70	77.9
1.5 h	33.7	44.8	52.8	60.7	71.7	80.4	89.5
2 h	37.2	49.5	58.2	67	79.1	88.7	98.7
4 h	43.8	58.3	68.5	78.9	93.1	104.4	116.2
6 h	48.2	64.1	75.4	86.8	102.5	114.9	127.9
8 h	51.6	68.6	80.7	92.9	109.7	123	136.9

10 h	54.3	72.3	85.1	97.9	115.6	129.6	144.3
12 h	56.7	75.5	88.8	102.2	120.7	135.3	150.6
16 h	60.7	80.8	95	109.4	129.2	144.8	161.2
20 h	64	85.2	100.2	115.3	136.1	152.7	169.9
24 h	66.8	88.9	104.6	120.4	142.1	159.4	177.4
1 d	55.6	73.9	87	100.1	118.2	132.5	147.5

4.2.3 Surface Water Quality

Aquatico was commissioned by Eloff Mining Company Pty Ltd to conduct surface water quality monitoring on a monthly basis at thirteen surface water localities (river, streams and pans) around the Kangala Colliery. Only six of the thirteen surface water localities; as well as the three waste water localities could be sampled in April 2018 as the majority of the localities were dry or the water stagnant.

For the Eloff Phase 3 Project, only 4 surface water localities are relevant for this report (Table 4.5) (Figure 4.4) (Aquatico, 2018). Of which, only one (INJ02) could be sampled.

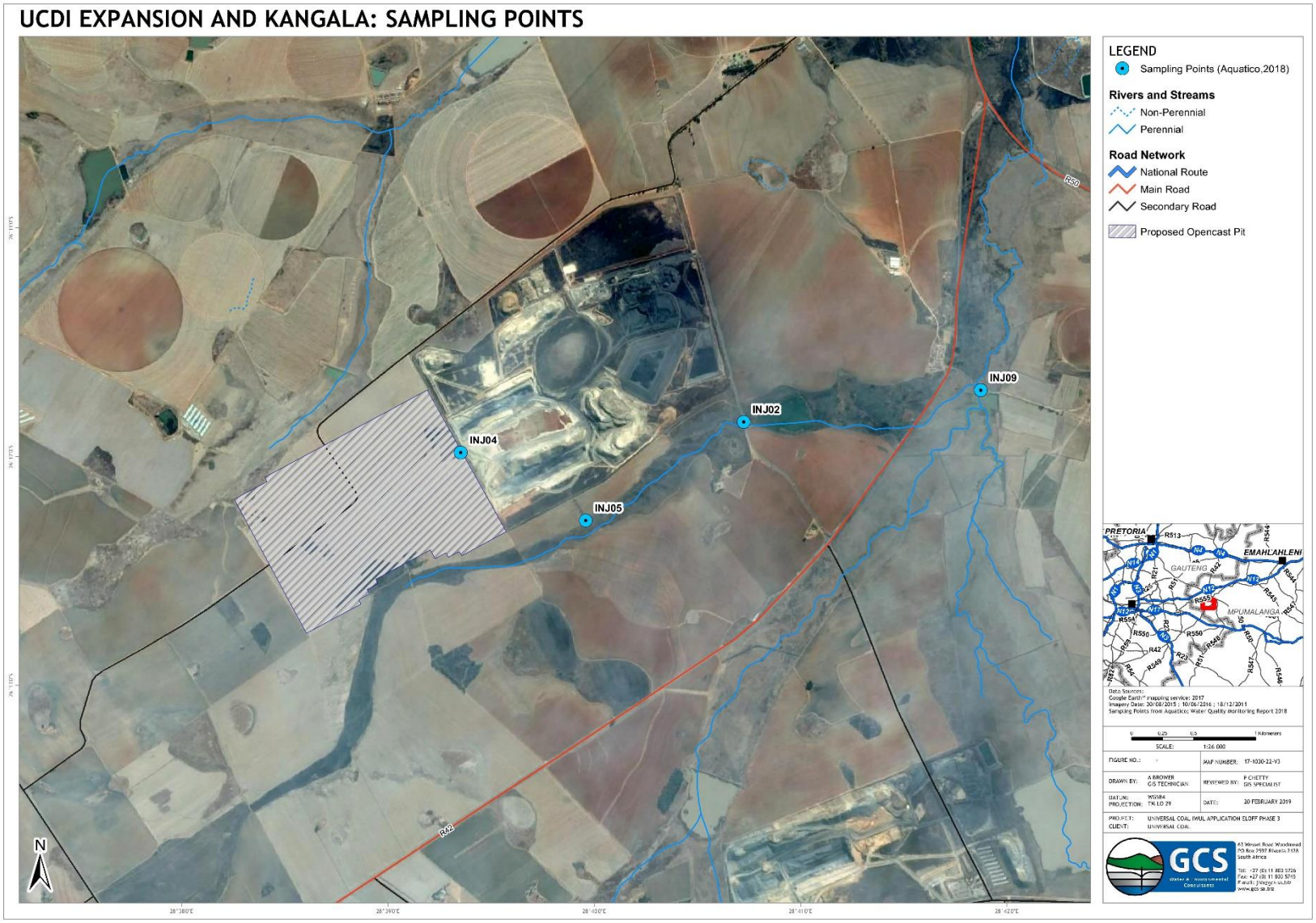


Figure 4.4: Eloff Phase 3 Project sampling points (Aquatico, 2018)

The following nomenclature was utilised for the identification of the water quality sampling points:

- The first two Letters in the ID number stands for the previous name of the Project i.e. "INJ" for Injula project assessment, which has now been replaced by "Kangala project assessment"; and
- The number following the project name abbreviation stands for the sample number e.g. "2" indicating this was the 2nd surface water source investigated.

Table 4.5 provides a summary of the locations, and the descriptive information of the points that were sampled, as well as the status of the surface water.

Table 4.5: Eloff Phase 3 Project: Monthly Sampling Register for April 2018 (Aquatico, 2018)

Locality	Description	Coordinates		Sample Time	Status	Flow/Level	Remarks
		Latitude	Longitude				
Surface Water							
INJ02	Stream outflow from mine area	S26.19762	E28.67884	2018/04/25 10:55	Yes	Low	Slightly Turbid
INJ04	Stream outflow from mine area	S26.19979	E28.65598	2018/04/25 11:05	Dry	Very Low	Dry
INJ05	Stream upstream from mine	S26.20479	E28.66606	2018/04/25 11:14	Dry	Very Low	Dry
INJ09	Stream downstream from mine	S26.19535	E28.69798	2018/04/25 9:50	Stagnant	Very Low	Stagnant

The water quality results and summary are presented in Table 4.6. The six surface water localities that were sampled and analysed are presented. Locality INJ02 is the only one relevant for Eloff Phase 3 Project.

Table 4.6: Water quality results at Kangala Colliery during April 2018.

Variable	UNIT	Universal Coal IWUL 2012 - Groundwater	SANS 241-1:2015 Drinking Water	Monitoring localities - Monthly Surface Water											
				INJ01		INJ02		INJ06		INJ07		INJ08		INJ10	
				B/line	04/18	B/line	04/18	B/line	04/18	B/line	04/18	B/line	04/18	B/line	04/18
pH @ 25°C		5 / 9	5 / 9.7	7.29	7.89	6.95	7.91	7.1	7.89	7.23	8.17	7.66	7.94	7.28	8.03
Electrical conductivity (EC) @ 25°C	mS/m	150.0 mS/m	170.0 mS/m	24.7	28.7	27.4	20	26.9	25.3	34	41.7	30.6	37	32.6	35.8
Total dissolved solids (TDS)	mg/l		1200 mg/l	162	210	170	148	162	201	330	251	190	243	202	229
Total alkalinity	mg/l			109	78	71	103	117	149	153	191	146	165	157	203
Chloride (Cl)	mg/l	200.0 mg/l	300.0 mg/l	13	28	30	12.6	11	13.4	18	19	11	27.4	13	11.5
Sulphate (SO_4)	mg/l	400.0 mg/l	500.0 mg/l	15.6	60.3	23.9	16.1	9	19.4	14.7	19.4	13.8	22.6	8.6	9.16
Nitrate (NO_3) as N	mg/l	10.00 mg/l	11.00 mg/l	-0.1	0.495	-0.1	0.364	-0.1	0.455	-0.1	0.604	-0.1	0.401	-0.1	0.337
Ammonium (NH_4) as N	mg/l		1.5 mg/l	0.78	0.102	0.39	0.117	0.75	0.221	-0.2	0.326	-0.2	0.214	0.89	0.042
Orthophosphate (PO_4) as P	mg/l	0.05 mg/l		-	0.184	-	0.038	-	0.053	-	0.07	-	0.088	-	0.068
Fluoride (F)	mg/l	1 mg/l	1.5 mg/l	-	0.43	-	<0.263	-	0.379	-	0.386	-	0.303	-	0.31
Calcium (Ca)	mg/l	150.0 mg/l		12.1	10.7	13.7	20.7	15.9	23.5	18	20.1	18.6	26.3	20.5	36.4
Magnesium (Mg)	mg/l	70.00 mg/l		9.93	9.08	8.68	10.4	11.4	16.5	14.7	14.8	15.6	17.5	14.7	22.3
Sodium (Na)	mg/l	200.0 mg/l	200.0 mg/l	22.4	38	22.2	15.1	18.8	21.8	29.1	50.6	20.1	35.1	22.3	15.3
Potassium (K)	mg/l			6.75	13.2	8.65	7.88	8.24	12.8	5.58	7.52	3.87	11.5	7.16	8.35
Aluminium (Al)	mg/l		0.3 mg/l	0.26	4.75	0.12	0.013	0.13	<0.002	0.12	0.008	0.12	0.053	0.13	<0.002
Iron (Fe)	mg/l	0.2 mg/l	0.3 mg/l	0.16	2.94	0.02	<0.004	-0.01	<0.004	1.21	0.057	-0.01	<0.004	-0.01	<0.004
Manganese (Mn)	mg/l	0.1 mg/l	0.1 mg/l	0.2	0.032	0.07	0.124	0.04	0.021	0.04	0.334	0.02	0.323	0.04	0.104
Total hardness	mg/l			-	64	-	95	-	127	-	111	-	138	-	183
Sodium Adsorption Ratio	SAR			-	2.07	-	0.68	-	0.84	-	2.09	-	1.3	-	0.49

*** Red values indicate concentrations exceeding one or both of the guidelines**

INJ02

In April 2018, the water sampled at this locality could be described as neutral, non-saline and moderately soft. Both the WUL limit and the SANS drinking water standard limit for manganese were exceeded in April 2018. Accordingly, the water is classified as good (class 1) for domestic use (WRC, 1998).

4.2.4 Mean Annual Run-off

The project area falls within the north western boundary of the B20A quaternary catchments. The quaternary catchment B20A has a net mean annual runoff (MAR) of 21.70 million cubic meters (mcm), and is based on the (WR90), however the total MAR has since been combined with quaternary catchment B20B, resulting in a total MAR for B20A and B20B amounting to 39.45 mcm (WR2005). Majority of the runoff from the project area is eventually drained north into the Olifants River.

4.2.5 Resource Class and River Health

The Present Ecological Status (PES) of the watercourses north and south of the Eloff Phase 3 Project was assessed based on water quality, integrity of the aquatic instream and riparian habitats, as well as the diversity of macro-invertebrate and fish species. The assessment was part of the annual aquatic assessment study for the rivers in and around the Eloff Phase 3 Project in B20A (Bronkhorstspruit Catchment) Quaternary Catchment, undertaken in winter (low flow) 2015 and summer (high flow) in 2016 by Digby Wells and Associates (Pty) Ltd.

The tributaries of the Bronkhorstspruit in Quaternary Catchment B20A are classified into the Highveld Ecoregion 11 of the Olifants Catchment. The Highveld Ecoregion is the largest ecoregion and measures approximately 163 615.1 km^2. The area consists of flat grasslands with rising and falling rocky zones on top of the escarpment (1500 and 1750 mamsl).

The study found that the overall, aquatic integrity of the site was Largely Modified (Class D). This was ascribed to impacts to the instream and riparian habitats (numerous impoundments), decreases in sensitive macro-invertebrate and fish species. These impacts were attributed to the accumulative effects of natural habitat variations and impacts from surrounding anthropogenic activities, including the coal mining activities, agriculture and impoundments (dams). A summary of the findings of the study are provided in Table 4.7.

Table 4.7: Summary of Aquatic Assessment and PES

Flow Regime/Period	IHI	SASS 5	MIRAI	OVERALL PES
Low Flow	D	E	D/E	D
High Flow	D	E	D/E	D

PES - *Present Ecological State*; **IHI** - *Instream Habitat Integrity*; **SASS5** - *South African Scoring system*; **MIRAI** – *Macroinvertebrate Assessment Index*

PES key: A – *Natural*; **B** – *Largely Natural*; **C** – *Moderately Modified*; **D** – *Largely Modified*; **E** – *Seriously Modified*; **F** – *Critically Modified*

Based on the above, the preliminary risk category of the mine is determined as High (Table 4.8).

Table 4.8: Eloff Phase 3 Project Preliminary Risk Categorisation

	Water Resource Sensitivity		
	High	**Medium**	**Low**
A (High)	H	H	M
B (Medium)	H	M	L
C (Low)	M	L	L

The Class and the Resource Quality Objectives (RQO) for the Upper Olifants WMA are described in Section 7.3.7.

4.2.6 Receiving Water Quality Objectives and Reserve

The Reserve for Quaternary Catchment B20A Olifants River WMA has not been provided by the Department of Water and Sanitation's Resources Directed Measures (RDM).

Table 4.9 lists the Resource Quality Objectives (RQO) for river instream habitat and biota. Table 4.10 lists the RQO for river riparian zone habitat for the Upper Olifants WMA.

Table 4.9: RQO for River Instream Habitat and Biota in the Olifants Catchment (GN 466).

RIVER INSTREAM HABITAT AND BIOTA						
IUA	**Class**	**River**	**RU**	**REC**	**RQO**	**Numerical Limits**
1. Upper Olifants River catchment	III	Olifants	11	D	Instream habitat must be in a largely modified or better condition to support the ecosystem and for ecotourism users. Instream biota must be in a largely modified or better conditions and at sustainable levels. Low and high flows must be suitable to maintain the river habitat for ecosystem condition and ecotourism. Water quality: Nutrient concentrations must be improved to prevent nuisance conditions for ecotourism Salt concentrations must be maintained at levels where they do not render the ecosystem unsustainable.	Instream Habitat Integrity category ≥ D (≥ 42) Fish ecological category: ≥ D (≥ 42) Macro-invertebrate ecological category: ≥ D (≥ 42) Instream Ecostatus category ≥ D (≥ 42) Hydrological category ≥ D (≥ 42) Water Quality category: ≥ D (≥ 42)

Table 4.10: RQO for River Riparian Zone Habitat in the Olifants Catchment (GN 466).

RIVER RIPARIAN ZONE HABITAT						
IUA	Class	River	RU	REC	RQO	Numerical Limits
1. Upper Olifants River catchment	III	Olifants	11	C	The riparian zone must be in a moderately modified or better condition to support the ecosystem and for ecotourism. Riparian vegetation must be in a moderately modified or better condition. Low and high flows must be in a largely modified or better condition to maintain the riparian habitat and for ecotourism.	Riparian Zone Habitat Integrity category ≥ C (≥ 62) Riparian ecostatus category : ≥ C (≥ 62) Hydrological category ≥ D (≥ 42)

4.2.7 Surface Water User Survey

A surface water user survey was undertaken using data from the DWS Water Authorisation and Registration Management System (WARMS). The surface water user's survey on the following farm portions was on the Bronkhorstspruit reach traversing the farms. The following water user sectors were identified:

- Environment (aquatic ecosystem);
- Domestic water supply;
- Agriculture: livestock watering ;
- Agriculture: irrigation; and
- Industries.

The total number of registered surface water users in Quaternary Catchment B20A is approximately 78. Most of the users' abstract water from Koffiespruit and Bronkhorstspruit rivers and their tributaries. The annual water volumes abstracted by users as per the DWS database range from 365 000 to 640 000m^3/a. About three (3) of these users are close to the proposed mining area. One user is located on the south-eastern corner of the farm to be affected by the Eloff Phase 3 Project. Another user is located 1.5 km south-east of the first one while the third user is 3.5 km downstream of the Eloff Phase 3 Project area.

The main registered water users identified are shown below in the area:

- Portion 6 of Weilaagte Farm, 271 IR;
- Portion 3 of Stompiesfontein Farm, 273 IR;
- Portion 33 of Strydpan Farm, 243 IR;
- Portion 20 of Strydpan Farm, 243IR;
- Portion 1 of Wolvenfontein Farm, 244IR;
- Portion 6 of Wolvenfontein Farm, 244 IR;
- Portion R of Wolvenfontein Farm, 244IR;
- Portion 3 of Wolvenfontein Farm, 244 IR; and
- Portion R of Witklip Farm, 299IR.

4.2.8 Sensitive Areas Survey

The National Wetland Classification Systems (NWCS) developed by the South African National Biodiversity Institute (SANBI) was considered for this study. This system comprises a hierarchical classification process of defining a wetland based on the principles of the hydrogeomorphic (HGM) approach at higher levels. In addition, the method also includes the assessment of structural features at the lower levels of classification.

The information contained in this section is sourced from the 2018 Wetland Assessment undertaken by The Biodiversity Company. The full Wetland Assessment report is attached as Annexure B.

4.2.8.1 Soil

According to the land type database (Land Type Survey Staff, 1972-2006) the project area is located within the Bb3 land type (Figure 4.5). The land type is described in the Table 4.11. The dominant soil forms on the upper and mid-slopes include the Hutton, Glencoe and Avalon forms, with pans also represented. The Rensburg and Katspruit soil forms are largely representative in the lower lying and valley bottom areas.

The geology of the land type is classified as shale, sandstone, clay, conglomerate, limestone and marl of the Ecca Group; shale and tillite of the Dwyka Formation, Karoo Sequence; dolerite; occasional Ventersdorp lava, Witwatersrand quartzite and slate; dolomite.

Table 4.11: The expected soil features for the land types present

Land Type	Expected Soil Features
Bb3	PLINTHIC CATENA: UPLAND DUPLEX AND MARGALITIC SOILS RARE; Dystrophic and/or mesotrophic; red soils not widespread

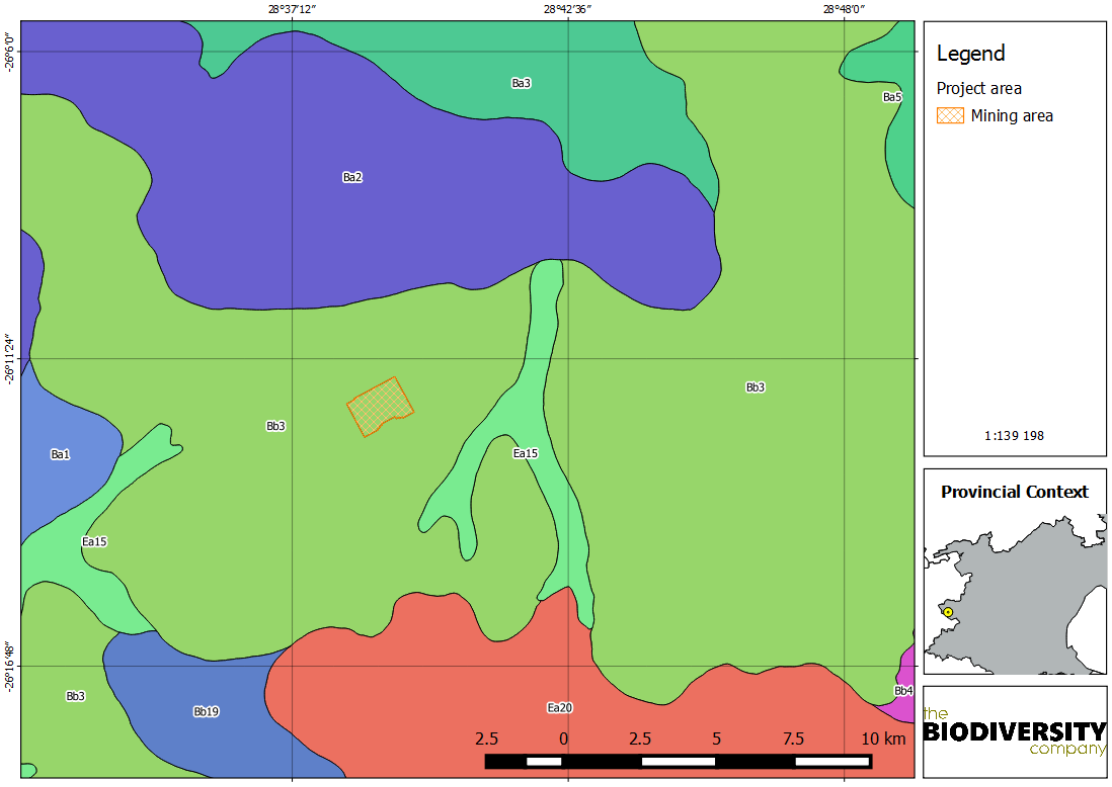


Figure 4.5: The land type in the project assessment area

4.2.8.2 Vegetation

The site is situated in the grassland biome. In South Africa, the grassland biome occurs primarily on the Highveld, the inland areas of the eastern seaboard, the mountainous areas of KwaZulu-Natal and the central parts of the Eastern Cape. The topography associated with these regions is mainly rolling to flat but also includes mountainous regions and the escarpment. Grasslands are landscapes structurally and visually dominated by grass.

The project area is situated in the Eastern Highveld Grassland (Gm12) vegetation community. Eastern Highveld Grassland (Gm12) occurs on plains in the Mpumalanga and Gauteng Provinces. This vegetation type extends from Johannesburg in the west to Belfast in the east and Bethal and Ermelo in the south. The topography consists of slightly to moderately undulating plains with some low hills and pan depressions. This vegetation type is classified as Endangered (EN) with only a small fraction conserved on statutory and private reserves. In 2010, 44% of this vegetation type was classified as transformed primarily by cultivation of crops, plantations, mining, urbanisation of building of dams.

4.2.8.3 Wetland National Freshwater Priority Areas

A total of five (5) Freshwater Ecological Priority Areas (FEPA) wetland types were identified within the assessment area of the project. The systems are either regarded as natural or

artificial systems. There is a gap in the dataset, and no details pertaining to the wetland condition and rank for this area are available. Based on this, this desktop information is omitted from the study, and this study will place emphasis in the extent of the delineated wetland areas. The FEPA wetland systems are listed in Table 4.12. The location of the FEPA wetlands in reference to the project area are provided in Figure 4.6.

Table 4.12: NFEPA description for the FEPA systems

Classification Levels				Wetland Vegetation Class	Natural / Artificial	Wetland Condition	Rank
L1 (System)	L2 (Ecoregion)	L3 Landscape Position	L4 HGM Classification				
Inland System	Highveld	Slope	Seep	Mesic Highveld Grassland	-	-	-
Inland System	Highveld	Valley Floor	Channelled	Mesic Highveld Grassland	-	-	-
Inland System	Highveld	Valley Floor	Floodplain	Mesic Highveld Grassland	-	-	-
Inland System	Highveld	Bench	Flat	Mesic Highveld Grassland	-	-	-
Inland System	Highveld	Bench	Depression	Mesic Highveld Grassland	-	-	-

Figure 4.6: The FEPA wetlands in the project assessment area

4.2.8.4 The Mpumalanga Highveld Wetlands

The Mpumalanga Highveld (MPHG) wetlands dataset was considered for the proposed mining project, with numerous HGM types located within the assessment area. The dominant wetland type within the assessment area was channelled valley bottom systems, with depression and seepage areas comprising a lower extent of the assessment area (Figure 4.7). The status of the wetlands within the project assessment area varies from Moderately Modified (Class C) to Largely / Heavily Modified (Class Z). From this desktop dataset it is likely that some wetland areas may be lost as a result of the project. In the event that these wetland areas (and associated buffers) cannot be avoided, a wetland offset strategy may be required.

Figure 4.7: The MPHG wetlands in the project assessment area

4.2.8.5 Onsite Wetland Assessment

GCS conducted a "Detailed Ecological Assessment of the Proposed Eloff Phase 3 Project Phase 1 Area" in 2017, which included a wetland component. It is apparent from the study that the wetland component was completed in 2016, but the study will be referenced to as a 2017 study. Information from the GCS study has been considered to supplement the findings of this study. The extent of wetland areas identified and delineated by GCS are presented in Figure 4.8 (it should be noted that since the undertaking of the 2017 study, the mining layout and associated infrastructure has changed. The wetland investigation undertaken by The Biodiversity Company in 2018 makes use of the new proposed infrastructure and mining layout).

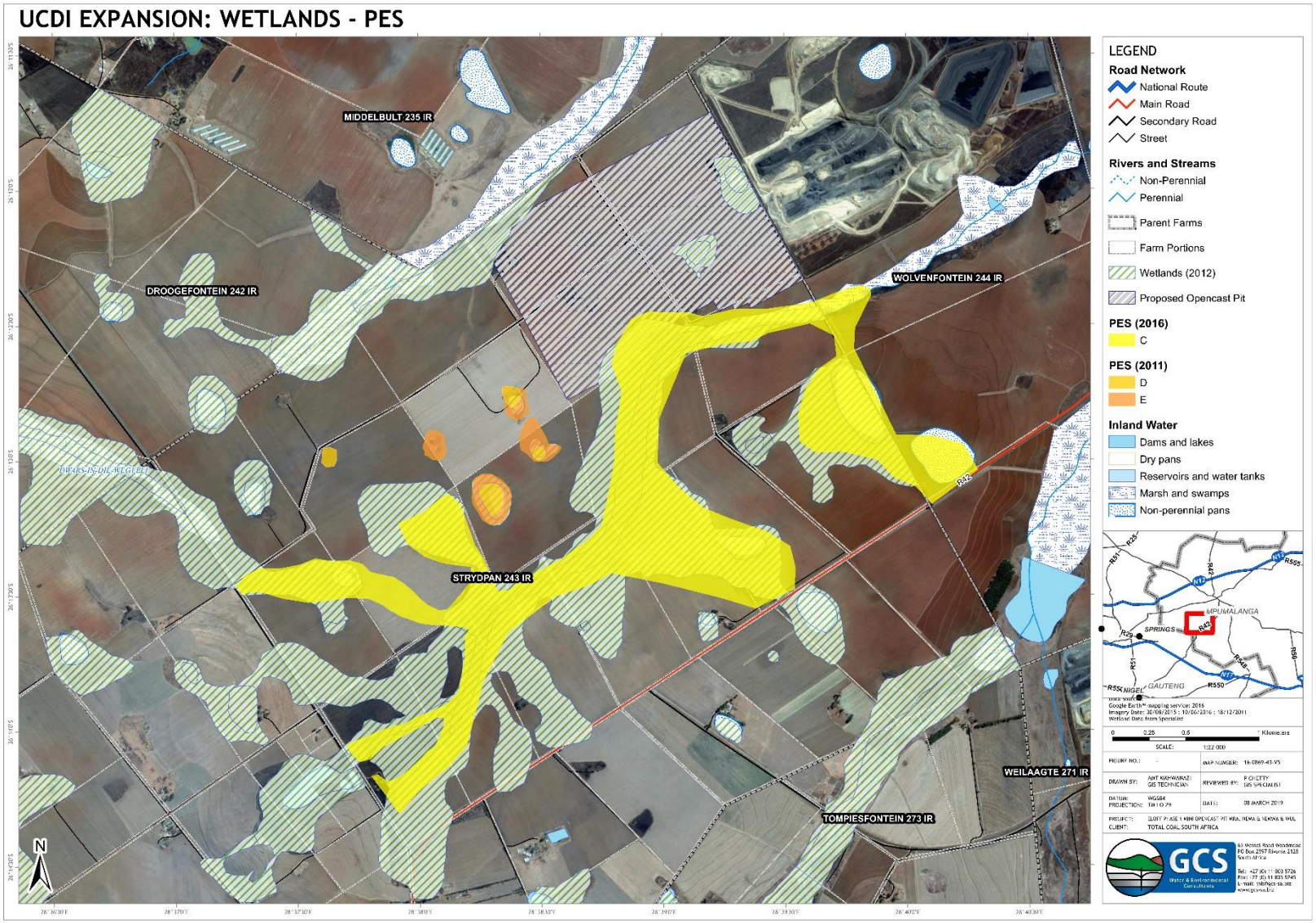


Figure 4.8: The wetland areas delineated for the assessment area

The wetland delineation for the purposed opencast and associated infrastructure is shown in Figure 4.9. The wetland classification as per SANBI guidelines (Ollis et al., 2013) is presented in Table 4.13. A total of three (3) HGM types were identified and delineated for the project.

Figure 4.9: The delineated wetland systems within 500m of the project area

Table 4.13: Wetland classification as per SANBI guideline (Ollis et al., 2013)

HGM	Level 2		Level 3	Level 4		
	DWS Ecoregion/s	NFEPA Wet Veg Group/s	Landscape Unit	4A (HGM)	4B	4C
1 & 2	Highveld	Mesic Highveld Grassland	Valley Floor	Unchannelled Valley Bottom	N/A	N/A
3	Highveld	Mesic Highveld Grassland	Bench	Depression	Endorheic	Without channel inflow
4	Highveld	Mesic Highveld Grassland	Slope	Seepage	Without channel outflow	N/A
5	Highveld	Mesic Highveld Grassland	Slope	Seepage	With channel outflow	N/A

A total of 15 separate HGM units were identified and delineated for the project. The study has ground truthed and prioritised the wetlands within the 500m assessment boundary and

making reference to similar wetland units in the vicinity of the study area. Where it is deemed acceptable (and appropriate), HGM units have been collectively assessed (or grouped) per the respective HGM type. Based on this, a total of five (5) HGM types (some comprising numerous HGM units) have been assessed in further detail, these include the following:

- HGM 1: Unchannelled valley bottom wetland;
- HGM 2: Unchannelled valley bottom wetland;
- HGM 3: Depression (with accompanying seepage areas);
- HGM 4: Seep (isolated); and
- HGM 5: Seep.

The two wetland systems located to the north and south of the project area have been identified as unchannelled valley bottom systems. The remaining HGM units comprised endorheic pans and seepage areas.

The wetland areas had the greatest plant species composition in comparison to all the remaining areas. Patches of *Phragmites australis, Imperata cylindrica, Agrostis lachnantha var. lachnantha* as well as *Typha capensis* occurred throughout the wetland systems. *Crinum bulbispermum, Eucomis autumnalis* as well as *Nerine angustifoli*a are flora species associated with marshy or moist areas, which occurred throughout the wetland area.

The range of Soil Forms identified for the study included the Willowbrook, Oakleaf, Tukulu, Bonheim, Inhoek, Mispah and Katspruit forms. The Kastspruit form was characteristic of the valley bottom wetlands.

Present Ecological State

The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present Ecological Status (PES) score. This takes the form of assessing the spatial extent of impact of individual activities/occurrences and then separately assessing the intensity of impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact. The Present State categories are provided in Table 4.14.

Table 4.14: The PES categories (Macfarlane, et al. 2009)

Impact Category	Description	Impact Score Range	Present State Category
None	**Unmodified, natural**	**0 to 0.9**	**A**

Small	**Largely Natural** with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	**1.0 to 1.9**	**B**
Moderate	**Moderately Modified.** A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.	**2.0 to 3.9**	**C**
Large	**Largely Modified.** A large change in ecosystem processes and loss of natural habitat and biota has occurred.	**4.0 to 5.9**	**D**
Serious	**Seriously Modified.** The change in ecosystem processes and loss of natural habitat and biota is great, but some remaining natural habitat features are still recognizable.	**6.0 to 7.9**	**E**
Critical	**Critical Modification.** The modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	**8.0 to 10**	**F**

The PES for the assessed HGM units is presented in Table 4.15 and Figure 4.10. The overall wetland health for the wetlands varied from Moderately Modified (Class C) to Largely Modified (Class D) systems, with the majority of the wetlands rated a Class C.

The hydrology within the catchment of the two valley bottom systems has been impacted on (or impeded) due to the placement of dams and access route crossings (further downstream). The extent of commercial agriculture has caused the loss of groundcover, which has resulted in increased run-off volumes and velocities across the catchment area. These increases have resulted in changes to the floodpeaks and hydrological regimes of the valley bottom wetlands. The extent of commercial farming (predominantly) has encroached into the depression and seepage wetlands, altering the vegetation composition and soil profile (somewhat), causing the narrowing of these systems. This has impacted on the hydrological inputs of these systems. A number of pump houses and irrigation systems were also encountered during the assessment. These will draw water from the created impoundments, removing water from the valley bottom systems, with a considerable proportion of water lost to evaporation.

The geomorphology of the valley bottom wetlands, notably HGM 1, has also been impacted on due to the placement of dams within these systems. Additionally, both valley bottom systems are traversed by formal and informal access routes. These have resulted in reaches of the system being inundated, and resulted in the onset or erosion, particularly downstream of the larger impoundments and crossing areas. The depressions are predominantly restricted to the higher lying areas of the topography. These areas are flat, with poorly drained soils. The seepage areas are located on the slopes of the catchment, with some seeps being isolated and others connected to other wetland systems. The local commercial farming and mining

activities have largely avoided direct impacts to the basins of the depressions, and also the seepage areas, but the periphery of these systems has been encroached upon. This has resulted in the narrowing of these systems.

The vegetation of the wetland systems has been predominantly impacted on by the commercial agricultural, and infrastructure development and mining but to a lesser extent. The agricultural areas are the areas which has been degraded significantly. The agricultural areas were cultivated with crops whereas the areas adjacent to the mining and other infrastructure projects are associated with stands of weeds and bare soil due to the disturbance to the topsoil layer. The disturbed area didn't contain a large amount of diverse indigenous vegetation mainly due to the anthropogenic influence. Weeds such as Bidens pilosa, Conyza bonariensis, Cortaderia selloana, Verbena bonariensis and Tagetes minuta occurred throughout the project area and the overall state of the area was degraded.

Table 4.15: Summary of the scores for the wetland PES

HGM Type	Hydrology		Geomorphology		Vegetation	
	Rating	Score	Rating	Score	Rating	Score
HGM 1 - Unchannelled valley bottom	C: Moderately Modified	3.5	C: Moderately Modified	2.4	D: Largely Modified	5.3
Overall PES Score	3.7		Overall PES Class		C: Moderately Modified	
HGM 2 - Unchannelled valley bottom	C: Moderately Modified	3.1	C: Moderately Modified	2.3	D: Largely Modified	5.2
Overall PES Score	3.5		Overall PES Class		C: Moderately Modified	
Pans (and connected seeps)	C: Moderately Modified	3.0	A: Unmodified	0.4	E: Seriously Modified	6.7
Overall PES Score	4.4		Overall PES Class		D: Largely Modified	
Seeps (isolated)	D: Largely Modified	4.0	A: Unmodified	0.6	E: Seriously Modified	7.8
Overall PES Score	4.1		Overall PES Class		D: Largely Modified	
Seeps	C: Moderately Modified	3.3	B: Largely Natural	1.6	C: Moderately Modified	3.1
Overall PES Score	2.8		Overall PES Class		C: Moderately Modified	

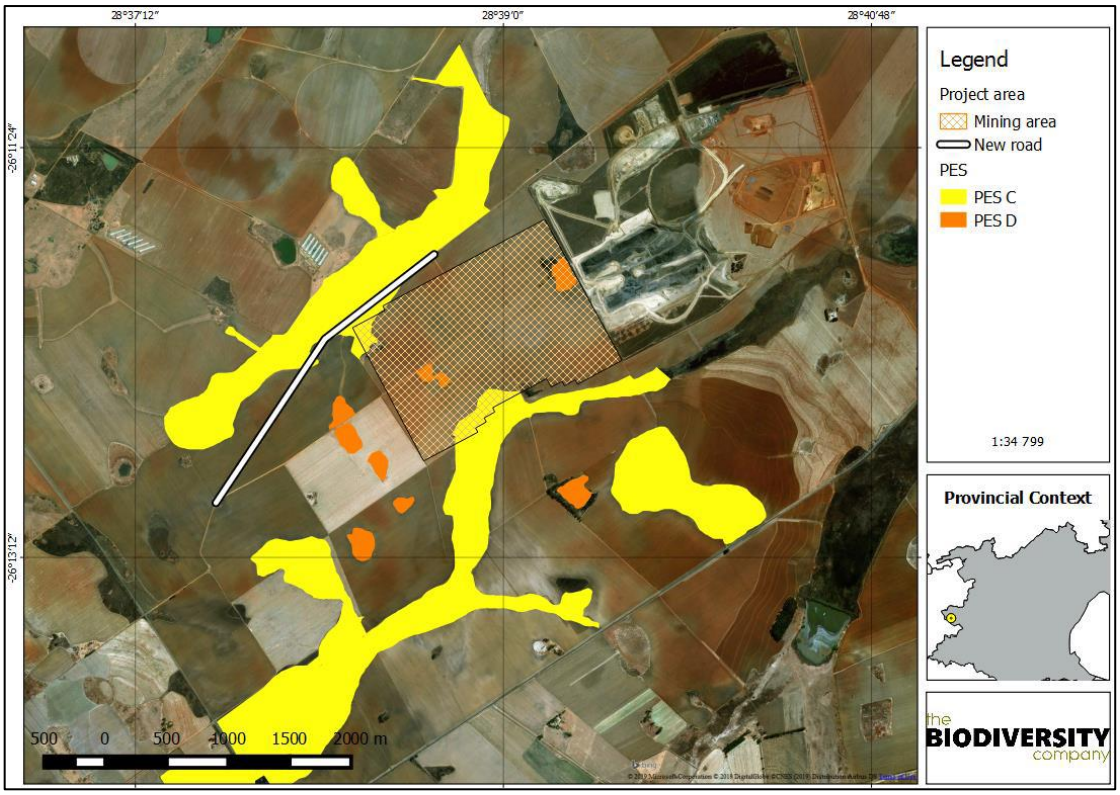


Figure 4.10: The depicted PES of the wetlands

<u>Ecosystem Services Assessment</u>

The Ecosystem services provided by the HGM units present at the site were assessed and rated using the WET-EcoServices method (Kotze, et al. 2009). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the services are provided (Table 4.16). The summarised results for the HGM types are shown in Table 4.17 and presented in Figure 4.11.

Table 4.16: Classes for determining the likely extent to which a benefit is being supplied

Score	Rating of likely extent to which a benefit is being supplied
< 0.5	Low
0.6 - 1.2	Moderately Low
1.3 - 2.0	Intermediate
2.1 - 3.0	Moderately High
> 3.0	High

The two valley bottom wetland types, HGM 1 and HGM 2, had overall moderately high level of service, with the remaining wetland units displaying an intermediate level of service. A number of moderately high benefit services were identified for the various wetland systems, these include:

- Flood attenuation;
- Streamflow regulation;
- Water quality enhancement;
- Biodiversity maintenance; and
- Provision benefits.

Table 4.17: The Eco-Services being provided by the wetland units

Wetland Unit					HGM 1	HGM 2	HGM 3	HGM 4	HGM 5
Ecosystem Services Supplied by Wetlands	Indirect Benefits	Regulating and supporting benefits	Flood attenuation		2.1	2.3	1.7	1.8	2.2
			Streamflow regulation		2.8	2.7	2.0	2.0	2.3
			Water Quality enhancement benefits	Sediment trapping	2.5	2.5	1.9	1.8	2.4
				Phosphate assimilation	2.9	2.8	2.4	2.4	2.4
				Nitrate assimilation	3.1	3.1	2.9	2.5	2.6
				Toxicant assimilation	2.7	2.7	2.3	2.3	2.4
				Erosion control	2.0	2.3	2.6	2.2	2.3
			Carbon storage		2.3	2.3	2.3	2.3	2.4
	Direct Benefits	**Biodiversity maintenance**			2.1	2.2	1.5	1.6	2.2
		Provisioning benefits	Provisioning of water for human use		1.6	1.7	0.9	0.8	0.9
			Provisioning of harvestable resources		1.6	1.6	1.0	0.9	1.0
			Provisioning of cultivated foods		2.2	2.3	1.0	0.8	1.0
		Cultural benefits	Cultural heritage		1.0	1.1	1.0	1.0	0.7
			Tourism and recreation		2.1	2.1	0.7	0.6	1.1
			Education and research		2.0	2.0	1.8	1.3	1.8
Overall					33.2	33.9	25.9	24.2	27.7
Average					2.2	2.2	1.7	1.6	1.8

Table 4.18 presents a summary of the service classifications for the respective wetland units. It is important from the summary that all the wetland units contribute considerably (moderately high) to regulating and supporting services, the bulk of which includes the enhancement of water quality. In addition to this, the two valley bottom systems and the adjoining seepage areas also provide supporting biodiversity maintenance services considered to be of a moderately high benefit. The direct services provided by the wetland units, referring to provisioning and cultural benefits, are less significant with the majority of the system providing an overall moderately low level of benefit.

Table 4.18: Summary of Eco-Service classes being provided by the wetland units

Service	HGM 1	HGM 2	HGM 3	HGM 4	HGM 5
Indirect benefits	2.6	2.6	2.3	2.2	2.4
Direct benefits	1.8	0.8	1.1	0.9	1.0
Biodiversity maintenance	2.1	2.2	1.5	1.6	2.2

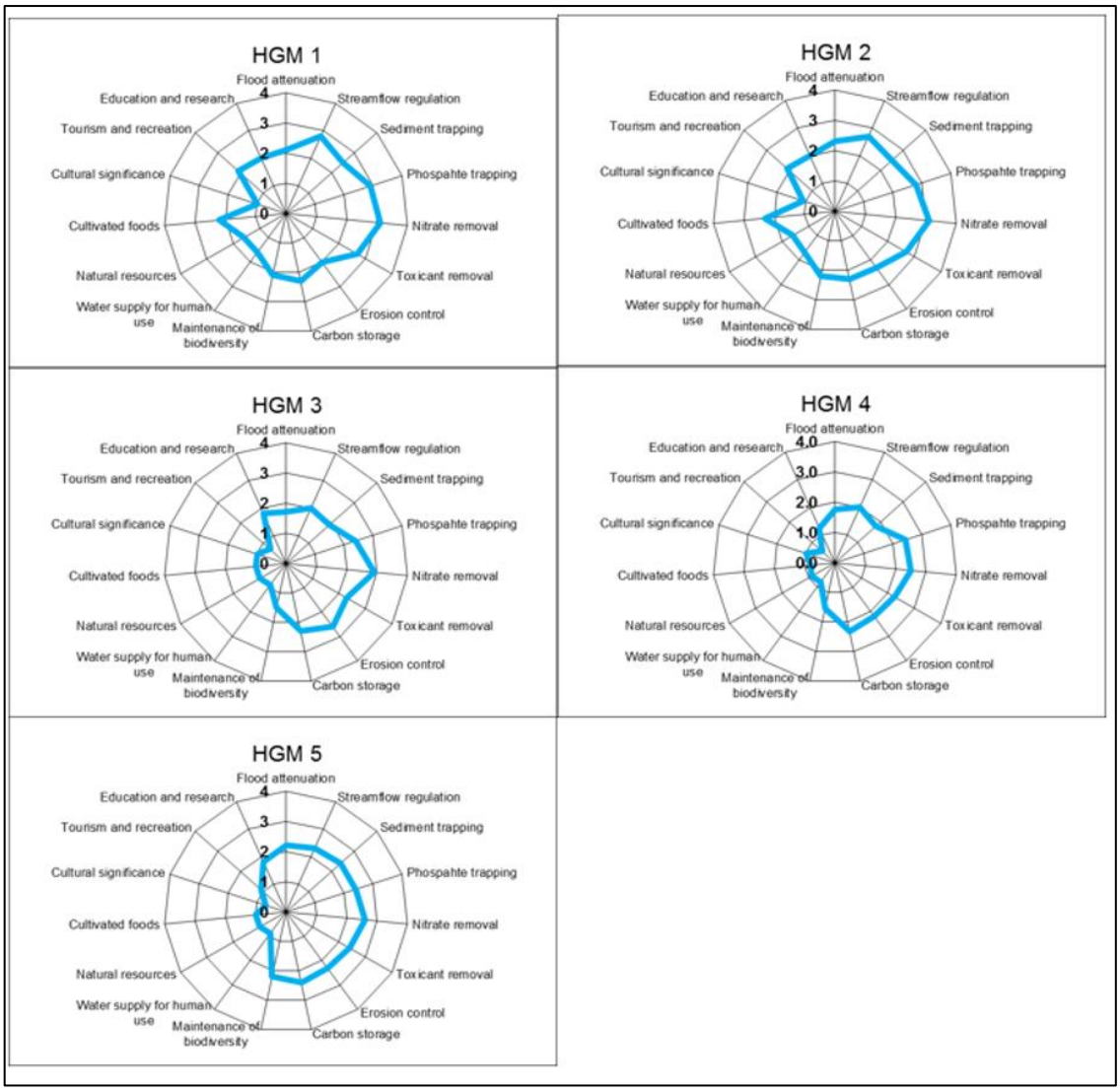


Figure 4.11: Radar plots depicting the ecological services for the wetland types

Ecological Importance and Sensitivity

The method used for the EIS determination was adapted from the method as provided by DWS (1999) for floodplains. The method takes into consideration PES scores obtained for WET-Health as well as function and service provision to enable the assessor to determine the most representative EIS category for the wetland feature or group being assessed. A series of determinants for EIS are assessed on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. The mean of the determinants is used to assign the EIS category as listed in Table 4.19.

Table 4.19: Description of EIS categories

EIS Category	Range of Mean	Recommended Ecological Management Class
Very High	3.1 to 4.0	**A**
High	2.1 to 3.0	**B**
Moderate	1.1 to 2.0	**C**
Low Marginal	< 1.0	**D**

The EIS assessment was applied to the HGM units described in the previous section in order to assess the levels of sensitivity and ecological importance of the wetland. The results of the assessment are shown in Table 4.20. The following findings from the ecological assessment were considered for the EIS classification:

- The project area is not associated within any formally protected areas;
- The wetland findings for this study present a considerable expanse (or extent) of wetland area, comprising varying HGM types. These wetlands are considered to be predominantly in a moderately modified state and provide moderately high levels of indirect benefits;
- The results of the PES assessment conducted by The Biodiversity Company (2017) derived a largely modified ecological category (Class D) for the Bronkhorstspruit system. This PES is below the attainable ecological management class (Class C);
- No plants Species of Conservation Concern (SCC) were recorded for the project area. The likelihood of occurrence of any of the Red and Orange List plant species is low to medium;
- Seventy-six (76) bird species were recorded in the general project area (since January 2018). No bird SCC were recorded during the survey, although based on the various wetland habitats encountered in the project area, the likelihood that bird SCC occur there is rated as high;
- Overall, mammal diversity in the project area was considered high, with eighteen (18) mammal species being recorded in the general project area based on either direct observation, camera trap photographs or the presence of visual tracks & signs;
- Three (3) mammal SCC were recorded in the general project area. Serval (Leptailurus serval) have been recorded on a number of occasions in the area, and it appears that a healthy population of these threatened mammals occur within the general area. Similarly, there seems to be healthy populations of Cape Clawless Otters (Aonyx capensis) along the wetland areas and in the dams within the general area;

- Six (6) reptile species were recorded in the project area during the January 2018. One near-endemic snake and one endemic snake species were recorded in the project; and
- Four (4) amphibian species was recorded in the project area during the January 2018 survey based on visual observations as well as from calls made by various frog species

The EIS of the two valley bottom wetland types, and the adjoining seepage systems was rated as high (Class B), with the remaining wetland types being rated as moderate (Class C). The hydrological / functional importance was rated as Moderate (Class C) for all the wetland systems. The direct human benefits were rated, varying from moderate (Class C) to low (Class D) for all the wetland systems. These findings are based on the Eco-Services classifications.

Table 4.20: The EIS results for the delineated wetlands

WETLAND IMPORTANCE AND SENSITIVITY	HGM 1	HGM 2	HGM 3	HGM 4	HGM 5
Ecological Importance & Sensitivity	2.6	2.6	1.6	1.5	2.3
Hydrological / Functional Importance	2.6	2.6	2.3	2.2	2.4
Direct Human Benefits	1.8	0.8	1.1	0.9	1.0

4.2.8.6 Buffer Zones

The project is for the proposed opencast mining operation and supporting infrastructure. The proposed mining area will result in the loss of some of the delineated wetlands. The DWS buffer tool recommends at a desktop level that the required buffer for opencast mining be 180m. The Mpumalanga Tourism and Parks Agency (MPTA) will request a minimum buffer width of 100m from the edge of the delineated wetlands.

A minimum buffer zone of 175 m is recommended for the wetlands with regards to a mining operation (Macfarlane et al., 2009). These minimum buffer widths (to protect core wetland habitat and aquatic functioning) are calculated based on a simple classification of wetland types and land use categories, broadly grouped as riverine and palustrine systems. Ecological and landscape characteristics are then assessed to establish the need to increase the buffer width, if at all.

The model shows that the largest risks (Very High) posed by the project during the construction phase is that of “increased sediment inputs and turbidity”. During the operational phase Very High risks were flagged for “alterations to flow volumes as well as patterns” and “inputs of heavy metal contaminants”. A number of High risks are also

expected for the operational phase of the project (Table 4.23). These risks are calculated with no prescribed mitigation and presented in Table 4.21.

Table 4.21: Pre-mitigation buffer requirement

Required buffer before mitigation measures have been applied	
Construction Phase	56 m
Operational Phase	96 m

According to the buffer guideline (Macfarlane et al., 2015) a high-risk activity would require a buffer that is 95% effective to reduce the risk of the impact to a low-level threat. The tool is regarded as a guideline; adjustments have been made to provide a better suited buffer width. The prescribed mitigation measures will reduce the risks for some aspects and the required buffer is then 45m and 65m (Table 4.22) for the construction and operational phases respectively. It is recommended that the larger buffer width of 65m be implemented from the onset of the construction phase of the project.

Table 4.22: Post-mitigation buffer requirement

Required buffer after mitigation measures have been applied	
Construction Phase	45 m
Operational Phase	65 m

Table 4.23: The risk results from the wetland buffer model for the proposed project

	Threat Posed by the proposed land use / activity	Specialist Threat Rating	Refined Threat Class	Specialist justification for refined threat ratings.
Construction Phase	1. Alteration to surface runoff flow volumes	Low		
	2. Alteration of patterns of flows (increased flood peaks)	Medium		
	3. Increase in sediment inputs & turbidity	Very High	High	Avoidance of valley bottom, and adjoining seepage areas and buffer. Dry season construction, limit (and demarcate) the disturbance footprint area, silt traps, stripping in a phased approach, begin vegetation clearing upslope and work downslope, managed stockpiles, storm water management
	4. Increased nutrient inputs	Low		
	5. Inputs of toxic organic contaminants	Medium		
	6. Inputs of toxic heavy metal contaminants	Medium	Low	Off-site equipment and vehicle fuelling and maintenance, storage of chemicals and fuel in bunded area, no on-site fabrication, oil spill kits, equipment & vehicle inspections.
	7. Alteration of acidity (pH)	Low		
	8. Increased inputs of salts (salinization)	Low		
	9. Change (elevation) of water temperature	Low		
	10. Pathogen inputs (i.e. disease-causing organisms)	Very Low		
Operational Phase	1. Alteration to flow volumes	Very High	High	Avoidance of valley bottom, and adjoining seepage areas and buffer. Minimise opencast pit footprint area. Pumping of clean water back into the wetland systems. Divert clean water around working areas, with controlled release into valley bottom areas. Stockpiling (and shaping) of soils and materials within the existing working area, and not within preferential flow paths.
	2. Alteration of patterns of flows (increased flood peaks)	Very High	High	
	3. Increase in sediment inputs & turbidity	High	Medium	Stockpiling of soils and materials within the existing working area, and not within preferential flow paths. Compile a stormwater management plan for the area. Separate clean and dirty water, intercept surface run-off and direct this around the working area.

Threat Posed by the proposed land use / activity	Specialist Threat Rating	Refined Threat Class	Specialist justification for refined threat ratings.
4. Increased nutrient inputs	High	Medium	Provide sanitation, and waste storage area. Service waste depots and facilities regularly and dispose of waste in demarcated areas.
5. Inputs of toxic organic contaminants	High		
6. Inputs of toxic heavy metal contaminants	Very High	High	Off-site equipment and vehicle fuelling and maintenance, storage of chemicals and fuel in bunded areas, no on-site fabrication, oil spill kits, equipment & vehicle inspections.
7. Alteration of acidity (pH)	High		
8. Increased inputs of salts (salinization)	High		
9. Change (elevation) of water temperature	Medium		
10. Pathogen inputs (i.e. disease-causing organisms)	Low		.

4.3 Groundwater

A geohydrological investigation was undertaken by GCS in 2018. Refer to Annexure C for the full Geohydrological report. It must be noted that the waste stockpiles were included in the geohydrological study; however, the waste stockpiles will be located at the existing Kangala Colliery. Thus, a conservative approach has been taken.

4.3.1 Aquifer Characterisation

Based on the lithological units identified from the 1:250 000 geological map it is believed that the following three types of aquifers exist within the project area, two of which are located within the Karoo Supergroup and the third aquifer in the deeper underlying Transvaal Supergroup:

Weathered zone aquifer unit

The first aquifer is a shallow, semi-confined or unconfined aquifer that occurs in the transitional soil and weathered bedrock zone. Depending on the depth of the groundwater level and extent/depth of weathering, this aquifer unit is typically between 0 and 17 metres thick. The shallow aquifer system is undeveloped/absent in areas where the groundwater level is deeper than the contact between the weathered zone and fresh bedrock.

Yields in this aquifer are generally low (less than ±0.5 l/s) and the aquifer is usually not fit for supplying groundwater on a sustainable basis. The aquifer receives on average ±3% recharge from rainfall. This aquifer often acts as a pathway for contamination and is therefore considered during seepage estimations from pollution sources to receiving groundwater and surface water systems. The weathered zone aquifer is usually only affected by opencast mining or by high extraction or shallow underground mining where subsidence occurs and the entire roof strata above the mined area is destroyed. Where mining becomes deeper the weathered zone aquifer is usually affected to a very limited extent. According to the Parsons Classification System, this aquifer is usually regarded as a minor- and in some cases a non-aquifer system.

Fractured Karoo rock aquifer unit

The second aquifer unit is the deeper secondary fractured rock aquifer that is hosted within the sedimentary rocks of the Karoo Supergroup and occurs at depths generally exceeding 20 metres below surface. Groundwater yields, although more heterogeneous, can be higher. This aquifer system usually displays semi-confined or confined characteristics with piezometric heads often significantly higher than the water-bearing fracture position.

Fractures may occur in any of the co-existing host rocks due to different tectonic, structural and genetic processes.

This aquifer is reported to be approximately 40 m thick. From previous investigations in similar geological units the saturated hydraulic conductivity of the Ecca Group was found to vary between $1x10^{-1}$ and $1x10^{-3}$ m/day. echarge to this aquifer is estimated to vary between 1 and 3% of the mean annual rainfall. According to the Parsons Classification System, this aquifer could be regarded as a minor aquifer system, but also a sole aquifer system in some cases where groundwater is the only source of domestic water.

Malmani dolomitic aquifer

The Malmani Subgroup forms the third and main aquifer and consists mainly of alternating layers of chert free dolomite and chert rich dolomite. Overlying the dolomite is the Dwyka Group with a limited or low aquifer potential, followed by the Vryheid Formation. The Dwyka Group shale and tillite are often seen as an aquitard or even an aquiclude that separates the dolomitic aquifer from the Vryheid Formation in which the planned mining will take place.

The Malmani dolomite has typically an effective depth of 300 m, the maximum depth to which significant dissolution of the dolomite has taken place. A hydraulic conductivity that varies between 10 and 100 m/day is considered representative of the Malmani dolomite. Recharge to this aquifer is estimated to vary between 2 and 6% of the mean annual rainfall (GCS, 2014), although this could be higher depending on the overlying cover material or geological units and the formation of surface karst features. According to the Parsons Classification System, this aquifer could be regarded as a major aquifer system, but also a sole aquifer system in some cases where groundwater is the only source of domestic water.

4.3.2 Groundwater Quality

The 2015 groundwater monitoring results for the Eloff Phase 3 Project (Table 4.24) showed that the calcium, magnesium and chloride content of groundwater from borehole EBA47 were slightly elevated in comparison with the other seven monitoring boreholes.

The values of each groundwater sampling point for the 2015 monitoring year were used to plot a Piper diagram. The Piper diagram (Figure 4.12) is a tri-linear plot that groups the water chemistry of the samples according to their chemical composition. Most of the groundwater samples plot in the left quadrant of the Piper diagram classification field, which is often an indication of freshly recharged water. Most boreholes have a Ca-Mg/HCO_3 water type, except for EBA37 and EBA38 that are dominated by Na-Cl/HCO_3. This anomaly cannot be explained at this point in time.

Table 4.24: Results of chemical and physical groundwater analyses (2015)

BH	Date	pH	EC mS/m	TDS mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	Cl mg/l	SO_4 mg/l	NO_3 mg/l	F mg/l	Al mg/l	Fe mg/l	Mn mg/l
EBA06	2015/03/20	8.4	22.0	-	21.1	7.3	10.7	3.0	12.7	14.7	1.0	0.21	<0.006	<0.006	<0.001
EBA37	2015/03/20	7.9	57.5	-	39.4	8.7	70.3	4.1	49.2	2.5	0.5	0.41	<0.006	<0.006	<0.001
EBA37	2015/09/10	7.7	104.0	564.0	24.8	6.3	187.0	3.8	196.0	<0.132	<0.392	1.08	<0.006	<0.006	<0.001
EBA38	2015/03/20	7.4	108.0	-	11.7	3.9	201.0	5.7	160.0	17.4	10.6	1.20	<0.006	<0.006	0.01
EBA38	2015/09/10	8.0	36.2	188.0	33.9	14.9	19.9	6.3	6.2	<0.132	1.8	<0.472	<0.006	<0.006	<0.001
EBA46	2015/09/10	7.4	47.6	288.0	44.5	21.0	23.0	10.8	15.2	<0.132	<0.392	<0.472	<0.006	2.52	1.09
EBA47	2015/03/20	8.0	148.0	-	134.0	63.7	75.4	13.4	230.0	24.5	9.2	0.31	<0.006	<0.006	<0.001
EBA47	2015/09/10	7.4	152.0	906.0	145.0	66.7	86.4	13.9	242.0	22.0	8.8	<0.472	<0.006	<0.006	<0.001
EBA49	2015/09/10	7.8	61.0	372.0	68.2	23.1	30.0	6.9	37.2	23.6	5.0	<0.472	<0.006	<0.006	<0.001
EBA62	2015/03/20	8.1	51.5	-	50.0	22.8	23.2	4.5	24.9	9.1	0.5	0.41	<0.006	<0.006	0.01
EBA62	2015/09/10	7.7	50.8	266.0	50.8	23.5	24.3	4.8	25.4	7.5	<0.392	0.52	<0.006	<0.006	0.07
EBA34	2015/09/10	7.9	50.6	322.0	37.7	20.3	39.8	3.5	36.3	20.7	3.9	<0.472	<0.006	<0.006	<0.001

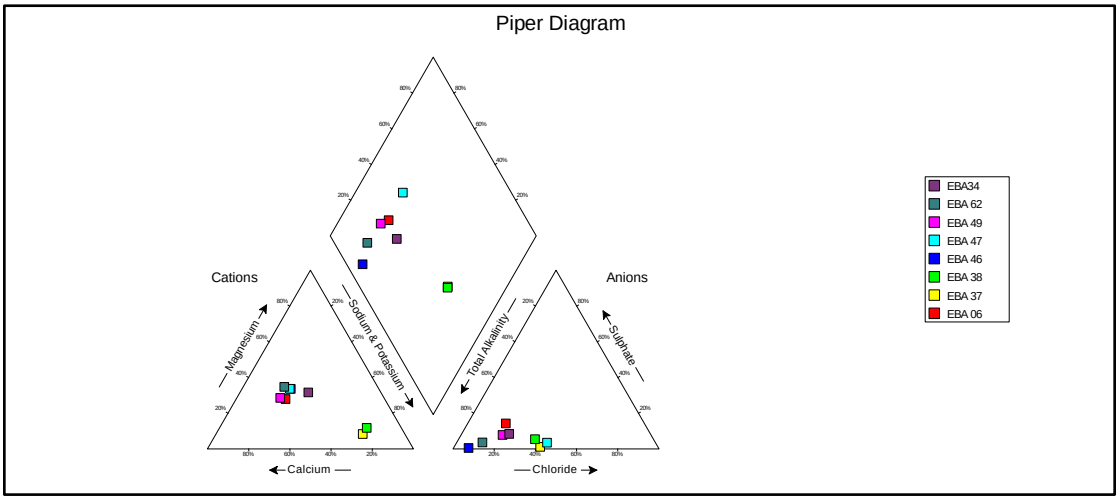


Figure 4.12: Piper diagram of groundwater monitoring points

The six groundwater samples that were collected during the 2016 GCS hydrocensus were firstly tested in the field for pH, EC and temperature (Table 4.25). The groundwater samples were then submitted to a SANAS accredited laboratory where they were analysed for a wide range of chemical and physical indicator parameters (Table 4.26).

The groundwater quality data was evaluated with the aid of diagnostic chemical diagrams and by comparing the inorganic concentrations to the South African National Standards for Drinking Water. One of the most appropriate ways to interpret the type of water at a sampling point is to assess the plot position of the water quality on different analytical diagrams like a Piper, Expanded Durov and Stiff diagrams. Of these three types, the Expanded Durov diagram probably gives the most holistic water quality signature.

Although never clear-cut, the general characteristics of the different fields of the diagram could be summarized as follows:

<u>Field 1:</u>

Fresh, very clean recently recharged groundwater with HCO_3 and CO_3 dominated ions.

<u>Field 2:</u>

Field 2 represents fresh, clean, relatively young groundwater that has started to undergo mineralization with especially Mg ion exchange.

<u>Field 3:</u>

This field indicates fresh, clean, relatively young groundwater that has undergone Na ion exchange (sometimes in Na - enriched granites or felsic rocks) or because of contamination effects from a source rich in Na.

Field 4:

Fresh, recently recharged groundwater with HCO_3 and CO_3 dominated ions that has been in contact with a source of SO_4 contamination or that has moved through SO_4 enriched bedrock.

Field 5:

Groundwater that is usually a mix of different types – either clean water from fields 1 and 2 that has undergone SO_4 and NaCl mixing / contamination or old stagnant NaCl dominated water that has mixed with clean water.

Field 6:

Groundwater from field 5 that has been in contact with a source rich in Na or old stagnant NaCl dominated water that resides in Na rich host rock/material.

Field 7:

Water rarely plots in this field that indicates NO_3 or Cl enrichment or dissolution.

Field 8:

Groundwater that is usually a mix of different types – either clean water from fields 1 and 2 that has undergone SO_4, but especially Cl mixing/contamination or old stagnant NaCl dominated water that has mixed with water richer in Mg.

Field 9:

Old or stagnant water that has reached the end of the geohydrological cycle (deserts, salty pans etc.) or water that has moved a long time and / or distance through the aquifer or on surface and has undergone significant ion exchange because of the long distance or residence time in the aquifer.

The layout of the fields of the Expanded Durov diagram (EDD) is shown in Figure 4.13.

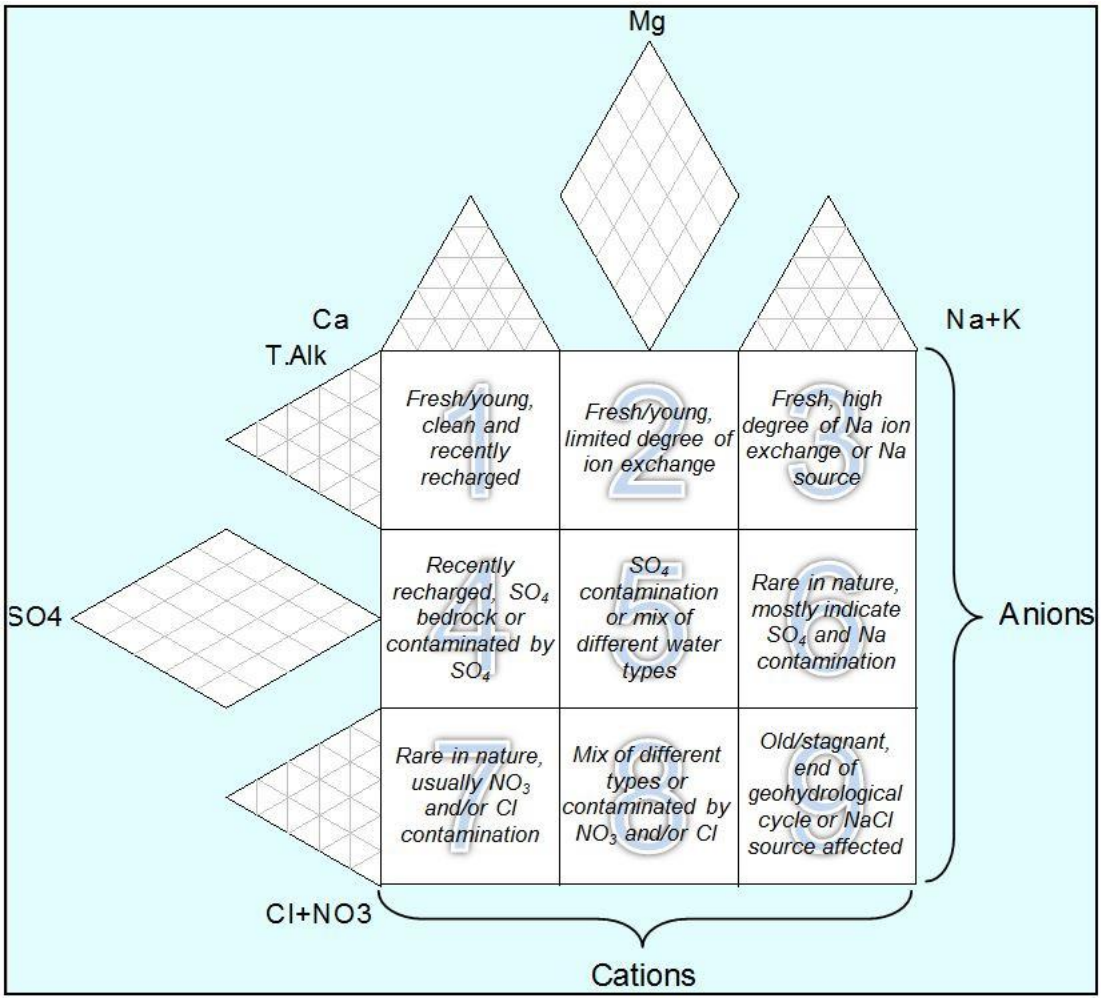


Figure 4.13: Layout of fields of the Expanded Durov diagram (EDD)

The results of the field analyses show neutral pH values for five boreholes and a slightly acidic pH (6.58) for EBA38. EC values range from 223 µS/cm in EBA02 and EBA38 to 1 260 µS/cm in EBA47 (Table 4.25).

The groundwater is considered to be of good quality as the concentrations of most chemical and physical indicator parameters are well below the SANS Drinking Water Standards (Table 4.26). The groundwater ammonium content in EBA37 does however exceed the maximum permissible SANS concentration of 1.5 mg/l, which at this point in time cannot be explained with the information available.

Groundwater from all six boreholes plot in fields 1, 2 and 3 of the EDD (Figure 4.14) that often represent fresh, clean, relatively young groundwater (fields 1 and 2), while EBA02 (field 3) has most likely undergone ion exchange with sodium enrichment and may consequently be slightly older.

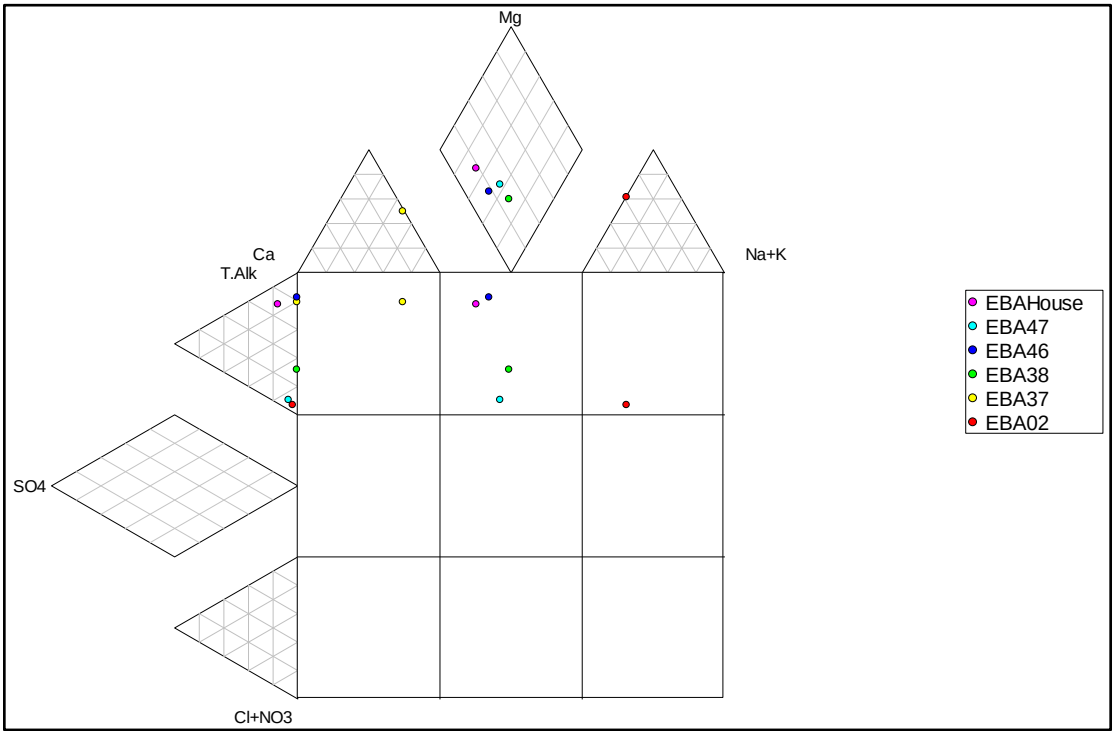


Figure 4.14: Expanded Durov diagram of groundwater chemistries for hydrocensus boreholes

Table 4.25: Field physio-chemical data (November 2016)

Borehole ID	Coordinates Information		Field Physio-Chemical Information:			Sampling Information:			
	Coordinates		pH	EC	Temp	Date	Time	Method	Depth
	East	South							
	[m]	[m]	[pH Value]	[µS/cm]	[°C]	[dd-mm-yyyy]	[hh:mm]		[m bRL]
EBA02	28.63038	26.2887	7.95	223	23.7	02/11/2016	_	Bailer	15 m
EBA37	28.63572	24.2468	7.06	415	24.6	01/11/2016	14:36	Bailer	15 m
EBA38	28.63534	26.2462	6.58	223	23.7	01/11/2016	15:04	Bailer	26 m
EBA46	28.63917	26.2554	7.26	400	23.6	01/11/2016	16:19	Existing Pump System	Handpump
EBA47	28.64412	26.252	7.05	1260	21.9	01/11/2016	16:05	Bailer	15 m
EBAHOUSE	28.17293	26.1729	7.77	551	23.7	01/11/2016	11:20	Tap	Tap

Table 4.26: Results of groundwater analyses (November 2016)

Locality	pH	EC	TDS	Alk	Cl	SO_4	NO_3	NH_4	PO_4	F	Ca	Mg	Na	K	Al	Fe	Mn
Unit	*pH*	*mS/m*	*mg/l*	*mg $CaCO_3$/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/l*
EBA02	8	142	790	380	235	12.8	0.3	0.1	-0.005	0.4	57.8	56.5	175	3.1	-0.002	-0.004	-0.001
EBA37	7	37.8	260	189	15	-0.141	0.3	2.7	-0.005	0.3	41	12.2	19.1	6.8	-0.002	0.3	0.2
EBA38	6.6	23.9	187	69.1	17	-0.141	3.4	0.1	0.015	-0.263	16.1	8.1	15	5	-0.002	-0.004	-0.001
EBA46	7.6	40.2	233	201	13.1	-0.141	0.3	1.2	-0.005	-0.263	36.6	17.7	20.6	10.2	-0.002	-0.004	0.6
EBA47	7.4	130	724	338	192	21.5	0.9	0.1	-0.005	0.3	99.2	59.9	82.8	13.2	-0.002	-0.004	0.1
EBAHouse	8.1	53.9	344	264	15.1	23.5	0.5	0.1	-0.005	-0.263	52.8	33	23.8	1.9	-0.002	-0.004	-0.001

Note: Red – Parameter value exceeds maximum concentration allowed in drinking water (Table 5-5)

4.3.3 Hydro-census

The majority of groundwater user information was collected during two individual and historical hydrocensus investigations, namely:

- Digby Wells and Associates – survey was conducted in September 2009 as input to the EIA and EMP studies for Kangala Colliery; and
- GCS Water and Environment – survey was conducted in November 2016 as input to the EIA and EMP studies for Eloff Colliery.

The Digby Wells & Associates hydrocensus of 2009 was conducted on the farm portions directly bordering the mining area. Five farms were visited, namely Middelbult 235IR, Strydpan 243 IR, Welgevonden 272 IR, Wolvefontein 244 IR and Witklip 232 IR. A total of 40 boreholes were located and their positions are indicated in Figure 4.15. Four of these boreholes are the property of the DWS and were drilled into the underlying dolomite specifically for water level monitoring purposes. More borehole related information is provided in Table 4.27.

A total of 38 boreholes were located during the GCS hydrocensus of 2016 and their positions are indicated in Figure 4.15. More information is provided in Table 4.28 regarding borehole coordinates, status and measured groundwater levels. Information pertaining to water use of the 38 boreholes is listed below:

- 17 boreholes were used for domestic purposes; 2 boreholes were used for stock watering; and 2 boreholes were used for irrigation; and
- 1 borehole was not in use.

Five boreholes could not be located on site during the GCS hydrocensus of 2016, however their coordinates are known from previous surveys and are also provided in Table 4.28. Boreholes EF, EBA03, EBA30/KGA39 and KGA40 are located within the proposed pit and stockpile footprint areas and will be demolished at some point during the life of mine. It must be noted that only boreholes EBA30/KGA39 and KGA40 were however in use at the time of the surveys.

Table 4.27: Digby Wells and Associates hydrocensus information of 2009

Borehole ID	Coordinates		Site type	Use	Farm	Equipment
	South	East				
G37017	-26.2305	28.6488	Borehole	DWS dolomite report borehole	Strydpan 243 IR	None
G37018	-26.2030	28.6785	Borehole	DWS dolomite report borehole	Wolvefontein 244 IR	None
G37030	-26.2588	28.6928	Borehole	DWS dolomite report borehole	Welgevonden 272 IR	None
KGA01	-26.1695	28.6805	Borehole	Domestic	Witklip 232 IR	Submersible pump
KGA02	-26.1695	28.6837	Borehole	None	Witklip 232 IR	None
KGA03	-26.1558	28.6811	Borehole	Domestic	Witklip 232 IR	Submersible pump
KGA04	-26.1564	28.6822	Borehole	Domestic and irrigation	Witklip 232 IR	Submersible pump
KGA05	-26.1562	28.6822	Borehole	Domestic	Witklip 232 IR	Submersible pump
KGA06	-26.1580	28.6770	Borehole	Domestic	Witklip 232 IR	Submersible pump
KGA07	-26.1591	28.6752	Borehole	Domestic and irrigation	Witklip 232 IR	Submersible pump
KGA08	-26.1573	28.6760	Surface water dam	Irrigation	Witklip 232 IR	None
KGA09	-26.1565	28.6740	Borehole	None	Witklip 232 IR	None
KGA10	-26.1683	28.6905	Borehole	None (planned for domestic use in future)	Witklip 232 IR	None
KGA11	-26.1666	28.6805	Borehole	Domestic	Witklip 232 IR	Submersible pump
KGA12	-26.1813	28.6683	Borehole	DWS directorate of geohydrology borehole	Witklip 232 IR	None
KGA13	-26.1963	28.6807	Surface water dam	Livestock	Wolvefontein 244 IR	None
KGA14	-26.2024	28.6772	Borehole	Domestic	Wolvefontein 244 IR	Submersible pump
KGA15	-26.2062	28.6838	Borehole	Domestic	Wolvefontein 244 IR	Submersible pump
KGA16	-26.1918	28.6945	Borehole	None (pump had seized)	Wolvefontein 244 IR	Hand pump
KGA17	-26.2038	28.7012	Borehole	Livestock and irrigation	Wolvefontein 244 IR	Submersible pump
KGA18	-26.1974	28.7126	Borehole	Livestock and irrigation	Wolvefontein 244 IR	Submersible pump
KGA19	-26.1959	28.7061	Surface water dam	Livestock	Wolvefontein 244 IR	None
KGA20	-26.1958	28.6985	Surface water dam	Livestock and irrigation	Wolvefontein 244 IR	None
KGA21	-26.1857	28.6918	Borehole	Domestic	Wolvefontein 244 IR	Submersible pump
KGA22	-26.1666	28.6607	Borehole	Livestock and irrigation	Middelbult 235 IR	Submersible pump
KGA23	-26.1659	28.6591	Borehole	Livestock and irrigation	Middelbult 235 IR	Submersible pump

Borehole ID	Coordinates		Site type	Use	Farm	Equipment
	South	East				
KGA24	-26.1641	28.6595	Borehole	Livestock and irrigation	Middelbult 235 IR	Submersible pump
KGA25	-26.1634	28.6591	Borehole	Livestock and irrigation	Middelbult 235 IR	Submersible pump
KGA26	-26.1700	28.6542	Borehole	Livestock and irrigation	Middelbult 235 IR	Submersible pump
KGA27	-26.1695	28.6542	Borehole	Livestock and irrigation	Middelbult 235 IR	Submersible pump
KGA28	-26.1730	28.6513	Borehole	Livestock and irrigation	Middelbult 235 IR	Submersible pump
KGA29	-26.1735	28.6502	Borehole	Domestic	Middelbult 235 IR	Submersible pump
KGA30	-26.1755	28.6327	Borehole	Livestock and irrigation	Middelbult 235 IR	Submersible pump
KGA31	-26.1765	28.6303	Borehole	Livestock and irrigation	Middelbult 235 IR	Submersible pump
KGA32	-26.1761	28.6279	Borehole	Livestock and irrigation	Middelbult 235 IR	Submersible pump
KGA33	-26.1760	28.6287	Borehole	Livestock and irrigation	Middelbult 235 IR	Submersible pump
KGA34	-26.1761	28.6266	Borehole	Livestock and irrigation	Middelbult 235 IR	Submersible pump
KGA35	-26.1754	28.6280	Borehole	Livestock and irrigation	Middelbult 235 IR	Submersible pump
KGA36	-26.1911	28.6204	Borehole	Livestock and irrigation	Middelbult 235 IR	Submersible pump
KGA37	-26.1668	28.6568	Borehole	Domestic	Middelbult 235 IR	Submersible pump
KGA38	-26.1700	28.6624	Borehole	None	Middelbult 235 IR	None
KGA39	-26.2045	28.6400	Borehole	Domestic and livestock	Strydpan 243 IR	Submersible pump
KGA40	-26.2064	28.6519	Borehole	Domestic	Strydpan 243 IR	Bucket and rope
KGA41	-26.2144	28.6543	Borehole	Domestic	Strydpan 243 IR	Bucket and rope
KGA42	-26.1941	28.6456	Surface water dam	Livestock and irrigation	Middelbult 235 IR	None

Table 4.28: GCS hydrocensus information of 2016

Borehole ID	Coordinate Information		Bore/Spring Construction Information	Borehole Equipment & Status		Hydrogeological Information
	Coordinates		Collar Height	Equipment	Status:	Static Water Level
	South	East	[m]			[m bRL]
EBA01	-26.2835	28.62908	0.12	N/A	Blocked	Blocked
EBA02	-26.2887	28.63038	0	Hand pump	Good	4.37
EBA03	-26.2141	28.63836	Unknown	N/A	Blocked	Blocked
EBA04	-26.2505	28.56264	0.27	N/A	Blocked	Blocked
EBA05	-26.516	28.56253	0.21	N/A	Blocked	Blocked
EBA06	-26.2436	28.57786	Equipped	None	Good	Equipped
EBA07	-26.2523	28.59951	Unknown	Unknown	Not located	Unknown
EBA34	-26.2001	28.5744	0.12	N/A	Good	Equipped
EBA35	-26.1808	28.5746	Unknown	Unknown	Not located	Unknown
EBA36	-26.2459	28.63547	0.21	Submersible pump	Good	8.49
EBA37	-24.2468	28.63572	0	N/A	Good	5.24
EBA38	-26.2462	28.63534	0.12	N/A	Good	24.78
EBA28	-26.17544	28.62779	0.5	Submersible pump	Good	27.76
EBA30	-26.20445	28.64031	0.15	Submersible pump	Good	6.82
EBA39	-26.2435	28.63553	0	N/A	Blocked	Blocked
EBA40	-26.2419	28.63441	0.1	Submersible pump	Good	19.08
EBA42	-26.2693	28.65342	0.35	Submersible pump	Good	6.4
EBA43	-26.2666	28.64934	0.45	Submersible pump	Good	6.38
EBA44	-26.2569	28.63456	0.1	None	Good	5.38
EBA45	-26.2555	28.63558	0	Submersible pump	Good	17.38

Borehole ID	Coordinate Information		Bore/Spring Construction Information	Borehole Equipment & Status		Hydrogeological Information
	Coordinates		Collar Height	Equipment	Status:	Static Water Level
	South	East	[m]			[m bRL]
EBA46	-26.2554	28.63917	0	Hand pump	Good	Sealed top
EBA47	-26.252	28.64412	0.1	N/A	Good	11.39
EBA48	-26.246	28.64926	Windmill	Windmill	Good	Windmill
EBA49	-26.2324	28.66189	0.23	N/A	Good	8.56
EBA50	-26.233	28.67144	Handpump	Hand pump	Good	Hand pump
EBA51	-26.2639	28.66284	0.37	N/A	Blocked	Blocked
EBA52	-26.2632	28.66353	0.4	N/A	Blocked	Blocked
EBA53	-26.2715	28.65157	0.48	Submersible pump	Good	Equipped
EBA54	-26.2321	28.65527	0.22	N/A	Good	Blocked
EBA55	-26.2346	28.65671	Unknown	Unknown	Not located	Unknown
EBA56	-26.2369	28.66129	0.36	Submersible pump	Good	Equipped
EBA60	-26.236	28.61618	0	Windmill	Good	Windmill
EBA60A	-26.23662	28.61675	0.17	Submersible pump	Good	58.02
EBA63	-26.2393	28.6159	No access	Unknown	Unknown	No Access
EBA64	-26.2403	28.61725	No access	Unknown	Unknown	No Access
EBA65	-26.2435	26.64207	Unknown	Unknown	Not located	Unknown
EBA66	-26.2405	28.6413	0.27	Submersible pump	Good	28.41
EBA67	-26.2407	28.64045	32	Submersible pump	Good	Equipped
EBA74	-26.2045	28.56058	0.1	N/A	Unknown	No Access
EBA75	-26.204	28.55943	No access	N/A	Blocked	Blocked
EBAHOUSE	-26.17293	28.17293	0.45	Submersible pump	Good	34.34

Borehole ID	Coordinate Information		Bore/Spring Construction Information	Borehole Equipment & Status		Hydrogeological Information
	Coordinates		Collar Height	Equipment	Status:	Static Water Level
	South	East	[m]			[m bRL]
EF	-26.2071	28.64383	Unknown	Unknown	Not located	Unknown
G37017	-26.23052	28.64882	0.35	None	Good	46.85
SMVDYK	-26.2218	28.55277	Equipped	Submersible pump	Good	Equipped

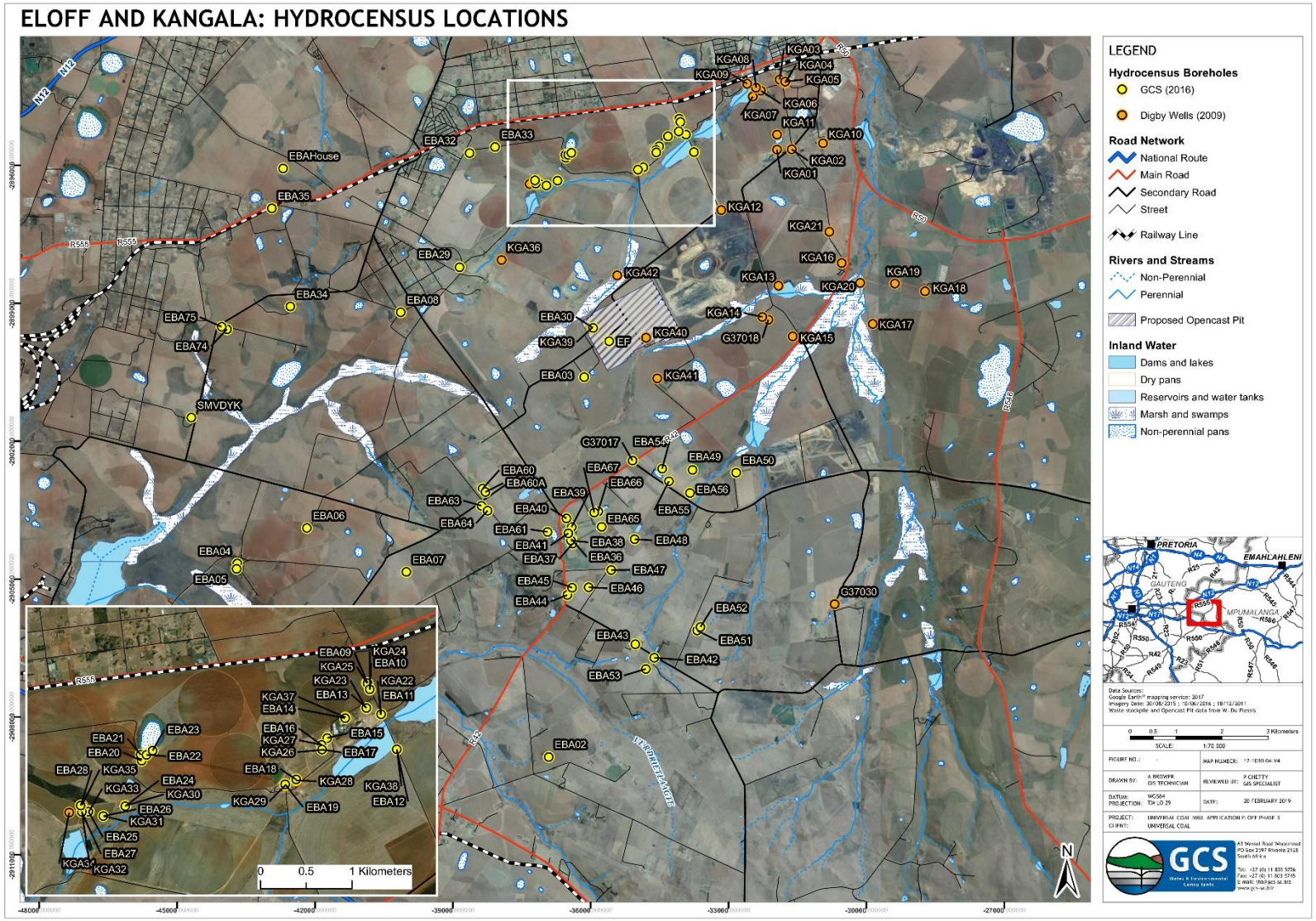


Figure 4.15: Hydrocensus localities

4.3.4 Potential Pollution Source Identification

The proposed new mining activities are an expansion of the already existing Kangala Colliery and only includes additional opencast mining. All existing mining and related infrastructure will be utilised throughout the life of mine and have already been included and approved in previous EMP and EIA studies.

An evaluation of the proposed mining and related activities revealed two additional source areas that may potentially pose a risk to the underlying groundwater in terms of quality and are listed and briefly discussed in Table 4.29.

Table 4.29: Potential sources of groundwater contamination

Source	Contamination risk	Comments
1. Waste rock stockpiles and coal stockpiles*	Medium to high	Surface water run-off originating from these source areas, toe-seeps and seepage through the base may potentially be affected by acid mine/rock drainage. This seepage may have a high salt concentration, especially sulphate. Some localised low pH seepage may also occur, resulting in elevated metals such as iron
2. Opencast pit	Medium to high	Contamination will only leave the pit area after groundwater levels have recovered post closure. Water collecting in the mine void is usually characterised by high concentrations of sulphate, with localised low pH due to acid mine drainage. Pit water is planned to be pumped to the existing pollution control dam at the Kangala Colliery.

*It must be noted that the waste stockpiles will be located at the existing Kangala Colliery and no longer at the Eloff Phase 3 Project.

A receptor of groundwater contamination usually occurs in the form of a groundwater user that relies on groundwater for domestic, irrigation or livestock watering purposes. Surface water features (stream, river, dam, etc.) that rely on groundwater base flow for the sustainment of the aquatic environment are also considered to be important receptors.

Numerous user boreholes were located during the hydrocensus/user surveys and their positions are indicated in Figure 4.15. Five boreholes are located within a one kilometre radius of the proposed new opencast pit. Four of these boreholes will be demolished during

the life of mine (EF, EBA03, EBA30/KGA39 and KGA40), while borehole KGA41 is located in the up gradient groundwater flow direction. Please note that only boreholes EBA30/KGA39 and KGA40 were however in use at the time of the surveys. No major or perennial rivers/streams are located within close proximity of the proposed new mining activities that may potentially act as receptors.

4.3.5 Groundwater Model

The numerical groundwater model is a simplified representation of the very complex and heterogeneous interacting aquifer systems underlying the project area.

During the steady state calibration of the flow model changes were made to mainly the aquifer hydraulic property, transmissivity and effective recharge, until an acceptable correlation was achieved between the observed groundwater elevations and those simulated by the model. Groundwater level information obtained from the hydrocensus/user surveys was used in the calibration process. A good correlation (i.e. root mean square error or RMSE of ±2.7) was achieved with the calibration of the flow model.

The good correlation suggests that the simulated water levels in the simplified model simulation are closely representing the actual water levels. Model predictions in reasonable time frames should provide results to acceptable levels of confidence. However, it should be noted that areas do exist where very little or even no water level information is available, which combined with the highly heterogeneous nature of the fractured rock aquifer are bound to result in over- and/or underestimations of the groundwater elevations.

The calibrated groundwater elevations were exported from the flow model and used to construct a contour map of the steady state groundwater elevations (Figure 4.16). The lowest groundwater elevations were simulated to occur in the north-eastern down gradient direction.

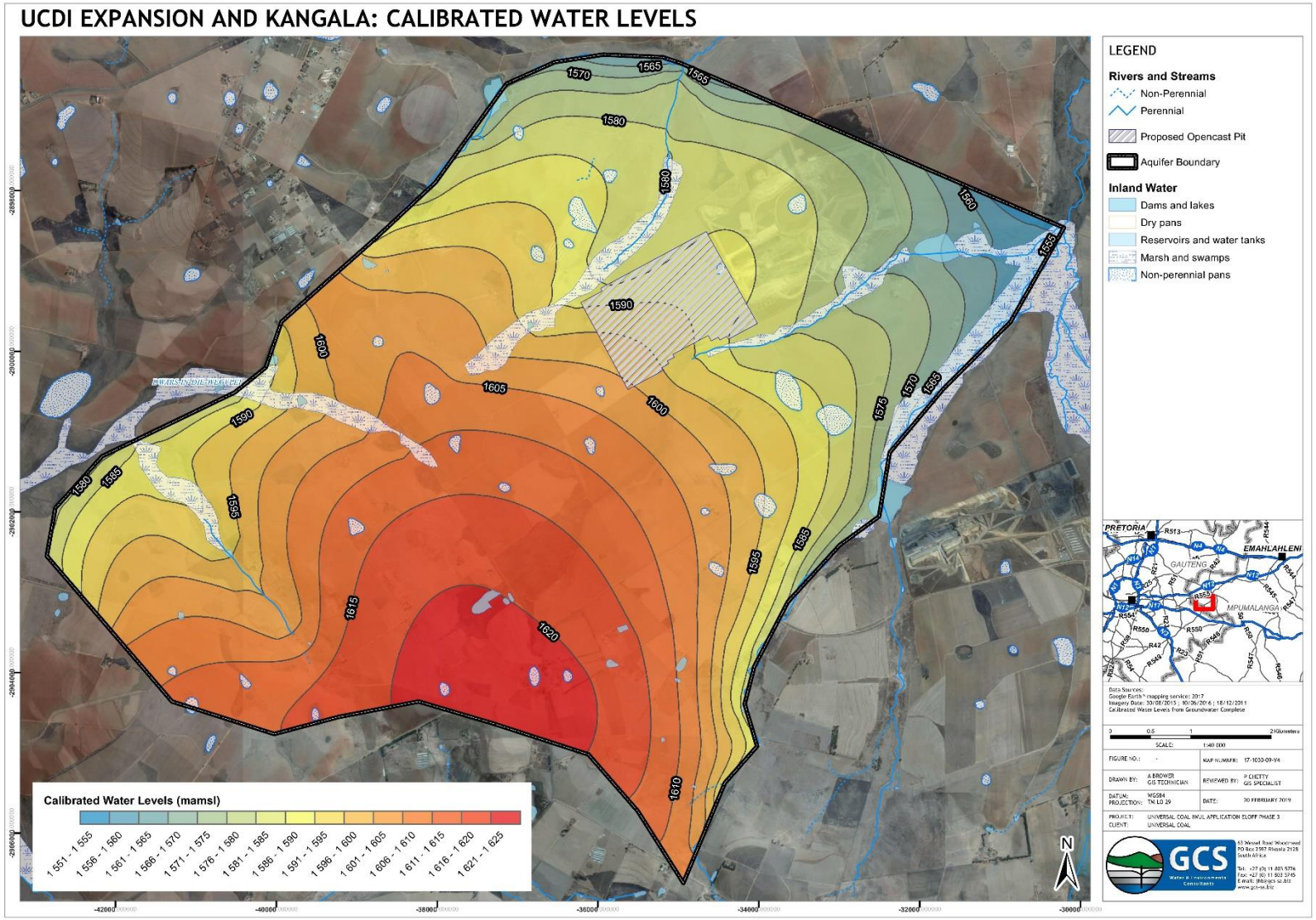


Figure 4.16: Model simulated steady state groundwater elevations (mamsl)

Flow Model

Impacts on groundwater levels are expected to occur as a result of pit dewatering. The flow model was therefore used to simulate this potential impact. The extent of the groundwater level impacts is governed by the hydraulic properties (transmissivity) of the aquifer host rock, storativity and time. The influence of transmissivity on the radius/extent of the cone of depression (water level impact) is explained by means of the following equation:

$$R(t) = 1.5(Tt/S)^{1/2}$$

Where R = *Radius (m),*

T = *Aquifer transmissivity* (m^2/d),

t = *Time (days),*

S = *Storativity.*

From the equation it is clear that an increase in transmissivity will lead to an increase in the radius of influence (extent of depression cone). Impacts on groundwater levels are therefore expected to extend along transmissive geological structures, which is why structural geological information plays such an important role in the construction of an accurate flow model. Furthermore, such structures may also greatly increase groundwater discharge into the mine void.

A stress period in the model is a period where groundwater flow and contaminant transport conditions are constant. All time dependent parameters in the model, like drains, rivers, aquifer recharge, contaminant sources, sinks and contaminant concentrations remain constant during the course of a stress period. The total model simulation runtime of 61 years was subdivided into thirteen individual stress periods (Table 4.30):

Table 4.30: Stress periods

Stress period	Simulation time	Comments
1 - 3	3 Years	Simulate active opencast mining of only the Kangala coal reserves directly east of the Eloff Block.
4 - 11	8 Years	Mining of Kangala coal reserves ceases at the end of stress period 4, while opencast mining of the Eloff Block was simulated from stress period 4 through to the end of stress period 11.
11 - 13	50 Years	Simulate post closure impacts, especially in terms of groundwater quality (contaminant migration).

In order to better indicate the impact of the planned opencast mining activities on the surrounding groundwater levels (drawdown), initial groundwater elevations were subtracted from the simulated groundwater elevations at mine closure.

The difference between these two data sets therefore represents the expected total groundwater level drawdown over the operational life of the mine. This data was used to construct a contour map of the model simulated groundwater depression cone, which is indicated in Figure 4.17. Groundwater user boreholes located within the mining rights areas are indicated in the above mentioned figure with the use of black placemarks.

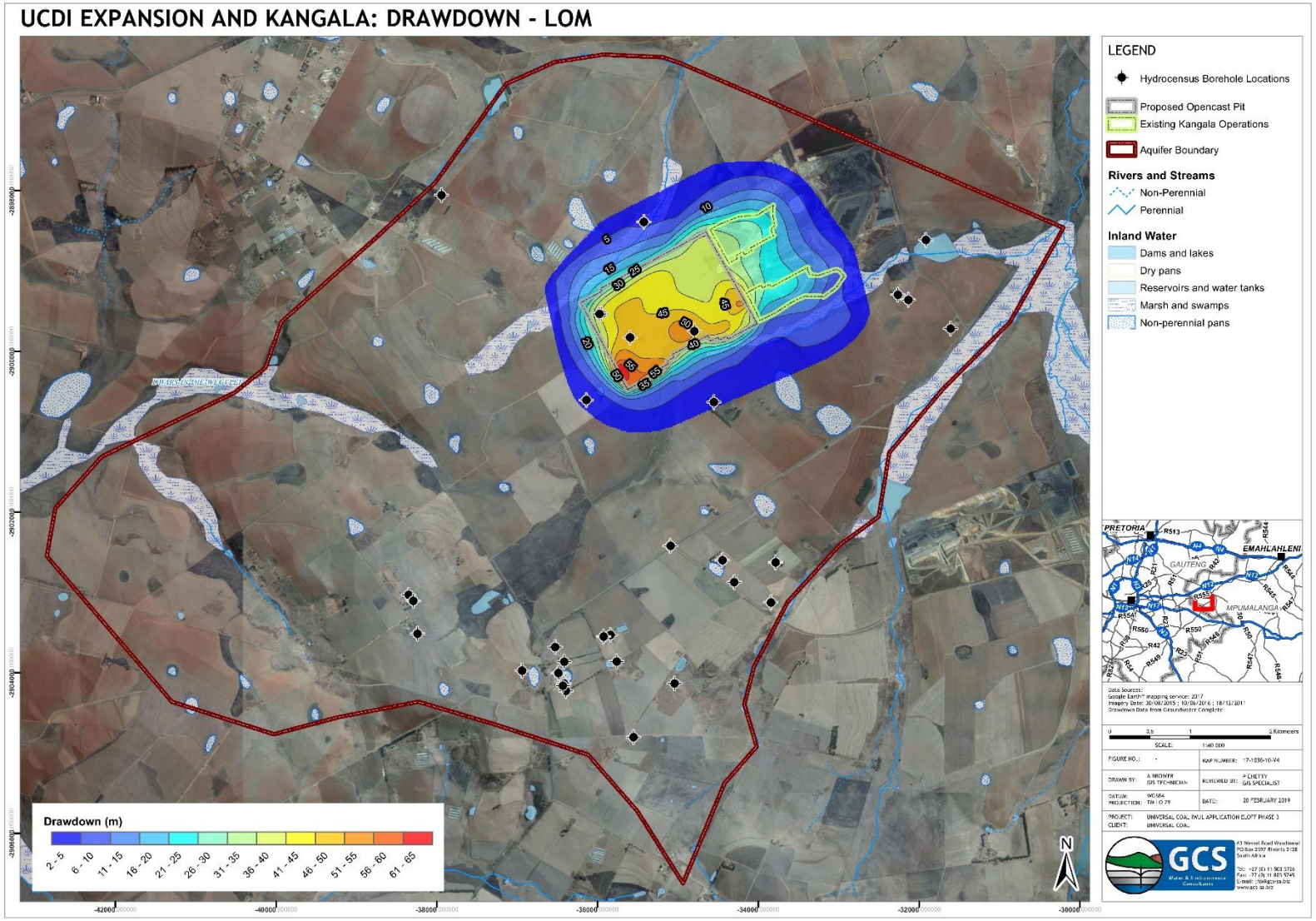


Figure 4.17: Model simulated groundwater depression cone at mine closure

Contaminant Transport Model

The calibrated flow model was used as a basis for the contaminant transport model, which was constructed to simulate the migration of contaminants from the contaminant source areas towards the surrounding aquifer system. The potential source areas listed and discussed in Table 5-16 were simulated in the contaminant transport model. Waste rock is planned to be placed back into the pit during backfilling and all waste rock stockpiles were consequently excluded from the post-closure model simulations.

Please note that most source areas (if practically possible) are lined with some form of a clay or synthetic liner, covered with concrete or have a subsurface drainage system installed to prevent contamination from entering the underlying aquifer and eventually contaminating the groundwater. Source areas (i.e. waste rock and coal stockpiles) were however simulated without any such form of lining and the model results are therefore considered to be representative of a worst case scenario. However, the waste stockpiles will be located at the Kangala Colliery instead.

In order to better indicate the impact of the potential sources on the surrounding groundwater quality conditions, contamination contours were exported from the contaminant transport model after a 25 (Figure 4.18) and 50 (Figure 4.19) years post closure simulation runtime.

The contamination was simulated by applying contaminated recharge to the entire surface areas of the contaminant source areas. Source concentrations were based on the results of the geochemistry and waste classification study that was conducted by Digby Wells in 2017. All source areas were assigned a Total Dissolved Solids (TDS) concentration of 1 500 mg/l, similar to what was used by Head Waters in their February 2018 study for the Middelbult Expansion Project.

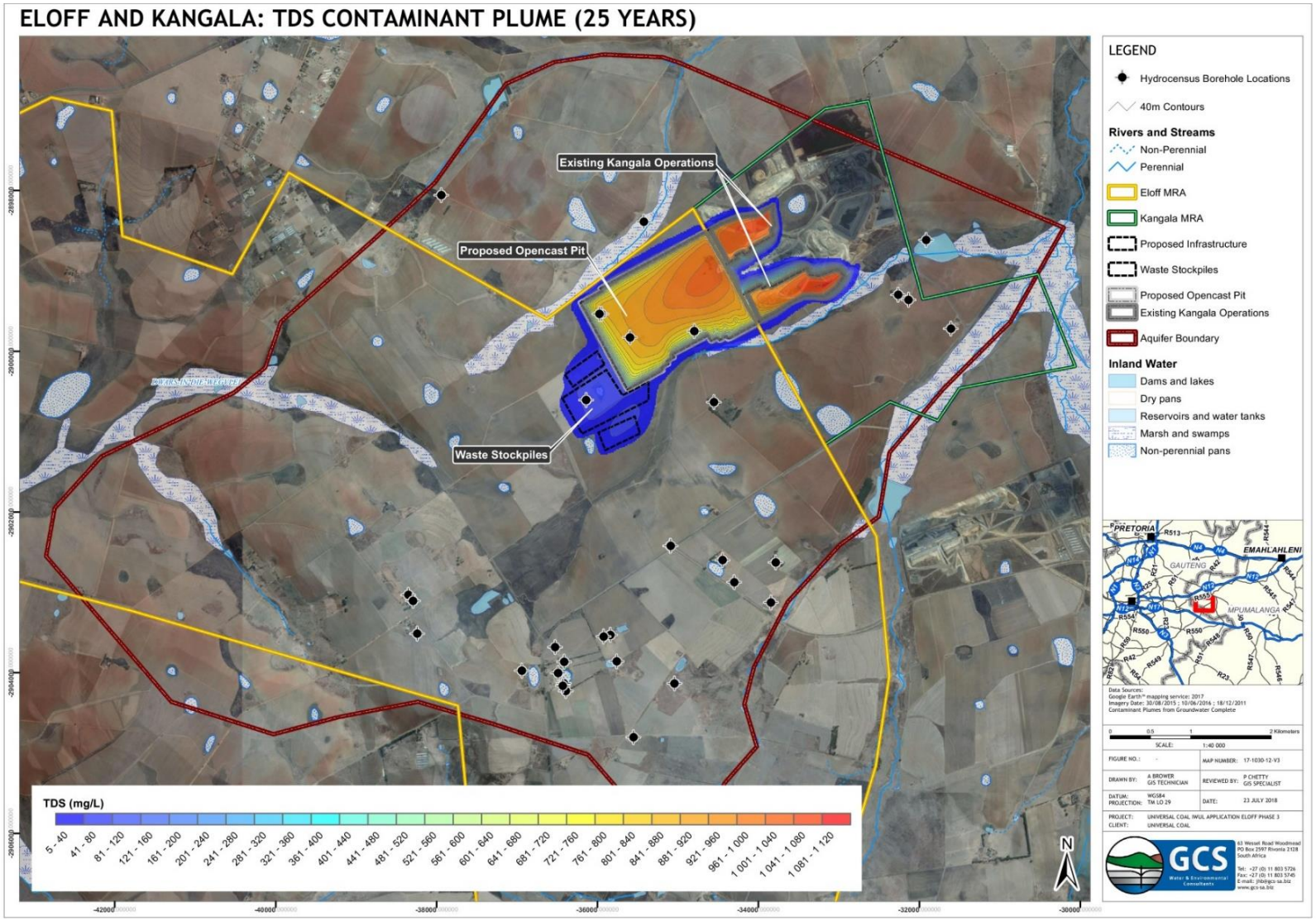


Figure 4.18: Simulated plume migration at 25 years post closure

***It should be noted that the plume was modelled to include the waste stockpile area. The waste stockpiles will, however, be located at the existing Kangala Colliery and no longer at the Eloff Phase 3 Project.**

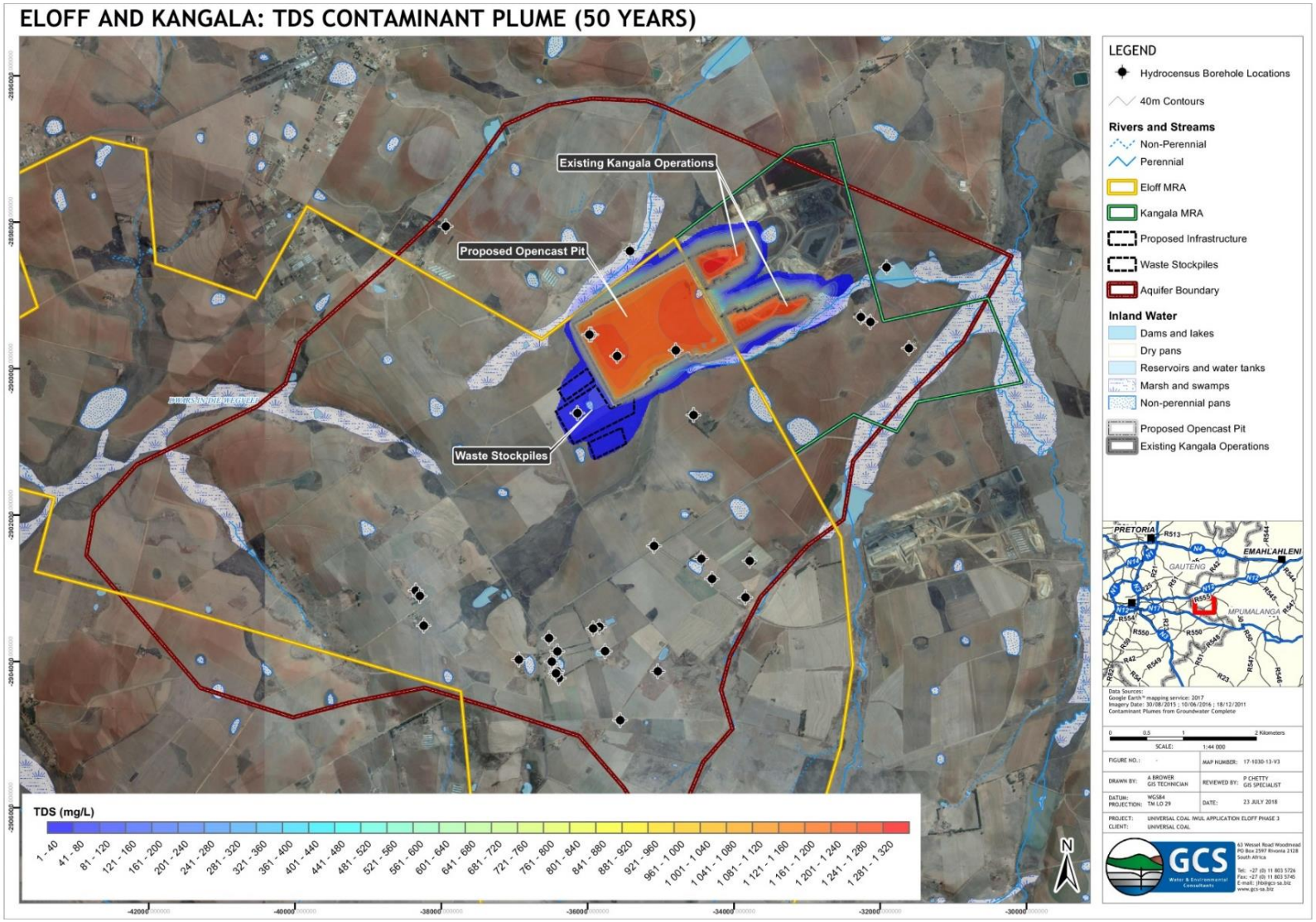


Figure 4.19: Simulated plume migration at 50 years post closure

***It should be noted that the plume was modelled to include the waste stockpile area. The waste stockpiles will, however, be located at the existing Kangala Colliery and no longer at the Eloff Phase 3 Project.**

4.4 Socio-economic Environment

4.4.1 Regional Context

The Eloff Phase 3 Project lies in the south-western parts of Mpumalanga Province within ward 7 of the Victor Kanye Local Municipality which is under the jurisdiction of the Nkangala District Municipality. The Victor Kanye Local Municipality is strategically located, as it is situated between Johannesburg in Gauteng and Nelspruit in Mpumalanga. It is also located close to the economically thriving metropolitan municipalities in Gauteng namely, Ekurhuleni and Tshwane. It is 10km from the N12 Highway, which joins the N4 Maputo corridor, the main link between Gauteng, Mpumalanga and Mozambique.

The Victor Kanye Local Municipality is approximately 1 570km^2 in extent and has a population of 75 452 according to the 2011 census (Stats SA, 2018). The area is mostly plain with a few rocky outcrops and meandering rivers. Settlements in the area are sparsely distributed. Urban settlements are found mostly in Eloff, Sundra, Delmas and Botleng. Rural settlements include Brakfontein, Argent, Arbor, Dryden and Waaikraal. Agricultural settlements in the form of smallholdings are also found in Eloff, Sundra (Droogefontein and Reitkol), Strydpan and Delmas (Leeupoort) (Stats SA, 2018). Dryden is also a railway settlement with industrial development.

4.4.2 Local Context

4.4.2.1 Demographics

According to the 2011 census, Mpumalanga recorded a population size of 4 039 939, ranking it sixth out of the nine provinces (Stats SA, 2014). The total population of Victor Khanye Local Municipality is approximately 75 452 persons, which amounts to 5.8% of the total Nkangala District Municipality population of 1 308 129 and 1.8% of the Mpumalanga province population (Stats SA, 2018). Of which, 82.3% are Black Africa, 16% are White, 1.1% are Coloured, and the remaining 0.3% are Indian/Asian (Figure 4.20) (Stats SA, 2018).

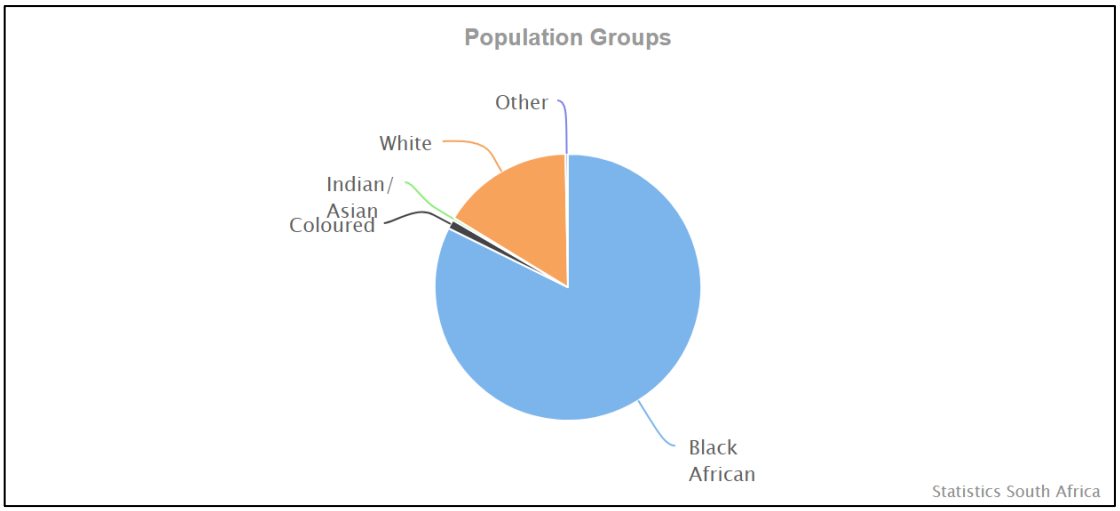


Figure 4.20: Population groups (Stats SA, 2018)

The majority of the population is men with 51.4% (as seen in Figure 4.21). The most spoken language (Figure 4.22) in the Victor Khanye Local Municipality is isiZulu (35.7%), followed by IsiNdebele (25.1%) and Afrikaans (15.7%).

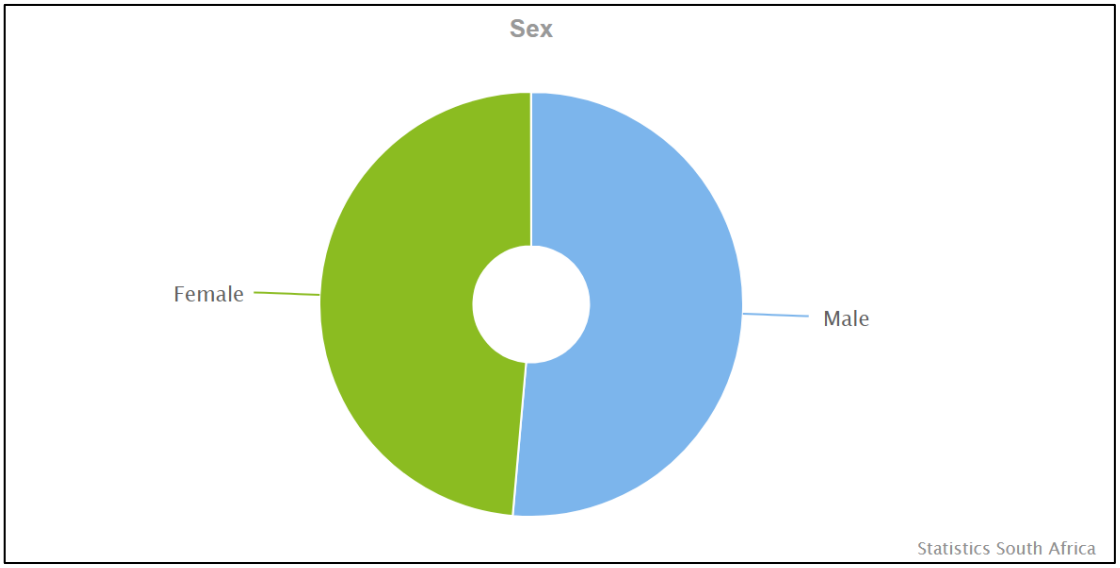


Figure 4.21: Sex (Stats SA, 2018)

In addition, the highest level of education (Figure 4.23) includes 'some primary' (41.6%), 'some secondary' (32.8%) and 'completed secondary' (12.9%). A total of 4.1% have no schooling, while 1.3% have a higher education level (Stats SA, 2018).

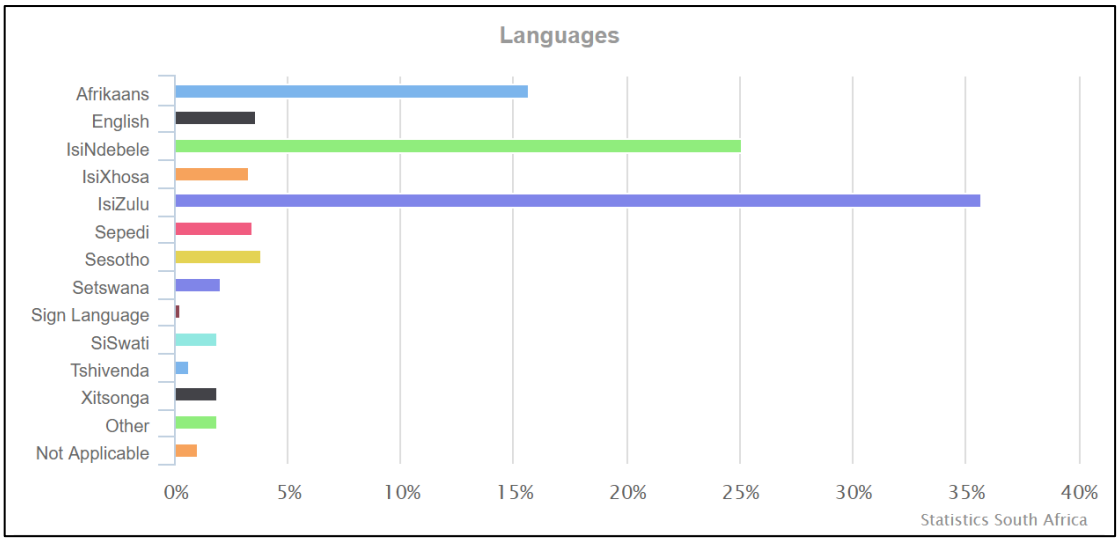


Figure 4.22: Languages spoken (Stats SA, 2018)

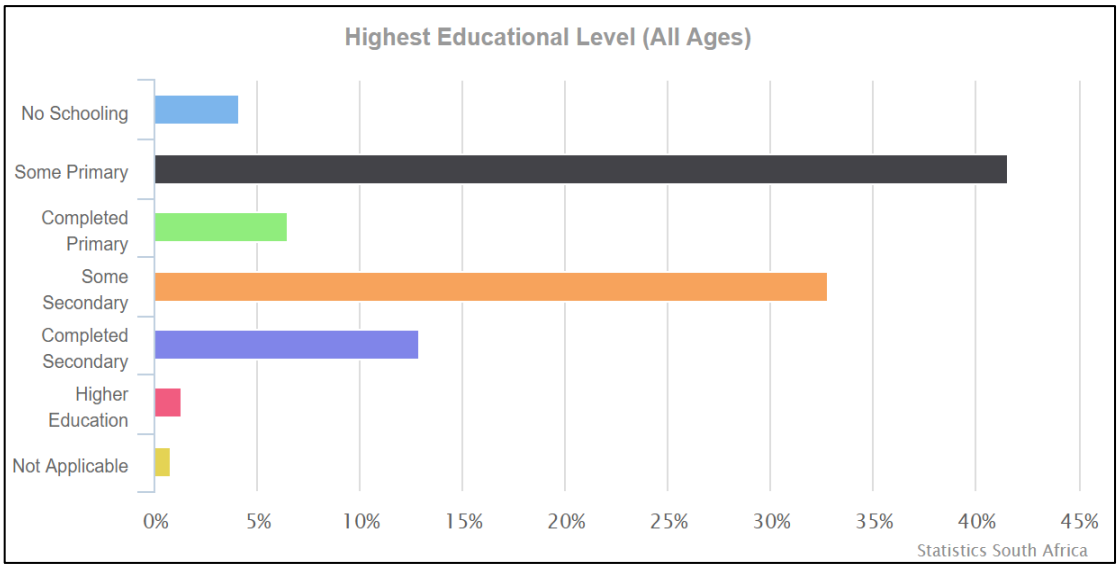


Figure 4.23: Highest educational level (Stats SA, 2018)

4.4.2.2 Living Conditions

According to Stats SA (2018), most households in the municipality (48,4%) have access to piped water in their dwelling, with 34,8% of households having access to piped water in their yard. Only 4,3% of households do not have access to piped water. The majority (78.3%) of the population live in an urban area and the majority use electricity (Figure 4.24) for cooking (63.5%), heating (43.9%) and lighting (84.9%). Coal is the second most used energy source for cooking (18.7%) and heating (31.6%) (Stats SA, 2018). In terms of the source of water (Figure 4.25), 76.4% use regional/local water schemes, while 14.8% use boreholes and 4.6% use water tankers.

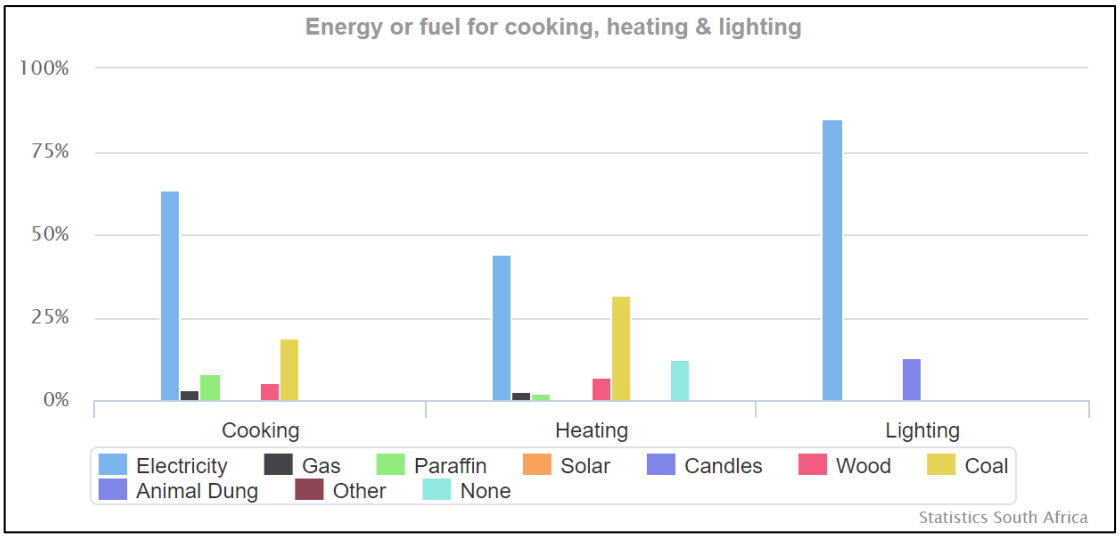


Figure 4.24: Energy or fuel for cooking, heating and lighting (Stats SA, 2018)

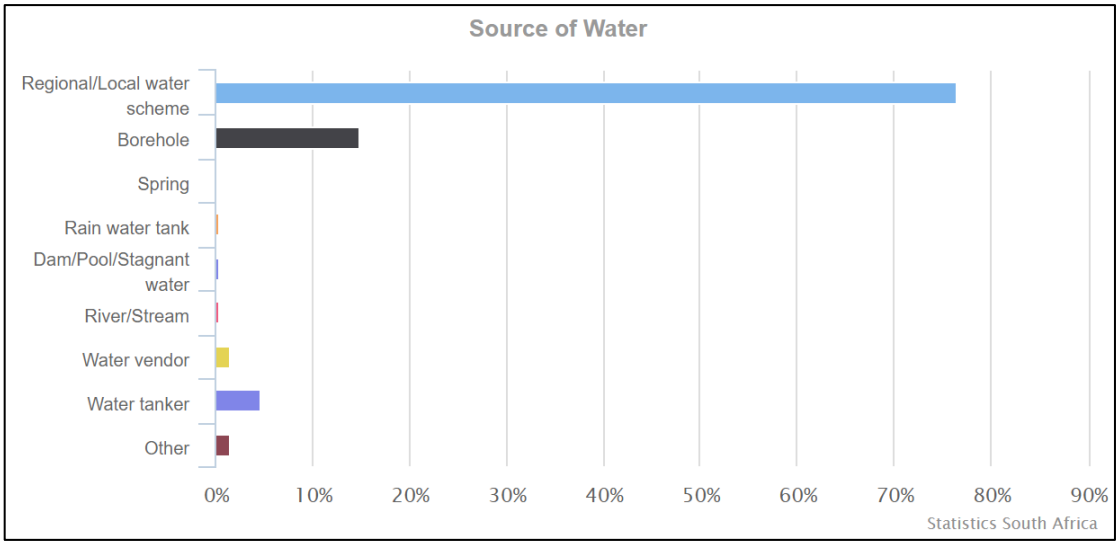


Figure 4.25: Source of water (Stats SA, 2018)

4.4.2.3 Economy

Farming is the most dominant economic activity in Victor Khanye Local Municipality, occupying approximately 60% of the total physical area. However, in terms of output and proportional contribution to the local economy, the largest sector is trade, followed by agriculture and mining sectors. In terms of employment between the ages of 15-64 (Figure 4.26), 21 843 people are employed, while 8 573 (28.2%) are unemployed.

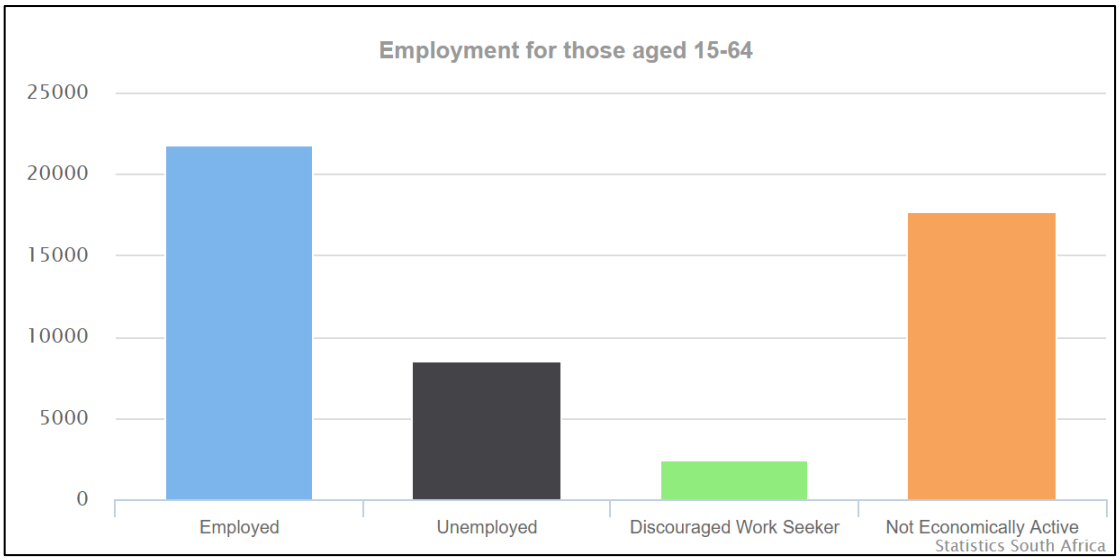


Figure 4.26: Employment for those aged 15-64 (Stats SA, 2018)

5 ANALYSIS AND CHARACTERIZATION OF THE WATER USE ACTIVITY

5.1 Site Delineation for Characterization

Refer to Section 1.3 for the extent of the project area.

5.2 Water and Waste Management

5.2.1 Process Water

The process flow diagram compiled for the mining the Eloff Phase 3 Project is illustrated in Figure 5.1. The water balance for the expansion project is provided in Table 5.1. It must be noted that the hydrology study included the waste stockpiles in the report, however, the waste stockpiles will be placed at the existing Kangala waste stockpiles and no longer at Eloff Phase 3 Project.

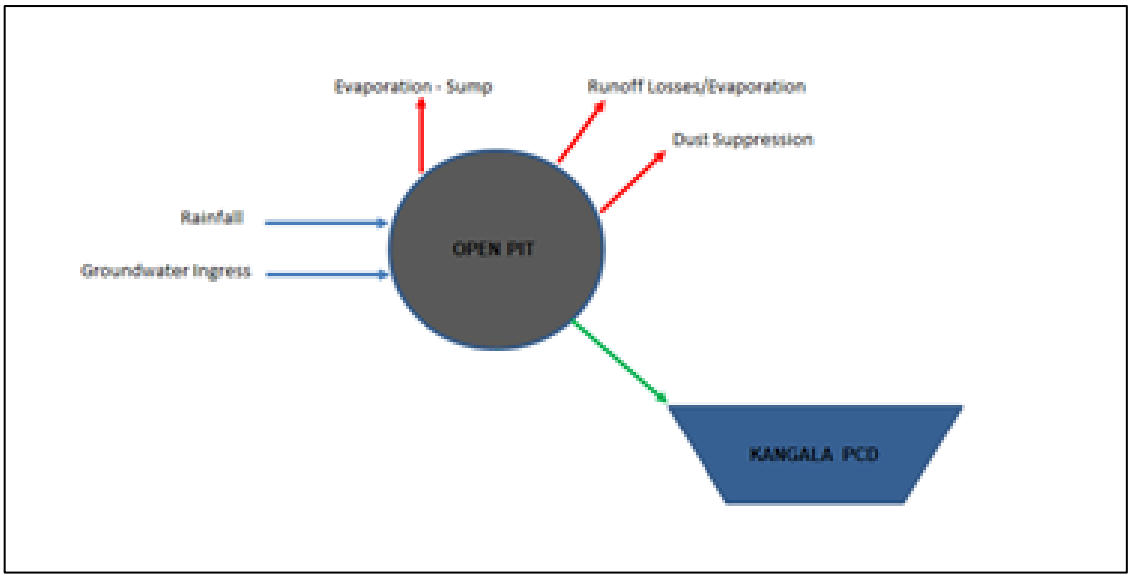


Figure 5.1: Summary of PFD

*The waste stockpiles will be located at the existing Kangala Colliery and no longer at the Eloff Phase 3 Project.

Table 5.1: Summary of water balance for average conditions

Facility Name	Water In		Water Out		Balance
	Water Circuit/stream	Quantity (m^3/month)	Water Circuit/stream	Quantity (m^3/month)	
OPEN PIT	Rainfall	123 425	Evaporation	12 546	
	Groundwater Ingress	8 528	Evaporation/run off losses	61 534	
	Runoff - waste/stockpile dump	8 892	Kangala PCD	56 068	
			Dust Suppression	10 698	
	Total	**140 845**		**140 845**	-
WASTE /STOCKPILE DUMPS	Rainfall	35 569	Evaporation/run off losses	26 676	
			Open Pit	8 892	
	Total	**35 569**		**35 569**	-
Total Water Balance		**176 414**		**176 414**	

*The waste stockpiles will be located at the existing Kangala Colliery and no longer at the Eloff Phase 3 Project

All water from the Eloff Phase 3 Project will be processed at the Kangala Colliery. Process water at Kangala Colliery includes water supply allocation from Randwater, water abstracted through KAM01 and KAM03 boreholes, dewatering from the opencast workings (pit), as well as return water from slurry facility. Unit process water supply for the mine is shown in the tabulation below.

Make-up water required for the coal processing plant is approximately 1 400.852m^3/day. About 94 % of the make-up water is pumped from the pressed steel tank, whilst recycled water from the PCD accounts to 6 %. Approximately 917.491m^3/day of slurry is generated in the washing coal and is co-disposed of into the discard and slurry facility (DSF). Waste water from the DSF then gravitates through a penstock into a PCD, for reuse into the coal processing plant.

5.2.2 Stormwater

A stormwater management plan is required to ensure there is adequate clean and dirty water separation such that, all water emanating from the mine area (dirty water) is captured, conveyed and safely contained, whilst the clean water emanating from the upstream environment is diverted away to the nearest watercourse or downstream environment.

The regulation, which allows for the management of clean and dirty water within a mining environment is Government Notice 704 and is described in the section below.

5.2.2.1 Government Notice 704

GN 704 (Government Gazette 20118 of June 1999) was established to provide regulations on the use of water for mining and related activities aimed at the protection of water resources. The five main principle conditions of GN 704 applicable to this project are:

- **Condition 4** which defines the area in which, mine workings or associated structures may be located, with reference to a watercourse and associated flooding. Any residue deposit, dam, reservoir together with any associated structure or any other facility should be situated outside the 1:100 year flood-line. Any underground or opencast mining, prospecting or any other operation or activity should be situated or undertaken outside of the 1:50 year flood-line. Where the flood-line is less than 100 metres away from the watercourse, then a minimum watercourse buffer distance of 100 metres is required for infrastructure and activities;
- **Condition 5** which indicates that no residue or substance which causes or is likely to cause pollution of a water resource may be used in the construction of any dams, impoundments or embankments or any other infrastructure which may cause pollution of a water resource;
- **Condition 6** which describes the capacity requirements of clean and dirty water systems. Clean and dirty water systems must be kept separate and must be designed, constructed, maintained and operated to ensure conveyance of flows of a 1:50 year recurrence event. Clean and dirty water systems should not spill into each other more

frequently than once in 50 years. Any dirty water dams should have a minimum freeboard of 0.8m above full supply level;

- **Condition 7** which describes the measures which must be taken to protect water resources. All dirty water or substances which may cause pollution should be prevented from entering a water resource (by spillage, seepage, erosion etc.) and ensure that water used in any process is recycled as far as practicable; and
- **Condition 10** which describes the requirements for operations involving extraction of material from the channel of a watercourse. Measures should be taken to prevent impacts on the stability of the watercourse, prevent scour and erosion resulting from operations, prevent damage to in-stream habitat through erosion, sedimentation, alteration of vegetation and flow characteristics, construct treatment facilities to treat water before returning it to the watercourse, and implement control measures to prevent pollution by oil, grease, fuel and chemicals.

5.2.2.2 Stormwater Management Plan

A stormwater management plan is required as per GN 704 of the National Water Act, 1998 (Act No 36 of 1998) (NWA), with the main objective of the proposed stormwater management plan being to ensure the separation of clean and dirty water during the proposed mining operation. It must be noted that the SWMP has been designed to include the waste stockpiles. The waste stockpiles will no longer be located at the Eloff Phase 3 Project, but instead located at the existing Kangala Colliery.

<u>Conceptual sizing of clean and dirty water channels</u>

The proposed project infrastructure is positioned such that the upstream clean and dirty water catchment occurs in a south easterly direction. All clean water channels are to be placed upstream of all infrastructure areas to ensure the runoff collected is diverted to the downstream clean water environment or the nearest watercourse. All dirty water channels are to be placed around the waste/stockpile dump area so that runoff is collected in a sump and conveyed to the Open Pit. All dirty water will then be pumped to the existing Kangala PCD.

It is proposed that all clean water channels be unlined vegetated trapezoidal channels of which an example is shown below in Figure 5.2, whilst all dirty water channels constructed as concrete lined rectangular channels.

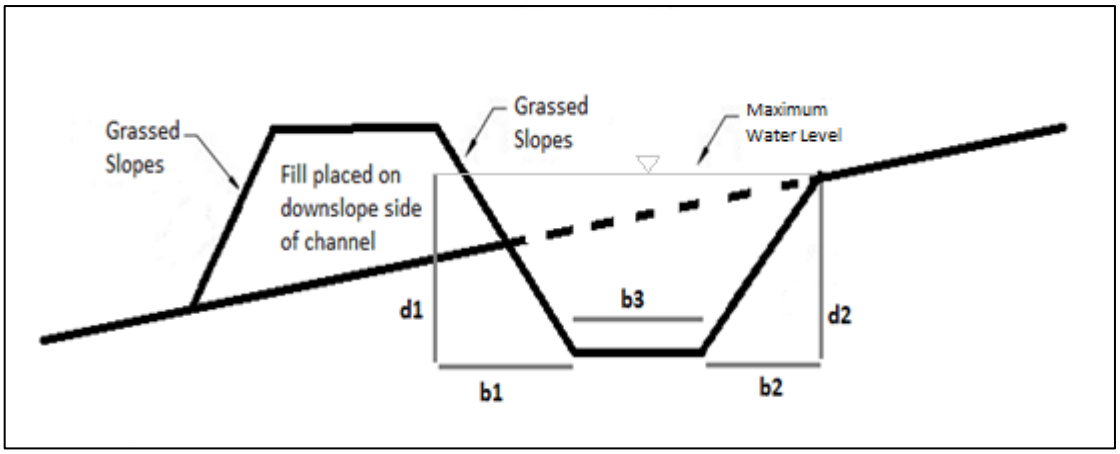


Figure 5.2: Clean water diversion channel conceptual design

Summary of the catchment hydrology was based on an average estimation of catchment sizes applicable to the project area, which represents both the clean and dirty water environments.

Summary of the catchment hydrology, peak flow estimations and clean and dirty water conceptual sizing of the channels are shown below in Table 5.2, Table 5.3, and Table 5.4 respectively.

Table 5.2: Summary of catchment hydrology

Name	Area (km^2)	Length of longest watercourse (m)	Height Difference (m)	Rainfall Intensity (Q_{50})	Tc (hours)	C-Factor
Clean water catchment	1.6951	3812	28.82	56	1.22	0.29
Dirty water catchment	0.2850	1676	13.5	86	0.63	0.54

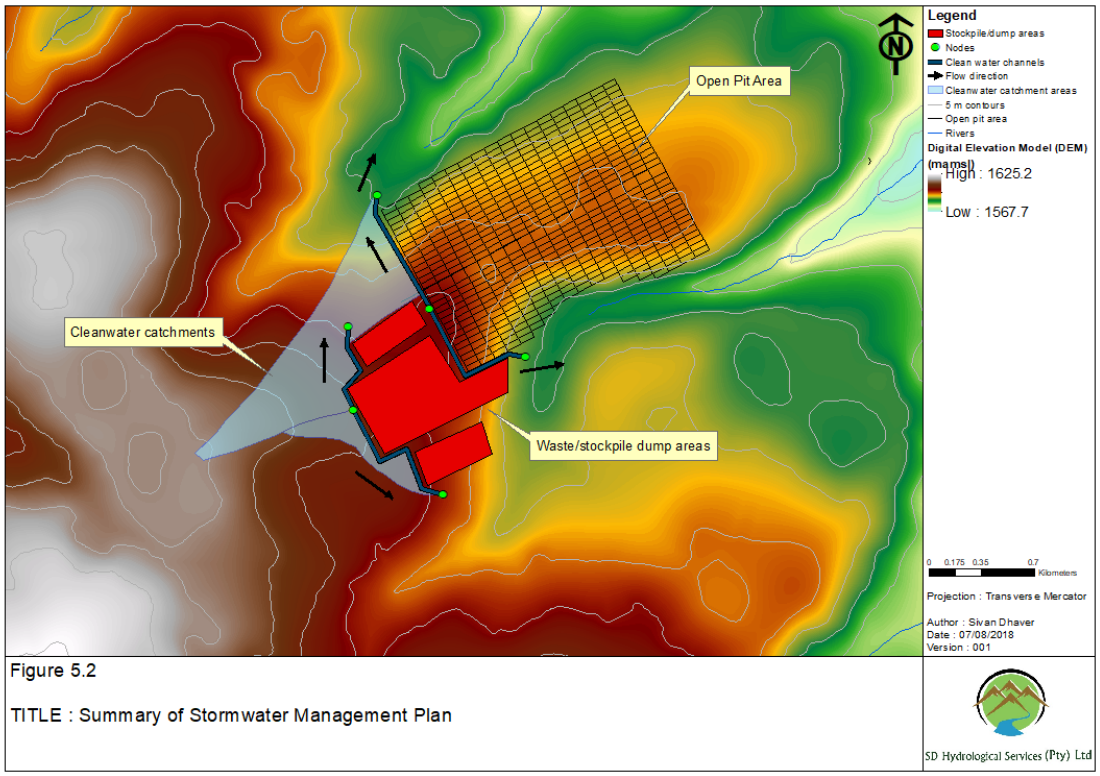
Table 5.3: Summary of peak flows for clean water catchments

Name	Peak flows for various recurrence intervals (years)					
	2 year	5 year	10 year	20 year	50 year	100 year
Clean water catchment	1.79	2.62	3.37	4.33	6.33	8.55
Dirty water catchment	1.56	2.14	2.58	3.08	3.93	4.76

Table 5.4: Summary of clean water channel sizing

Channel Section	Q (m^3/s)	left and right slope (1:X)	Bottom width (m)	Calculated Top width (m)	Calculated depth (m)	Velocity (m/s)	Design depth (m)	Type
Clean water channels	6.33	3	4.0	8.56	0.76	1.33	1.0	Trapezoidal
Dirty water channels	3.93	N/A	2.0	2.00	0.61	3.23	1.0	Rectangular

All dirty water will be captured and contained in the proposed Open Pit where it will then be pumped to the existing Kangala PCD. A summary of the stormwater management plan is shown below in Figure 5.3.



*The waste stockpiles will be located at the existing Kangala Colliery and no longer at the Eloff Phase 3 Project

Figure 5.3: Summary of stormwater management plan

5.2.3 Groundwater

All of the water abstracted for the purpose of the continuation of mining, is pumped to the Kangala PCD for re-use in the plant.

5.2.4 Waste

The principles of sustainable waste management have been implemented and are currently applied on a day-to-day basis as waste management measures for Kangala Colliery. These include the following:

- **Waste prevention**: the prevention and avoidance of the production of waste;
- **Recovery**: the recycling or re-use of waste;
- **Waste reduction**: the reduction of the volume/quantity or hazardous nature of waste during mine operation and production;

- **Waste treatment**: the treatment of waste to reduce the volume of waste, risk to human and the environmental, and the degree of hazard; and
- **Waste disposal/discharge/emission**: the environmentally acceptable and safe disposal or discharge of waste in line with the National Environmental Management Waste Act, 2008 (Act No. 59 of 2008).

Hazardous and industrial waste such as hydrocarbon products i.e. used oil, grease, and diesel are stored in containers and collected at regular intervals by either BME or Interwaste (Pty) Ltd for recycling and reuse. No hydrocarbon products are disposed of on the mine premises. Full, sealed hazardous waste containers for used oil are collected by BME (approved contractor) and Interwaste (Pty) Ltd for recycling and reuse. Safe Disposal Certificates are kept in record at the mine. All spillages are cleaned up and disposed of in an appropriate manner.

All general waste at Kangala Colliery classified as General Waste under the South African Minimum Requirements for Waste Disposal by Landfill (DWS, 1998) are removed from the mine by Whale Rock Industries and disposed of at a licensed general waste facility. Safe Disposal Certificates are kept in record at the mine.

All raw sewage from the chemical mobile toilets provided at the mine is collected by Lemon Trees Toilet Hire (Pty) Ltd for disposal into an authorized sewage treatment works. Safe Disposal Certificates are kept in record at the mine.

5.3 Operational Management

5.3.1 Organizational Structure

Refer to Section 2.7 of this report.

5.3.2 Resources and Competence

Eloff Mining Company Pty Ltd has appointed a qualified permanent Environmental Officer (Ms. Mokgadi Masiagwala) who is responsible for the mine environmental issues and compliance.

5.3.3 Education and Training

Eloff Mining Company Pty Ltd has a continual process of raising awareness through Tool Box Talk information pack, which includes water conservation/water demand and waste management initiatives. The awareness and training is facilitated by Ms. Mokgadi Masiagwala, who is a qualified Environmental Officer for the mine. The previous awareness at the mine was conducted in March 2016.

In addition, the Environmental Officer identified the SHE (induction) training requirements for all mine personnel and contractors. The training programmes undertaken are recorded and all mine personnel who have been involved in the training are required to confirm in an attendance register.

5.3.4 Internal and External Communication

Interested and affected parties (I & APs) register is continually updated and kept at the mine. Communication lines are drawn and cascade from the Environmental Officer through to the general workers, authorities and other interested and affected parties. Kangala Colliery initiates numerous activities to engage stakeholders at a national level, including the following:

- One-on-one meetings with specific stakeholders on pertinent issues;
- Public liaison and forum participation; and
- Distribution of information through newspaper advertisements, written documentation posted out within the vicinity of the mining area.

5.3.5 Awareness Raising

All mine personnel at Kangala Colliery as well as at the Eloff Phase 3 Project have to undergo environmental awareness and training (induction) in terms of the Mine Health and Safety Act, 1996 (Act No. 29 of 1996).

5.4 Monitoring and Control

Water resources monitoring is undertaken in terms of the Department of Water and Sanitation (DWS) Best Practice Guidelines (BPG) for Water Monitoring Systems (2007). The objective of monitoring system is to:

- Develop environmental and water management plans based on impact monitoring;
- Generate monitoring data for the operational phase of the mine to be compared with baseline date before project implementation;
- Assess the impacts on receiving water environment; and
- Assess compliance with legal requirements.

Internal reporting includes monthly reports to the mine management on the performance against management commitments and expectation against authorisations and permits. External reporting requirements is guided by the permit and licenses received to that effect and the mine commit to comply with these statutory requirements at all times. This encompass incident reporting, which in terms of the EMS, requires classification of incidents

into three categories (Levels 1, 2 & 3) depending on their severity or potential consequence to the environment.

5.4.1 Surface Water Monitoring

The surface water monitoring is to be carried out during specific periods of the year, these periods include pre-wet season, pre-dry season and peak wet season months. In addition, the primary purpose of the stormwater maintenance plan is to ensure proper functioning of the stormwater controls.

The rationale behind these key periods is listed below:

- Pre-wet season - During the period leading up to the wet season various activities are required to ensure that all stormwater controls are functioning effectively. These activities include undertaking a site inspection to assess blockages/debris within key locations including main channels (clean and dirty water). Levels of siltation should also be checked, and the appropriate action taken to ensure sufficient storage is available for the wet period. The pre-wet season site inspection should occur towards the end of September.
- Peak wet season – During this period, site inspections should be undertaken as a follow up on the initial pre-wet season site inspection. This is undertaken so as to determine if the preceding rains resulted in any damages to the stormwater controls, and if any blockages had occurred at key locations mentioned. Peak wet season month site inspections should occur towards the end of December and January.
- Pre-dry season – During this period, a site inspection should be undertaken to assess and rectify any damages as a result of the rainfall for the remainder of the wet season following January. Although during the dry season no major rainfall is anticipated, there may be short duration high intensity rainfall events that could produce high peak flows at the stormwater control outlets. It is therefore necessary to undertake a site visit to ensure all stormwater controls are functioning correctly. Pre-dry season site inspection should be undertaken towards the end of April. Summary of the stormwater maintenance plan is indicated in Table 5.5.

Table 5.5: Summary of stormwater maintenance plan

Months	Dry Season	Wet Season	SITE INSPECTION AND REMEDIATION		
			Pre Wet Season	Pre Dry Season	Peak Wet Season
January					
February					
March					
April					
May					
June					
July					
August					
September					
October					
November					
December					

A monitoring programme is essential as a management tool to detect negative impacts as they arise and to ensure that the necessary mitigation measures are implemented. It also ensures that storm water management structures are in working order. Monitoring should be implemented throughout the project life.

5.4.2 Groundwater Monitoring

Groundwater monitoring should be conducted to assess the impacts of the proposed new mining activities on groundwater quality and quantity (water levels).

Groundwater monitoring (i.e. sampling and water level measurements) should be conducted at quarterly intervals. This monitoring schedule should be re-assessed by a qualified geohydrologist at a later stage in terms of stability of water levels and quality. If the sampling program requires changes, it should be done so in consultation with the appropriate authorities.

At first only source monitoring boreholes in close proximity to the potential sources of groundwater contamination are necessary. Only after the source monitoring program has positively identified a pollution breakthrough would additional plume monitoring boreholes be required further away (down gradient) from the now confirmed sources. A minimum of three source monitoring boreholes are recommended and their positions are indicated in Figure 5.4. More information regarding these three boreholes is provided in Table 5.6.

Groundwater samples should be analysed for chemical and physical constituents normally associated with coal mining (Table 5.7).

Table 5.6: Summary of proposed source monitoring boreholes

BH	Coordinates *(WGS 84)*		Elevation (mamsl)	Depth (m)	Comments
	South	East			
EMBH01	-26.21489	28.63388	1 607	30	Up gradient from mining activities
EMBH02	-26.21419	28.64626	1 594	30	Down gradient from waste rock stockpiles*
EMBH03	-26.20885	28.64971	1 589	30	Down gradient from decant position

*It must be noted that the monitoring borehole near the waste stockpiles will remain despite the stockpiles being located at the existing Kangala Colliery.

Table 5.7: Groundwater constituents for routine analysis

Monitoring	Variable
Quarterly	EC, pH, TDS, total hardness, total alkalinity, calcium, magnesium, sodium, potassium, chloride, sulphate, fluoride, nitrate, iron, manganese, aluminium and turbidity.

Laboratory results should be assessed against the target water quality guidelines for domestic use (SANS 241:2015), the aquatic environment, livestock watering and irrigation.

Monitoring results should be entered into an electronic database and at no less than one quarterly interval, allowing:

- Data presentation in tabular format,
- Time-series graphs with comparison abilities,
- Statistical analysis (minimum, maximum, average, percentile values) in tabular format,
- Graphical presentation of statistics,
- Linear trend determination,
- Performance analysis in tabular format,
- Presentation of data, statistics and performance on diagrams and maps, and
- Comparison and compliance to target water quality guidelines.

The quarterly report should be an update of the database with time-series graphs and statistical analysis (average, maximum, minimum, 5 -, 50 – and 95 percentile values as well as linear performance). Data should also be presented in a map format to present a clear

picture of the water quality situation. Furthermore, a detailed annual evaluation report on the groundwater monitoring results should be prepared to investigate trends and non-compliance over the past monitoring year.

In terms of flow, all water uses, and discharges should be measured on an ongoing basis and typically include:

- Volumes of groundwater seepage into the opencast pit, and
- Volumes of contaminated water used for dust suppression.

As far as possible, the same monitoring points should be used during all mining/project phases to develop a long data record, which will enable trend analysis and recognition of progressive impacts with time.

The following maintenance activities should be adhered to:

- Monitoring boreholes should be capped and locked at all times,
- Borehole depths should be measured quarterly, and the boreholes blown out with compressed air, if required and
- Vegetation around the boreholes should be removed on a regular basis and the borehole casings painted, when necessary, to prevent excessive rust and degradation.

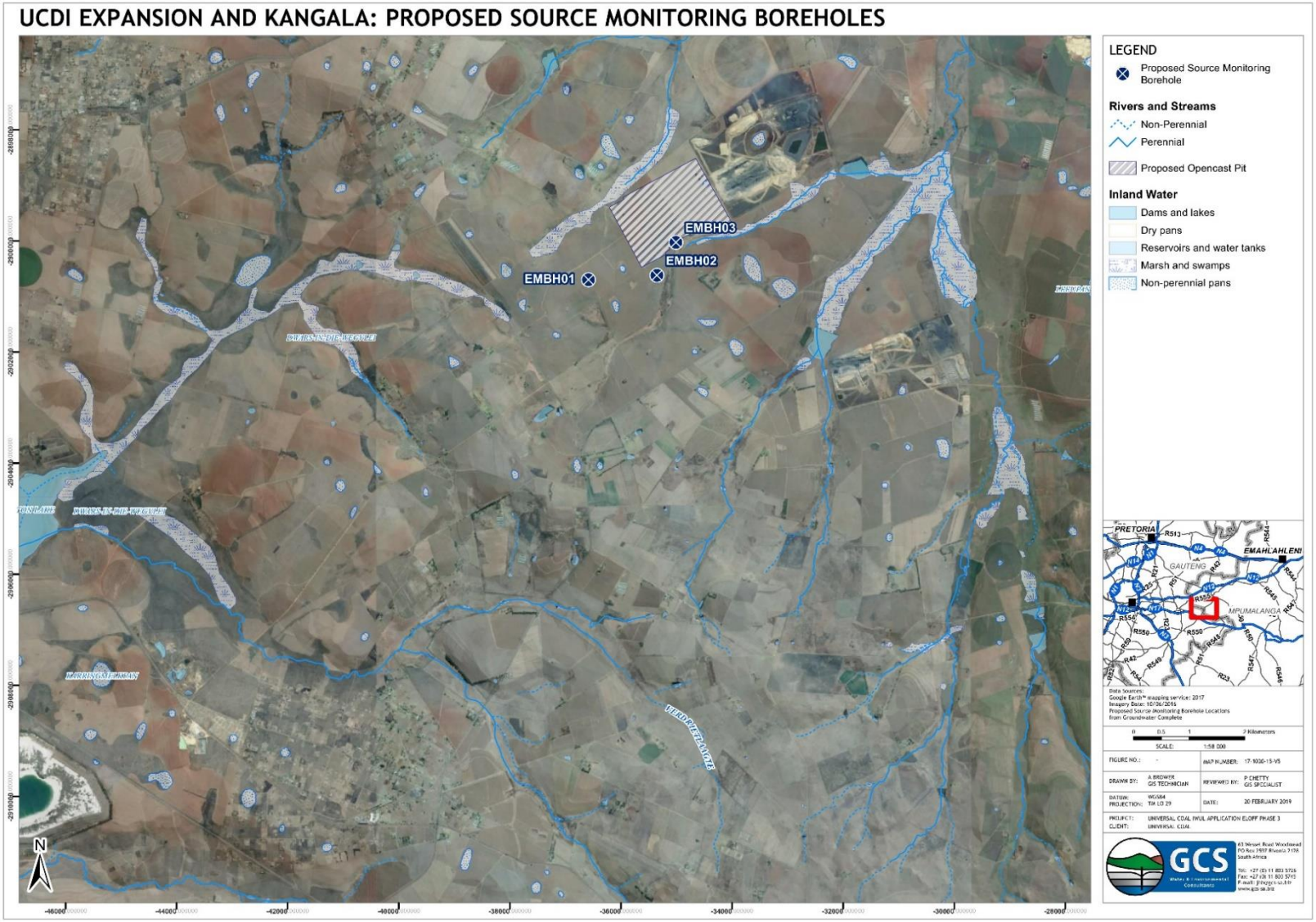


Figure 5.4: Conceptual positions of source monitoring boreholes

5.4.3 Bio Monitoring

Aquatic biomonitoring is currently being undertaken for the Kangala Colliery as per conditions of the Water Use Licence (WUL). It is recommended that this biomonitoring programme be expanded to include this proposed mining area. In addition to this, it is recommended that wetland monitoring be conducted simultaneously with the biomonitoring programme.

A monitoring 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 5.8 highlights some important aspects to monitor for the duration of the programme.

Table 5.8: Aquatic and Wetland Ecology Monitoring Plan

Location	Monitoring objectives	Frequency of monitoring	Parameters to be monitored
Expanded current biomonitoring site allocation. Identify wetland monitoring sites.	Overall Aquatic PES Wetland PES, functioning & EIS	Bi-annual	Standard aquatic ecology (Ecostatus) methods Wetland WET-Series
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.

5.4.4 Waste Monitoring

In terms of the waste monitoring that is performed on site, a risk management approach is adopted. Continuous assessment are also performed i.e. audits, in order to assess the performance of the waste management on site.

5.5 Risk Assessment/ Best Practice Assessment

5.5.1 Impact Assessment Methodology

The following methodology was used to rank these impacts. Clearly defined rating and rankings scales (Table 5.9 to Table 5.15) were used to assess the impacts associated with the proposed activities. The impacts identified by each specialist study and through public participation were combined into a single impact rating table for ease of assessment.

Each impact identified was rated according the expected magnitude, duration, scale and probability of the impact (Table 5.16).

To ensure uniformity, the assessment of potential impacts will be addressed in a standard manner so that a wide range of impacts is comparable. For this reason, a clearly defined rating scale will be provided to the specialist to assess the impacts associated with their investigation.

Each impact identified will be assessed in terms of scale (spatial scale), magnitude (severity) and duration (temporal scale). Consequence is then determined as follows:

Consequence = Severity + Spatial Scale + Duration

The Risk of the activity is then calculated based on frequency of the activity and impact, how easily it can be detected and whether the activity is governed by legislation. Thus:

Likelihood = Frequency of activity + frequency of impact + legal issues + detection

The risk is then based on the consequence and likelihood.

Risk = Consequence x likelihood

In order to assess each of these factors for each impact, the ranking scales in Table 5.9– Table 5.15 were used.

Table 5.9: Severity

Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful / within a regulated sensitive area	5

Table 5.10: Spatial Scale - How big is the area that the aspect is impacting on?

Area specific (at impact site)	1
Whole site (entire surface right)	2
Local (within 5km)	3
Regional / neighboring areas (5km to 50km)	4
National	5

Table 5.11: Duration

One day to one month (immediate)	1
One month to one year (Short term)	2
One year to 10 years (medium term)	3
Life of the activity (long term)	4
Beyond life of the activity (permanent)	5

Table 5.12: Frequency of the activity - How often do you do the specific activity?

Annually or less	1
6 monthly	2
Monthly	3
Weekly	4
Daily	5

Table 5.13: Frequency of the incident/impact - How often does the activity impact on the environment?

Almost never / almost impossible / >20%	1
Very seldom / highly unlikely / >40%	2
Infrequent / unlikely / seldom / >60%	3
Often / regularly / likely / possible / >80%	4
Daily / highly likely / definitely / >100%	5

Table 5.14: Legal Issues - How is the activity governed by legislation?

No legislation	1
Fully covered by legislation	5

Table 5.15: Detection - How quickly/easily can the impacts/risks of the activity be detected on the environment, people and property?

Immediately	1
Without much effort	2
Need some effort	3
Remote and difficult to observe	4
Covered	5

Environmental effects will be rated as either of high, moderate or low significance on the basis provided in Table 5.16.

Table 5.16: Impact Ratings

RATING	CLASS
1 - 55	(L) Low Risk
56 - 169	M) Moderate Risk
170 - 600	(H) High Risk

5.5.2 Impacts Identified

The following impacts have been identified for the Eloff Phase 3 Project and shown in Table 5.17.

Table 5.17: Impact descriptions for Eloff Phase 3 Project

Impact description					Impact before mitigation	Impact after mitigation	Mitigation measures
No.	Phases	Activity	Aspect (cause of the impact)	Impact	Risk Rating	Risk Rating	
Wetlands (Refer to Section 4.2.8 and Annexure B)							
1	Construction	Site clearing / preparation	Creation of access routes and new road	Loss of surface roughness	M	M	Demarcate footprint areas to be cleared to avoid unnecessary clearing. Exposed areas must be ripped and vegetated to increase surface roughness.
2	Construction	Site clearing / preparation	Creation of laydown areas and offices / ablutions / camps	Loss of seepage (infiltration) areas	L	L	• Prior to construction, fences should be erected in such a manner to prevent access and damage to the wetland and associated buffer areas. Where fences cannot be erected, these sensitive areas must be clearly demarcated, and sign posted; and • Demarcate footprint areas to be cleared to avoid unnecessary clearing. Exposed areas must be ripped and vegetated to increase surface roughness.
3	Construction	Soil excavations	Removal of top and sub-soil layers	Alteration to surface runoff flow volumes	L	L	• 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; and • Compacted areas must be ripped (perpendicularly) to a depth of 300mm. A seed mix must be applied to rehabilitated and bare areas. Any gullies or dongas must also be backfilled. The area must be shaped to a natural topography. No grazing must be permitted to allow for the recovery of the area.
4	Construction	Soil excavations	Stockpiling of soils	Alteration of patterns of flows (increased flood peaks)	L	L	• 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; and • Compacted areas must be ripped (perpendicularly) to a depth of 300mm. A seed mix must be applied to rehabilitated and bare areas. Any gullies or dongas must also be backfilled. The area must be shaped to a natural topography. No grazing must be permitted to allow for the recovery of the area.
5	Construction	Soil excavations	Change in topography and slope	Alteration of patterns of flows	L	L	• Construct cut-off berms downslope of working areas; • Demarcate footprint areas to be cleared to avoid unnecessary clearing.

				(increased flood peaks)			Exposed areas must be ripped and vegetated to increase surface roughness; and • Compacted areas must be ripped (perpendicularly) to a depth of 300mm. A seed mix must be applied to rehabilitated and bare areas. Any gullies or dongas must also be backfilled. The area must be shaped to a natural topography. No grazing must be permitted to allow for the recovery of the area.
6	Construction	Heavy machinery and vehicle movement	Spills, leaks and dust fallout	Increase in sediment inputs & turbidity	L	L	• Drip trays or any form of oil absorbent material must be placed underneath vehicles/machinery and equipment when not in use; • No servicing of equipment on site unless absolutely necessary; • Leaking equipment shall be repaired immediately or be removed from site to facilitate repair; and • All vehicles and equipment must be well maintained to ensure that there are no oil or fuel leakages.
7	Construction	Heavy machinery and vehicle movement	The change in vegetation communities	Alien vegetation infestation	L	L	An alien invasive plant management plan needs to be compiled and implemented prior to construction and continued through the life of the mine, to control and prevent the spread of invasive aliens. Clean vehicles on-site and prioritise the cleaning of vehicles gaining access from surrounding areas.
8	Construction	Light vehicles, machine and equipment use	Spills, leaks and dust fallout	Impaired water quality	L	L	• Drip trays or any form of oil absorbent material must be placed underneath vehicles/machinery and equipment when not in use; • Any possible contamination of topsoil by hydrocarbons, concrete or concrete water must be avoided. Spill kits must be available and on hand to clean these spills; • No servicing of equipment on site unless absolutely necessary; • Leaking equipment shall be repaired immediately or be removed from site to facilitate repair; and • All vehicles and equipment must be well maintained to ensure that there are no oil or fuel leakages.
9	Construction	Increased presence of staff, personnel and contractors on site	Ablutions	Pathogen inputs (i.e. disease-causing organisms)	L	L	• All personnel and contractors to undergo Environmental Awareness Training. A signed register of attendance must be kept for proof. Discussions are required on sensitive environmental receptors within the project area, with particular reference to the wetland systems; and • Determine the likelihood of AMD, and proactively implement measures to prevent or reduce this. Priority would be to ensure the treatment of this water to suitable standards for aquatic ecology.

10	Construction	Increased presence of staff, personnel and contractors on site	Waste management	Pathogen inputs (i.e. disease-causing organisms)	M	L	• All personnel and contractors to undergo Environmental Awareness Training. A signed register of attendance must be kept for proof. Discussions are required on sensitive environmental receptors within the project area, with particular reference to the wetland systems; and • A site plan must be provided indicating waste areas, chemical storage areas, fuel storage area, site offices and placement of ablution facilities and the designated mining area.
11	Construction	Infrastructure establishment	Storage of materials and solutions	Loss of, or impaired ecosystem services	L	L	Where applicable, materials must be stored in leak-proof, sealable containers or packaging. Materials must also be stored in bunded areas which can accommodate the required volumes.
12	Construction	Infrastructure establishment	Spills and leaks	Inputs of toxic heavy metal contaminants	L	L	Any possible contamination of topsoil by hydrocarbons, concrete or concrete water must be avoided. Spill kits must be available and on hand to clean these spills.
13	Construction	Infrastructure establishment	Uncontained run-off	Inputs of toxic organic contaminants	M	L	Compile a suitable stormwater management plan, which must be implemented from the onset of the project and continued for the life of the project.
14	Operation	Blasting	Coal dust fallout	Loss of, or impaired ecosystem services	M	M	Determine the likelihood of AMD, and proactively implement measures to prevent or reduce this. Priority would be to ensure the treatment of this water to suitable standards for aquatic ecology.
15	Operation	Blasting	Dust fallout	Increase in sediment inputs & turbidity	M	L	Dust suppression must be continuous.
16	Operation	Opencast mining	soil excavation	Loss of seepage (infiltration) areas	H	H	Limited the extent (or size) of the void, rehabilitation must be concurrent. All voids must be backfilled, and surface infrastructure must be removed from the site when no longer required.
17	Operation	Opencast mining	Change in topography and slope	Loss of aquifers, wetlands (and recharge zones)	H	H	• 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; and • Compacted areas must be ripped (perpendicularly) to a depth of 300mm. A seed mix must be applied to rehabilitated and bare areas. Any gullies or dongas must also be backfilled. The area must be shaped to a natural topography. No grazing must be permitted to allow for the recovery of the area.
18	Operation	Heavy machinery and vehicle movement	Surface compaction	Alteration to surface runoff flow volumes	M	L	Compacted areas must be ripped (perpendicularly) to a depth of 300mm. A seed mix must be applied to rehabilitated and bare areas. Any gullies or dongas must also be backfilled. The area must be shaped to a natural topography. No grazing must be permitted to allow for the recovery of the area.

19	Operation	Heavy machinery and vehicle movement	The change in vegetation communities	Alien vegetation infestation	L	L	An alien invasive plant management plan needs to be compiled and implemented prior to construction and continued through the life of the mine, to control and prevent the spread of invasive aliens. Clean vehicles on-site and prioritise the cleaning of vehicles gaining access from surrounding areas.
20	Operation	Light vehicles, machine and equipment use	Spills, leaks and dust fallout	Impaired water quality	M	L	• Drip trays or any form of oil absorbent material must be placed underneath vehicles/machinery and equipment when not in use; • Any possible contamination of topsoil by hydrocarbons, concrete or concrete water must be avoided. Spill kits must be available and on hand to clean these spills; • No servicing of equipment on site unless absolutely necessary; • Leaking equipment shall be repaired immediately or be removed from site to facilitate repair; and • All vehicles and equipment must be well maintained to ensure that there are no oil or fuel leakages.
21	Operation	Increased presence of staff, personnel and contractors on site	Ablutions	Pathogen inputs (i.e. disease-causing organisms)	M	L	All personnel and contractors to undergo Environmental Awareness Training. A signed register of attendance must be kept for proof. Discussions are required on sensitive environmental receptors within the project area, with particular reference to the wetland systems.
22	Operation	Increased presence of staff, personnel and contractors on site	Waste management	Inputs of toxic organic contaminants	M	L	All personnel and contractors to undergo Environmental Awareness Training. A signed register of attendance must be kept for proof. Discussions are required on sensitive environmental receptors within the project area, with particular reference to the wetland systems.
23	Operation	Plant operation	Storage of materials and solutions	Inputs of toxic organic contaminants	L	L	Where applicable, materials must be stored in leak-proof, sealable containers or packaging. Materials must also be stored in bunded areas, which can accommodate the required volumes.
24	Operation	Opencast mining	Spills and leaks	Inputs of toxic heavy metal contaminants	M	L	• Any possible contamination of topsoil by hydrocarbons, concrete or concrete water must be avoided. Spill kits must be available and on hand to clean these spills; • Where applicable, materials must be stored in leak-proof, sealable containers or packaging. Materials must also be stored in bunded areas which can accommodate the required volumes; and • All contaminated soil / yard stone shall be removed and be placed in containers.
25	Operation	Opencast mining	Untreated run-off	Impaired water quality	M	L	Compile a suitable stormwater management plan, which must be implemented from the onset of the project and continued for the life of the project.

Hydrology (Refer to Section 4.2.2 and Annexure A)							
26	Construction	Site clearing / preparation	Disturbance of soil	Sedimentation of downstream drainage/watercourses	L	L	Ensure the site stormwater management plan is in place prior to the construction activities. The temporary stormwater controls must be maintained such that no blockages are present in the channels and containment ditches to ensure effective functioning.
27	Construction	Heavy machinery and vehicle movement	Hydrocarbon Fuel Spillage	Pollution of nearby watercourses	L	L	Develop a detailed schedule of vehicles being used during the construction phase and their service history. Only vehicles which have been effectively services should be allowed onsite.
28	Construction	Infrastructure establishment	Permanent destruction of watercourse	Reduction of Catchment Yield	L	L	The loss of catchment area as a result of the associated infrastructure cannot be mitigated. The only way to mitigate the above mentioned impacts is to not proceed with the mining option. Therefore, the impact rating for pre and post mitigation measures will remain unchanged. It should also be noted that the footprint area less than 1% of the total quaternary catchment area of B20A and will therefore result in a negligible loss in runoff.
29	Construction	Infrastructure establishment	Increase of paved surfaces	Increased probability of flooding	M	L	The floodline modelling was undertaken for two river sections. All infrastructures falling within the 1:100 year floodline for the two rivers need to be repositioned.
30	Operation	Stockpiling	Dissolution of pollutants by incident rainfall and stormflow	Pollution of downstream watercourse	L	L	• During the operational phase of the mine, a stormwater management plan which adheres to GN 704 requirements in terms of separation of clean and dirty water is required so as to ensure no mixing of clean and dirty water occurs. Lack of proper stormwater controls will result in dirty water contaminating the downstream clean water environment; • Ensure that the conceptual stormwater management plan is implemented which includes the stormwater maintenance plan. The maintenance plan is required to ensure that all stormwater controls function efficiently; and • Dust suppression is required twice a week, with water sourced from the Open Pit sump. The estimated dust suppression volume is 11000 m^3/month.
31	Operation	Opencast mining	Reduction in catchment area	Reduction in Catchment Yield	L	L	• In the operational phase the reduction of catchment yield will occur due to the construction of the associated infrastructure and the implementation of the stormwater management plan. The loss of catchment area as a result of the associated infrastructure cannot be mitigated. The only way to mitigate the above mentioned impacts is to not proceed with the mining option. Therefore, the impact rating for pre and post mitigation measures will remain unchanged; and • It should also be noted that the footprint area less than 1% of the total quaternary catchment area of B20A and will therefore result in a negligible loss in runoff.
32	Operation	Infrastructure establishment	Infrastructure within the 1:100 year floodline	Flooding of proposed infrastructure	M	L	• During the operational phase of a mine, expansion or change in the mining footprint areas may result in additional areas falling within the delineated 1:100 year floodline or 100 m river buffer;

							• The current floodlines should be used and updated if required depending on additional project infrastructure placement and/or expansion in infrastructure areas; and • All new infrastructures or mine footprint area expansions are to be placed outside of the 1:100 year floodline or 100 m buffer, whichever is greater.
33	Decommissioning and Closure	Infrastructure removal	Dismantling and removal of major equipment and infrastructure	Siltation of water resources	M	L	Ensure that the surface profile is rehabilitated to promote natural runoff drainage and avoid ponding of water within the rehabilitated area. Surface inspection should be continuously undertaken to allow runoff to drain onto the downstream drainage/rivers. All rehabilitated areas must be established with vegetation
Groundwater (Refer to Section 4.3 and Annexure C)							
34	Operation	Opencast mining	Continuation of mining the pit	Dewatering of aquifer	M	M	Pit dewatering will be necessary to ensure dry and safe working conditions; therefore, no mitigation measures are available.
35	Operation	Leachate	Coal and waste stockpiles*	Pollution into the groundwater	M	L	Surface areas should be lined to prevent poor quality seepage from reaching and contaminating the underlying groundwater. Surface areas should be bunded to prevent clean surface water runoff from being contaminated by dirty surface areas. Stockpiles and dirty footprint areas should be kept as small as practically possible.

***It must be noted that the waste stockpiles will be located at the existing Kangala Colliery and no longer at the Eloff Phase 3 Project.**

5.6 Issues and Responses from Public Consultation Process

Universal Coal Plc recently purchased Exxaro's Eloff Mining Company (Pty) Ltd with a mining right situated in the Magisterial District of Delmas. Detailed public participation was undertaken as part of the mining right application to include the NWA requirements.

As the proposed opencast mining area for the Eloff Mining Company Pty Ltd falls within the approved mining rights area, the public participation undertaken for that process is being used in this report. An amendment application to the existing environmental authorisation is currently being undertaken to include the new proposed pit area.

The following public participation was used as part of the Eloff mining right application in 2017:

- Site Notice. Four site notices were placed on the 17 February 2017 at the following locations:
    - Intersection at R42 Road (26°13'50.5269" S and 28°38'57.1645" E);
    - Road between Eloff and R42 (26°13'27.2769" S and 28°37'14.8378" E);
    - Farm Fence and Deelkraal Road opposite Kangala Mine (26°11'52.8861" S and 28°38'39.7313" E); and
    - Intersection in Eloff Town (26°11'10.1643" S and 26°11'10.1643" S).
- Background Information documents (BID):
    - A BID dated March 2017was handed out in person to the adjacent landowners and sent via e-mail.
- Newspaper adverts:
    - Adverts were placed in the Delmas Streeknuus and the Citizen on 24 February 2017 and 21 February 2017 respectively for the scoping phase; and
    - Adverts were placed in English in the Delmas Streeknuus and Citizen Newspapers, on 13 October 2017 and 11 October 2017 respectively for the EIA Phase.
- Open Day:
    - An Open Day was held at the Delmas Agri Lapa on 2 March 2017 from 11h00 to 15h00. The aim of the Open Day was to introduce the proposed Eloff Phase 1 Pit 1 project to the affected community, landowners and stakeholders.

The following public participation has been undertaken by Environmental Impact Management Services (Pty) Ltd (EIMS) (the appointed Environmental Assessment Practitioner (EAP) to assist with compiling the necessary reports and undertaking the statutory consultation processes):

- Identification of I&APs:

- Notification of the process to the landowners and I&APs:
  - PPP for this process commenced on the 7 August 2018.
  - Notification was undertaking using the following avenues:
    - Registered letters, faxes and e-mails;
    - Sending out of BIDs;
    - Advertisement of the project in the Streeknuus Delmas:
    - Placement of site notices during July 2017.

The PPP is currently ongoing. Refer to Annexure D for the Public participation undertaken to date. All comments received from this process will be forwarded to the DWS.

5.7 Matters Requiring Attention/ Problem Statement

This section is not applicable to the Eloff Phase 3 Project.

5.8 Assessment of Level and Confidence of Information

All information contained in this IWWMP was sourced from the specialist studies conducted for the project area. The specialists appointed to undertake the various investigations are considered to be competent in their particular fields. In light of the above, the level of confidence with regards to the information and reports used to compile this document is high.

6 WATER AND WASTE MANAGEMENT

6.1 Water and Waste Management Philosophy

6.1.1 Process Water

The philosophy with respect to process water management is to:

- Minimise the amount of process water produced (continually investigate emerging technologies for coal processing);
- Contain all process water to ensure zero discharge to the environment; and
- Re-use process water for dust suppression and in the process.

6.1.2 Stormwater

The philosophy for stormwater management on site is in keeping with the GN704 principles:

- To keep clean and dirty water separated;
- To contain any dirty water within a system;
- To prevent contamination of clean water; and
- To return clean water to the catchment.

6.1.3 Groundwater

The philosophy for waste management at Eloff Phase 3 Project is:

- Ensure that all potential groundwater impacts are identified;
- Ensure that groundwater monitoring is conducted quarterly and that records are kept, and a database compiled to identify trends over time.

6.1.4 Waste

The philosophy for the management of the various waste streams on site is:

- Minimisation of waste;
- Monitoring of waste management practises;
- Best practise storage and disposal of waste; and
- Consideration of alternative cost effective technologies with regards to waste Management.

6.2 Strategies

6.2.1 Process Water

Process water management will consist of:

- Investigating new alternatives for process water treatment and re-use; and
- Continued, regular monitoring of existing dirty water dams at Kangala which contain process water to ensure that the water quality is appropriate for re-use.

6.2.2 Storm Water

A storm water management plan has been developed for the Eloff Phase 3 Project. Storm water management will comprise of:

- Regular monitoring of surface water quality; and
- Regular monitoring and maintenance of stormwater control structures.

6.2.3 Groundwater

Groundwater management strategies will comprise of:

- Continued, regular monitoring of groundwater levels and quality; and
- Annual compliance audits.

6.2.4 Waste

Waste management strategies will consist of:

- Implementation of good housekeeping and best practises;
- Investigating new, cleaner and more cost effective technologies to reduce and manage waste;
- Monitor compliance with best practises; and

- Creating environmental awareness and sensitivity through improvements to the induction programme for employees.

6.3 Performance Objectives/ Goals

The following objectives and strategies are followed in order to achieve the Safety, Health, Environment and Quality Policy:

- Compliance:
  - Identify all applicable legislation and other applicable requirements to the identified environmental aspects and will ensure that the operations remain in compliance with such legislation and requirements.
- Pollution Prevention:
  - Identify the impacts that all operations, processes and products have on the environment and will ensure that pollution on the environment is prevented or minimised.
- Improvement:
  - Set objectives and targets to improve environmental performance and the Environmental Management System and will continually strive to find even better sustainable solutions to problems.
- Competence:
  - Ensure that all people who perform work for or on behalf of the Eloff Mining Company Pty Ltd are competent and understand the impact of their activities on the environment, and their role in the prevention of pollution and the maintenance of the Environmental Management System.
- Communication:
  - Actively communicate this policy to persons working for and on behalf of Eloff Mining Company Pty Ltd to ensure that they understand the content intent and will make it available to the public.
- Review:
  - Review the continued sustainability and adequacy of this policy at least annually to ensure it remains valid at all times.

6.4 Measures to Achieve and Sustain Performance Objectives

Eloff Mining Company Pty Ltd currently and intends to operate in line with the principles of ISO 14001 Environmental System (EMS) for the operational and decommissioning phases of Kangala Colliery, respectively. The water user has developed an EMS that aims at ensuring that all possible impacts associated with mining activities or processes are identified and mitigation measures are implemented to avoid or minimise environmental degradation and to promote a healthy and safe working environment.

The EMS have incorporated environmental procedures to manage aspects that have the potential to pose a risk of environmental pollution or degradation. These procedures include water and waste management procedures. Environmental procedures are updated regularly as aspect change or when there is a need for operational and technological advancement. The EMS provide the mine with reporting requirements and conditions of the issued licenses form an integral part of the system. This inadvertently ensure that mitigation measures for impacts associated with mining activities or processes on neighbouring communities and other stakeholders are undertaken with due consideration of the relevant stakeholders' interests. The ISO 14001 system is based on the Deming`s management approach (Plan-Do-Check-Act) (PDCA), and all systems, procedures and documents are reviewed regularly to ensure that objectives of the system are being met, and that the system is continually improved.

6.5 Option Analyses and Motivation for Implementation of Preferred Options

The Eloff Phase 3 Project is an expansion from the Kangala Colliery which is an existing operation and as such no alternatives have been investigated.

6.6 IWWMP Action Plan

An Action Plan provided herein shall provide water and waste management options for issues requiring immediate attention at the Kangala Colliery as well as the Eloff Phase 3 Project. The broad objective of the Action Plan is to provide robust and sustainable water and waste management practice for the mining operation. The following aspects will be addressed as part of the Action Plan:

- Key performance areas;
- Objectives;
- Roles and responsibilities; and
- Timeframes.

The compilation of an IWWMP is a long-term commitment in terms of resources requirements including technical investigations that are conducted. These also require disbursing financial resources to implement management measures which can in most cases take months. With this in mind, this IWWMP has been developed for medium term (i.e. first 5 years of operation of the mine), with the Action Plan herein reviewed and updated every year. It is thus the intention of the mine to have yearly interaction with DWS and update the Action Plan accordingly. The Action Plan for the Eloff Phase 3 Project is stipulated in the table (Table 6.1) overleaf:

Table 6.1: Eloff Phase 3 Project IWWMP action plan

Components	Objectives	Responsibility	Target Dates
Statutory Requirements	Ensure that safe disposal certificates for sewage waste, general waste and hazardous waste are in place.	Supply Chain	On going
	Continuously update the IWUL file on site	Environmental Specialist	On going
	Submission of annual IWUL External Audit Report	Environmental Specialist	Annually
	Submission of annual IWWMP Update Report to DWS	Environmental Specialist	Annually
	Implement continuous bio-monitoring for the mine and incorporate the neighboring farms or monitoring data from neighboring water users to investigate the impact of Kangala mining activities on the environment.	Environmental Specialist	Biannually
Risk Management	Continuously implement water quality monitoring programme for indicator variables at strategic boreholes and surface water monitoring points in relation to the infrastructure developed on site.	Environmental Specialist/Water Resources Managers	On going
	Implement the stormwater management plan.	Engineering Manager	During construction phase
	Investigate Best Practice Environmental Option (BPEO) for dust control systems (suppression technologies and products) in the market and choose the appropriate one for haul road and general plant dust suppression with the view to reduce water usage for dust suppression.	Engineering Manager	On going
Water Efficiency	Optimize recovery and reuse of process water and water from discard facility.	Plant Manager and Environmental Specialist	On going
	Ensure calibration of the implement flow gauging meters on site.	Plant Manager and Environmental Specialist	On going
	Annual review of water balance model to optimize water usage and conservation.	Environmental Specialist	On going

	Regular monitoring of water management facilities according to water use license conditions and report accordingly.	Environmental Specialist	On going
Water Management	Ensure equipment used for monitoring purposes are calibrated and that calibration certificates are safely stored in water and fireproof storage areas for easy retrieval during unplanned audits.	Environmental Specialist and Administrator	On going
	Logging of water and waste management data into the suitable system.	Environmental Specialist	On going
	update the groundwater flow model and inflows into the open-cast pit	Environmental Specialist	Annually
	Implement the rehabilitation plan (July 2011) for Kangala Colliery accordingly	Environmental Specialist	On going

6.7 Control and Monitoring

Water resource monitoring is undertaken in terms of the Department of Water and Sanitation (DWS) Best Practice Guidelines (BPG) for Water Monitoring Systems (2007). The objective of monitoring system is to:

- Develop environmental and water management plans based on impact monitoring;
- Generate monitoring data for the operational phase of the mine to be compared with baseline date before project implementation;
- Assess the impacts on receiving water environment; and
- Assess compliance with legal requirements.

Internal reporting includes monthly reports to the mine management on the performance against management commitments and expectation against authorisations and permits. External reporting requirements is guided by the permit and licenses received to that effect and the mine commit to comply with these statutory requirements at all times. This encompass incident reporting which in terms of the EMS, requires classification of incidents into three categories (Levels 1, 2 & 3) depending on their severity or potential consequence to the environment.

6.7.1 Monitoring of Change in Baseline (Environment) Information

6.7.1.1 Surface Water

Refer to Section 5.4.1 for the monitoring and control of the surface water at the Eloff Phase 3 Project.

6.7.1.2 Groundwater

Refer to Section 5.4.2 for the monitoring and control of the groundwater at the Eloff Phase 3 Project.

6.7.1.3 Bio-monitoring

Refer to Section 5.4.3 for the monitoring and control of the bio-monitoring at the Eloff Phase 3 Project.

6.7.2 Audit and Report on Performance Measures

Each component within the IWUL (when issued) will have an associated audit and performance review component. Regular review and auditing is important to ensure systems are up-to-date and still relevant for current situations. Evaluation is required to verify its appropriateness and suitability by comparing performance to objectives set. Changes or adjustments to systems are required where review/auditing highlights shortcomings or gaps. Performance should be measured against:

- Internal audit (conducted annually);
- External audit (conducted annually); and
- DWS reporting (conducted bi-annually).

6.7.3 Audit and Report on Relevance of IWWMP Action Plan

Audits of the water and waste management programmes are undertaken in line with license requirements. They include assessments of performance in relation to the action plan, whilst reviewing the relevance of all provisions or commitments in the plan.

7 CONCLUSION

7.1 Regulatory Status of Activity

Universal Coal's Kangala Colliery is the holder of a Mining Right (Ref. No.: **MP30/5/1/2/2/429 MR**) for the existing Kangala Colliery granted by the Department of Mineral Resources Mpumalanga Regional Office in terms of section 23 of the Mineral and Petroleum Resources Development

Act, 2002 (Act No. 28 of 2002) (MPRDA). In addition, Kangala Colliery have been issued with IWUL (**Licence no. 04/B20A/A/4683**) which authorises the following water uses:

- Section 21(a) – 'Taking water from a water resource'.
- Section 21(b) – 'Storing of water'.
- Section 21(c) – 'Impeding or diverting the flow of water in a watercourse'.
- Section 21(g) – 'Disposing of waste in a manner which may detrimentally impact on a water resource'.
- Section 21(i) – 'Altering the bed, banks, course or characteristics of a watercourse'.
- Section 21(j) – 'Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people'.

7.2 Statement of Water Uses Requiring Authorisation

The Eloff Phase 3 Project is an extension of Kangala Colliery. The following water uses that are being applied for in the IWULA have been triggered by the expansion:

- Section 21(c) – 'Impeding or diverting the flow of water in a watercourse'.
- Section 21(g) – 'Disposing of waste in a manner which may detrimentally impact on a water resource'.
- Section 21(i) – 'Altering the bed, banks, course or characteristics of a watercourse'.
- Section 21(j) – 'Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people'.

7.3 Section 27 Motivation

The NWA requires that the responsible authority, i.e. Department of Water and Sanitation (DWS), considers factors summarised below in deciding on an application for authorisation of water uses.

7.3.1 Existing Lawful Water Use

An Existing Lawful Water Use (hereinafter referred to as "ELWU") is a water use which has taken place at any time during a period of two years immediately before the date of commencement of the National Water Act, 1998 (Act No. 36 of 1998) (hereinafter referred to as "NWA") or which has been declared an existing lawful water use in terms of Section 33 of the NWA and which was authorised by or under any law which was in force immediately before the date of commencement of the NWA.

There are no ELWU associated with the application in question. There are existing water uses on the subject properties, associated with the agricultural activities. However, information quantities and lawfulness of these water uses is not at the applicant's disposal.

7.3.2 The need to Redress the Results of Past Racial and Gender Discrimination

Eloff Mining Company is a Level 2 B-BBEE Contributor, and its black ownership is 29.5%. Therefore, efforts to redress the results of past racial and gender discrimination are being supported through the mining activities of the applicant. Furthermore, the applicant has a Social and Labour Plan (SLP), which is being considered by the DMR with the Mining Right application process. Amongst other imperatives, it outlines policy commitments and programmes that give effect to empowerment of women and Historically Disadvantaged Individuals (HDIs) through the mining activities and associated water uses.

7.3.3 Efficient and Beneficial Use of Water in the Public Interest

The Extension project will ensure that the existing 700 employees keep their jobs over the 12 year LOM. Furthermore, there are other social benefits that will be realized due to the mining operation. Thus, the beneficial use of water is in the public interest in respect of job opportunities, Local Economic Development (LED), poverty alleviation, and social infrastructure development.

7.3.4 The Socio-Economic Impact

I. <u>If authorised</u>

If authorised, the water uses in question will enable and support the growth of the mining operation, which contributes to social and economic development in the area, and the

national tax revenue. When authorised, the water uses will facilitate mining activities employing 700 people. Furthermore, the activities contribute to Local Economic Development (LED) in the area through procurement of goods and services from local enterprises. Eloff Mining Company Pty Ltd has established Skills Development Programme within the jurisdiction Victor Khanye Local Municipality, which has produced over 200 qualified articulated dump trucks (ADT) and excavator operators recognized by the Mining Qualification Authority (MQA), ABET graduates and Artisans. The applicant also partnered with the Department of Education, Victor Khanye Local Municipality, and Exxaro Leeuwpan Colliery and have funded the building of Nkangala Further Education Training (FET) Satellite College, of which its first enrolment of students is expected in the first quarter of year 2018.

II. of the failure to authorise the water use or uses

Failure to authorise the water uses would result in cessation of Kangala Colliery mining project at the current LOM. The Extension project would not be feasible as mine workings would not be safe if dewatering is not permitted. Coal processing would also not be viable without permission to dispose of discard and slurry.

In this scenario, all social and economic benefits that would otherwise accrue from authorisation of the water uses and continuation with the mine Extension operations would be lost. This would have undesirable consequences for the Delmas. Amongst other ramifications, over 650 permanent job opportunities would be lost, with ripple effect to families that have been supported through income from the mine.

7.3.5 Any Catchment Management Strategy Applicable to the Relevant Water Resource

There is currently no catchment management strategy for the Olifants Water Management Area (WMA) within the project site falls. The Department of Water Sanitation (DWS) has instituted an Internal Strategic Perspective (ISP) as the policy document for management of water resources within the WMA, and consideration of applications for new allocation of water.

With the Olifants WMA deemed as being stressed and in deficit in terms of water availability, the reconciliation strategy recognises the potential for use of mine affected water and protection of water quality through pollution prevention interventions. Consistent with the ISP and reconciliation strategy, this application entails the use of mine-affected water including pit water and runoff from dirty areas. The site is a zero waste discharge operation, with no proposal to discharge polluted water to watercourses.

7.3.6 The Likely Effect of the Water Use to be Authorised on the Water Resource and on Other Water Users

The likely impact of the water uses to be authorised on water resources and other water users has been investigated and is considered low and acceptable if all prevention and mitigation measures are implemented. A wetland offset strategy for the two-small piece of depression wetlands that will be mined through has been recommended. The other wetlands occurring within the study area that are not going to be affected a minimum buffer zone of 100 m was recommended. Although depression wetlands will be mined, the impact of these on the broader catchment and functioning of the valley bottom wetlands is considered Low to insignificant.

The impact on the deeper dolomitic aquifer (groundwater resources) underlying the proposed mining area is low to negligible. The pit workings are not likely to impact on the dolomitic aquifer, on which the communities in and around Delmas are dependent for domestic water supply and agriculture. The latter is a key economic output driver in the area.

7.3.7 The Class and the Resource Quality Objectives (RQO) of the Water Resource

The class of the water resources and the feasibility to meet resource quality objectives will not be negated by the proposed additional water uses. The class of the water resources already considers mining, agriculture, residential development and other land-based activities within the catchment.

7.3.8 Investments Already made and to be made by the Water User in Respect to the Water Use in Question

The applicant has made substantial investments towards the Kangala Colliery project. With mining and related activities having commenced in 2013, the applicant has already made significant investments that include capital expenditure, construction and development of the mine and key infrastructure such as the coal processing plant.

7.3.9 The Strategic Importance of the Water Uses to be Authorised

Universal Coal's customer is Eskom power stations. The proposed water uses are of strategic importance, by virtue of supply of coal to Eskom for electricity generation. The coal is a key input for electricity generation for the national energy grid as per the Integrated Resource Plan. Therefore, the proposed water uses for the Extension are of strategic importance, in keeping with the National Water Resources Strategy II.

7.3.10 The Quality of Water in the Water Resource which may be required for the Reserve and for meeting International Agreements

With reference to the hydrogeological model simulated, the quality of water required for the Reserve from the deeper dolomitic aquifer will not be adversely affected by the proposed water uses, if the mitigation measures recommended are implemented and the coal extraction terminated above the shale and tillite formations. A monitoring programme has been proposed to serve as an early-warning system for impending deterioration in resource water quality. According to the hydrogeological model, post-closure water qualities are not likely to negatively impact on resource water quality of the deeper dolomitic aquifer.

7.3.11 The Probable Duration of any undertaking or which a Water use is to be Authorised

Eloff Mining Company Pty Ltd undertakes to operate the proposed Extension over a period of 12 years. The duration of this undertaking is in line with proposed Life of Mine (LOM).

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