BEAL

CONSULTING ENGINEERING & PROJECT MANAGEMENT

REPORT

ENVIRONMENTAL IMPACT MANAGEMENT SERVICES

SURFACE WATER IMPACT ASSESSMENT FOR THE PROPOSED VLAKVARKFONTEIN OPEN CAST MINING OPERATIONS ON THE FARM VLAKVARKFONTEIN 213 IR-REV 1

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

None

1. INTRODUCTION

EIMS commissioned **Error! Reference source not found.** (BEAL Consulting) to do a surface water impact assessment for the proposed Vlakvarkfontein colliery on the farm Vlakvarkfontein 213 IR. This report details the results of the study, as well as recommendations coming from the work done.

1.1. Study Objectives

The study objectives are as follows:

- Surface water impact assessment; and
- Floodlines and buffer zone calculation.

This report constitutes the outcome of the specialist studies undertaken by BEAL Consulting related to the environmental impact of the proposed colliery on the farm Welgelegen 221 IS.

1.2. Scope of work

The scope of work is summarised as follows:

- Floodlines and buffer zone determination in accordance with GN 704 of the South African National Water Act, Act 36 of 1998;
- Impact assessment; and
- Compilation of an impact assessment report which can be used as input into the EIA application.

1.3. Battery limits

The study battery limits are the mining rights area, shown in green in **Error! Reference source not found.**. All work is confined to these battery limits unless otherwise specified.

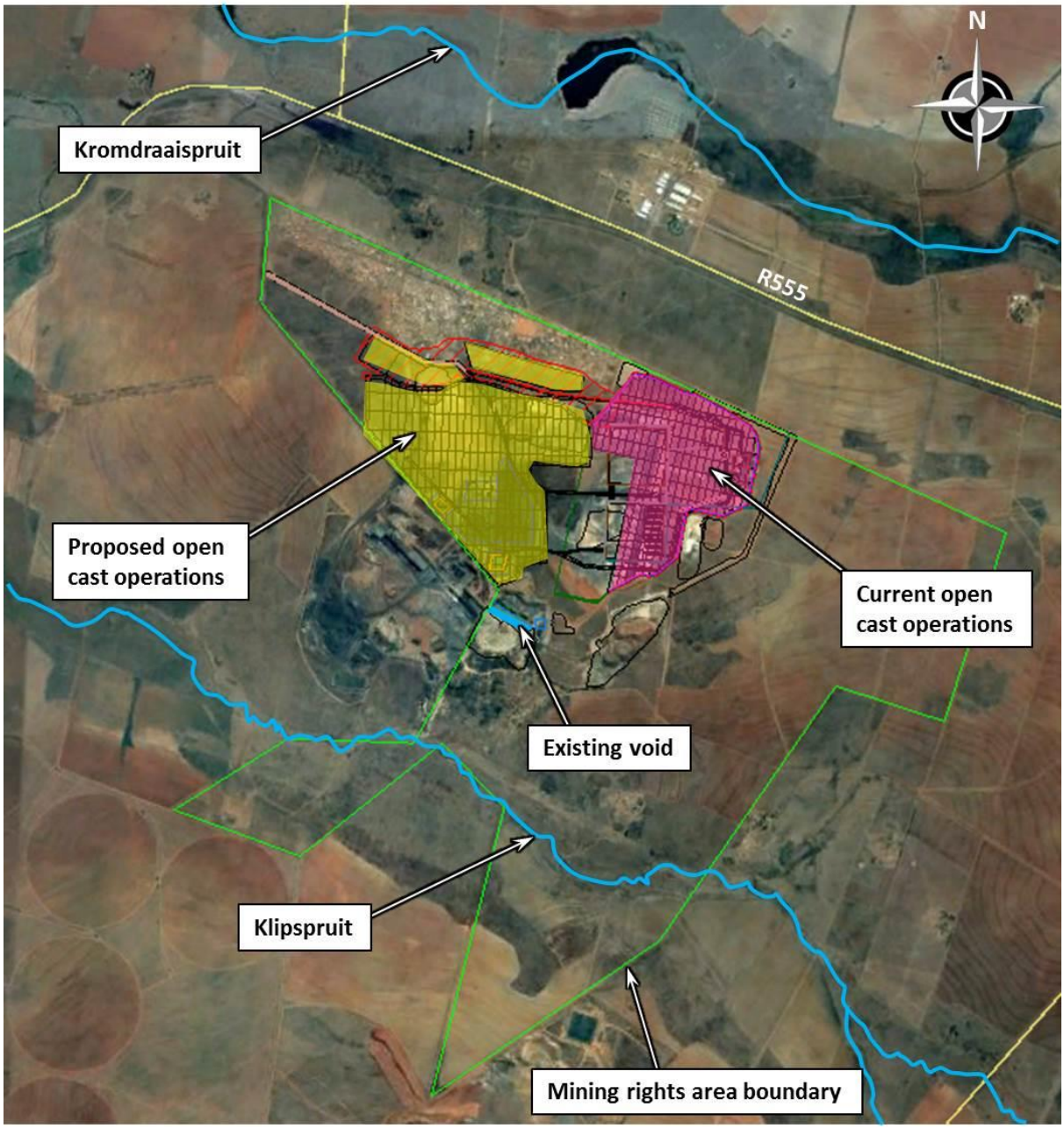

Figure 1: Study battery limits

2. REGIONAL SETTING

Vlakvarkfontein colliery is located in the Mpumalanga Province of South Africa. It is located approximately 39 km south west of Emalahleni (Witbank), in the upper reaches of the Wilge River catchment. The Wilge River is a tributary of the Olifants River. This section of the Olifants River catchment is adjacent to the Witbank Dam catchment and discharges into the Loskop and Flag Boshielo Dams.

The Loskop and Flag Boshielo dams are located downstream of Witbank Dam and are an important source of domestic, irrigation and industrial water to their surrounding areas. The Olifants River is an international river, flowing through the Kruger National Park and into Mozambique. With the Olifants River flowing through the Kruger National Park, provision for meeting ecological requirements is one of the controlling factors for managing water resources throughout the Olifants River catchment.

The Wilge River catchment measures 4 360 km^2. The mean annual precipitation in this catchment is generally uniform with an average precipitation of approximately 670 mm, varying between 650 mm and 700 mm.

The mean annual evaporation (S-Pan) varies between 1 677 mm in the south western regions of the catchment and 1 800 mm in the north western regions of the catchment.

The natural vegetation in the catchment is predominantly grassland. Extensive irrigated and dry-land agricultural activities are prevalent, along with various forms of livestock farming. Power stations and mining activities occur in the Wilge River catchment, as do a number of small towns. These include Delmas, Bronkhorstspruit, Lionelton, Kendal, and New Largo.

3. LOCAL SETTING

The mining rights area is located on the boundary between quaternary catchments B20E and B20F. It is located approximately 6 km west of Kendal and 24 km north east of Delmas.

A tributary of the Wilge River (Klipspruit) flows through the mining rights area (refer to **Error! Reference source not found.**). The Klipspruit is perennial and flows generally in a westerly direction through the southern part of the mining rights area, and to the south of the proposed open cast operations.

4. FLOODLINES

4.1. Flood peak calculation

A long term rainfall data set from gauge 0477762 (Strehla) was sourced from the CCWR rainfall database. The daily rainfall record was analysed and the annual maximum series was extracted from the data. This annual maximum series was statistically analysed to determine various T-year recurrence interval 24-hour storm depths. A Log Pearson Type 3 fit was selected as the most appropriate statistical fit.

The Standard Design Flood method, the Unit Hydrograph method, the Rational method, the Alternate Rational method, and the Empirical method (based on Francou-Rodier RMF calculations – Kovacs, 1988) were used to determine flood peaks for the Klipspruit. The Alternative rational method was used as the most appropriate flood peak for the Klipspruit. The results of the above calculation are summarised in Table 1.

Table 1: Summary of Klipspruit flood peak calculations

Recurrence Interval	Flood peak
50-yr	290 m^3/s
100-yr	351 m^3/s

4.2. Backwater analysis

A 1-D backwater analysis was performed using HEC-RAS. The backwater analysis was performed using HEC-RAS. Cross sections were taken from the 0.5 m contour. A Manning's n of 0.035 was used for the grass covered areas of the river and overbanks. A Manning's n of 0.05 was used for the areas containing willow trees and other woody vegetation. Cross sections were taken from the survey data at approximately 50 m intervals.

The 50-year and 100-year floodlines are shown in **Error! Reference source not found.**, plotted on a Google earth background image. No floodlines were done on the Wilge River as the proposed infrastructure is located sufficiently far away from the Wilge River.

The Klipspruit is small with defined channels in most areas. Some areas have incised channels. The Klipspruit is generally free of trees and woody vegetation. The channel mostly consists of grasses, sedges and reed beds. The banks are well vegetated, mainly with grasses.

The accuracy of the survey data cannot be verified. It is assumed that the survey data provided is a true reflection of the topography within the study area. The accuracy of the floodlines is dependent on the accuracy of the survey data.

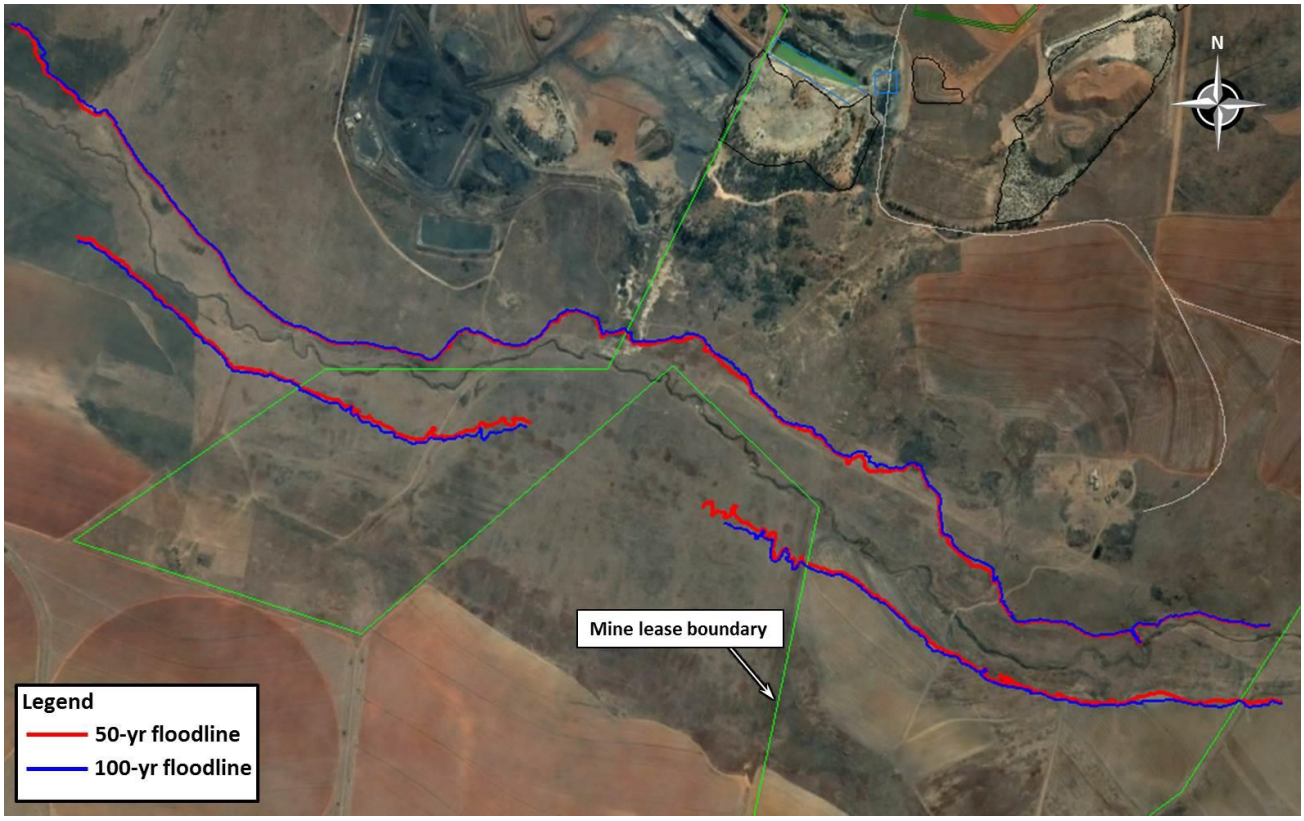

Figure 2: Floodlines on the Klipspruit

5. BUFFER ZONES

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

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

Pollution control dams are required, as part of the project so Section 4a of GN 704 will apply to these. The surface water buffer zone therefore is the greater of the 100-year floodline or 100 m from the watercourse. The buffer zones for the tributary of the Wilge River are shown in **Error! Reference source not found.**.

Figure 3: Buffer zones on the Klipspruit

6. CONSIDERATION OF ALTERNATIVES

A number of alternatives have been considered for the management of product, waste and water. These are discussed below:

6.1. Filter Cake

The option to stockpile for use as non-select product (Alternative P2a) as well as the option for disposal (Alternative P2b) will be assessed in the EIA phase. Surface water impacts for both alternatives are the same.

Provision has already been made for product stockpile areas in the dirty water management system. Provided that new areas outside of the current dirty water footprint are not required for filter cake stockpiles, the current dirty water management systems will be adequate for this purpose. The dirty water footprint does allow for limited expanded product stockpile area should they be required.

In pit disposal of the filter cake will have no surface water impacts apart from the possible deterioration of decant water quality. If the filter cake is disposed of below the water table, the surface water impacts from the filter cake are expected to be negligible.

6.2. Carboniferous Wastes (discards)

For the disposal of carboniferous wastes (wash plant waste rock and possibly filter cake), the option of disposal of beneficiation plant waste rocks and filter cake to pit (Alternative P3d) appears to be most suitable at this stage because no new dump on surface will be required and this will assist with rehabilitation volumes.

This will have surface water impact advantages if the carboniferous wastes are disposed of below the water table. Disposing of these wastes in a dedicated facility will involve the construction of a discard dump. Polluted surface water emanating from this discard dump will be managed in the mine's dirty water system, so no additional surface water impacts are expected. However, the discard dump increases the risk of contaminated seepage polluting decant water if the discard dump liner system fails and if the dump is located on old rehabilitated mining areas.

Disposal to a surface waste disposal facility located on old rehabilitated mine area (Alternative P3a) may also be assessed if disposal to the open pit is deemed to be an issue from an environmental perspective. In the event that designing the dumps on rehabilitated areas becomes problematic, the option of disposal to a surface waste disposal facility located on un-mined area (Alternative P3b) will also be considered.

Disposal of carboniferous wastes in pit (Alternative P3d), below the water table, is the preferred method of disposal from a surface impact water perspective. Disposal of carboniferous wastes in a lined discard dump on unmined land (Alternative P3b) is the second preferred alternative. Disposal of carboniferous wastes in a lined discard dump on previously mined land (Alternative P3a) is the least preferred alternative.

6.3. Dewatering Water Management

In terms of dewatering options, both Pump-treat-discharge (Alternative P4a) and Pump-store - treat-discharge (Alternative P4b) will be assessed in the EIA phase.

The surface water impacts for both alternatives are considered to be positive, provided the treatment improves the water quality to that of acceptable discharge standards. These standards are normally set by the appropriate Catchment Management Agency (CMA) if it exists, the local Resource Water Quality Objectives (RWQO) if they exist, or standards agreed by the Department of Water and Sanitation.

The pump-treat-discharge alternative (Alternative P4a) will likely yield greater volumes if discharged treated water than the pump-store -treat-discharge (Alternative P4b). The storage component of Alternative P4b will attenuate some of the dewatering water and less water will be available for treating and release.

The positive impacts of Alternative P4a will therefore be larger than Alternative P4b.

7. IMPACT ASSESSMENT

7.1. Project Description

Ntshovelo Mining Resources (Pty) Ltd (hereafter referred to as Ntshovelo) wishes to extend the mining operations at the Vlakvarkfontein colliery. The proposed extension will include open cast mining operations, using the roll-over method, onto portion 5 of the farm Vlarkvarkfontein 213R. Furthermore, the new proposed mining operations are likely to necessitate the relocation and re-establishment of the existing ancillary infrastructure associated with the current mining operations, including the pollution control dam and the administrative structures. Ntshovelo also wishes to establish a new washing, screening, and crushing plant to decontaminate the run-of-mine coal. The proposed extension of the mine and new coal washing plant will be located within the Mining Right boundary. The proposed project includes:

- The proposed new open cast mining area extension;
- A new washing, screening, and crushing plant;
- Dedicated ROM stockpiles to temporarily store run of mine and product;
- Filter press to dry the slurry before being sold;
- Dedicated dewatered slurry stockpiles to temporarily store dewatered slurry;
- A new water treatment facility;
- A discard (wash plant waste) disposal;
- New pollution control infrastructure such as
    - clean storm water diversions;
    - dirty water concrete collection trenches; and
    - pollution control dams.
- Topsoil and overburden stockpiles;
- Haul roads where coal will be transported; and
- Contaminated storm water is assumed to be collected in dedicated pollution control dams.

7.2. Surface Water Impact Receivers

The mine is located on a watershed so surface water impacts will be to the north and south of the mine. Impacts to the north will be in the Kromdraaispruit. Impacts to the south will be in Klipspruit, also a tributary of the Wilge River. The location of these two rivers is shown in **Error! Reference source not found.**.

7.3. Methodology for Impact Assessment

Method of Assessing Impacts:

The impact assessment methodology is guided by the requirements of the NEMA EIA Regulations (2010). The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/likelihood (P) of the impact occurring. This determines the environmental risk. In addition other factors, including cumulative impacts, public concern, and potential for

irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S).

Determination of Environmental Risk:

The significance (S) of an impact is determined by applying a prioritisation factor (PF) to the environmental risk (ER).

The environmental risk is dependent on the consequence (C) of the particular impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and reversibility (R) applicable to the specific impact.

For the purpose of this methodology, the consequence of the impact is represented by:

$$C = \frac{E + D + M + R}{4} \times N$$

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in Table 2.

Table 2: Criteria for Determining Impact Consequence

Aspect	Score	Definition
Nature	- 1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary),
	3	Local (i.e. the area within 5 km of the site),
	4	Regional (i.e. extends between 5 and 50 km from the site
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years),
	3	Medium term (6-15 years),
	4	Long term (the impact will cease after the operational life span of the project),
	5	Permanent (no mitigation measure of natural process will reduce the impact after construction).
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected),
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected),
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way),
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.

Aspect	Score	Definition
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible Impact

Once the C has been determined, the ER is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/scored as per Table 3.

Table 3: Probability Scoring

Probability	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),
	2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Medium probability (the impact may occur; >50% and <75%),
	4	High probability (it is most likely that the impact will occur- > 75% probability), or
	5	Definite (the impact will occur),

The result is a qualitative representation of relative ER associated with the impact. ER is therefore calculated as follows:

$$\boldsymbol{ER = C \, x \, P}$$

Table 4: Determination of Environmental Risk

Consequence	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
	Probability					

The outcome of the environmental risk assessment will result in a range of scores, ranging from 1 through to 25. These ER scores are then grouped into respective classes as described in Table 5.

Table 5: Significance Classes

Environmental Risk Score	
Value	**Description**
< 9	Low (i.e. where this impact is unlikely to be a significant environmental risk),
≥9; <17	Medium (i.e. where the impact could have a significant environmental risk),
≥ 17	High (i.e. where the impact will have a significant environmental risk).

The impact ER will be determined for each impact without relevant management and mitigation measures (pre-mitigation), as well as post implementation of relevant management and mitigation measures (post-mitigation). This allows for a prediction in the degree to which the impact can be managed/mitigated.

Impact Prioritisation:

In accordance with the requirements of Regulation 31 (2)(l) of the EIA Regulations (GNR 543), and further to the assessment criteria presented in the Section above it is necessary to assess each potentially significant impact in terms of:

- Cumulative impacts; and
- The degree to which the impact may cause irreplaceable loss of resources.

In addition it is important that the public opinion and sentiment regarding a prospective development and consequent potential impacts is considered in the decision making process.

In an effort to ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impact ER (post-mitigation). This prioritisation factor does not aim to detract from the risk ratings but rather to focus the attention of the decision-making authority on the higher priority/significance issues and impacts. The PF will be applied to the ER score based on the assumption that relevant suggested management/mitigation impacts are implemented.

Table 6: Criteria for Determining Prioritisation

Public response (PR)	Low (1)	Issue not raised in public response.
	Medium (2)	Issue has received a meaningful and justifiable public response.
	High (3)	Issue has received an intense meaningful and justifiable public response.

Cumulative Impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable loss of resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.
	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

The value for the final impact priority is represented as a single consolidated priority, determined as the sum of each individual criteria represented in Table 11. The impact priority is therefore determined as follows:

$$\boldsymbol{Priority} = \boldsymbol{PR} + \boldsymbol{CI} + \boldsymbol{LR}$$

The result is a priority score which ranges from 3 to 9 and a consequent PF ranging from 1 to 2 (Refer to Table 7).

Table 7: Determination of Prioritisation Factor

Priority	Ranking	Prioritisation Factor
3	Low	1
4	Medium	1.17
5	Medium	1.33
6	Medium	1.5
7	Medium	1.67
8	Medium	1.83
9	High	2

In order to determine the final impact significance the PF is multiplied by the ER of the post mitigation scoring. The ultimate aim of the PF is to be able to increase the post mitigation environmental risk rating by a full ranking class, if all the priority attributes are high (i.e. if an impact comes out with a medium environmental risk after the conventional impact rating, but there is significant cumulative impact potential, significant public response, and significant

potential for irreplaceable loss of resources, then the net result would be to upscale the impact to a high significance).

Table 8: Final Environmental Significance Rating

Environmental Significance Rating	
Value	**Description**
< 10	Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
≥10 <20	Medium (i.e. where the impact could influence the decision to develop in the area),
≥ 20	High (i.e. where the impact must have an influence on the decision process to develop in the area).

7.4. Impacts during the Construction Period

A distinction needs to be made between the construction of infrastructure and the open cast mining. Both will require heavy earthmoving machinery. The impacts described in this section relate to the construction of pre-mining infrastructure around the open cast workings and the pre-deposition works on the various stockpiles. Mining and stockpiling of materials falls within the operational period. Impacts relating to the operational period are discussed in Section **Error! Reference source not found.**.

7.4.1. Impacts due to topsoil stripping

Impact assessment

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

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

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

Mitigation

Mitigation of the impacts should include the following:

- Areas that are stripped should be optimised to limit unnecessary stripping.
- Storm water from upslope of the stripped areas should be diverted around these areas to limit the amount of storm water flowing over these areas.
- The timing of the topsoil stripping should be optimised to limit the time between stripping and construction/deposition. Where practical constraints exist and areas need to be left stripped for long periods, contour ploughing or ripping could reduce run-off and hence reduce erosion.
- Dry season construction is preferable.

- Hydro seeding of topsoil stockpiles is recommended to speed up vegetation cover. An appropriate seed mix should be designed by a vegetation specialist.

Residual impact

The residual impacts will probably be very low due to the temporary nature of the impact. Large storm flows in the two rivers will wash the excess sediment into downstream river systems. These sediment loads are likely to be very small in relation to the sediment loads in the two rivers. This sediment may ultimately reach the Loskop Dam.

Cumulative impact

Topsoil stripping will add to sediment loads produced by erosion from upstream agricultural activities. While it occurs, the impact will be significant compared to upstream impacts of a similar nature. The impact will be temporary and will cease shortly after construction commences and the topsoil stockpile is vegetated.

Impact rating table

Impact Name	**Topsoil stripping**				
Alternative	**Alternative 1**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	3	1
Extent of Impact	2	2	Reversibility of Impact	2	2
Duration of Impact	2	2	Probability	5	5
Environmental Risk (Pre-mitigation)					-11.25
Mitigation Measures					
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Environmental Risk (Post-mitigation)					-8.75
Degree of confidence in impact prediction:					Low
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.33
Final Significance					-11.67

7.4.2. Impacts due to construction related pollution

Impact assessment

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

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

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

Mitigation

Mitigation of the impacts should include the following:

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

Residual impact

If limited soil contamination occurs, the residual impacts will probably be very low.

Cumulative impact

There are no known significant upstream sources of hydrocarbon pollutants, although farming activities and urban settlements in the catchment could result in hydrocarbon pollution. Hydrocarbons are currently not measured in the Klipspruit and the Kromdraaispruit and it is unlikely that significant amounts of hydrocarbon pollution exist in these rivers.

Impact rating table

Impact Name	**Construction related pollution**				
Alternative	**Alternative 1**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	2	2
Extent of Impact	2	2	Reversibility of Impact	3	3
Duration of Impact	2	2	Probability	3	2
Environmental Risk (Pre-mitigation)					-6.75
Mitigation Measures					
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Environmental Risk (Post-mitigation)					-4.50

Degree of confidence in impact prediction:	Low
Impact Prioritisation	
Public Response	1
Low: Issue not raised in public responses	
Cumulative Impacts	2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.	
Prioritisation Factor	1.33
Final Significance	-6.00

7.4.3. Impacts due to upfront dewatering water discharge

Impact assessment

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

- Flows in the Klipspruit will be increased and will experience a relatively constant inflow of good quality water. The volume of water is not currently known and this will depend largely on how early the mine starts dewatering.
- Dry season impacts will be higher than wet season impacts. These will be positive impacts.
- The pump-treat-discharge alternative (Alternative P4a) will likely yield greater volumes if discharged treated water than the pump-store -treat-discharge (Alternative P4b). The storage component of Alternative P4b will attenuate some of the dewatering water and less water will be available for treating and release.

Mitigation

No mitigation is necessary.

Residual impact

The residual impacts will probably be low due to the temporary nature of the impact. The impacts will stop when the treatment and discharge stops.

Cumulative impact

The cumulative impacts will be negligible, as the treated inflows will be small compared to the natural flows in the downstream river systems. The impact will be temporary and will cease shortly after the inflows stop.

Impact rating table

Impact Name	**Treated water discharge (Wet season)**				
Alternative	**Alternative P4a**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	1	1	Magnitude of Impact	4	4

Extent of Impact	3	3	Reversibility of Impact	1	1
Duration of Impact	2	2	Probability	5	5
Environmental Risk (Pre-mitigation)					12.50
Mitigation Measures					
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Environmental Risk (Post-mitigation)					12.50
Degree of confidence in impact prediction:					Low
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.33
Final Significance					16.67

Impact Name	**Treated water discharge (Dry season)**				
Alternative	**Alternative P4a**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	1	1	Magnitude of Impact	5	5
Extent of Impact	3	3	Reversibility of Impact	1	1
Duration of Impact	2	2	Probability	5	5
Environmental Risk (Pre-mitigation)					13.75
Mitigation Measures					
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Environmental Risk (Post-mitigation)					13.75
Degree of confidence in impact prediction:					Low
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.33
Final Significance					18.33

Impact Name	Treated water discharge (Wet season)				
Alternative	**Alternative P4b**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	1	1	Magnitude of Impact	3	3
Extent of Impact	3	3	Reversibility of Impact	1	1
Duration of Impact	2	2	Probability	5	5
Environmental Risk (Pre-mitigation)					11.25
Mitigation Measures					
Edit this once pasted into the report					
Environmental Risk (Post-mitigation)					11.25
Degree of confidence in impact prediction:					Low
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.33
Final Significance					15.00

Impact Name	Treated water discharge (Dry season)				
Alternative	**Alternative P4b**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	1	1	Magnitude of Impact	4	4
Extent of Impact	3	3	Reversibility of Impact	1	1
Duration of Impact	2	2	Probability	5	5
Environmental Risk (Pre-mitigation)					12.50
Mitigation Measures					
Edit this once pasted into the report					
Environmental Risk (Post-mitigation)					12.50
Degree of confidence in impact prediction:					Low
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.33

Final Significance	16.67

7.5. Impacts during the Operational Phase

7.5.1. Impacts due to contaminated water discharge

Impact assessment

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

Mitigation

The proposed colliery must have an undertaking to comply with Government Notice 704 of the South African National Water Act. This act limits discharges of contaminated water from mining related activities to less than once in 50 years on average. Contaminated water should be reused or treated to adequate discharge standards prior to release.
Should a legal discharge occur as a result of extreme rainfall conditions, the Klipspruit and the Kromdraaispruit should have sufficient capacity to dilute poor quality spillage water. The impacts from extreme rainfall conditions should be low and will last for a short duration. Impacts resulting from negligence or mismanagement could be more severe. The severity of the impacts would be related to the volume and quality of water that is spilled. Impacts relating to small spillages would probably be relatively low to moderate and would be short in duration. Impacts relating to large spillages would be high. The effects would be short to medium term.

Mitigation of the impacts must include the following:

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

Residual impact

Proper water management, along with adequately designed infrastructure should result in no accidental spillages, other than those resulting from extreme rainfall and discharges within the ambit of the law. Based on the assumption that proper management will take place and that infrastructure is adequately sized, the residual impacts will be low. Impacts could occur during the life of the mine.

Cumulative impact

The impacts resulting from contaminated water discharges will result in short term water quality deterioration in the Klipspruit and the Kromdraaispruit provided the discharges are isolated events. The impacts resulting from contaminated water discharges are likely to result in water quality deterioration in the Klipspruit and the Kromdraaispruit.

Impact rating table

Impact Name	Contaminated water discharge				
Alternative	**Alternative 1**				
Phase	**Operation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	3	3
Extent of Impact	4	4	Reversibility of Impact	3	3
Duration of Impact	4	1	Probability	5	2
Environmental Risk (Pre-mitigation)					-17.50
Mitigation Measures					
Edit this once pasted into the report					
Environmental Risk (Post-mitigation)					-5.50
Degree of confidence in impact prediction:					Low
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.33
Final Significance					-7.33

7.5.2. Loss of catchment yield

Impact assessment

During the operational phase, storm water generated from the open pits, overburden stockpiles and surrounding areas considered as dirty, will be collected in the dirty water system. This water would have contributed to the flow in the Klipspruit and the Kromdraaispruit. The loss of catchment yield will result in a negligible reduction in flow in the catchment of the Klipspruit. The loss of flow in the Kromdraaispruit will be moderate. This loss is quantified in Table 9.

Table 9: Loss of catchment yield

Parameter	Opencast pit	Dirty catchments of colliery (incl. PCD)
Dirty catchment MAR* (Volume lost)	177 614 m^3	5 224 m^3
Impact on the Klipspruit	0.2% of MAR (0.1mm of run-off)	N/A
Impact on the Kromdraaispruit	7.9% of MAR (2.6mm of run-off)	0.2% of MAR (0.1 mm)

** Note: Assuming maximum pit extent*
Note: MAR is mean annual runoff
Refer to ***Error! Reference source not found.*** *on page 4 for stream locations.*

Mitigation

As is best practice, dirty areas must be minimised. This will have the dual benefit of smaller dirty water management systems and reduction in catchment yield loss. This must include the separation of overburden stockpiles into topsoil, softs (uncontaminated) and hards (contaminated).

The open cast operations must be rehabilitated to return as much storm water to the environment as possible.

Residual impact

Once open cast mining ceases and effective rehabilitation is completed, the area will once again contribute to the catchment yield. Run-off from rehabilitated spoils will be negligibly reduced due to slightly higher infiltration but this impact is insignificant.

Cumulative impact

The impacts on the Klipspruit will be negligible and the Kromdraaispruit will be moderate.

Impact rating table

Impact Name	**Loss of catchment yield**				
Alternative	**Alternative 1**				
Phase	**Operation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	2
Extent of Impact	3	3	Reversibility of Impact	4	4
Duration of Impact	3	3	Probability	5	5
Environmental Risk (Pre-mitigation)					-17.50
Mitigation Measures					
Edit this once pasted into the report					
Environmental Risk (Post-mitigation)					-15.00
Degree of confidence in impact prediction:					Low
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.33
Final Significance					-20.00

7.5.3. Impacts due to wash bays and workshops

Impact assessment

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

Mitigation

Mitigation of the impacts should include the following:

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

Residual impact

The residual impacts of the wash bays and workshops will probably be low. The impacts will occur for the life of the mine.

Cumulative impact

There are no known significant upstream sources of hydrocarbon pollutants apart from farming activities. These impacts will have a small detrimental effect on the water quality in the receiving waters.

Impact rating table

Impact Name	Pollution from wash bays and workshops				
Alternative	**Alternative 1**				
Phase	**Operation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	2	2
Extent of Impact	3	3	Reversibility of Impact	2	2
Duration of Impact	1	1	Probability	2	1
Environmental Risk (Pre-mitigation)					-4.00
Mitigation Measures					
Edit this once pasted into the report					
Environmental Risk (Post-mitigation)					-2.00
Degree of confidence in impact prediction:					Low
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.33
Final Significance					-2.67

7.5.4. Impacts due to burst water pipes

Impact assessment

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

Mitigation

Mitigation of the impacts should include the following:

- Pipe lines should be subjected to frequent patrols. An efficient system of reporting should be available to allow the immediate tripping of pumps.
- Where practical, pipelines should be installed within dirty areas.

Residual impact

The residual impacts of a pipe line burst could be the contamination of the soil in the location of the burst. Salts will be introduced into the upper soil strata.

Cumulative impact

The impacts resulting from burst dirty water pipes will result in short term water quality deterioration in the Klipspruit and the Kromdraaispruit, provided the discharges are isolated events. The impacts resulting from contaminated water discharges are likely to result in water quality deterioration in the Klipspruit and the Kromdraaispruit.

Impact rating table

Impact Name	Contamination due to burst water pipes				
Alternative	**Alternative 1**				
Phase	**Operation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	3	2
Extent of Impact	3	2	Reversibility of Impact	2	2
Duration of Impact	2	2	Probability	4	3
Environmental Risk (Pre-mitigation)					-10.00
Mitigation Measures					
Edit this once pasted into the report					
Environmental Risk (Post-mitigation)					-6.00
Degree of confidence in impact prediction:					Low
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.33
Final Significance					-8.00

7.5.5. Impacts due to vehicle fleet-related pollution

Impact assessment

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

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

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

Mitigation

Mitigation of the impacts should include the following:

- All mining vehicles should be well maintained and inspected for hydrocarbon leaks weekly.
- Wash bay discharge water should flow through an oil separator.
- Fuel depots and refuelling areas should be bunded.

- Chemicals should be stored in a central secure area. Regular training on the responsible handling of chemicals should be undertaken. If contract mining is being used, responsible handling of chemicals and vehicle maintenance should be a key performance objective of the mining contractor.

Residual impact

If limited soil contamination occurs, the residual impacts will probably be very low.

Cumulative impact

There are no known significant upstream sources of hydrocarbon pollutants, although farming activities in the catchment could result in hydrocarbon pollution. Hydrocarbons are currently not measured in the two rivers and it is unlikely that significant amounts of hydrocarbon pollution exist in the Klipspruit and the Kromdraaispruit.

Impact rating table

Impact Name	**Vehicle fleet related pollution**				
Alternative	**Alternative 1**				
Phase	**Operation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	2	2
Extent of Impact	2	2	Reversibility of Impact	3	3
Duration of Impact	2	2	Probability	3	2
Environmental Risk (Pre-mitigation)					-6.75
Mitigation Measures					
Edit this once pasted into the report					
Environmental Risk (Post-mitigation)					-4.50
Degree of confidence in impact prediction:					Low
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.33
Final Significance					-6.00

7.6. Impacts during the Decommissioning Phase of the Project

7.6.1. Impacts due to the removal of surface infrastructure

Impact assessment

During the decommissioning phase, most impacts will be associated with the removal of surface infrastructure, final closure of the open cast workings and removal and rehabilitation of the ROM

and product stockpiles and other dirty areas. Haul roads will be removed, as will berms and diversion trenches.

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

Mitigation

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

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

Residual impact

The residual impacts will probably be very low due to the temporary nature of the impact. Large storm flows in the Klipspruit and the Kromdraaispruit will wash the excess sediment into downstream river systems. These sediment loads are likely to be very small in relation to the sediment loads in the Klipspruit and the Kromdraaispruit.

Cumulative impact

The newly disturbed areas will add to sediment loads produced by erosion from upstream agricultural activities. While it occurs, the impact will be significant compared to upstream impacts of a similar nature. The impact will be temporary and will cease once the affected areas are vegetated.

Impact rating table

Impact Name	**Removal of surface infrastructure**				
Alternative	**Alternative 1**				
Phase	**Decommissioning**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	3	1
Extent of Impact	2	2	Reversibility of Impact	3	3
Duration of Impact	2	2	Probability	5	5
Environmental Risk (Pre-mitigation)					-12.50
Mitigation Measures					
Edit this once pasted into the report					
Environmental Risk (Post-mitigation)					-10.00
Degree of confidence in impact prediction:					Low
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.33
Final Significance					-13.33

7.7. Impacts after the Closure Phase of the Project

7.7.1. Impacts due to open cast workings decant

Impact assessment

The groundwater study has not been completed at the time of writing. Whether or not the rehabilitated open cast workings will decant, still needs to be determined. For the surface water impact assessment, a conservative approach is followed and it is assumed that decant may occur from the rehabilitated open cast workings. Should the groundwater study prove that decant will not occur from the rehabilitated open cast workings, this impact assessment will become irrelevant.

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

Mitigation

Mitigation of the impacts should include the following:

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

Residual impact

The residual impacts will be dependent on the quality of rehabilitation and whether decant occurs. If decant is able to be prevented, impacts are expected to be negligible. If the rehabilitation quality is poor and/or groundwater contributions cause decant, impacts could be significant, particularly during the dry season when there is little assimilative capacity in the Klipspruit and the Kromdraaispruit.

Cumulative impact

If decant is able to be prevented, the cumulative impacts will be negligible. Should decant occur, the impacts resulting from decant will result in long term water quality deterioration in the Klipspruit and the Kromdraaispruit.

Impact rating table

If mitigation prevents decant, the following table applies:

Impact Name	**Pit decant**				
Alternative	**Alternative 1**				
Phase	**Rehab and closure**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	3	2
Extent of Impact	3	3	Reversibility of Impact	5	5
Duration of Impact	5	5	Probability	5	5
Environmental Risk (Pre-mitigation)					-20.00
Mitigation Measures					
Edit this once pasted into the report					
Environmental Risk (Post-mitigation)					-18.75
Degree of confidence in impact prediction:					Low
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.33
Final Significance					-25.00

Should mitigation be unsuccessful and decant occurs, the following table applies:

Impact Name	**Pit decant**				
Alternative	**Alternative 1**				
Phase	**Rehab and closure**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	3	3
Extent of Impact	3	3	Reversibility of Impact	5	5
Duration of Impact	5	5	Probability	5	5
Environmental Risk (Pre-mitigation)					-20.00
Mitigation Measures					
Edit this once pasted into the report					
Environmental Risk (Post-mitigation)					-20.00
Degree of confidence in impact prediction:					Low
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1.33
Final Significance					-26.67

8. STUDY ASSUMPTIONS AND LIMITATIONS

The assessment has been undertaken by BEAL Consulting subject to the following assumptions and limitations.

Floodlines

The floodlines are based on the survey data provided by the mine. The accuracy of the survey data cannot be verified. It is assumed that the survey data provided is a true reflection of the topography within the study area. The accuracy of the floodlines is dependent on the accuracy of the survey data.

Buffer zones

The 100 m buffer zones are measured from the stream centreline.

Impact Assessment

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

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