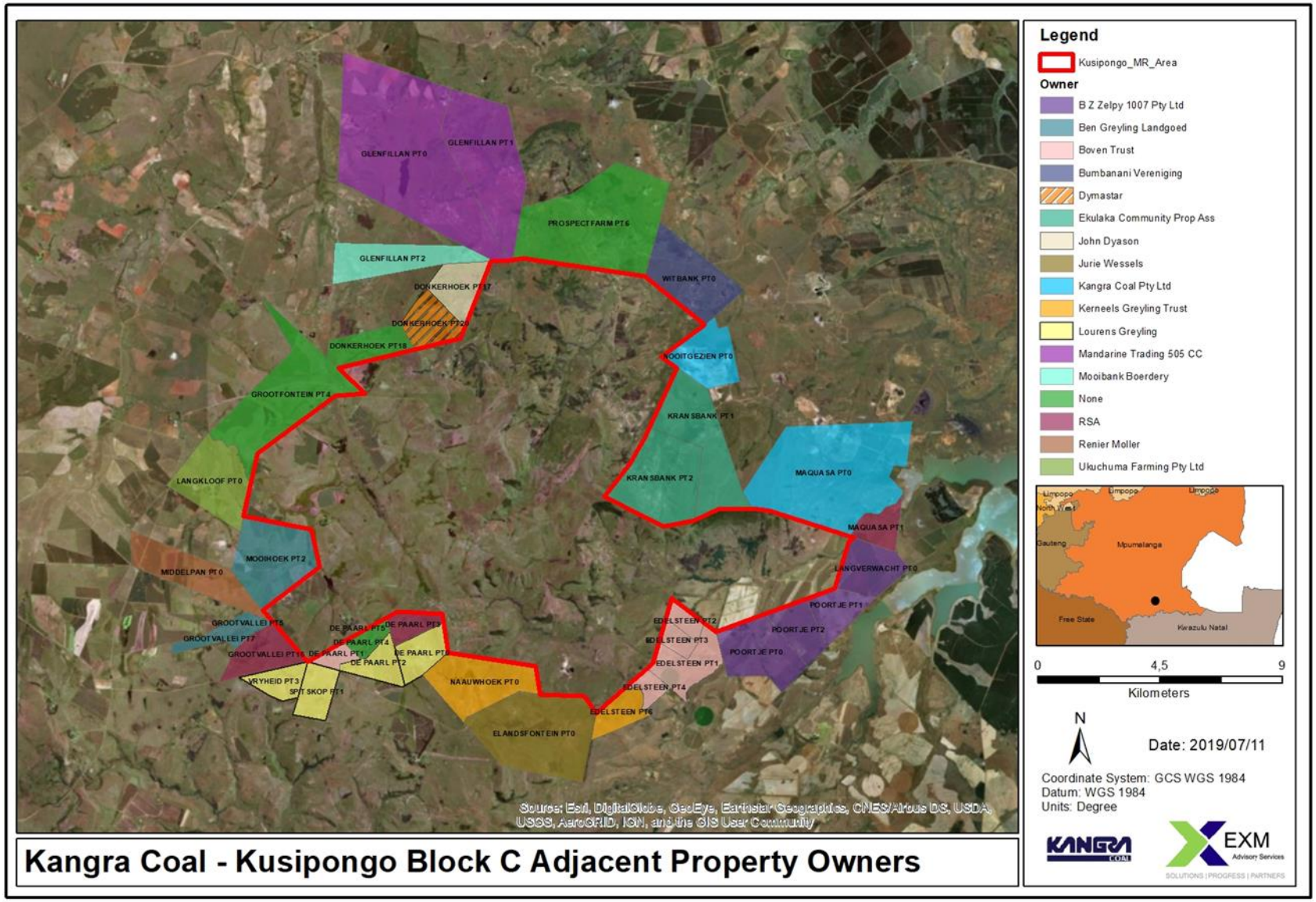

FIGURE 9-49: NEIGHBOURING LAND OWNERSHIP TO THE KUSIPONGO MINING RIGHT

9.10 Cultural Heritage

The description of the Cultural Heritage environment was sourced from the Heritage Impact Assessment (Professional Grave Solutions, September 2019)

9.10.1.1 General Desktop Study

An archaeological and historical desktop study was undertaken to provide a historical framework for the project area and surrounding landscape. This was augmented by an assessment of previous archaeological and heritage studies completed for the study area and surrounding landscape. An assessment was also made of the early editions of the relevant topographic maps. The assessment of previous archaeological and heritage studies revealed the presence of one previously identified heritage site within the present study area. This site was visited and included in the present report as site KCP 10.

9.10.1.2 Fieldwork

Intensive field surveys of the study area were undertaken by foot and vehicle by an experienced fieldwork team comprising one archaeologist/heritage specialist (Polke Birkholtz) accompanied by a fieldwork assistant (Derrick James). The fieldwork was aimed at locating and documenting sites falling within the proposed development area and was undertaken from Monday, 19 August to Friday, 23 August 2019.

The fieldwork resulted in the identification of 19 archaeological and heritage sites. For the purposes of this project, these sites were numbered from KCP 1 to KCP 19, and comprise the following:

- Burial grounds, graves and possible graves – nine sites
- Historic black homesteads where the risk exists for the presence of graves – four sites
- Historic black homesteads with graves and/or possible graves – two sites
- Late Iron Age stonewalled sites – one site
- Recent black homesteads where the risk exists for the presence of graves – one site
- Historic white farmsteads and structures – two sites

Further detail about each of the sites is provided in **Table 9**.43 and the Figures that follow:

TABLE 9.43: DETAILS OF HERITAGE SITES IDENTIFIED

Heritage site	Description	Site Significance
KCP 1	The site comprises a circular stonepacked feature, roughly three meters in diameter. Although no definite evidence for the presence of a grave could be observed here, such as a headstone or grave goods, the feature can be identified as a possible grave. The site appears to be associated with nearby sites such as KCP 2 and KCP 5.	Until such time that the presence of graves here has been confirmed or disproved, the site must be viewed as containing a grave. All graves have high levels of emotional, religious and in some cases historical significance. As a result, the site is provisionally deemed to be of Generally Protected A (GP. A) or Medium to High Significance. This indicates that the site may not be impacted upon without prior mitigation.
KCP 2	The site comprises a poorly preserved historic black homestead with one possible grave. The only tangible remains of the homestead still evident is a circular foundation for a hut, which has a diameter of four meters. A few meters east of the foundation structure an oval stone-lined feature was identified which has the appearance of a grave. The site is located in the general proximity of a possible grave at KCP 1 and a stonewalled livestock enclosure at KCP 5. Past experience has shown that in some cases unmarked stillborn babies were buried in close proximity to such black homesteads. As the site is not occupied anymore, no direct information with regards to the presence (or not) of such graves is currently available.	The tangible remains of the historic black homestead are in a poor state of preservation. As a result, without the presence of graves, the site would be of little heritage significance. However, the risk exists for unmarked stillborn graves to have been buried at the homestead. Furthermore, a possible grave was also identified here. While the presence of unmarked stillborn graves has not yet been verified, the presence of a possible grave at the homestead means that the site must be viewed as of Generally Protected A (GP. A) or Medium to High Significance. This indicates that the site may not be impacted upon without prior mitigation.
KCP 3	A single circular stonewalled enclosure of approximately 20m in diameter was identified here. The stonewalled enclosure is located roughly 25m from the proposed development footprint area known as Balgarthen B ROM Stockpile.	KCP 3 is certainly not unique within the surrounding landscape but represents the only site from within the present study area that can be associated with the Late Iron Age or early Historic Period. The site is of Generally Protected B (GP. B) or Medium Significance.
KCP 4	The site comprises a poorly preserved historic black homestead comprising a circular foundation for a hut, which is five meters in diameter. The central surface of the hut recedes down and may have been excavated. The site can be associated with nearby sites such as KCP 1, KCP 2 and KCP 5.	The tangible remains of the historic black homestead are in a poor state of preservation. As a result, without the presence of graves, the site would be of little heritage significance. However, the risk exists for unmarked stillborn graves to have been buried at the homestead. All graves have high levels of emotional, religious and in some cases historical significance. While the presence of unmarked stillborn graves has not yet been verified, the site can still be deemed to be of Generally Protected B (GP. B) or Medium Significance. This indicates that the site may not be impacted upon without prior mitigation.

Heritage site	Description	Site Significance
KCP 5	A stonewalled livestock enclosure with associated rectangular herder hut were identified here. While the herder hut is located within the proposed development footprint area known as Balgarthen B ROM Stockpile, other sections of the site fall outside this footprint area. The site can be associated with nearby sites such as KCP 1, KCP 2 and KCP 4. Although not certain, the potential risk does exist for unmarked stillborn graves (and other unmarked graves) to have been buried here.	On their own, the livestock enclosure and herder hut are of low significance. However, the risk exists for unmarked graves to have been buried here. While the presence of unmarked stillborn graves has not yet been verified, the site can still be deemed to be of Generally Protected B (GP. B) or Medium Significance. This indicates that the site may not be impacted upon without prior mitigation.
KCP 6	A historic black homestead is located here and comprises a large rectangular stonewalled livestock enclosure associated with two circular huts. The site is certainly older than 60 years, and possibly older than 100 years as well. The site is located 15m from the Balgarthen B OC Dump footprint area. Two circular hut foundations are located to the north-west of the livestock enclosure, with a crescent-shaped cooking screen identified between the two huts. The larger of the two huts is still in a very good condition and measures five meters in diameter, the smaller hut is four meters in diameter.	The tangible remains of the historic black homestead and kraal are in a relatively good state of preservation and provide a good example of this type of historic black homestead from the surroundings of the study area. Furthermore, the risk exists for unmarked graves to have been buried at the site. Until such time that the presence of stillborn graves here has been confirmed or disproved, the site must be viewed as containing graves. The site is of Generally Protected B (GP. B) or Medium Significance. This indicates that the site may not be impacted upon without prior mitigation.
KCP 7	A ce1111111111metery comprising 13 rectangular stonepacked graves was identified at site KCP 7. The site is located 14m outside the development footprint area known as Balgarthen B Adit Dump. The cemetery is enclosed by a well-built stonepacked wall, which shows evidence of having been extended at some point in the history of the cemetery to allow for the expansion of the burial ground.	All graves have high levels of emotional, religious and in some cases historical significance. The site is of Generally Protected A (GP. A) or Medium to High Significance. This indicates that the site may not be impacted upon without prior mitigation.
KCP 8	The site comprises a rudimentary stone structure which may have formed part of a historic black homestead. It is located 8m from the proposed development footprint area known as Balgarthen B Adit Dump.	Until such time that the presence of graves here has been confirmed or disproved, the site must be viewed as containing graves. All graves have high levels of emotional, religious and in some cases historical significance. The site is of Generally Protected B (GP. B) or Medium Significance. This indicates that the site may not be impacted upon without prior mitigation.

Heritage site	Description	Site Significance
	Although no surface evidence for graves could be identified at the site, past experience has shown that in some cases unmarked stillborn babies were buried in close proximity to such black homesteads. These stillborn babies were frequently buried along the sides, or underneath, the parents' dwelling. As the site is not occupied anymore, no direct information with regards to the presence (or not) of such graves is currently available.	
KCP 9	The site comprises the single grave of Mr. Albert Yete Ndlamenze and is located east of the homestead of the family. The grave is located 57m from the development footprint area known as the Twyfelhoek OC Pit. The grave dressing is orientated along the east-west axis, and has a granite-lined dressing with a formal granite headstone	All graves have high levels of emotional, religious and in some cases historical significance. The site is of Generally Protected A (GP. a) or High Significance. This indicates that the site may not be impacted upon without prior mitigation.
KCP 10	A cemetery comprising 42 graves was identified at site KCP 10. The burial ground is located within a clearing in a black wattle plantation. Barring two graves, all the graves dressings from the site are rectangular or oval shaped and stone packed. Quite a few of the graves have its own small enclosing wall of stone. Two of the graves have granite markers, whereas a number of graves have upright stones as headstones on which the name of the deceased was scratched. These granite markers and upright stones indicate that the cemetery can be associated with the Masondo family.	All graves have high levels of emotional, religious and in some cases historical significance. The site is of Generally Protected A (GP. A) or Medium to High Significance. This indicates that the site may not be impacted upon without prior mitigation.
KCP 11	The site comprises the single grave of Ms. Fikile Simelane and is located east of the homestead of the family. The grave is located 14m from the development footprint area known as the Twyfelhoek OC Pit. The grave has a stonepacked dressing that is orientated along the east-west axis. The grave has an upright stone on its western end on which the name 'Fikile' appears. This informal headstone also appears to contain the date of death, which appears to indicate that the deceased passed away in 1987.	All graves have high levels of emotional, religious and in some cases historical significance. The site is of Generally Protected A (GP. A) or Medium to High Significance. This indicates that the site may not be impacted upon without prior mitigation.

Heritage site	Description	Site Significance
KCP 12	The site comprises a currently occupied homestead that is located within the development footprint known as Twyfelhoek OC Pit. No residents of this homestead was at home at the time of the fieldwork. This means that this homestead is the only one from the study where the presence or absence of unmarked stillborn graves could not be confirmed with the family. The risk therefore exists for the presence of unmarked stillborn graves.	Until such time that the presence of graves here has been confirmed or disproved, the site must be viewed as containing graves. The site is of Generally Protected B (GP. B) or Medium Significance. This indicates that the site may not be impacted upon without prior mitigation.
KCP 13	A poorly preserved historic black homestead and burial ground were identified a few meters from the proposed development footprint area known as the Twyfelhoek OC Pit. The burial ground is located within the homestead and consists of a total o six stonepacked graves. A few of the graves have upright stones placed on their western ends for headstones, some of which contain the details of the deceased. From the names of the deceased that could be read on these informal headstones, the cemetery can be associated with the Masondo family.	All graves have high levels of emotional, religious and in some cases historical significance. The site is of Generally Protected A (GP. A) or Medium to High Significance. This indicates that the site may not be impacted upon without prior mitigation.
KCP 14	The site comprises the poorly preserved remains of a white farmstead. All that remains of the original farmhouse are some of the stone foundations, a section of a brick wall and planted vegetation such as jacaranda trees. A small distance west of the farmhouse the circular foundation structure for a hut-type structure known vernacularly as a rondawel was identified. The farmstead is depicted on the First Edition of the 2730AB Topographic Sheet that was surveyed in 1969. This means that the site is at least 50 years old.	The farmstead at site KCP 14 is poorly preserved. It is deemed to be of Generally Protected C (GP. C) or Low Significance.
KCP 15	A cemetery comprising six stonepacked graves for stillborn babies was identified at site KCP 15. These graves were buried adjacent to a dwelling and is located within a homestead. According to the head of the household, Mr. Masango, no other graves, marked or unmarked, are buried within this homestead.	All graves have high levels of emotional, religious and in some cases historical significance. The site is of Generally Protected A (GP. A) or Medium to High Significance. This indicates that the site may not be impacted upon without prior mitigation.

Heritage site	Description	Site Significance
KCP 16	The site comprises a single grave located within the footprint area of the proposed Twyfelhoek Adit. The grave is located on a slope, is stone packed and orientated along the east-west axis. No formal headstone or grave goods could be seen. The grave does not appear to be maintained by family.	All graves have high levels of emotional, religious and in some cases historical significance. The site is of Generally Protected A (GP. A) or Medium to High Significance. This indicates that the site may not be impacted upon without prior mitigation.
KCP 17	A cemetery comprising two graves was identified at site KCP 17. The two graves have stonepacked, oval-shaped grave dressings that are orientated along the east-west axis. No formal headstones or grave goods are visible. The size of both grave dressings suggest that the two graves are both for children. The graves are enclosed by a rectangular, stonepacked wall.	All graves have high levels of emotional, religious and in some cases historical significance. The site is of Generally Protected A (GP. A) or Medium to High Significance. This indicates that the site may not be impacted upon without prior mitigation.
KCP 18	The site comprises a poorly preserved white farmstead. The primary remaining elements of the original farmstead are two sandstone buildings. However, although these buildings are quite likely very old, they have both been extensively modified over the years. The farmstead is depicted on the First Edition of the 2730AB Topographic Sheet that was surveyed in 1969. This means that the site is at least 50 years old.	Both structures are certainly older than 60 years, however, they have been extensively modified over the years and have very little heritage value. The site is of Generally Protected C (GP. C) or Low Significance.
KCP 19	A cemetery comprising 17 graves was identified at site KCP 19. All of the graves from the site have oval and rectangular stone packed grave dressings, with a natural stone placed on the western ends as a headstone. One of the graves has a dressing comprising a concrete slab with an inscribed slate headstone placed on the western end of the dressing. The cemetery appears to be regularly maintained and cleaned by the family. Although the site is not located near any of the proposed development footprint area, it is located in reasonably close proximity to an existing road which may be used as an access and haul road to the Balgarthen section of the project. As a result, the cemetery was recorded and included in this report.	All graves have high levels of emotional, religious and in some cases historical significance. The site is of Generally Protected A (GP. A) or Medium to High Significance. This indicates that the site may not be impacted upon without prior mitigation.

FIGURE 9-50: HERITAGE SITES IDENTIFIED WITHIN THE BALGARTHEN AREA

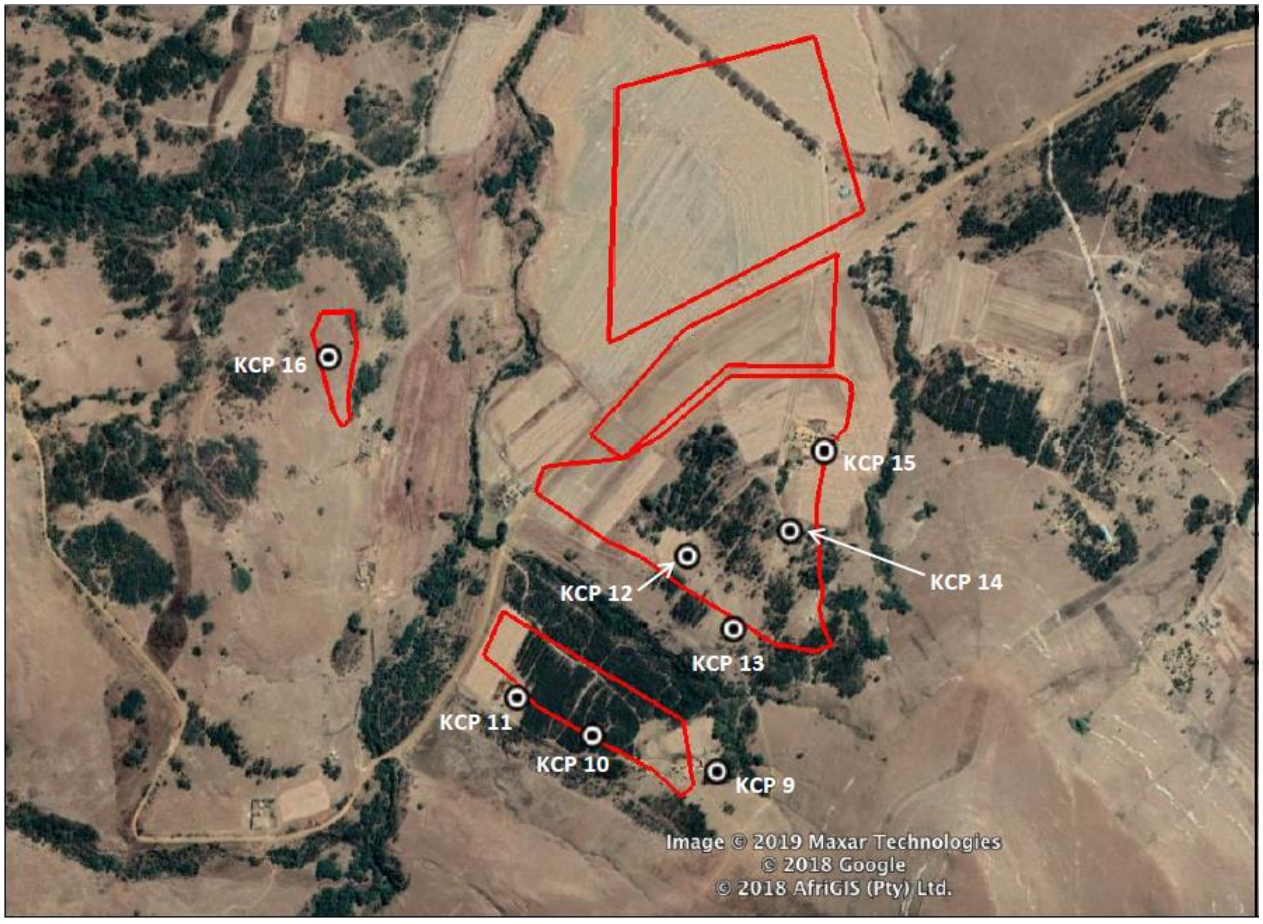

FIGURE 9-51: HERITAGE SITES IDENTIFIED WITHIN THE TWYFELHOEK AREA

FIGURE 9-52: HERITAGE SITES IDENTIFIED WITHIN THE BALGARTHEN AREA

9.10.2 Palaeontology

The description of the Palaeontological environment was sourced from the Palaoentological Assessment (Banzai Environmental, September 2019)

The proposed Kusipongo underground and opencast coal mine development is underlain by the Vryheid Formation of the Ecca Group (Karoo Supergroup), while the central portion of Kusipongo mining right application is underlain by the Volksrust Formation (Ecca Group) and Karoo dolerite (). According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Vryheid Formation is Very High and that of the Volksrust Formation is High while the Karoo Dolerite Suite consists of igneous rock and thus has a Palaeontological Sensitivity of zero (Almond and Pether 2008, SAHRIS website).

All the South African coalfields occur in the Main Karoo Basin or its associated sub-basins. The Main Karoo Basin forms part of a primary series of Gondwanan basins that was established along the southern boundary of Gondwana (Cole, 1992; De Wit and Ransome 1992; Veevers et al. 1994; Catuneanu et al. 1998;). These basins include Beacon Basin in Antarctica, Bowen Basin in Australia as well as the Paraná Basin in South America. The Basins formed between the Late Carboniferous and Middle Jurassic and their joint stratigraphies characterize the best record of non-marine sedimentation in the world.

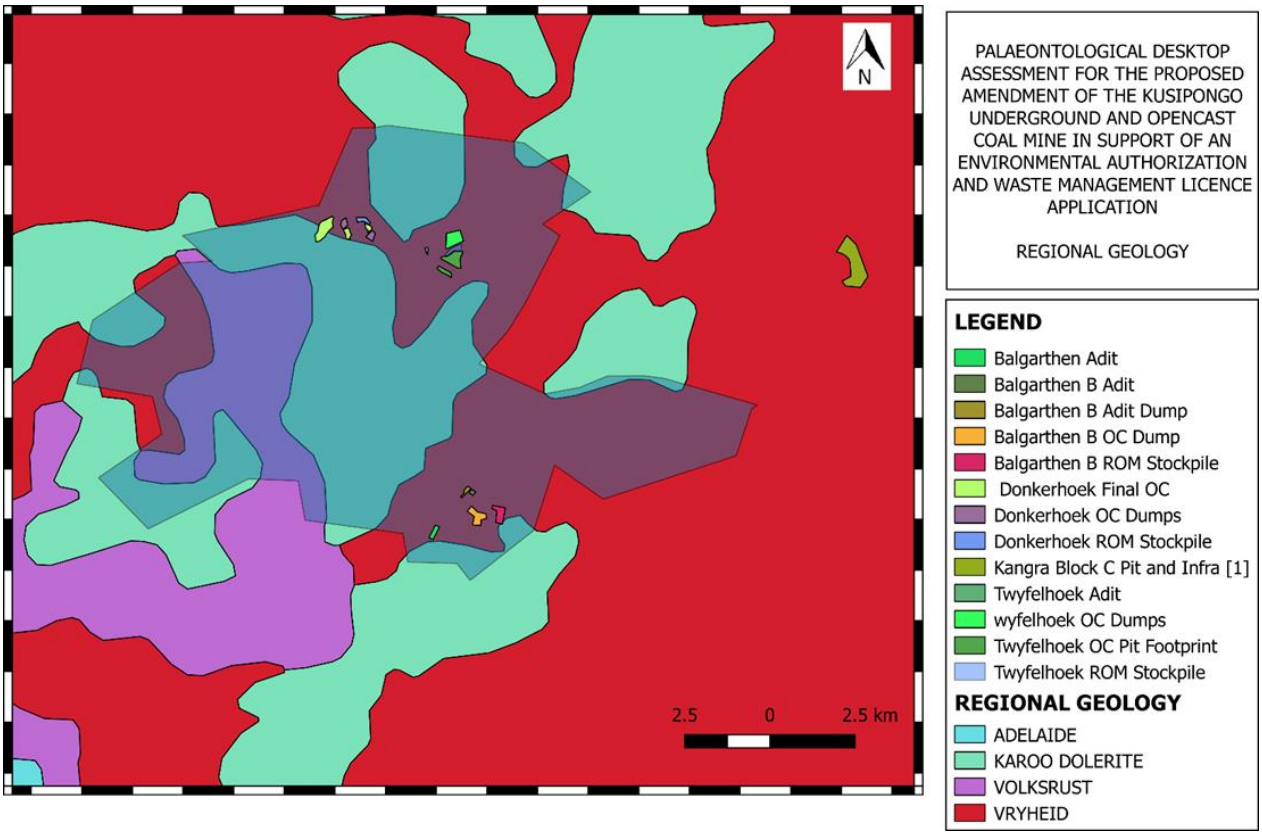

FIGURE 9-53: SURFACE GEOLOGY OF THE PROPOSED KUSIPONGO MINING AREA

9.11 Socio-Economic Environment

An overview of the Socio-Economic Environment is detailed in the sections below.

Provincial level (Mpumalanga)

• The primary economic activities in the Province are mining and manufacturing.

• The population is still young, with the majority being below the age of 35 years.

• The population growth rate between 2001 and 2011 was 1.83%.

District Level (Gert Sibande District Municipality)

• Has the smallest population size in the province (~ 1 043 194 persons in 2011).

• Smallest population growth rate in the Province between 2001 and 2011 at 1.48%. This is lower than the national and provincial growth rates.

• Youth (between 0 to 34 years) constituted the largest share of the District population at 69.8%.

Local Level (Mkhondo and Dr. Pixley Ka saka Seme Local Municipalities)

Mkhondo Local Municipality

• Mkhondo Local Municipality (LM) had the fastest population growth rate in the District at 1.84% (between 2001 and 2011). Between 1996 and 2011, the population nearly doubled from 98 967 to 171 591 people.

• 58.3% of the population is below the age of 24 years.

Dr. Pixley Ka saka Seme Local Municipality

• In 2011 the population was 83 007 people, with a population growth rate of 2.8% between 1996 and 2001, decreasing to 0.3% between 2001 and 2011.

• In 2011, majority of the population was black (91%).

• 55.6% of the population is below the age of 24 years.

Ward Level (Ward 2 and 3 of the Mkhondo LM and Wards 5 and 10 of the Dr. Pixley Ka saka Seme LM)

The following statistics are collective and show a cumulative value across all wards.

• A greater percentage of the population (44%) is in the 0 to 14 year age cohort, with 21% in the 15 to 24 years age group.

• Of the population, 51% fall within the potentially economically active population, i.e., between 15 and 64 years.

• Homesteads across all four wards average four to six members per homestead unit.

In Summary:

Mining is one of the main economic activities in Mpumalanga. The age of the population from Provincial through to Ward level is young. Majority of persons in the District, LMs and Wards are previously disadvantaged persons and a large percentage of the population (at a Ward level) is in the potentially economically active population (51%).

Local Level (Mkhondo and Dr. Pixley Ka saka Seme Local Municipalities)

Mkhondo Local Municipality

• About 70% of the adult population (people aged 20 years and older) do not have a high school education.

• In 2001 nearly 22 806 adults had no schooling. This figure dropped substantially to 15 914 in 2011 (30% decline).

• The number of matriculated students more than doubled from 8 674 in 2001 to 22 600 in 2011.

Dr. Pixley Kalsaka Seme Local Municipality

• Less than 68% of the adult population (people aged 20 years and older) do not have a high school education.

• In 2001, nearly 14 000 adults had no education and by 2011 this figure dropped to 8 950 (almost a 40% decline).

• The number of matriculating students increased from 4 938 in 2001 to 11 153 in 2011.

In Summary:

Although there have been significant improvements in the number of people attending school and

matriculating, a significantly large percentage of the population have less than a high school education.

HEALTH

Local Level (Mkhondo and Dr. Pixley Ka saka Seme Local Municipalities)

• Among those most at risk of contracting HIV/Aids are people within the age cohort of 16 to 35 years. This is a large proportion of both the LM's populations.

• In the Dr. Pixley Ka saka Seme LM, there has been a decreased growth rate in HIV prevalence (1996 to 2010), which if it continues could reduce the vulnerability of both LMs populations.

In Summary:

Although a large percentage of the LMs population is at an age which is at high risk of contracting HIV/Aids, the prevalence rate has decreased, thus reducing the vulnerability for both LMs.

TOURISM

Provincial level (Mpumalanga)

• Focus to promote tourism as a key sector of the economy.

• In 2010 the Province attracted 1.136 million foreign tourists, compared to 1.035 million in

2009 – a 9.6% increase.

District Level (Gert Sibande District Municipality)

• Have realised that the tourism sector is not properly developed, but are aiming at

optimising the potential that the district has in the form of wetlands, grasslands, etc.

Local Level (Mkhondo and Dr. Pixley Ka saka Seme Local Municipalities)

Mkhondo Local Municipality

• Tourism development and preservation are highlighted as being important for the LM.

• Has recognised a number of heritage sites for tourism.

Dr. Pixley Ka saka Seme Local Municipality

• Has recognised that Wakkerstroom (40km south-south-west of the Project Area) has the

potential to become a major destination for domestic as well as foreign tourists.

• Has recognised that Wakkerstroom wetland reserve is the main centre for bird watching in

South Africa.

In Summary:

Tourism is a major sector from the Provincial level through to the LM level. Amongst others,

Wakkerstroom has been identified as a major destination for the development and preservation

of tourism.

UTILITIES AND SERVICES

Provincial level (Mpumalanga)

• Water – a focused effort to provide piped water is noticeable in the Province, with only 13% of the population not having access to piped water.

• Energy/Fuel Sources – 86.4% of people living in the Province utilised electricity for lighting in 2011. At District level, the use of electricity for lighting is lower; however, this has narrowed significantly over the past 10 years.

In Summary:

Water and energy provision in the province have improved.

AGRICULTURE

The District features the largest agricultural sector in Mpumalanga Province with strong service centres like Standerton, Ermelo, Bethal and Piet Retief. Agricultural commodities produced within the District include maize, soybeans, sunflower, grain, sorghum, wheat, mutton (cattle and sheep), dairy and wool. Although some irrigated commercial agriculture does occur to the south of Ermelo and to the north and east of Manzana, the majority of the aforementioned commercial crops are grown on dryland. In total 23% of the District's land surface is under cultivation, of which approximately 99% constitutes commercial dry land under grains.

Significantly, the area between Carolina, Bethal and Ermelo produces the largest number of sheep and wool quantity in South Africa. The Standerton area is known for its large dairy industry and maize/ soybean agriculture. The majority of cattle farming activity occurs within the Dipaleseng, Dr Pixley ka Isaka Seme and Mkhondo Local Municipalities. Other types of crops grown in the District include potatoes, sweet potatoes, groundnuts and soybeans. A small measure of bee keeping and honey harvesting also occurs within the forests. Apart from commercial agriculture, subsistence farming plays an important part in the livelihoods of many of the District's communities, especially those in the Manzana and Lochiel areas. In respect of commercial agriculture support infrastructure, the District is supported by an extensive network of abattoirs, silos, fresh produce markets, and four agricultural offices (Balfour, Ermelo, Carolina, and Amsterdam).

Agriculture potential throughout the area is medium to high. There is commercial mixed farming with crop production occurring on higher potential soils, supplemented by beef and sheep farming. Irrigation of crops, fodder production and limited horticulture of apples, also contribute to the mix of farming activities. A large proportion of rural households depend on subsistence farming which is a very important part of people's livelihoods.

9.12 Roads and Traffic

The description of the traffic environment was sourced from work undertaken as part of the Traffic Impact Assessment (TTT Traffic, September 2019)

9.12.1 Baseline traffic conditions

9.12.1.1 Existing Road Network and Access

The existing road network comprise gravel roads, which will be utilised as far as possible for the proposed operations. D2548 and D1091 Routes, shown in the Figure below, follow existing gravel tracks. All proposed haul roads should be wide enough to allow for bi-directional travel. At least 3.5 times the width of the truck should be used for the road width for bi-directional travel. This width excludes shoulders, berms and drains. (Roger Thompson – Mining Roads: Mine Haul Road Design, Construction & Maintenance Management).

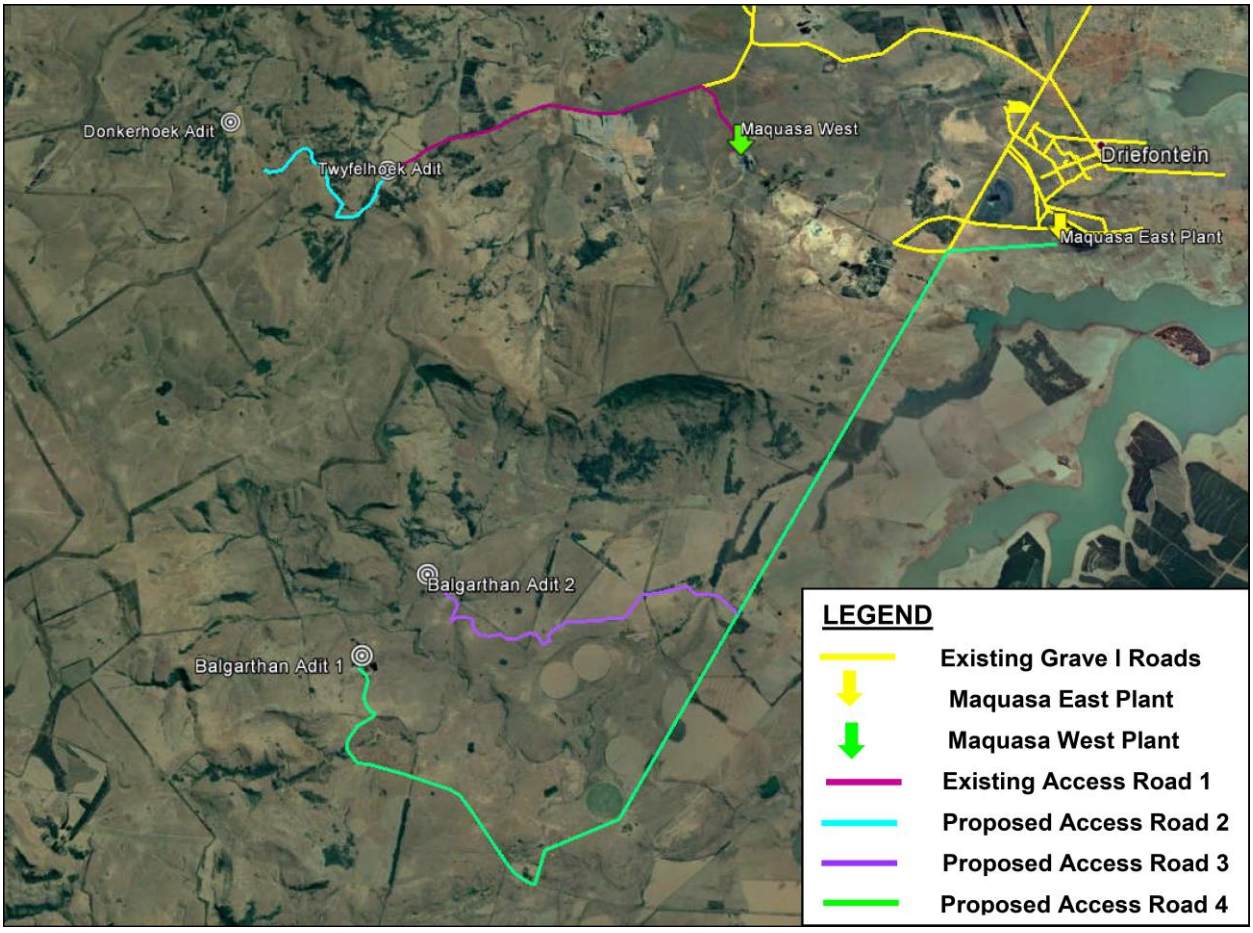

FIGURE 9-54: ACCESS ROADS

All processing plants and adits are easily accessed via the existing gravel road network. For heavy vehicles, which require a longer time of 12 seconds to pull away and turn from stop, longer clear sight distances are necessary. The alignment of the main road is straight and flat at the access position. Good and adequate sight distance in excess of 300 m is available on the main road and from the mine access in all directions.

The access to Balgarthian Adit 1 is through the minor access road which is shown on the Locality map. The Balgarthan Adit 1 access road intersects with D282 Route as shown in **Figure 9-55** below. The alignment of the local gravel routes is relatively straight and flat at all the access positions, and good sight-distance is available on the main roads from all the mine access in all directions.

FIGURE 9-55: WESTBOUND OF D282 / ACCESS TO BALGARTHAN ADIT 1

9.12.1.2 Current traffic volumes

Manual traffic counts were undertaken on 23 August 2019 during the AM peak period (06:00 – 07:30) and on 22 August 2019 during the PM peak period (15:30 – 17:30) at the two intersections shown in **Figure 9-56** below.

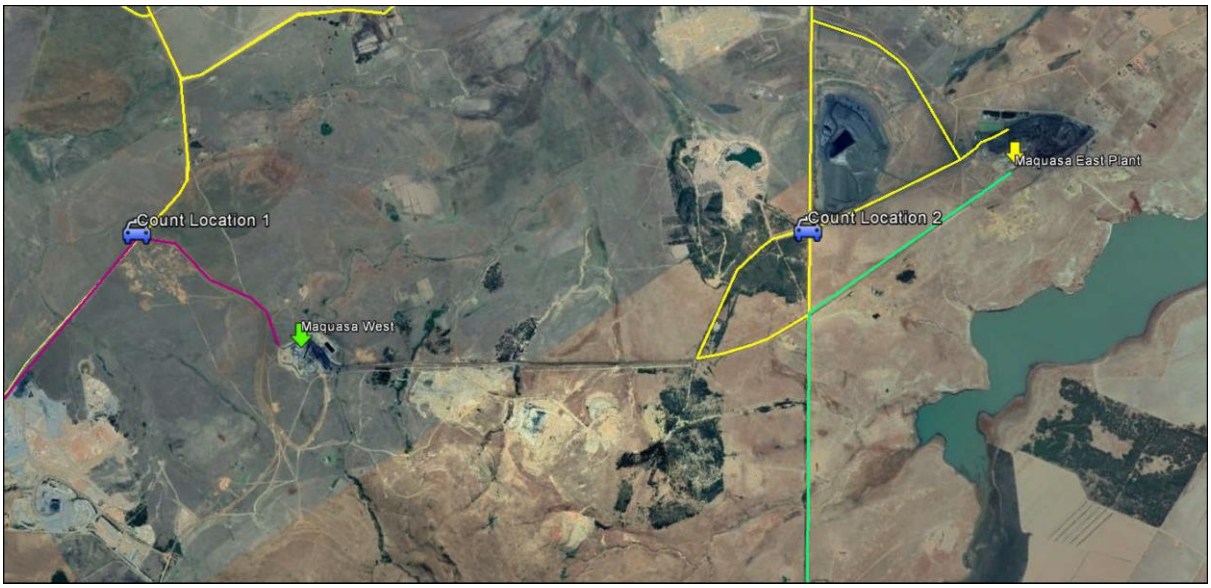

FIGURE 9-56: POSTIION OF TRAFFIC COUNT

The full results of the background traffic volumes passing through the two intersections is contained in the TIA. The results show that the background traffic volumes are considered low. Due to the relatively low traffic volumes, no operational problems are experienced by vehicles. The low volumes are also an indication that the roads are generally only used for mining activities and no external traffic traverses the area.

10. IMPACTS AND RISKS IDENTIFIED INCLUDING THE NATURE, SIGNIFICANCE, CONSEQUENCE, EXTENT, DURATION IN AND PROBABILITY OF THE IMPACTS, INCLUDING THE DEGREE TO WHICH THESE IMPACTS CAN BE REVERSED, AVOIDED, MANAGED, MITIGATED AND EXTENT TO WHICH THEY MAY CAUSE IRREPLACEABLE LOSS OF RESOURCES

10.1 Methodology used in determining the significance of environmental impacts

10.1.1 Impact Ranking Criteria

The impact assessment method used in this assessment takes into account the current environment, the details of the proposed amendment activities and the findings of the specialist studies. Cognisance has been given to both positive and negative impacts that may result from the developments. The significance of the impact is dependent on the consequence and the probability that the impact will occur.

impact significance = (consequence x probability)

Where:

consequence = (severity + extent)/2

and

severity = [intensity + duration]/2

Each criterion is given a score from 1 to 5 based on the definitions given below. Although the criteria used for the assessment of impacts attempts to quantify the significance, it is important to note that the assessment is generally a qualitative process and therefore the application of this criteria is open to interpretation. The process adopted will therefore include the application of scientific measurements and professional judgement to determine the significance of environmental impacts associated with the project. The assessment thus largely relies on experience of the environmental assessment practitioner (EAP) and the information provided by the specialists appointed to undertake studies for the EIA.

Where the consequence of an event is not known or cannot be determined, the "precautionary principle" has been applied and the worst-case scenario assumed. Where possible, mitigation measures to reduce the significance of negative impacts and enhance positive impacts will be recommended. The significance of the impact in light of the mitigation measures has also been rated based on a confidence rating of the mitigation measures.

Consideration will be given to the phase of the project during which the impact occurs. The phase of the development during which the impact will occur will be noted to assist with the scheduling and implementation of management measures.

TABLE 10.1: SEVERITY CRITERIA FOR ASSESSING THE IMPACT SIGNIFICANCE

INTENSITY = MAGNITUDE OF IMPACT	**RATING**
Insignificant: impact is of a very low magnitude	1
Low: impact is of low magnitude	2
Medium: impact is of medium magnitude	3
High: impact is of high magnitude	4
Very high: impact is of highest order possible	5
DURATION = HOW LONG THE IMPACT LASTS	**RATING**
Very short-term: impact lasts for a very short time	**1**
Short-term: impact lasts for a short time e.g. construction period	**2**
Medium-term: impact lasts for the for less than the life of operation.	**3**
Long-term: impact occurs over the operational life of the project	**4**
Residual: impact is permanent (remains after mine closure)	**5**
EXTENT = SPATIAL SCOPE OF IMPACT/FOOTPRINT AREA/NUMBER OF RECEPTORS	**RATING**
Limited: Impact only affects the mine site or part there of	**1**
Neighbours: Limited to the immediate surroundings;	**2**
Local: Affecting a larger area (beyond immediate surroundings or neighbours)	**3**
District: Affects entire district	**4**
Regional: Affects an entire region e.g. Province	**5**
PROBABILITY = LIKELIHOOD THAT THE IMPACT WILL OCCUR	**RATING**
Highly unlikely: the impact is highly unlikely to occur	**0.2**
Unlikely: the impact is unlikely to occur	**0.4**
Possible: the impact could possibly occur	**0.6**
Probable: the impact will probably occur	**0.8**
Definite: the impact will occur	**1**

IMPACT SIGNIFICANCE

NEGATIVE IMPACTS

≤1	Very low	Impact is negligible. No mitigation required.
>1≤2	Low	Impact is of a low order. Mitigation could be considered to reduce impacts. But does not affect environmental acceptability.
>2≤3	Moderate	Impact is real but not substantial in relation to other impacts. Mitigation should be implemented to reduce impacts.
>3≤4	High	Impact is substantial. Mitigation is required to lower impacts to acceptable levels.
>4≤5	Very High	Impact is of the highest order possible. Mitigation is required to lower impacts to acceptable levels. Potential Fatal Flaw.

POSITIVE IMPACTS

≤1	Very low	Impact is negligible.
>1≤2	Low	Impact is of a low order.
>2≤3	Moderate	Impact is real but not substantial in relation to other impacts.
>3≤4	High	Impact is substantial.
>4≤5	Very High	Impact is of the highest order possible.

DEVELOPMENT PHASE

C	Impact is applicable to the CONSTRUCTION PHASE ONLY
O	Impact is applicable to the OPERATIONAL PHASE ONLY
C&O	Impact is applicable to the CONSTRUCTION AND OPERATIONAL PHASE
PC	Impact is applicable to the POST-CLOSURE PHASE

The impacts before mitigation is then subject to the mitigation options and the EAP's confidence in the mitigation measures to address the impact. The mitigation confidence is rated a low confidence (1), moderate confidence (0,6), high confidence (0.2).

10.2 Impact Mitigation Hierarchy

The Impact Mitigation Hierarchy is a tool which is used reiteratively throughout a project lifecycle to limit negative impacts on the environment. The first tier considers how to avoid impacts entirely and is considered early in the project to allow for alternatives to be considered. The impacts which cannot be avoided should be minimised. Effective minimisation can eliminate some impacts and reduce others allowing for sustainability targets to be met. The next consideration is restoration/rehabilitation and takes place where minimisation efforts have failed to reach the required targets. Finally, and as a last resort to compensate for ecological loss or residual impacts, the environmental loss or damage can be offset through compensation. The intention of this level is to ensure the protection of equivalent or greater ecological assets than those lost or to rehabilitate a degraded environment restoring equivalent ecological assets (DEA, 2014).

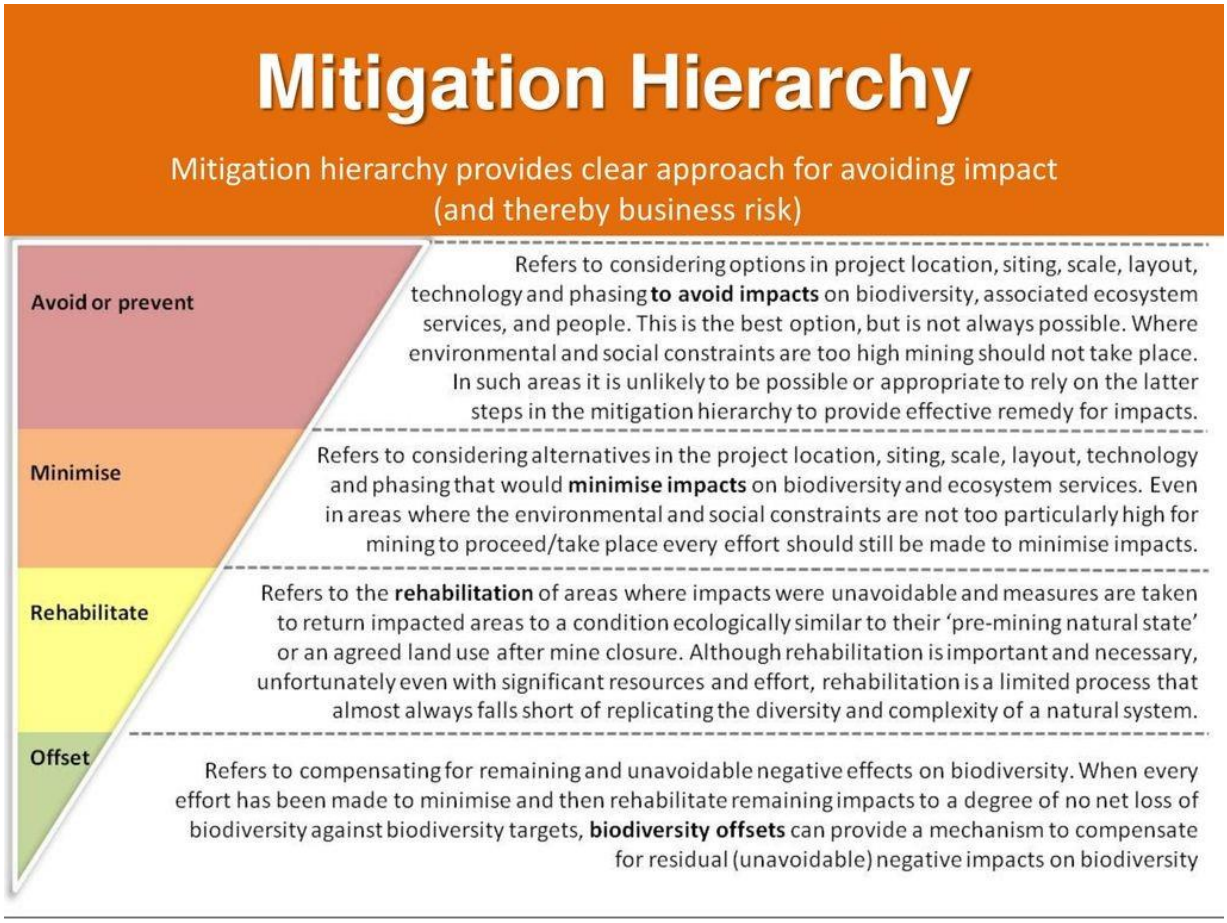

FIGURE 10-1: IMPACT MITIGATION HIERARCHY

10.3 The positive and negative impacts that the proposed activity (in terms of the initial site layout) will have on the environment and the community that may be affected

10.3.1 Groundwater Impacts

The impact prediction is based on the findings of the Geohydrological Assessment undertaken by Gradient Groundwater Consulting (September 2019).

The impacts associated with mining operations on the underground water is detailed below and was assessed using computerised flow modelling to simulate and predict impacts.

The groundwater model is based on three-dimensional groundwater flow.

10.3.1.1 Model simulation scenarios

Various management scenarios were modelled for the purposes of planning and decision making:

i. Scenario 01: Steady state, pre-mining water balance (∞).

ii. Scenario 02a: Balgarthen pit dewatering - LOM operational phase

iii. Scenario 02b: Twyfelhoek pit dewatering - LOM operational phase.

iv. Scenario 02c: Donkerhoek pit dewatering - LOM operational phase.

v. Scenario 02d: Underground dewatering (High Volatiles) - LOM operational phase.

vi. Scenario 03: Post-closure pit dewatering, hydraulic head rebound and decant simulations.

vii. Scenario 04a: LOM sulphate pollution plume.

viii. Scenario 04b: Post-closure sulphate pollution plume migration.

ix. Scenario 05a: Mitigation scenario -Cut-off trench.

x. Scenario 05b: Mitigation scenario - Seepage capturing/ scavenger boreholes.

10.3.1.2 Scenario 01: Steady state pre-mining water balance

TABLE 10.2: CATCHMENT WATER BALANCE – SCENARIO 01 STEADY STATE PRE-MINING

summarises the groundwater catchment water balance representing pre-mining steady state conditions. Recharge is assumed the only source of inflow to the system while the largest loss to the groundwater system is via baseflow. An assumption has been made for the total volume of groundwater abstraction from privately owned and community supply borehole accounts to 8.60E+02 m^3/d.

TABLE 10.2: CATCHMENT WATER BALANCE – SCENARIO 01 STEADY STATE PRE-MINING

Scenario 01: Steady state			
Parameter	**Inflow (m^3/d)**	**Outflow (m^3/d)**	**Balance (m^3/d)**
Recharge (m^3/d)	4.56E+04	0.00E+00	4.56E+04
Abstraction (m^3/d)	0.00E+00	8.60E+02	-8.60E+02
Baseflow (m^3/d)	0.00E+00	4.40E+04	-4.40E+04
Imbalance ignoring internal transfer (m^3/d)	0.00E+00	7.14E+02	-7.14E+02
Total (m^3/d)	**4.56E+04**	**4.56E+04**	**0.00E+00**

10.3.1.3 Scenario 2a: Balgarthen pit dewatering - LOM operational phase

Groundwater flow model simulations suggest relatively low groundwater ingress volumes for Balgarthen pit with an average rate of 10.6 m^3/d expected for the LOM operational period. A maximum dewatering rate of ~ 180 m^3/d during the operational period is anticipated. Due to the low dewatering volumes simulated, no significant depression zone and/or water level drawdown is anticipated. Losses in baseflow discharges is also deemed insignificant.

10.3.1.4 Scenario 2b: Twyfelhoek pit dewatering - LOM operational phase

Model simulations indicate an average groundwater ingress volume of 408.0 m^3/d, with a maximum dewatering volume of > 900.0 m^3/d expected during the operational period.

Figure 10-2 suggests a zone of depression footprint of approximately 0.78 km^2 reaching a maximum distance of ~300 m towards the north-eastern perimeter while the groundwater drawdown ranging from ~ 9.0 mbsl (meters below static level) to ~ 29.0 mbsl.

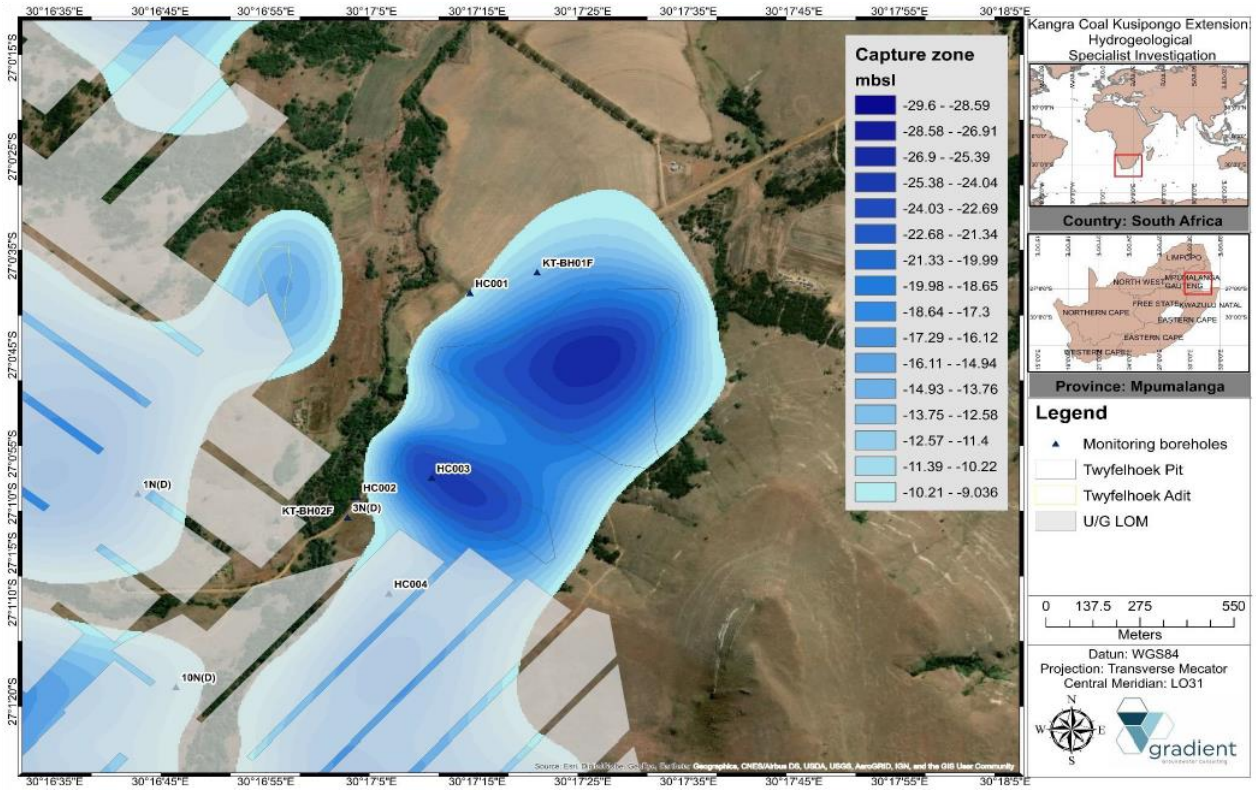

FIGURE 10-2: SCENARIO 2B – TWYFELHOEK PIT DRAWDOWN AND GROUNDWATER CAPTURE ZONE

10.3.1.5 Scenario 2c: Donkerhoek pit dewatering - LOM operational phase

Model simulations indicate an average groundwater ingress volume of 487.0 m^3/d, with a maximum dewatering volume of ~ 1400.0 m^3/d expected during the first operational period (Jan20 - Jun20) and ~ 600 m^3/d for the last phase of the operational period (Jan35 - Jan36).

Figure 10-3 indicates a zone of depression footprint of approximately 0.58 km^2 (western pit), 0.18 km^2 (central pit) and 0.18 km^2 (eastern pit) stretching to a maximum distance of ~230 m towards the south-western perimeter and the groundwater drawdown ranging from ~ 3.0 mbsl to ~ 24.0 mbsl.

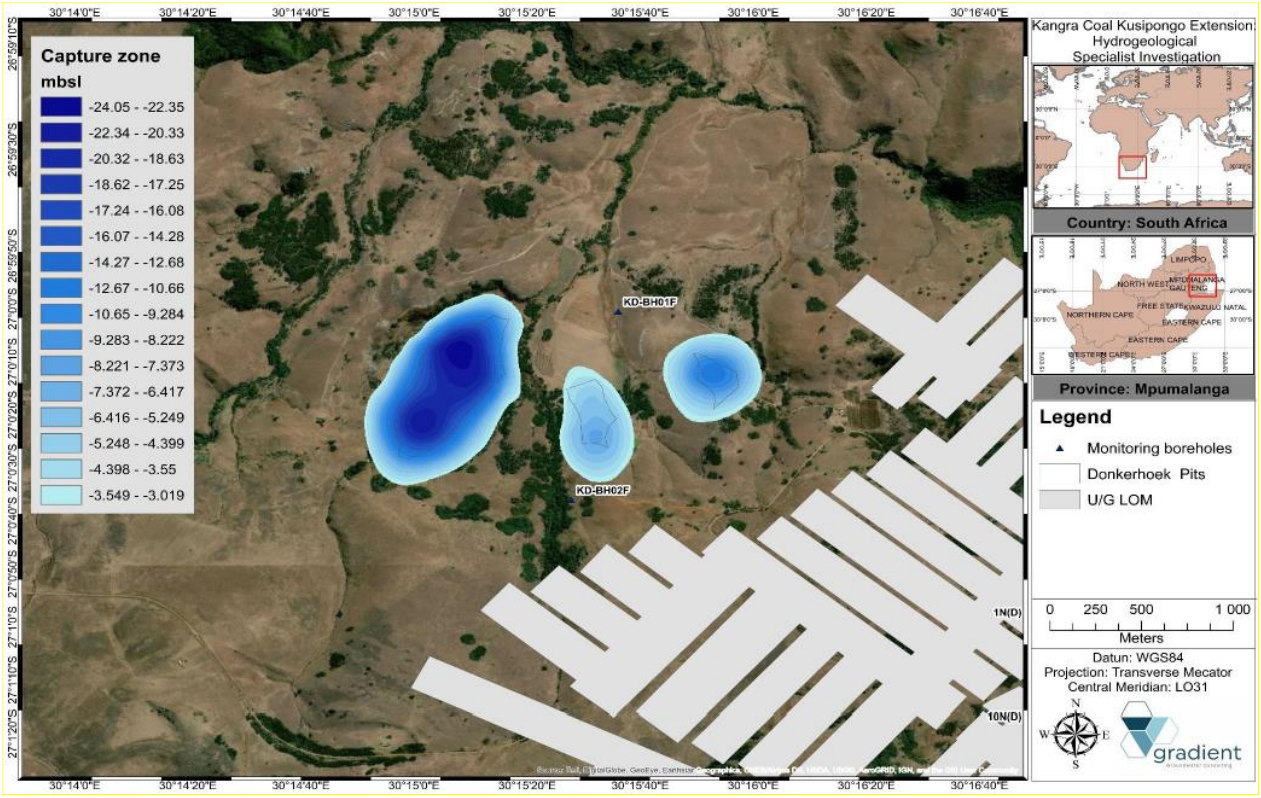

FIGURE 10-3: SCENARIO 2C – DONKERHOEK PIT DRAWDOWN AND GROUNDWATER CAPTURE ZONE

10.3.1.6 Scenario 02d: Underground dewatering - LOM operational phase

Model simulations indicate an average groundwater ingress volume of 968 m^3/d (Balgarthen), with a maximum dewatering volume of ~ 1035 m^3/d expected during the operational period, 823 m^3/d (Balgarthen A) with a maximum dewatering volume of ~ 1400 m^3/d during the operational period and, Twyfelhoek, 2082 m^3/d with a maximum volume of 3800 m^3/d during the initial stages of the operational phase.

Figure 10-4 indicates the expected groundwater zone of depression footprint of approximately 4.30 km^2 (Twyfelhoek UG), 4.50 km^2 (Balgarthen UG) and 3.04 km^2 (Balgarthen A UG) with the groundwater drawdown ranging from ~ 7.0 mbsl to ~ 27.0 mbsl.

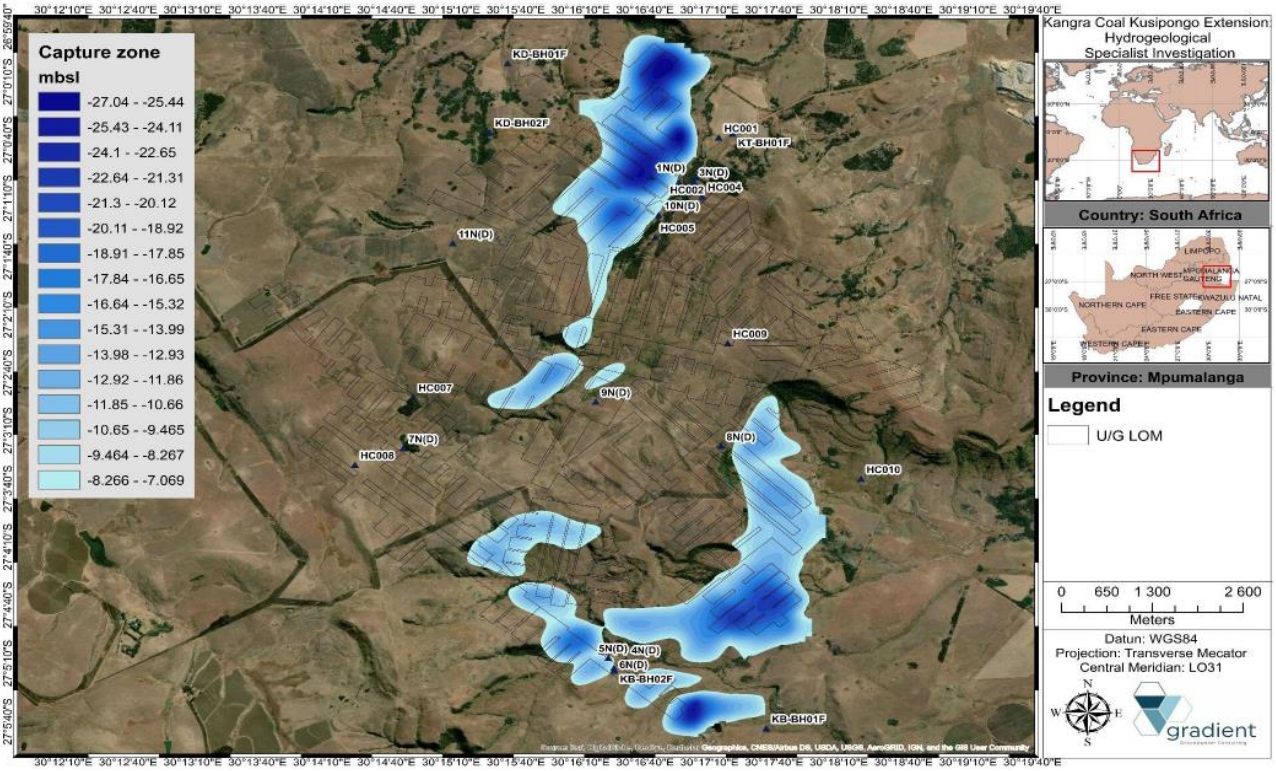

FIGURE 10-4: SCENARIO 2D – UNDERGROUND DRAWDOWN AND GROUNDWATER CAPTURE ZONE

10.3.1.7 Scenario 03: Post-closure pit dewatering, hydraulic head rebound and decant.

The following sub-sections provide a summary of expected hydraulic head recovery and decant volumes per facility. Decant water is potentially contaminated water from underground which reaches the surface following closure of a mine.

Balgarthen pit

Pit dewatering at Balgarthen will be limited and the majority of mining will take place above the saturated zone. Accordingly, no hydraulic head recovery simulations were performed for this facility.

Decant scenarios were calculated for a worst-case alternative and, as such, it should be assumed that water ingress reporting to the pit will be mostly rainfall recharge and interflow. Pit infiltration scenarios have an expected decant ranging from 10.88 m^3/d to 72.55 m^3/d.

Twyfelhoek pit

The mine post-closure scenarios indicate that the local hydraulic head distribution will return to pre-mining conditions within a period of approximately 4.0 to 5.0 years after termination of pit dewatering Decant volumes will range from <13.0 m^3/d to ~86.0 m^3/d depending on recharge volumes and will decant at zones as indicated in **Figure 10-5.**

Donkerhoek pit

The mine post-closure scenarios indicate that the local hydraulic head distribution will return to pre-mining conditions within a period of approximately 4.0 to 7.0 years after termination of pit dewatering. Decant volumes will range from approximately 15.0 m^3/d to > 100.0 m^3/d depending on recharge volumes.

Decant Points

The decant is forecasted to originate at the pits and adit entrances. Decant zones are indicated in **Figure 10-5**.

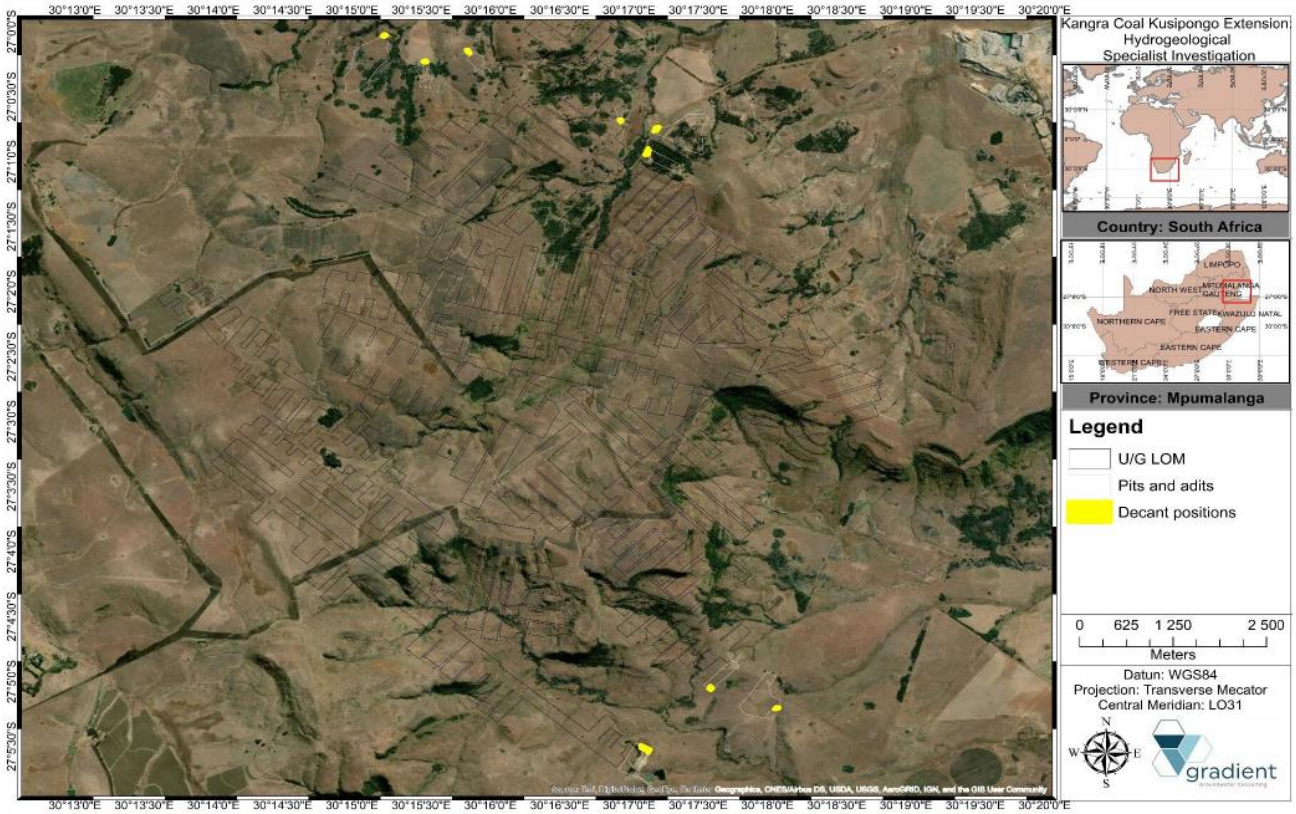

FIGURE 10-5: EXPECTED DECANT ZONES

10.3.1.8 Scenario 4a and 4b: LOM and Post-Closure sulphate pollution plume

Sulphate (SO_4) is a good indicator for coal mine pollution and is generated as a product from AMD. This anion is very stable i.e. relatively little decay and/or retardation and was used as source term and contaminant proxy. The geochemical characterisation did not reveal the presence of elevated sulphide minerals, hence sulphate concentrations remained relatively low. Accordingly, a source term was assigned a mass concentration of 2500 mg/ℓ[1] which is based on similar mining operations as well as published literature.

[1] Mass concentration boundary conditions were assigned in conjunction with the mining schedule and concurrent backfilling program.

Balgarthen Pit

Figure 10-6 depicts the expected sulphate pollution plume migration from Balgarthen, emanating from the run of mine (ROM) stockpile as well as back-filled pit. The simulated pollution plume is migrating in a downstream direction and reaches a maximum distance of 500 m in a north to north-eastern direction.

Figure 10-7 indicates the expected sulphate pollution plume migration post-closure. Model simulations suggest the plume continues migrating in a down-gradient direction stretching to a distance of 900 m in a north to north-eastern direction.

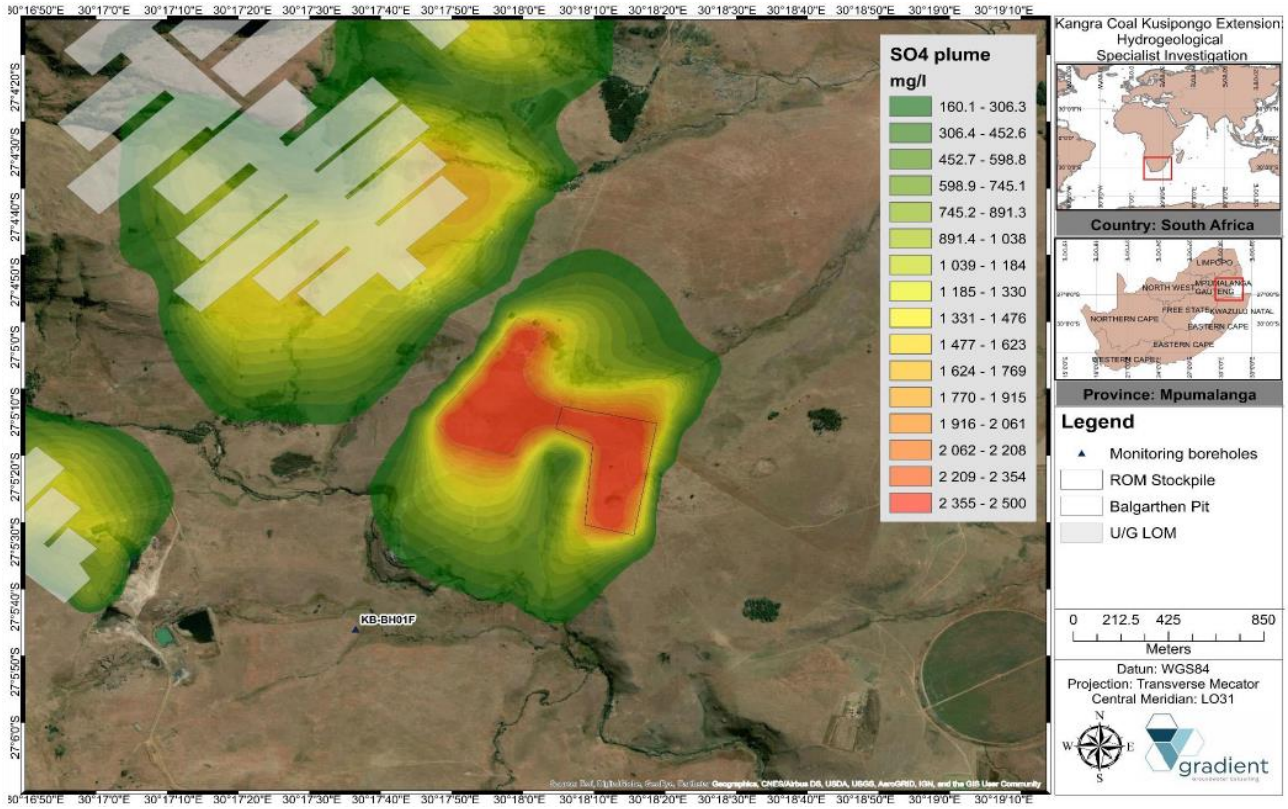

FIGURE 10-6: SCENARIO 4A – LOM POLLUTION PLUME BALGARTHEN PIT

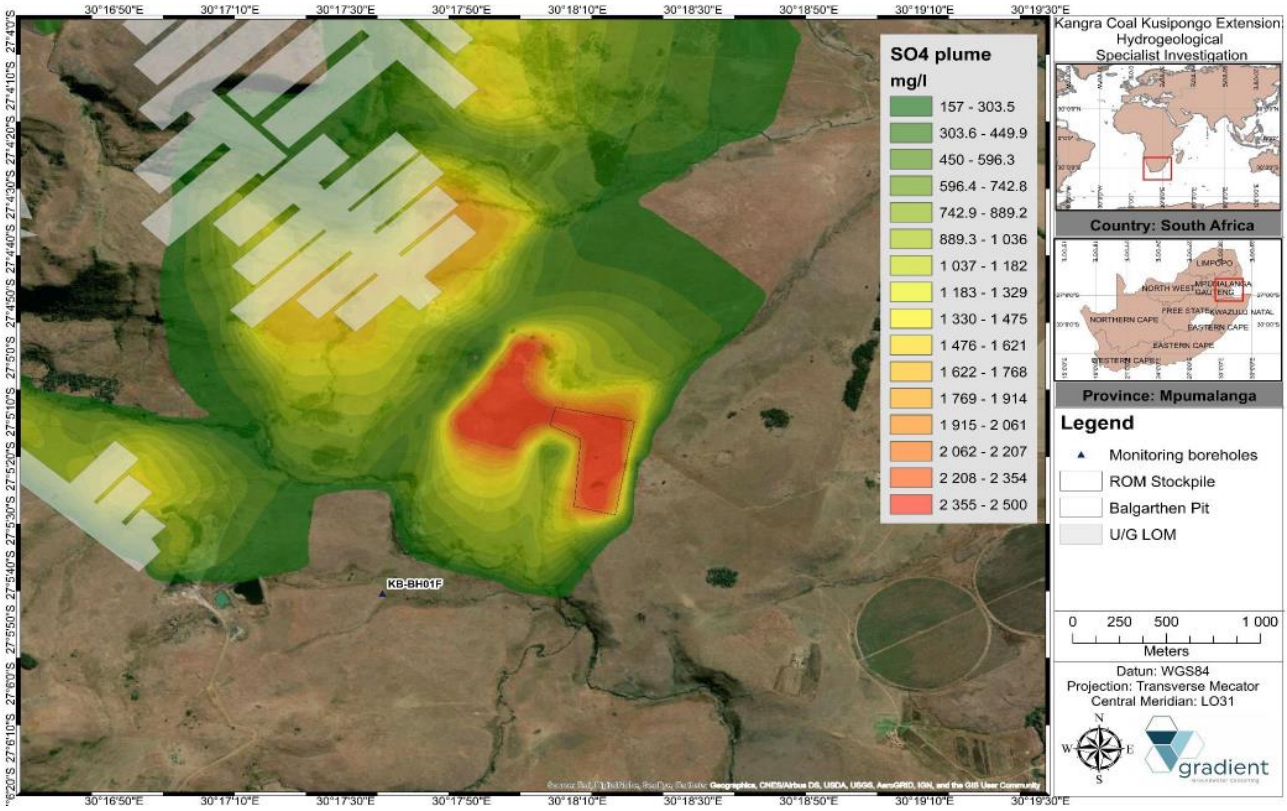

FIGURE 10-7: SCENARIO 4B – POST CLOSURE SULPHATE POLLUTION PLUME BALGARTHEN PIT

Twyfelhoek Pit

Figure 10-8 depicts the expected sulphate pollution plume migration from Twyfelhoek, emanating from the run of mine (ROM) stockpile as well as back-filled pit. The simulated pollution plume is migrating in a downstream direction and reaches a maximum distance of 550 m in a north to north-eastern direction.

Figure 10-9 indicates the expected sulphate pollution plume migration post-closure. Model simulations suggest the plume migrates in a down-gradient direction to a distance of 1200 m in a general north to north-eastern direction.

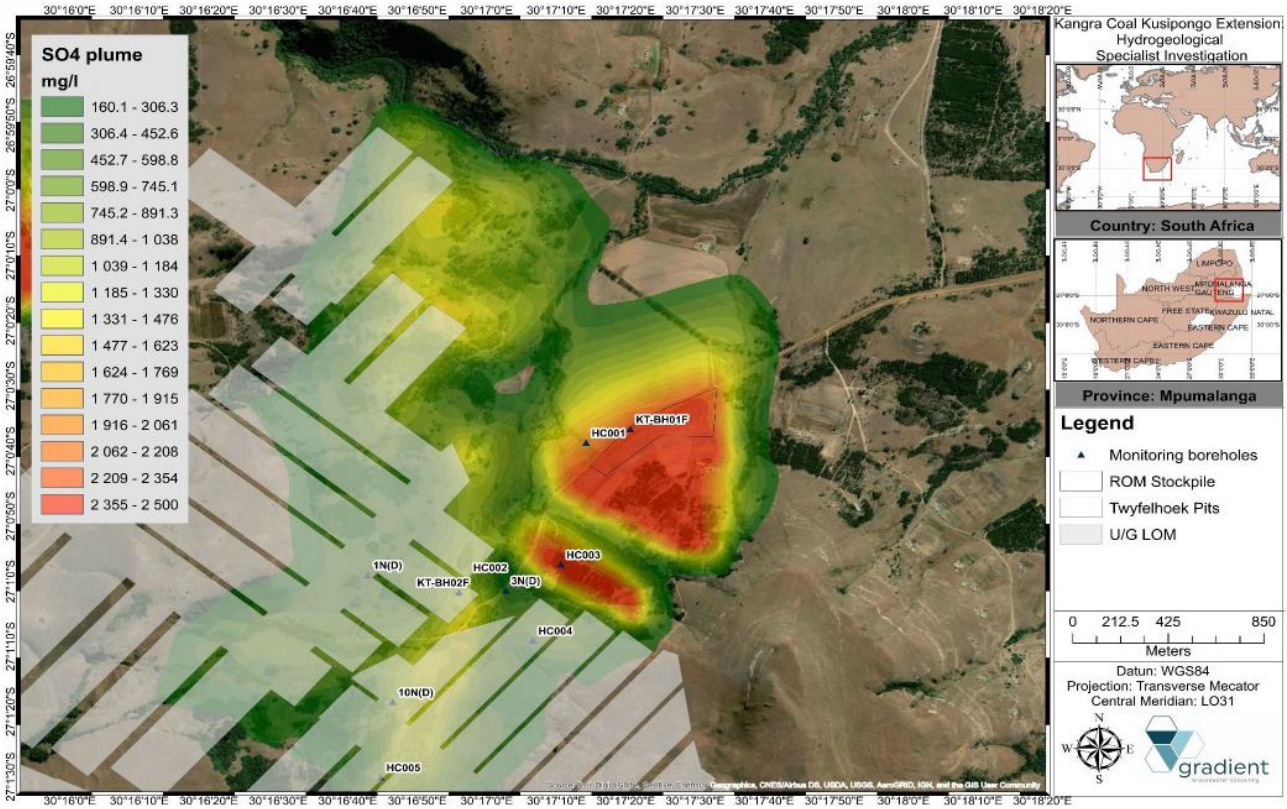

FIGURE 10-8: SCENARIO 4A - LOM SULPHATE POLLUTION PLUME TWYFELHOEK PIT

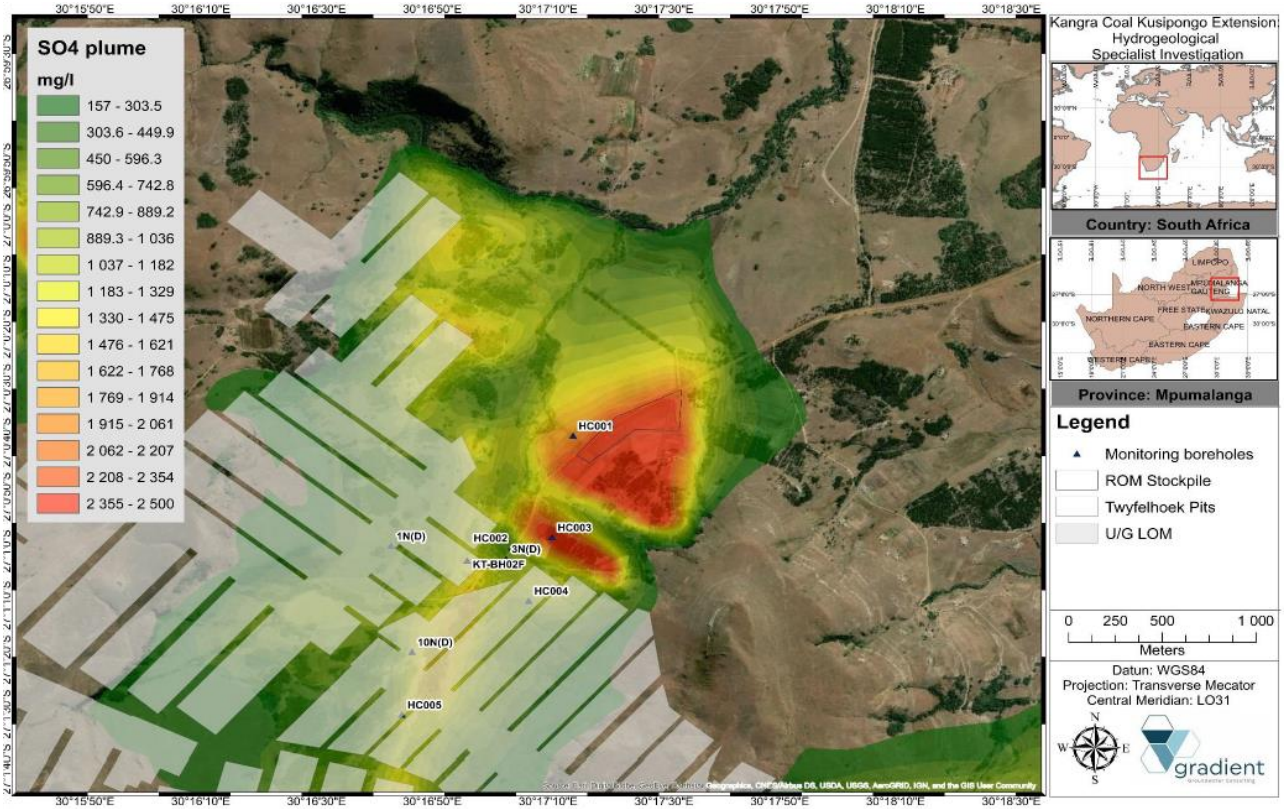

FIGURE 10-9: SCENARIO 4B – POST CLOSURE SULPHATE POLLUTION PLUME TWYFELHOEK PIT

Donkerhoek Pit

Figure 10-10 depicts the expected sulphate pollution plume migration from Donkerhoek, emanating from the run of mine (ROM) stockpile as well as back-filled pit. The simulated pollution plume migrates in a downstream direction and reaches a maximum distance of 800 m in a north to north-eastern direction.

Figure 10-11 indicates the expected sulphate pollution plume migration post-closure. Model simulations suggest the plume migrates in a down-gradient direction to a distance of 900 m in a north to north-eastern direction.

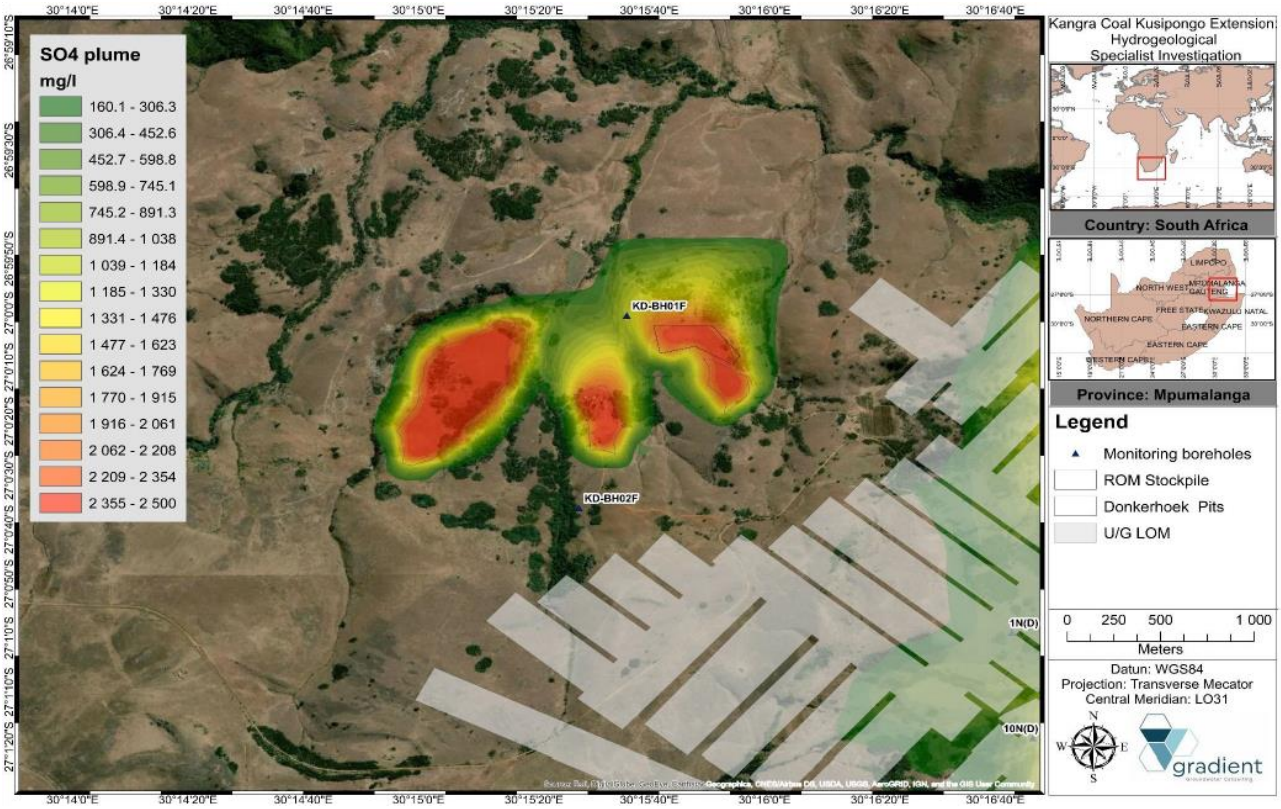

FIGURE 10-10: SCENARIO 4A – LOM SULPHATE POLLUTION PLUME DONKERHOEK PIT

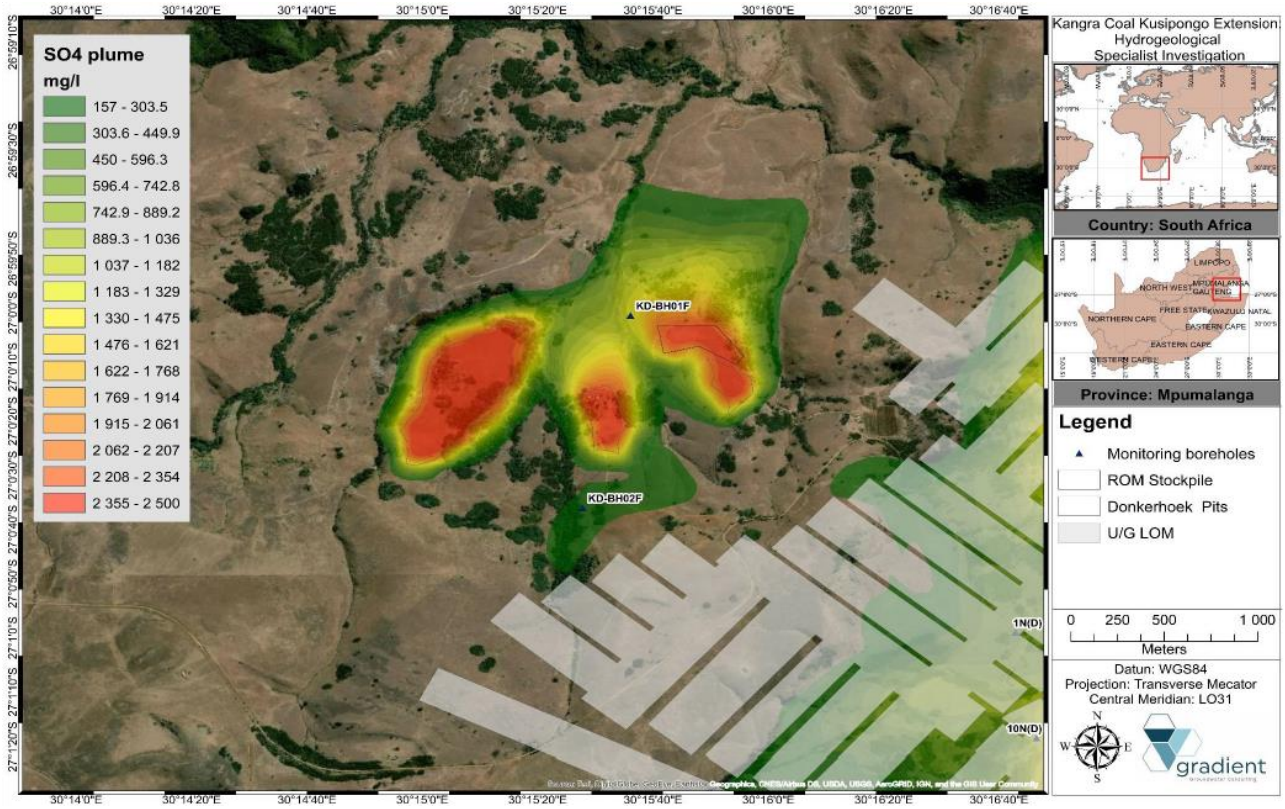

FIGURE 10-11: SCENARIO 4B – POST CLOSURE SULPHATE POLLUTION PLUME DONKERHOEK PIT

Underground Operations

Figure 10-12 and **Figure 10-13** depicts the simulated pollution plume for the weathered and fractured aquifers respectively while **Figure 10-14** indicates the expected post-closure sulphate pollution plume migration emanating from the underground operations. The simulated pollution plume migrates towards lower-lying, downstream direction, reaching a maximum distance of ~650 m towards the eastern and north-eastern perimeters. Post-closure the sulphate pollution plume migrates further and stretches to a distance of 1.50 km in an eastern and north-eastern direction.

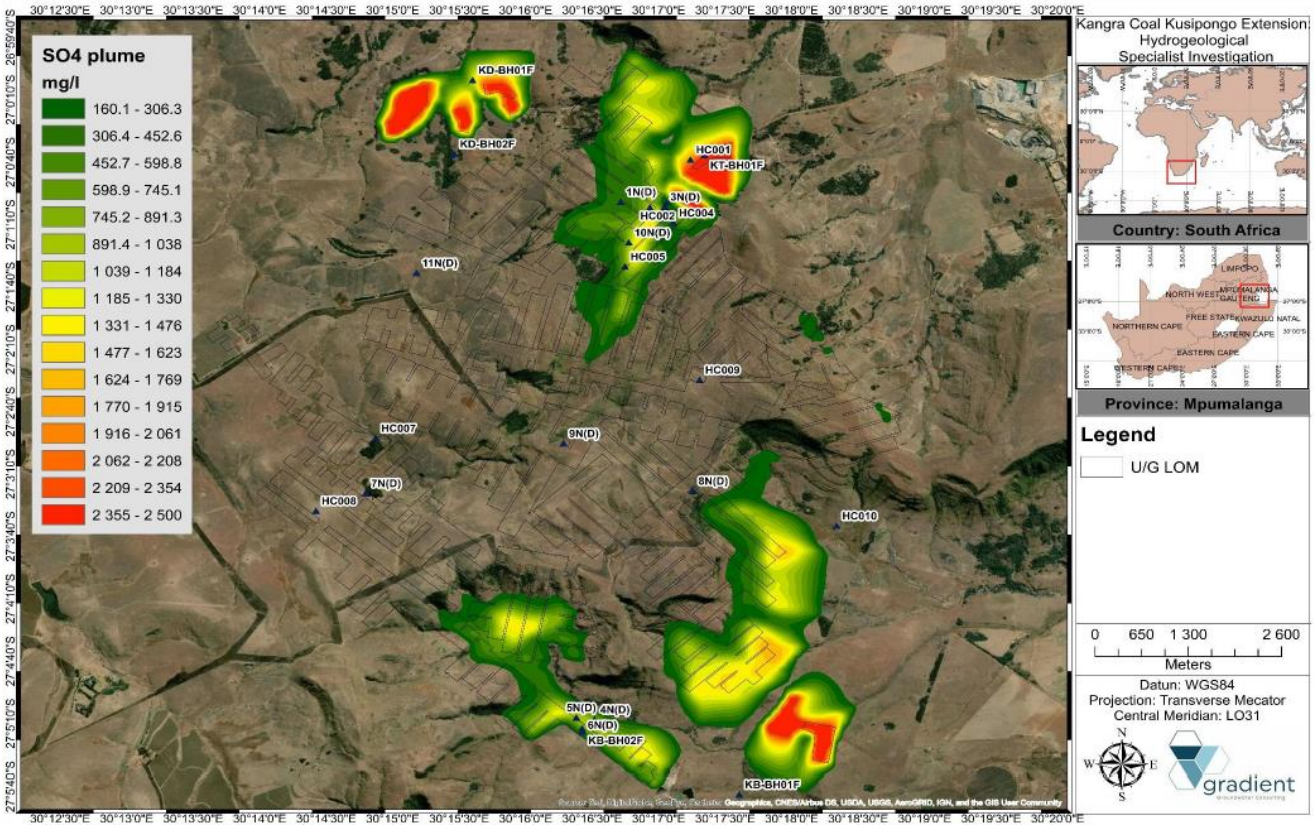

FIGURE 10-12: SCENARIO 4A – LOM SULPHATE POLLUTION PLUME UNDERGROUND OPERATIONS (WEATHERED AQUIFER)

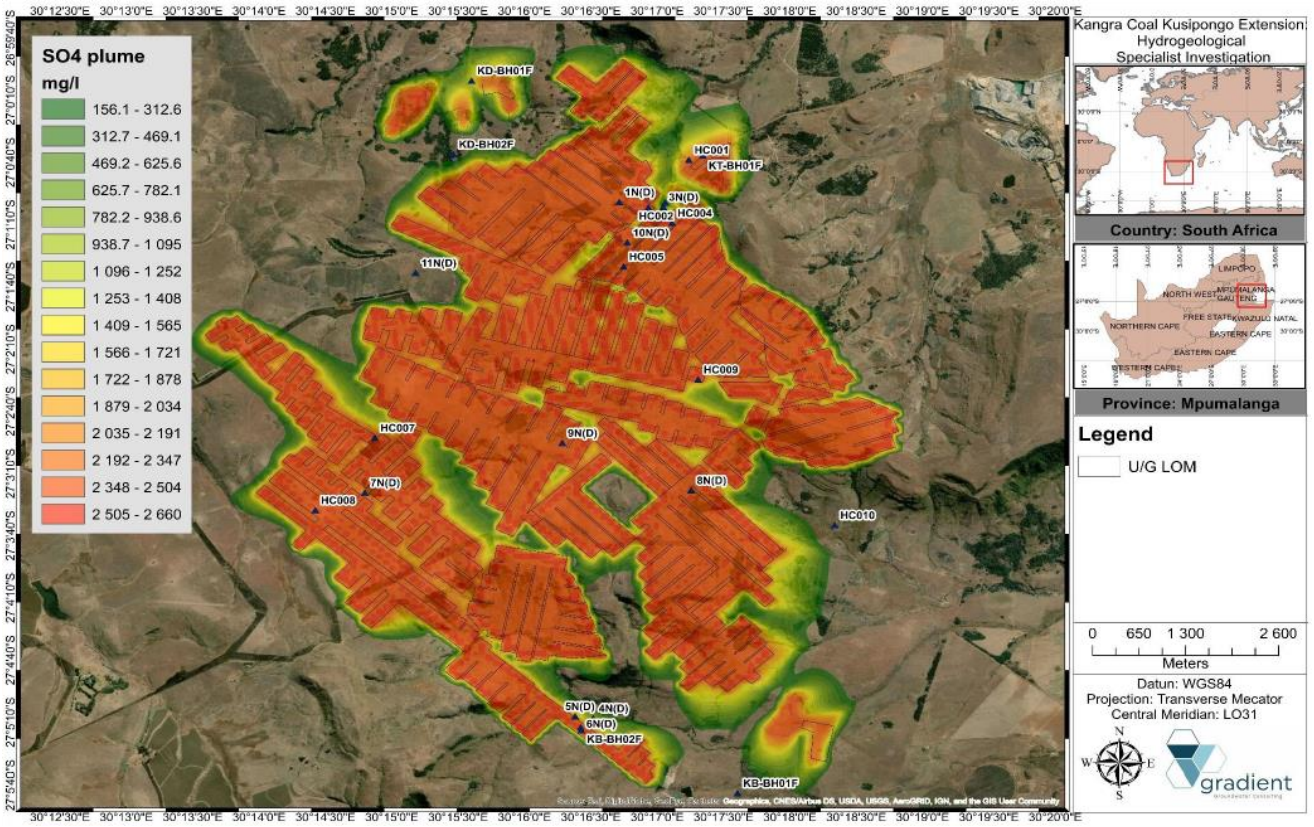

FIGURE 10-13: SCENARIO 4A – LOM SULPHATE POLLUTION PLUME UNDERGROUND OPERATIONS (FRACTURED AQUIFER)

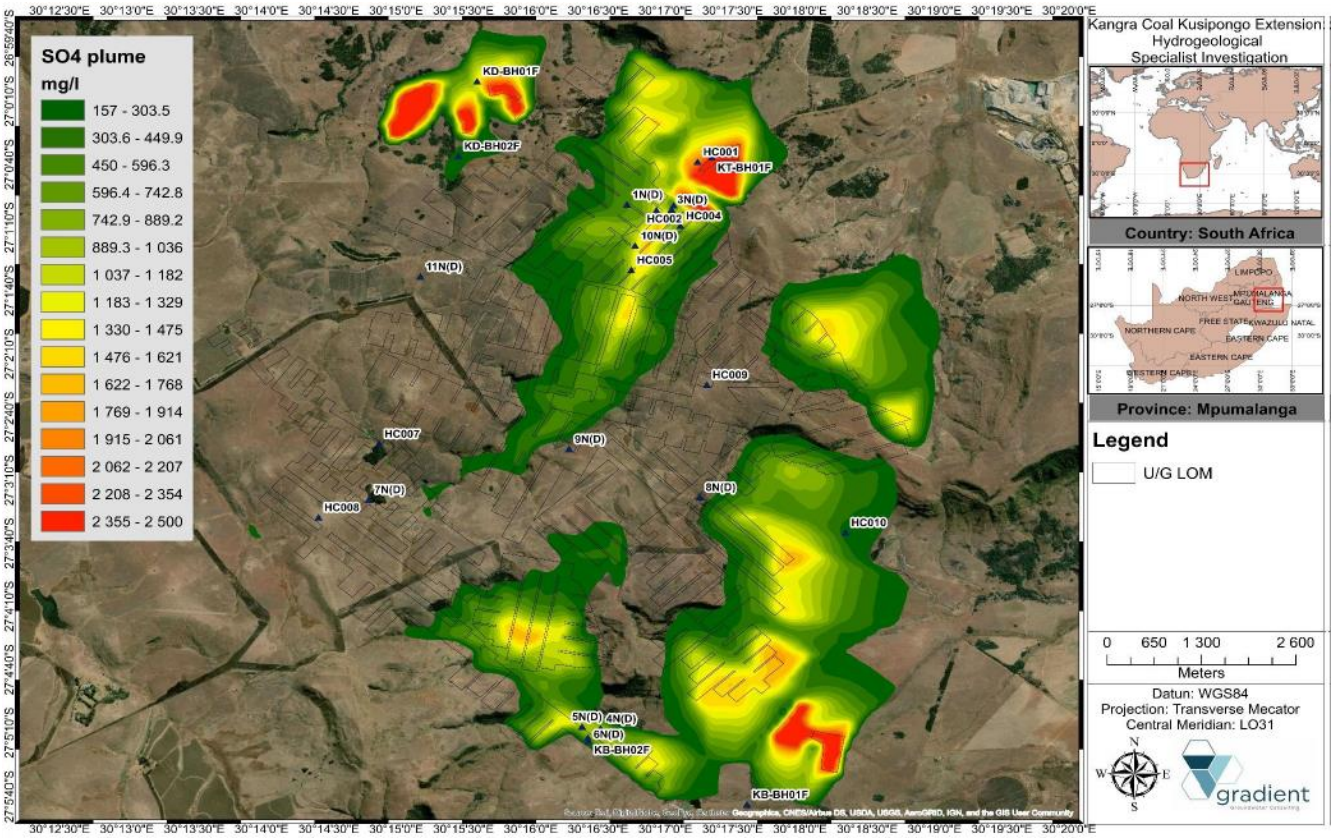

FIGURE 10-14: SCENARIO 4B – POST CLOSURE SULPHATE POLLUTION PLUME UNDERGROUND OPERATIONS (WEATHERED AQUIFER)

10.3.2 Contamination of Underlying Aquifers

The impact prediction is based on the findings of the Waste Assessment undertaken by Gradient Groundwater Consulting (September 2019).

The mineralogy of the samples was determined through X-Ray diffraction (XRD). The results from the XRD analyses are summarised below:

Balgarthen

- The major minerals in both samples taken at Balgarthen are quartz and kaolinite with quartz being the main mineral in KB01 (39.3%) and kaolinite the main mineral in KB02 (29.1%);
- Smectite which is typically associated with clays i.e. in shales was, as expected, detected in both samples, more so in the shale sample (KB02) at 8.3%;
- Organic carbon made up 17.6% of KB01 and 7.7% of KB02.

Donkerhoek

- The major minerals in both samples taken at Donkerhoek are quartz (41.2% and 61.5% respectively) followed by kaolinite (34.6% and 9.3% respectively);
- Calcite and siderite were detected in the sandstone sample (KD02) but not in the mudstone sample (KD01);
- Organic carbon made up 7.7% of KB01 and 12.4% of KB02.

Twyfelhoek

- As expected, the major mineral in the coal sample (KT01) is organic carbon (70.6%) with quartz (45.8%) being the dominant mineral in the interlaminated sandstone – siltstone sample (KT02);
- Kaolinite was also one of the dominant minerals in both KT01 (8.1%) and KT02 (29.2%);
- Smectite made up 5.4% of KT01 and 9.0% of KT02.

The element specific concentrations were obtained from the XRF analyses

- The Balgarthen samples have concentrations of cobalt (KB02), lead (KB01 & KB02), selenium (KB02) and zinc (KB02) which are elevated above the Alloway Crustal Abundance of the earth's crust;
- The Donkerhoek samples have concentrations of arsenic (KD01), mercury (KD02), molybdenum (KD02), lead (KD01) and selenium (KD01) which are elevated above the Alloway Crustal Abundance of the earth's crust;
- The Twyfelhoek samples have concentrations of mercury (KT01) and lead (KT02) which are elevated above the Alloway Crustal Abundance of the earth's crust.

These elements could potentially pose a risk to the environment should the coal / carbonaceous material contain significant concentrations of pyrite (FeS) and siderite ($FeCO_3$) which may result in the generation of acid mine drainage (AMD) and a lowering of the pH. Siderite has been shown to oxidise and the resultant precipitation of iron hydroxide consumes base ions thereby reducing the ability of siderite to off-set acid generation (Skousen *et al*). However, the samples do not contain considerable amounts of pyrite and siderite, therefore it is unlikely to generate AMD.

The results of the waste assessment are summarised below:

Balgarthen samples:

- In terms of the LC's, only arsenic and mercury exceed the respective Leach Concentration Threshold 0 (LCT0) values;
- In terms of the TC's, however, the concentrations of barium and lead exceed their respective Total Concentration Threshold 0 (TCT0) values;
- Based on the National Norms and Standards for the Assessment of Waste for Landfill Disposal, the Balgarthen samples are therefore assessed as a Type 3 waste (low hazardous waste).

Donkerhoek samples

- In terms of the LC's, only arsenic exceed the Leach Concentration Threshold 0 (LCT0) values;
- In terms of the TC's, however, the concentrations of arsenic, barium, copper and lead exceed their respective Total Concentration Threshold 0 (TCT0) values;
- Based on the National Norms and Standards for the Assessment of Waste for Landfill;
- Disposal, the Donkerhoek samples are therefore assessed as a Type 3 waste (low hazardous waste).

Twyfelhoek samples

- In terms of the LC's, none of the constituents exceed their Leach Concentration Threshold 0 (LCT0) values;
- In terms of the TC's, only barium exceed the Total Concentration Threshold 0 (TCT0) values;
- Based on the National Norms and Standards for the Assessment of Waste for Landfill Disposal, the Twyfelhoek samples are therefore assessed as a Type 3 waste (low hazardous waste).

The waste assessment conducted in terms of the Norms and Standards for the Assessment of waste indicated that all samples submitted was Type 3 waste (Low hazardous waste). It is noted that the coal has the potential to generate Acid Mine Drainage, and with the overburden material and ROM being classified as a Type 3 waste, these stockpiles will require a Class C liner.

In terms of Acid Mine Drainage (AMD) potential, the hanging wall sandstone and mudstone samples have a very low to no potential for acid generation. The coal samples suggest low to medium potential for acid generation capacity, however due to the low sulphide concentrations observed, there is insufficient oxidisable sulphides to sustain long term acid generation.

10.3.3 Air Quality

The potential impacts associated with air quality have been sourced from work undertaken as part of the Air Quality Impact Assessment (Rayten Engineering Solutions, September 2019)

The dispersion model output plots for dust-fall rates, PM_{10} and $PM_{2.5}$ concentrations due to mining activities at the proposed Kusipongo Operations, before mitigation measures are implemented, are given in **Figure 10-15** and **Figure 10-19**Figure 10-15 below.

Predicted incremental dust-fall rates comply with the residential area standard of 600 mg/m^2/day and non-residential area standard of 1200 mg/m^2/day over most of the project area. Exceedances of the standards are observed along the proposed main haul routes and around the mine operational areas (within ~500m from road and mine operational areas) (**Figure 10-15**).

Relatively high daily average concentrations are predicted for PM_{10}, with exceedances of the daily standard of 75 µg/m^3 recorded within 4km of the Balgarthan, Donkerhoek and Twyfelhoek mining areas and the proposed haul routes (**Figure 10-16**Figure 10-16**)**. High daily concentrations are also observed around the Maquasa East and West Plants. Predicted annual average PM_{10} concentrations comply with the annual standard of 40 µg/m^3 over most of the project area, with exceedances observed mostly along the haul roads and in close proximity to the Kusipongo operational areas (**Figure 10-17**).

Predicted incremental daily and annual average $PM_{2.5}$ concentrations are generally low and comply with the applicable standards over most of the project area, with exceedances limited to the Donkerhoek and Balgarthan operational areas. (**Figure 10-18** and **Figure 10-19**)

Low predicted concentrations of PM_{10}, $PM_{2.5}$ and dust-fall rates are observed at the majority of the discrete receptors surrounding mine, except for the receptors situated in near proximity to the Balgarthan, Donkerhoek and Twyfelhoek mining areas, the proposed haul routes and the Maquasa plants. Exceedances of the daily PM_{10} standard are observed at ten of the discrete receptors located east of the Kusipongo mining right area and within the northern sections of the mining right area. One exceedance of the dust-fall standard for residential areas is observed at discrete receptor 16, which is located near to the main haul road between Balgarthan and Maquasa East Plant.

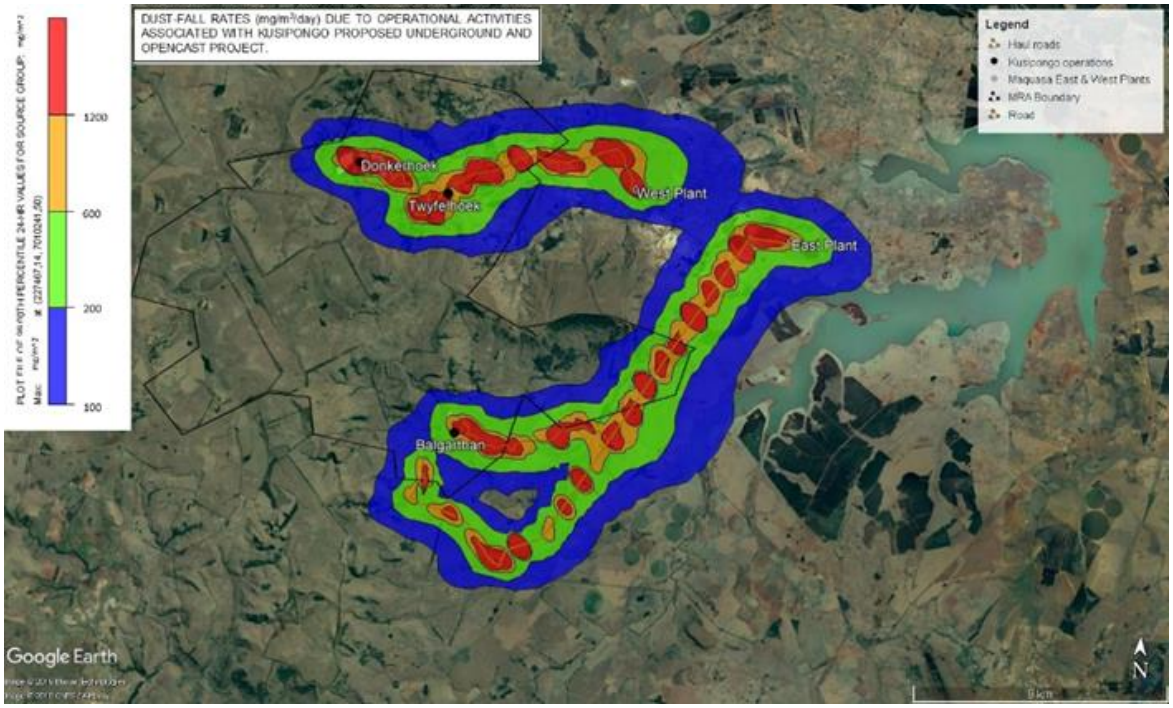

FIGURE 10-15: PREDICATED DUST FALL RATES ASSOCIATED WITH KUSIPONGO

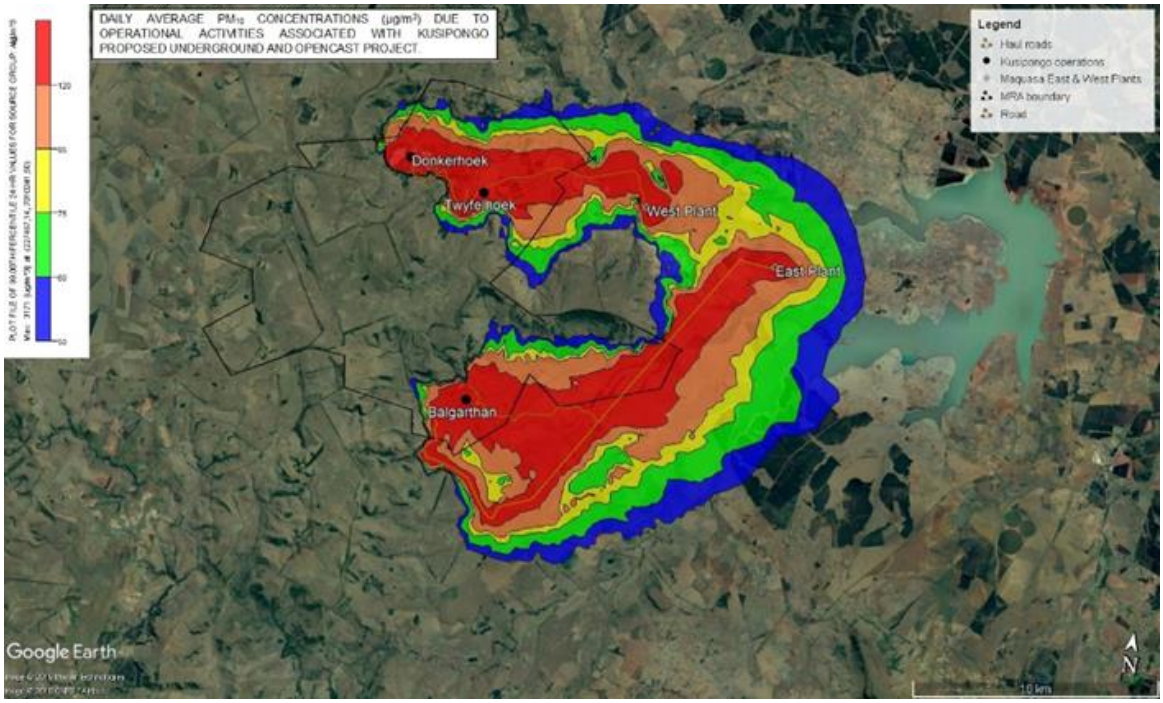

FIGURE 10-16: PREDICATED DAILY AVERAGE PM_{10} CONCENTRATIONS

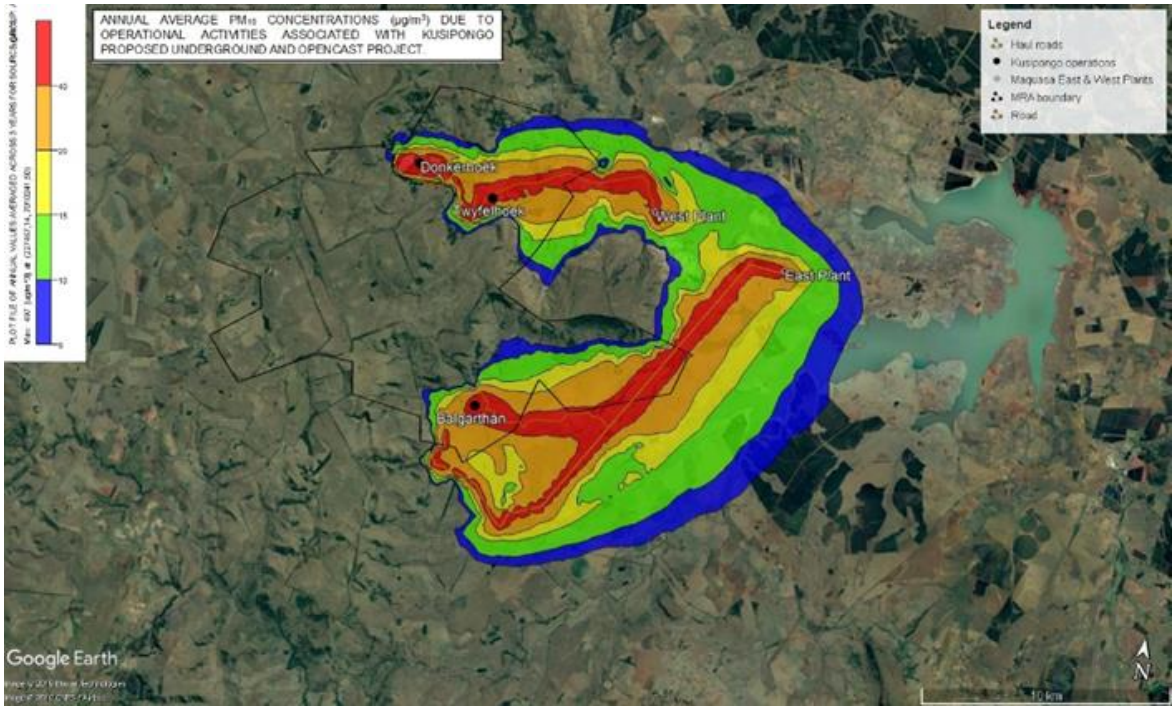

FIGURE 10-17: PREDICTED ANNUAL AVERAGE PM_{10} CONCENTRATIONS

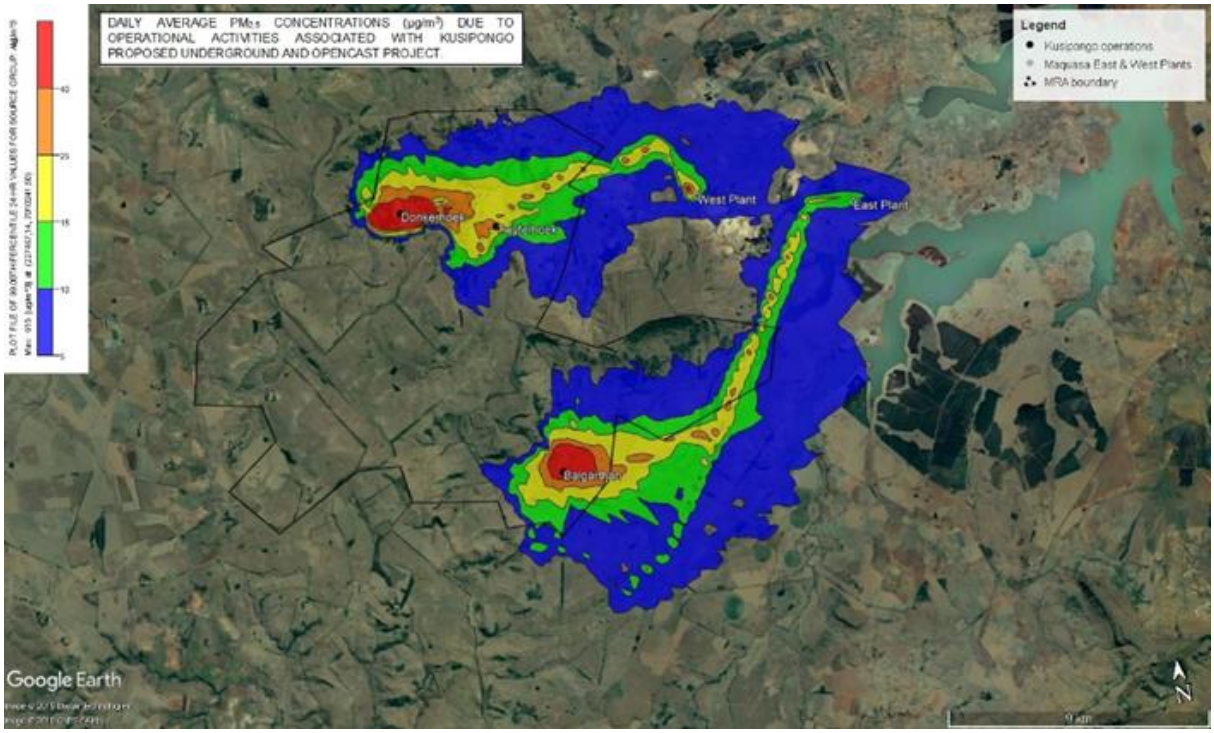

FIGURE 10-18: PREDICATED DAILY AVERAGE $PM_{2.5}$ CONCENTRATIONS

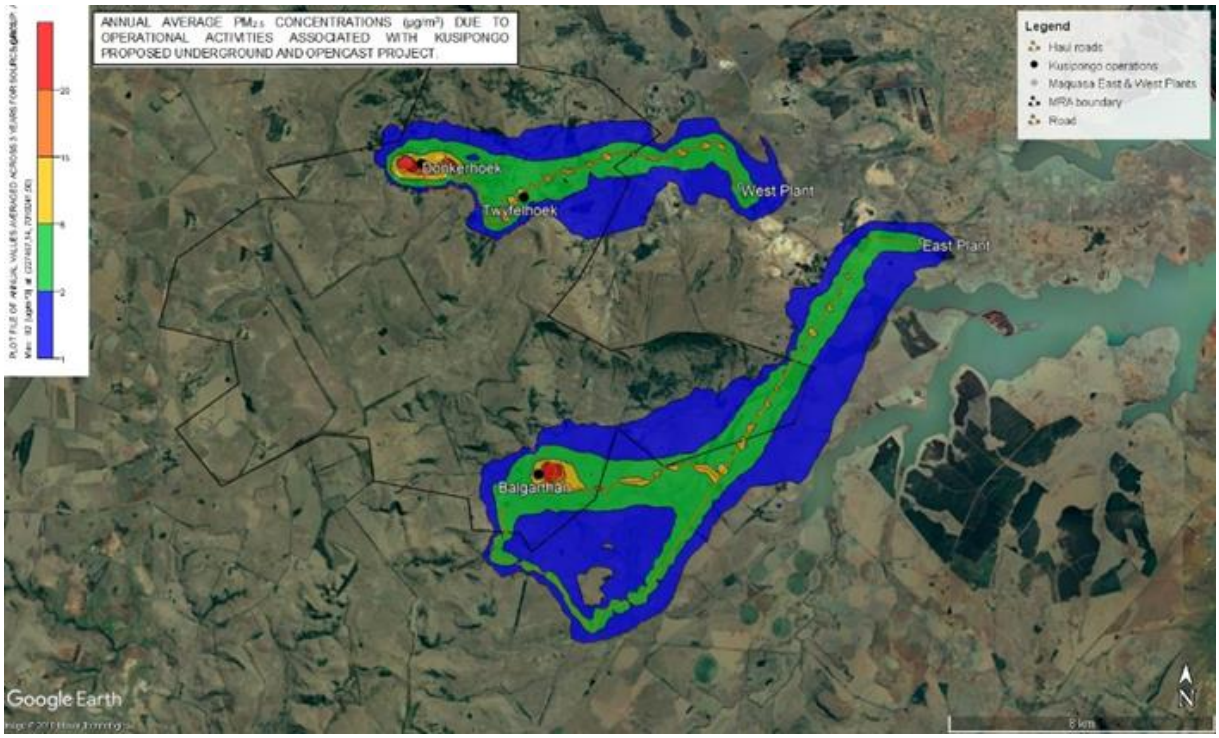

FIGURE 10-19: PREDICATED ANNUAL AVERAGE $PM_{2.5}$ CONCENTRATIONS

10.3.4 Noise Impacts

The potential noise related impacts were assessed part of the Noise Impact Assessment (Enviro Acoustic Research, September 2019)

On site ambient sound measurements indicated ambient sound levels typical of a rural noise district at this level of development. Considering the developmental nature of the area, the ideal rating level would be typical of a sub-urban noise district, set as:

- A daytime rating level of 45 dBA and
- A night-time rating level of 35 dBA

These noise rating levels however would limit any development (including residential, agriculture or commercial activities). Considering the requirements of the National Noise Control Regulations, noise generating activities should not change the ambient sound levels with more than 7dB.

The activities from the mine should not increase the total noise levels above the following noise levels:

- 52 dBA during the daytime; and
- Use of a noise limit of 42 dBA during the night-time.

Construction

Based on noise modelling, due to the worst-case cumulative scenario being investigated the following can be concluded:

- Mining construction activities may start to change the potential ambient sound (quiet environment) levels up to 3,300m from activities;
- Mining construction activities may change the potential ambient sound levels to higher than 40 dBA up to 2,200m from the mining activities;
- Mining construction activities may change the potential ambient sound levels higher than 45 dBA within 1,500m from the mining activities.

The significance of the daytime noise impact is medium. The significance of the night-time noise impact may be high although mitigation measures have been proposed which would reduce the significance to medium.

Operational

The following can be concluded:

- Mining construction activities may start to change the potential ambient sound (quiet environment) levels up to 5,000 m from activities;
- Mining construction activities may change the potential ambient sound levels to higher than 40 dBA up to 2,200m from the mining activities;
- Mining construction activities may change the potential ambient sound levels higher than 45 dBA within 1,500m from the mining activities;

The significance of the daytime noise impact was concluded to be low, while the significance of the night-time noise impact may be moderate before and after mitigation.

10.3.5 Soils, Land Capability and Land Use

The impacts on soils, land capability and land use were assessed by Scientific Terrestrial Services (September 2019.

The areas where the proposed mining operation and related infrastructure are to occur are mainly comprised of high potential agricultural soils. Thus, high impacts are foreseen on these soils from a land capability point of view before mitigation measures have been implement and moderate after mitigation has been carefully implemented during all phases of development. The dominant soils are deemed to have a significant contribution to agricultural productivity on both local, regional, provincial as well as national food production. The protection and conservation of the agricultural valuable soils where feasible is deemed imperative to ensure conservation of agricultural resources in line with CARA (1983).

The proposed mining operations and associated infrastructure is anticipated to result in a significant loss of portions of agricultural land capability since the focus area is dominated by arable soils. These soils are currently of significant importance in supporting rural communities surrounding the Twyfelhoek and Donkerhoek focus areas, on both subsistence farming and small-scale commercial farming.

The land capability loss is anticipated to be medium-high as the dominant soils are considered ideal for cultivation, attributable to their deep well-drained nature and low erosion hazard. The soils also indicate a wetness factor that supports winter growth of pasture.

10.3.6 Terrestrial Biodiversity

The potential impact on terrestrial biodiversity has been assessed by Scientific Terrestrial Services (September 2019).

10.3.6.1 Critical Biodiversity Areas

Based on the results of the floral assessment, it is the opinion of the specialist that the proposed mining activities within the various focus area within the Kusipongo Mining Rights areas (MRA) has the potential to significantly impact on biodiversity locally, with the potential for regional-scale impacts.

There are areas of Donkerhoek and a small section of the Twyfelhoek focus area that fall within Irreplaceable Critical Biodiversity Areas (CBAs) and most of the Balgarthen focus area falls within Ecological Support Areas (ESAs) (**Figure 10-20** and **Figure 10-21** and **Figure 10-22**). Thus, where the proposed Alternative B mine layout falls within Irreplaceable CBAs. Opencast mining is considered to be a land-use that will compromise the biodiversity objective and is deemed a conflicting land use to the management objective for the area (MTPA, 2014).

Of the three pit sections for Donkerhoek one (western pit) is within the irreplaceable CBA. The other two pit sections are within landscape corridors. Irreplaceable CBAs cannot be offset and therefore mining of the western pit is not recommended. If the mining of the central and eastern pit sections are approved within the focus areas, compensation for residual loss of primary grasslands will have to take place by conserving other important biodiversity aspects in acknowledgment of the loss of CBA habitat.

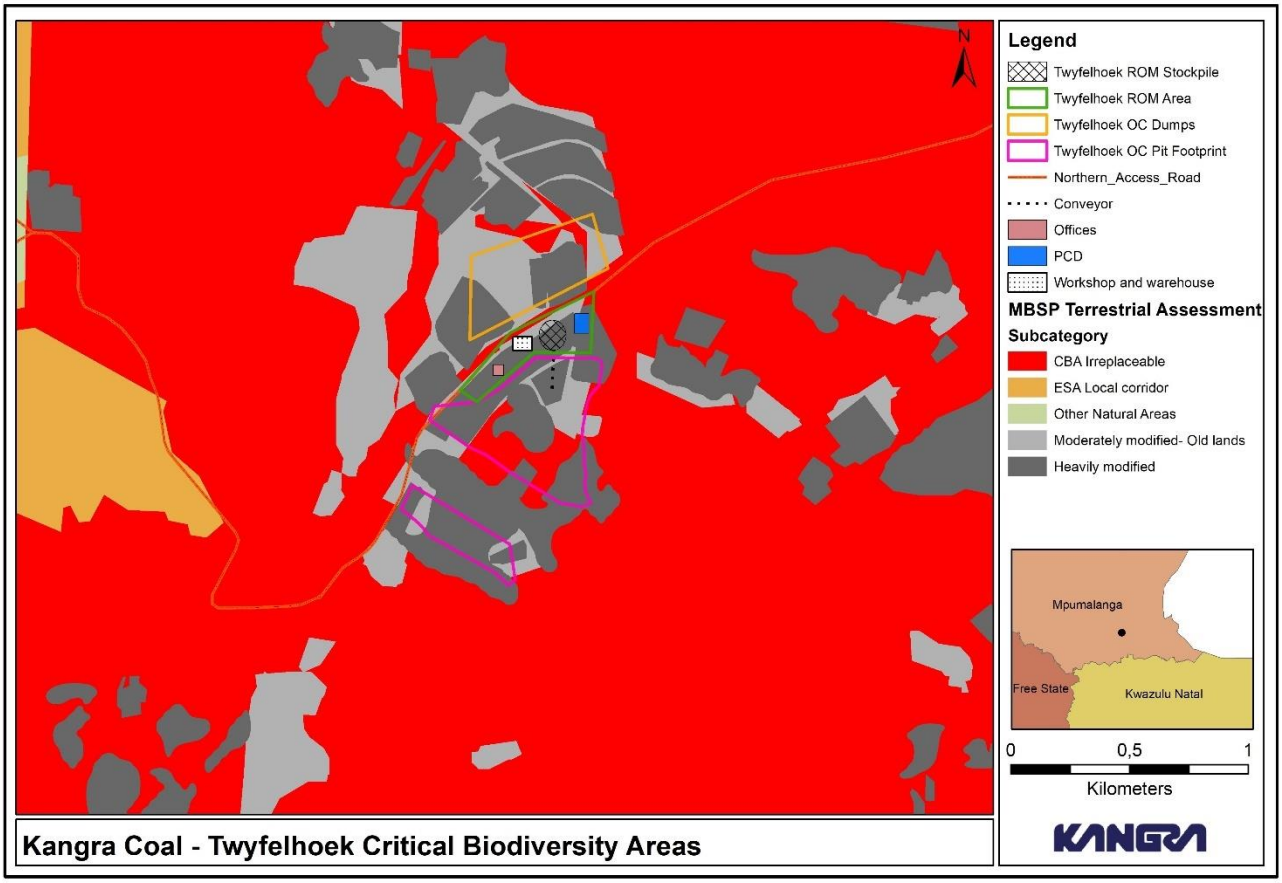

FIGURE 10-20: TWYFELHOEK CRITICAL BIODIVERSITY AREAS

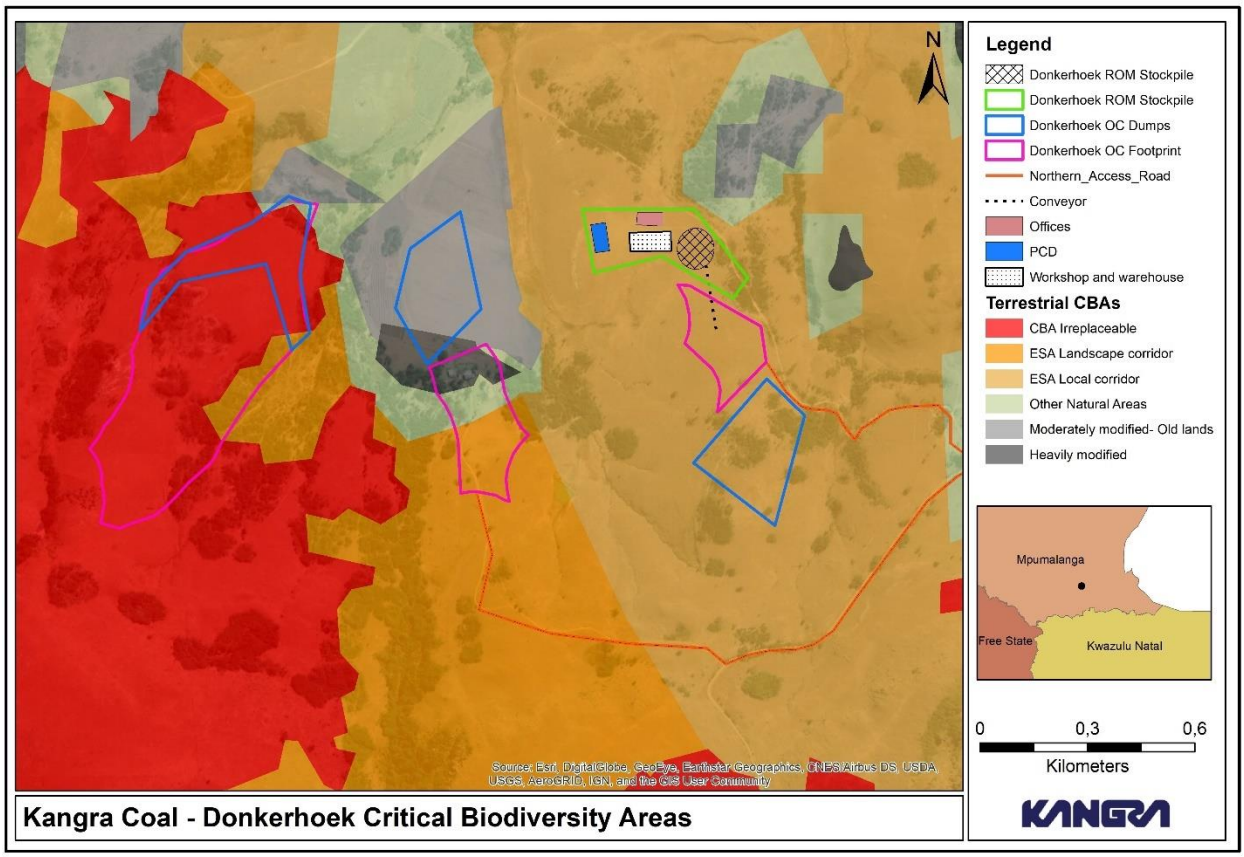

FIGURE 10-21: DONKERHOEK CRITICAL BIODIVERSITY AREAS

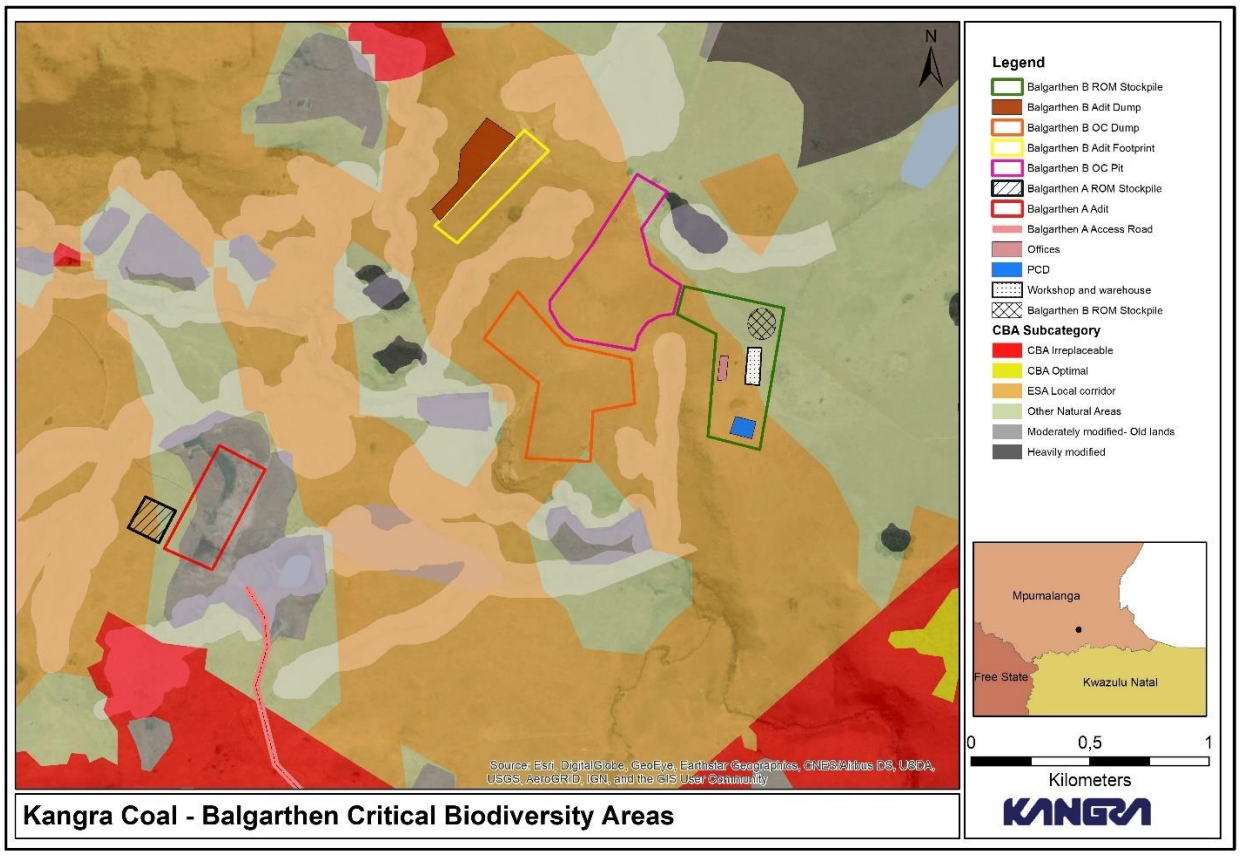

FIGURE 10-22: BALGARTHEN CRITICAL BIODIVERSITY AREAS

10.3.6.2 Floral Impacts

Alternative A – three large opencast areas and adits

Floral impacts associated with Alternative A (three large opencast areas) were briefly assessed as part of the Floral Impact Assessment study. The vegetation clearing will be extensive and due to the availability of suitable habitat for a wide range of floral species, Alternative A will have a detrimental impact on floral species and communities within the focus areas. Small sections of confirmed CBA Irreplaceable areas will be destroyed within the Donkerhoek and Twyfelhoek focus areas, with large portions of confirmed Ecological Support Areas (ESA) destroyed within the Balgarthen focus area. There are also areas of Highest Biodiversity Importance that will be destroyed within all three focus areas and this will impact on biodiversity targets for the region. The Balgarthen and Donkerhoek focus areas, as well as the western boundary and south-eastern corner of the Twyfelhoek focus area, fall within the remaining extent of the Endangered Wakkerstroom/Luneburg Grassland. Development within these areas, therefore, will result in the loss and fragmentation of this threatened ecosystem type. biodiversity offset investigation process would need to be initiated to address all residual impacts which are likely to occur as a result of the proposed Alternative A mine layout if a no net loss of biodiversity was to be achieved.

The specialist study concluded that from a floral sensitivity and diversity perspective, Alternative A should not be considered for further planning.

Alternative B – Reduced Footprint (six mini opencast areas and adits)

A detailed assessment of Alternative B, the preferred alternative was undertaken for the Floral Impact Assessment study. The impacts identified by the specialist are summarised below.

Balgarthen Focus Area

The Balgarthen focus area is largely characterised by a landscape of intact, natural vegetation that has been minimally impacted by, or exposed to, anthropogenic disturbances; resulting in high levels of integrity and ecological functioning. Limited disturbed areas are available to accommodate the placement of the mine infrastructure in areas that will have a low impact on the floral biodiversity of the region. The proposed Alternative B layout is therefore mostly situated within highly sensitive floral habitat.

Impacts on Floral Habitat and Diversity as well as impacts on Floral SCC for the grassland and rocky habitat units was **very high** pre-mitigation and remained **high** with mitigation measures in place during the construction and operational phases of the mine.

Impacts on Floral Habitat and Diversity for the wetland and woody habitat units were **medium high** pre-mitigation and **low** post mitigation. While impacts on the Floral SCC for these habitat units were **high** and **very high** pre-mitigation and **medium low** after mitigation.

Donkerhoek Focus Area

The Donkerhoek focus area is associated with more disturbances than the Balgarthen focus area. The presence of cultivated lands and wattle proliferation has fragmented the Donkerhoek focus area to some extent, resulting in large stretches of undisturbed vegetation interspersed between modified vegetation.

The undisturbed vegetation comprises high floral diversity with largely intact habitat integrity – deemed important, and sensitive, from a floral biodiversity management perspective.

Alternative B will have detrimental impacts on floral habitat associated with the Grassland Habitat Unit and Rocky Habitat Unit. Even with mitigation measures fully implemented, impacts from Alternative B is anticipated to result in long-term, or potentially permanent, alteration of floral communities at both local and regional scales.

The specialist recommended that a modified Option B be investigated or that Alternative C be further investigated to reduce impacts.

Impacts on Floral Habitat and Diversity as well as impacts on Floral SCC for the grassland and rocky habitat units was **very high** pre-mitigation and remained **high** within the grassland unit and **medium high** within the rocky habitat with mitigation for Donkerhoek.

Impacts on Floral Habitat and Diversity for the wetland and woody habitat units were **medium high** pre-mitigation and **low** post mitigation. While impacts on the Floral SCC for these habitat units were **high** pre-mitigation and **medium low to low** after mitigation.

Twyfelhoek Focus Area

In contrast to the Balgarthen and Donkerhoek focus areas, the Twyfelhoek focus area is mostly considered to be modified by cultivation, wattle proliferation and built-up areas. The natural vegetation remaining within this focus area is intact and a moderately high diversity of floral species were recorded despite the assessment occurring outside of the flowering season.

The proposed Alternative B layout is mostly situated within modified habitat and is not deemed likely to have significant impacts on local or regional floral habitat conservation. The impacted Grassland Habitat is considered small enough to allow for restoration of floral communities' post-closure. From a floral biodiversity management perspective, this site can be more intensively exploited, however very significant care must be taken to minimise the impacts on the adjacent areas which are more intact.

Impacts on Floral Habitat and Diversity for the grassland habitat unit was **high** pre and post mitigation. Impacts on Floral SCC for the grassland unit were **medium high** pre-mitigation and **medium low** after mitigation measures are in place. Impacts on the rocky habitat unit were **high** and **medium high** pre-mitigation but could be mitigated to a **low** significance. Impacts on the wetland and woody habitat units could be mitigated to a **low** significance.

10.3.6.3 Faunal Impacts

Alternative A – three large opencast areas and adits

The faunal impacts associated with Alternative A were briefly assessed as part of the Faunal Impact Assessment undertaken by SAS. As detailed in Section 10.3.6.2, the large tracts of vegetation that will be cleared will have a negative impact on faunal species. Areas within the Balgarthen focus area form pathways and critical habitat linkages that should not be lost and the CBA Irreplaceable areas act as critical habitat linkages associated with Critically Endangered Ecosystems.

All the focus areas are marked as an Important Bird Area for grassland birds and vegetation clearance activities will likely have a significant high impact on avifaunal SCC. There is also likely to be a loss of species diversity and SCC due to decreased suitable habitat, food resources and breeding grounds.

The specialist findings concluded that based on the impacts associated with this alternative layout the loss of faunal habitat and displacement of faunal species which occupy sensitive habitat types along with the potential edge effects from the extensive underground mining, this alternative is deemed to be unacceptably high.

Alternative B - six mini opencast areas and adits

The two primary impacts associated with the proposed mining operations are impacts on the faunal diversity and habitat, and the impacts associated with faunal SCC.

Balgarthen Focus Area

Impacts on Faunal Habitat and Diversity for the grassland habitat unit were **high** pre-mitigation and **medium high** with mitigation measures implemented, while the rocky habitat was **medium high** pre mitigation and **medium low** post mitigation. Impacts on the Faunal Habitat and Diversity for the freshwater and woody habitats was **high** before mitigation and **medium high** after mitigation.

Impacts on the Faunal SCC for the grassland, rocky habitat, freshwater and woody ravine habitat units were **high** and **very high** pre-mitigation and remained **high** with mitigation measures in place.

Donkerhoek Focus Area

The impacts on Faunal Habitat and Diversity for all four of the habitat units (grassland, rocky habitat, freshwater and woody ravine) was considered **medium high** before mitigation and **medium low** with mitigation. The impacts on Faunal SCC for all four of the habitat units was **very high** pre-mitigation and remained **high** with mitigation measures implemented.

Twyfelhoek Focus Area

The impacts on Faunal Habitat and Diversity for the four habitat units was considered **medium low** before mitigation measures and remained **medium low** with mitigation in place. The impacts on Faunal SCC for all four of the habitat units was **high** pre-mitigation and **medium high** post mitigation.

The specialist study concluded that the impacts associated with Alternative B range from medium-low to high prior to mitigation due to the sensitive rocky and grassland habitat units which offer niche habitats for potential faunal SCC. Impacts associated with Alternative C for the Balgarthen and Twyfelhoek adits will likely be site specific which will have the least faunal impacts.

10.3.7 Freshwater Resources and Wetlands

The Watercourse and Aquatic Ecological Assessment Part D (Scientific Aquatic Services, September 2019) provides detail on the impacts to surface water bodies.

There are seven potential impacts that may have an effect on the overall ecological function of watercourses in the vicinity of the proposed Kusipongo project, four possible impacts on the wetland and riparian resources and three possible impacts on the aquatic resources.

Impacts identified are listed below:

- Modification of wetland hydrological function;
- Changes to wetland geomorphological processes;
- Loss of wetland habitat and ecological integrity;
- Impact on wetland biota;
- Impact on water quality;
- Loss of aquatic habitat; and
- Impact on aquatic biota.

The impacts on the wetland and riparian systems during all of the project phases range from medium-low to medium-high to high impacts. Mitigation measures available will minimise the impacts on the receiving wetland environment and impact significance can be reduced to medium-low.
The impacts on the various aquatic tributaries are either high or medium-high significance. However, with mitigation, impacts may be reduced to mostly medium-low impact significance.

Impacts within each Focus Area

Impacts on wetland and riparian resources within the Balgarthen focus area were considered to be **very high** pre mitigation and **medium high** post mitigation.

The Donkerhoek focus area had impacts which were considered **high** pre-mitigation and **medium low** with mitigation measures implemented.

Impacts in the Twyfelhoek focus area were found to be **medium high** before mitigation and **medium low** with mitigation measures in place.

The impacts on aquatic resources within all three of the focus areas were **high** before mitigation measures and **medium low** after implementation of mitigation.

10.3.8 Socio-Economic

There are both positive and negative socio-economic impacts associated with the proposed mining project.

Employment

The primary positive socio-economic impact is the retention of employment for personell at the Maquasa East mining operations. The coal resources at the current Maquasa East operations are nearing depletion and additional mining reserves are required in order to sustain the current production rates and employee numbers. The Kusipongo will prevent significant financial and job losses, relating to approximately 750 employees and additional contractor workers.

Coal is an important provider of electricity, and therefore plays a crucial role in the South African energy- economy. The local and international markets are, at present, highly dependent on South Africa being a main provider of coal and coal mining is a key economic activity in Mpumalanga.

Generation of Dust from Transport Affecting Land Use

The impacts of fallout dust from vehicle transport has the potential to affect both grazing and quality of wool where sheep is grazed near the transport route. This impact is not quantifiable as the nature of the animals will be to move away from areas where pasture is not palatable or where high noise is expected.

Loss of Agricultural Land Use and Fragmentation of Camps

The development of the surface infrastructure will result in a loss of agricultural land for grazing (Balgarthen and Donkerhoek) as well as crop production (Twyfelhoek pits). The total direct area lost is not significant due to the small scale in context to the region. It can however be anticipated that grazing will not be utilised in the direct area of the various operations due to noise and blasting.

Influx of People

It is anticipated that there will be an influx of people within the area especially during the construction phase as people seek employment opportunities. Social risks such as an increase in theft, the spread of diseases and hawking can be expected due to the increased number of people within the surrounding area. This impact is a result of development and it is critical that Kangra play an active role in safety and security at the planned area of operation.

10.3.9 Blasting

Blasting impacts have been assessed by Blast Management and Consulting (September 2019).

10.3.9.1 Project Sensitivity

Figure 10-23, Figure 10-24, Figure 10-25 and **Figure 10-26** shows the sensitivity mapping with the identified points of interest (POI) in the surrounding areas for the different proposed Kusipongo Project areas.

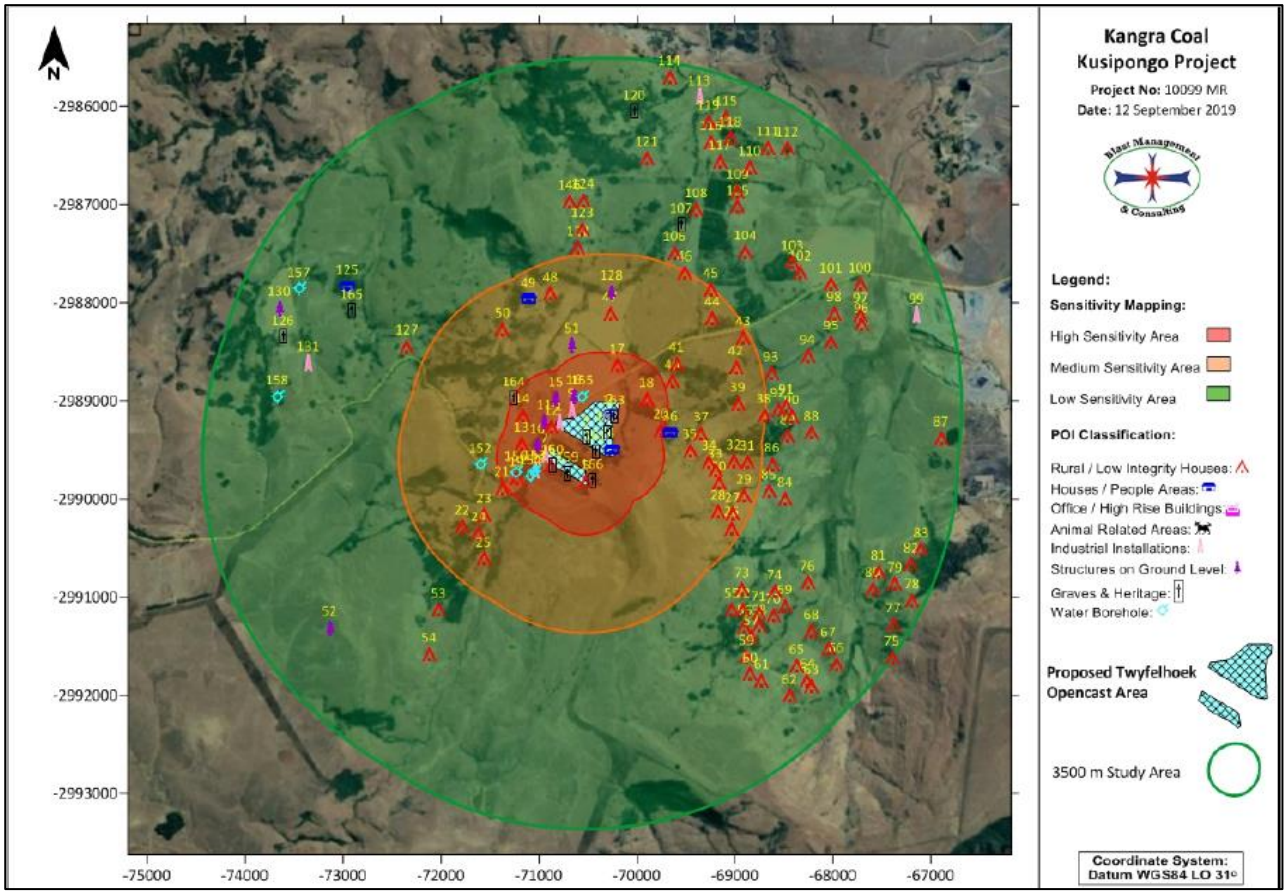

FIGURE 10-23: SENSITIVE AREAS FOR THE TWYFELHOEK OPENCAST AREAS

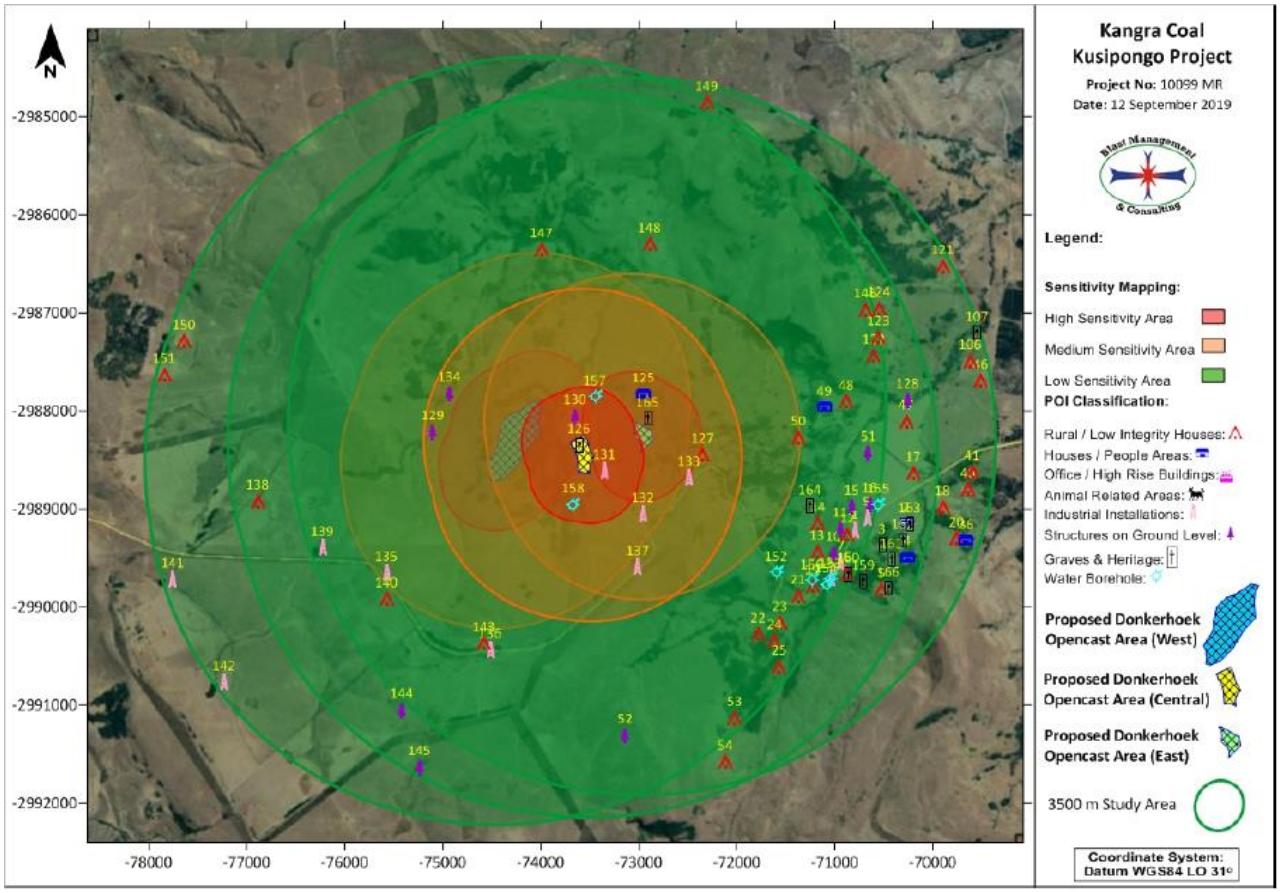

FIGURE 10-24: SENSITIVE AREAS FOR THE DONKERHOEK OPENCAST AREAS

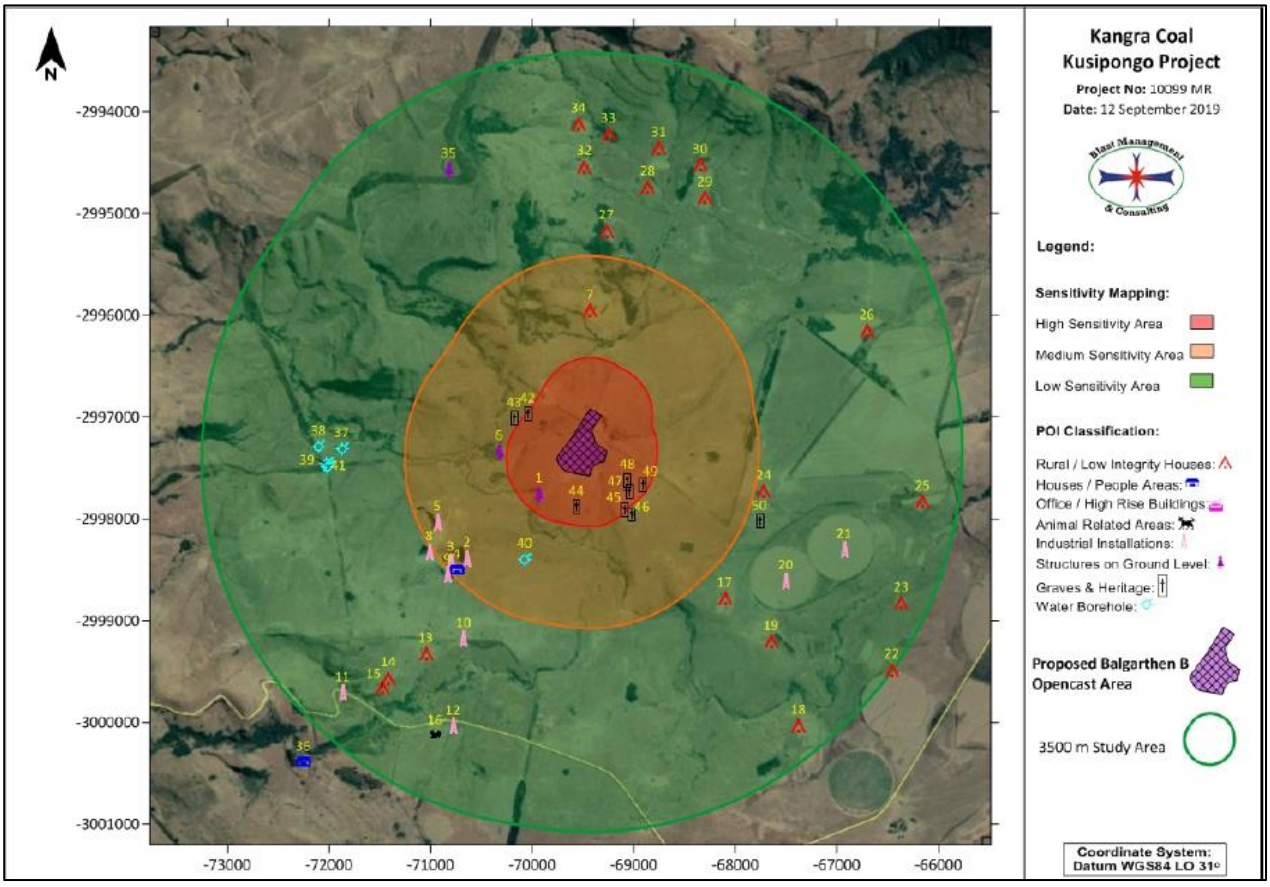

FIGURE 10-25: SENSITIVE AREAS FOR THE BALGARTHEN B OPENCAST AREA

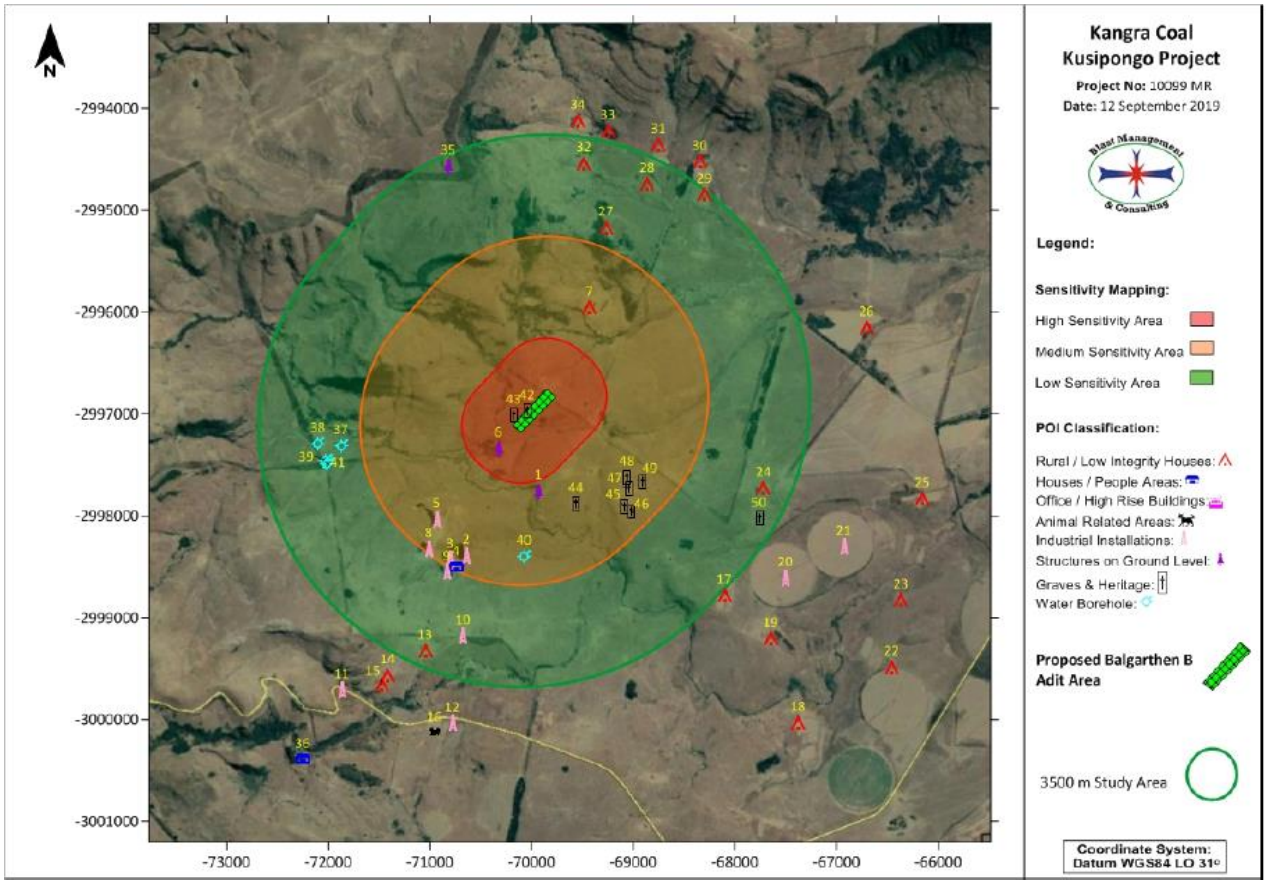

FIGURE 10-26: SENSITIVE AREAS FOR THE BALGARTHEN B ADIT AREA

10.3.9.2 Ground Vibration Levels

Twyfelhoek Opencast Pit:

Various POI's were identified as problematic. Nine POI's are found within the boundaries of the pit area. Evaluation of minimum charge showed that ground vibration may be problematic for seven other POI's that range in distance from next to the pit up to 290 m. Structures beyond 290 m showed levels of ground vibration to be within accepted norms with no concerns for negative influence. Evaluation of maximum charge showed 15 POI's ranging from next to the pit up to 593 m could experience ground vibration levels as problematic. Houses beyond 593 m from the pit area showed levels within accepted norms with no concern for damage from maximum charge evaluated. On human perception scale 11 POI's were identified that will experience ground vibration as intolerable and unpleasant.

Donkerhoek Opencast Pit (West)

The nearest house structures observed are further than 1000 m from the pit area. No probable negative influences were observed from minimum and maximum charge evaluations for any of the POI's identified.

Donkerhoek Opencast Pit (Central)

The nearest house structures observed are further than 730 m from the pit area. One POI was identified, which are the remains of a historic farmstead, being within the bounds of the proposed mining area. One POI around the pit area, a dam, showed expected ground vibration levels greater than limits proposed for maximum charge only. No other influences were observed for minimum or maximum charge.

Donkerhoek Opencast Pit (East)

Various POI's were identified as problematic. Evaluation of minimum charge showed that ground vibration expected is greater than the proposed limit for one POI. Four POI's were identified as problematic for maximum charge evaluated. The nearest structure is located 125 m from the pit boundary. House structures beyond 600 m showed levels of ground vibration to be within accepted norms with no concerns for negative influence. On the human perception scale, 2 POI's were identified that will experience ground vibration as unpleasant.

Balgarthen B Opencast Pit

Various POI's were identified surrounding the pit area. The nearest informal settlement is 968 m from the pit boundary. Most of the POI's closest to the pit area are heritage related POI's. Expected levels of ground vibration are greater than the proposed limits for one POI on minimum charge evaluated. Eight POI's showed levels greater than proposed for the maximum charge. On the human perception scale, a limited number of houses were identified that will experience ground vibration as perceptible.

Balgarthen B Adit

Various POI's were identified surrounding the pit area. The nearest informal settlement is 911 m from the adit boundary. One POI, a cemetery comprising 13 stone-packed graves is found within the bounds of the adit area. One POI next to the adit showed expected levels of ground vibration greater than proposed limits for minimum and maximum charge. None of the other POI's identified showed concerns regarding ground vibration. On the human perception scale, a limited number of houses were identified that will experience ground vibration as perceptible.

10.3.9.3 Potential that vibration will upset adjacent communities

Ground vibration and air blast generally upset people living in the vicinity of mining operations. There are settlements of people in close proximity of the planned operations, although this applies mainly at the Twyfelhoek operations. These buildings/structures are located such that levels of ground vibration predicted may be problematic and damaging. Ground vibration levels expected from maximum charge has the possibility to be perceptible up to 2108 m. Lesser charges will reduce this distance and at minimum charge this distance is expected to be 1035 m. Within these distance ranges there are a number of houses.

The importance of good public relations cannot be under stressed. People tend to react negatively on experiencing of effects from blasting such as ground vibration and air blast. Even at low levels when damage to structures is out of the question it may upset people. Proper and appropriate communication with neighbours about blasting, monitoring and actions done for proper control will be required.

10.3.9.4 Structural Damage

The proposed limits as applied in this document i.e. 6 mm/s, 12.5 mm/s and 25 mm/s are considered sufficient to ensure that additional damage is not introduced to the different categories of structures. It is expected that, should levels of ground vibration be maintained within these limits, the possibility of inducing damage is limited.

10.3.9.5 Air Blast

Twyfelhoek Opencast Pit:

Two POI's were identified where air blast will be greater than limits for minimum and maximum charge evaluated. A further two houses were identified where air blast levels expected are high enough that it could lead to complaints.

Donkerhoek Opencast Pit (West)

No POI's were identified where air blast is expected to contribute negatively to damage on structures nor cause reason for complaints.

Donkerhoek Opencast Pit (Central)

No POI's were identified where air blast is expected to contribute negatively to damage on structures nor cause reason for complaints.

Donkerhoek Opencast Pit (East)

One POI was identified where air blast is expected to be less than the limits set but high enough that it could lead to complaints for minimum charge evaluated. Two POI's were identified as "complaints" for the maximum charge evaluated. The rest of POI's identified were far enough away that no concern for damages were registered.

Balgarthen B Opencast Pit

None of the POI's identified and air blast levels evaluated indicate concerns regarding possible damage or complaints. POI's are at distances away from the pit area that influence is expected to be low.

Balgarthen B Adit

None of the POI's identified and air blast levels evaluated indicate concerns regarding possible damage or complaints. POI's are at distances away from the pit area that influence is expected to be low.

The current accepted limit on air blast is 134 dBL. Damages are only expected to occur at levels greater than 134 dBL. Prediction shows that air blast will be greater than 134 dB at distances of 71 m or less to any of the opencast pit or adit boundaries.

10.3.9.6 Fly-rock Unsafe Zone

The results from the calculations for fly rock based on a 141 mm diameter blast hole, a 2.4 m stemming length and with a safety factor of 2 was calculated to be **527 m**. The absolute minimum unsafe zone is then the 527 m. This calculation is a guideline and any distance cleared should not be less. Best practices should be implemented at all times as the occurrence of fly rock can be mitigated, but the possibility of the occurrence thereof can never be eliminated.

10.3.9.7 Possible Relocation

There are nine houses / settlements identified within 500 m from mainly the Twyfelhoek and Donkerhoek East operations. Some of these POI's are very close to the boundaries of the mining areas.

Consideration should be given to relocate these households or find agreement to vacate these households during blasting times. Specific attention should be given to those closer than 250 m. Relocation or frequent evacuation will reduce the general impact on the surrounding areas of the opencast pits and adits.

10.3.10 Traffic

The impacts associated with traffic and roads were assessed by TTT Traffic and JG Africa (September 2019).

10.3.10.1 Trip Generation

It is expected that construction related impacts will have a low significance as the trip generation is fairly low in comparison to the operational phase. Construction activities will be undertaken by a contractor with a small workforce on site and will have minimal impact on traffic volumes.

The operational trip generation was analysed based on traffic counts undertaken at two intersections as well as the projected mine output (personnel trips and production trips for coal trucks).

- Maquasa West Intersection (Traffic Count Location 1)

The intersection will operate adequately at Level of Service (LOS) A and average delay of 9.0 seconds per vehicle for the south approach. The analysis shows that the development trips will have **very little traffic impact** on the surrounding intersection and road network.

- Maquasa East Intersection (Traffic Count Location 2)

The intersection will operate adequately at LOS A and average delay of 9.0 seconds per vehicle for both the west and east approaches. The analysis shows that the development trips will have **very little traffic impact** on the surrounding intersection and road network.

FIGURE 10-27: TRAFFIC COUNT POSITIONS

10.3.10.2 Roads

The proposed gravel roads to be used to haul coal are depicted in **Figure 10-28** below.

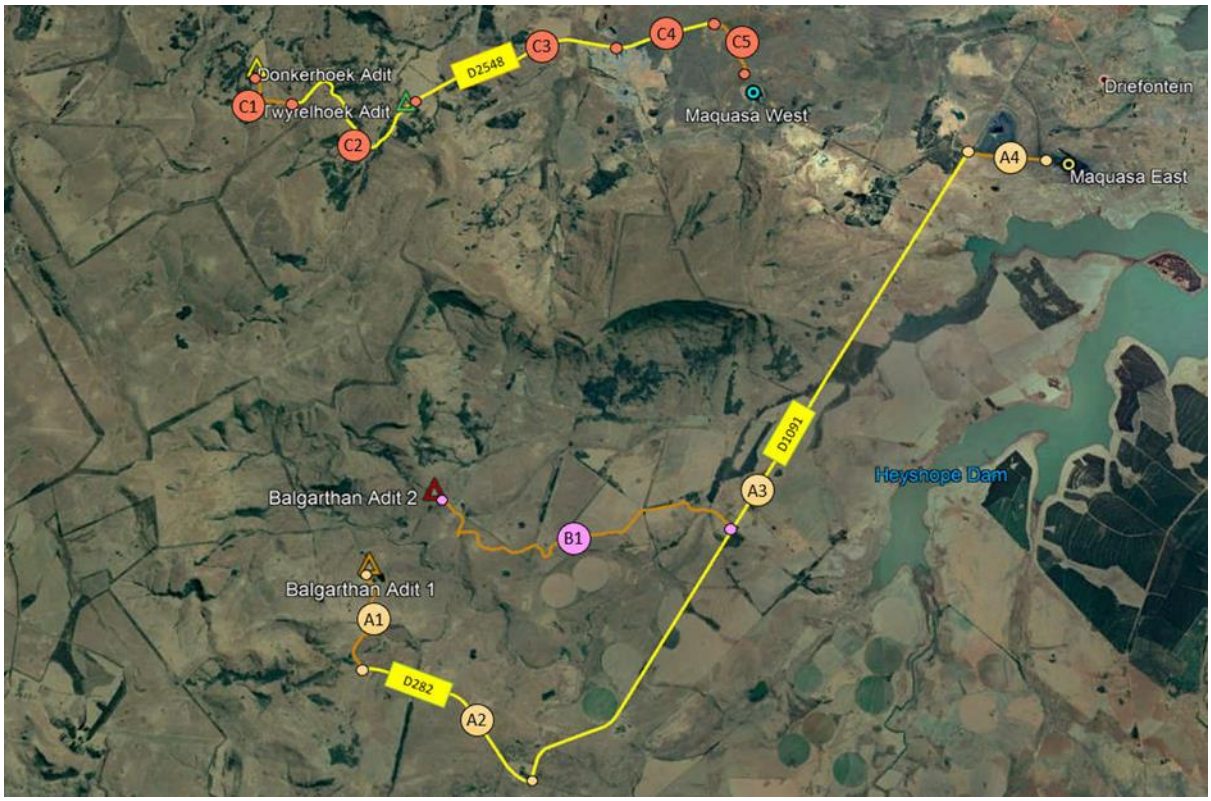

FIGURE 10-28: PROPOSED HAUL ROADS TO BE USED AT KUSIPONGO

The road assessment found that the trucks may not be able to navigate the steep slopes in some areas and that there are some narrow one-vehicle stream crossings where widening may not be feasible. The structural capacity of collapsed and eroded culverts is required. An approval from the road authority is required prior to constructing an access onto a provincial road or for a road crossing. There is a vehicle tonnage restriction on the access road to the Balgarthen Adit A.

10.3.11 Cultural Heritage

The impacts associated with cultural heritage sites was assessed by Professional Grave Solutions (September 2019).

Please refer to **Figure 9-51** and **Figure 9-52** in Section 9.10 for the layout maps showing the locality of heritage sites.

Of the Heritage sites identified, KCP 1 – KCP 19, an impact assessment was not undertaken on three of these sites. KCP 14 and KCP 18 were considered to have a Low Significance and will therefore not require mitigation, while KCP 9 was located far enough from the proposed development footprints that no development impacts are expected.

Heritage sites - KCP 1, KCP 10, KCP 15, KCP 16 and KCP 17 all comprise graves or possible graves located within the development footprints. It is expected that should the development proceed without any mitigation; these sites will be destroyed during the Pre-Construction Phase of the project. Heritage sites KCP 7, KCP 11, KCP 19 and KCP 13 are graves or possible graves and associated structures located just outside of the proposed development footprints. The impacts on these sites is considered to be of high significance.

There are only two mitigations which can be undertaken for graves within or very close to the development footprint, the best option is to change the development footprint to allow for the *in situ* preservation of these sites. However, should it not be possible to preserve these sites *in situ* a grave relocation process must be undertaken.

Heritage sites KCP 2, KCP 4, KCP 5, KCP 6, KCP 8 and KCP 12 include the possibility of graves and a social consultation process will be required to assess whether any local residents or the wider public is aware of the presence of graves.

Depending on the outcome of the social consultation process, three different outcomes would be the result, namely:

- Outcome 1: The social consultation absolutely confirms that no graves are located here.
- Outcome 2: The social consultation absolutely confirms that graves are located here.
- Outcome 3: The social consultation does not yield any confident results.

If the site is found to fall under Outcome 1:

- No further mitigation would be required in terms of the possible risk for unmarked stillborn graves, however the mitigation measures outlined in Outcome 3 would be required for the site's possible

If the site is found to fall under Outcome 2:

- A grave relocation process must be undertaken.

If the site is found to fall under Outcome 3:

- Test excavations to physically confirm the presence or absence graves.
- If no evidence for graves is found, the site will fall within Outcome 1 as outlined above. This means that no further mitigation measures would be required.
- If evidence for graves is found, the site will fall within Outcome 2 as outlined above. This means that a full grave relocation process must be implemented.

Site KCP 3 comprises a Late Iron Age or early Historic Period stonewalled enclosure. Although the stonewalled enclosure is located approximately 25m from the nearest development footprint area, it is possible for less visible components of the site, such as huts and middens, to be located either closer to the development footprint area, or just within it.

An archaeological site layout plan must be compiled using accepted archaeological techniques. During the recording of the archaeological site layout plan, an attempt must be made to establish the extent of the site on its north-western, northern and north-eastern ends to confirm whether any components of the site are located within the nearby development footprint area.

If the recording of the site and its layout proves that no component of the site is located within the nearby development footprint area, no further mitigation would be required. However, if this work indicates that sections of the site are indeed located within this development footprint area, archaeological test excavations and a destruction permit would be needed.

10.3.11.1 Palaeontology

Impacts relating to Palaeontology were assessed by Banzai Environmental (September 2019)

The proposed Kusipongo underground and opencast coal mine development as well as all alternatives is underlain by the Vryheid Formation of the Ecca Group (Karoo Supergroup), while the central portion of Kusipongo mining right application is underlain by the Volksrust Formation (Ecca Group) and Karoo dolerite. According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Vryheid Formation is **Very High** and that of the Volksrust Formation is **High** while the Karoo Dolerite Suite consists of igneous rock and thus has a Palaeontological Sensitivity of **zero** (Almond and Pether 2008, SAHRIS website).

In order to actively quantify the potential impacts, an EIA level/Phase 1 palaeontology report will be required to assess the value and prominence of fossils in the development area.

10.4 The possible mitigation measures that could be applied and the level of residual risk

The impact assessment and mitigation measures for each of the identified impacts are included in **Figure 10-29 .** Mitigation of key impacts and risks are also discussed in detail in Part B: Environmental Management Programme.

The significance of the impact with mitigation has been weighted by multiplying the significance rating without mitigation by the following, depending on the confidence placed in the successful implementation of the mitigation measures or the effectiveness of those measures in reducing the impact.

1	**Very low**	Measures are very difficult or expensive to implement or are not expected to be effective in reducing the impact (No Confidence)
0.8	**Low**	Measures are difficult or expensive to implement or are expected to have limited effectiveness in reducing the impact (20% Confidence)
0.6	**Moderate**	Measures can be implemented with some effort and cost and/or the measures can be effective in mitigating the impact if implemented (50% Confidence)
0.4	**High**	There is high confidence that mitigation measures can be implemented and can be effective in mitigating the impact (80% Confidence)

10.5 Motivation where no alternative sites were considered

Not applicable, as alternatives layouts have been considered based on the identification of impacts during screening as well as the mitigation of impacts.

10.6 Statement motivating the alternative development location within the overall site

Alternative A for the proposed mining operations was revised due to the significance and severity of potential impacts as well as stakeholder consultation undertaken. Following detailed specialist assessments, the preferred alternative development is a combination of Alternatives B and C, as detailed in Section 12.2.

10.7 Full description of the process undertaken to identify, assess and rank the impacts and risks the activity will impose on the preferred site (in respect of the final site layout plan) through the life of the activity

Please refer to Section 10.1 for the methodology used in the ranking of impacts. Please refer to Section 10.4 for the methodology used for the application of a mitigation confidence ranking to the impact ranking.

10.8 Assessment of each identified potentially significant impact risk

A summary of the impact significance, as detailed in Section 10.1 is provided below:

IMPACT SIGNIFICANCE

NEGATIVE IMPACTS

≤1	Very low	Impact is negligible. No mitigation required.

>1≤2	Low	Impact is of a low order. Mitigation could be considered to reduce impacts. But does not affect environmental acceptability.
>2≤3	Moderate	Impact is real but not substantial in relation to other impacts. Mitigation should be implemented to reduce impacts.
>3≤4	High	Impact is substantial. Mitigation is required to lower impacts to acceptable levels.
>4≤5	Very High	Impact is of the highest order possible. Mitigation is required to lower impacts to acceptable levels. Potential Fatal Flaw.

POSITIVE IMPACTS

≤1	Very low	Impact is negligible.
>1≤2	Low	Impact is of a low order.
>2≤3	Moderate	Impact is real but not substantial in relation to other impacts.
>3≤4	High	Impact is substantial.
>4≤5	Very High	Impact is of the highest order possible.

FIGURE 10-29: IMPACT ASSESSMENT

Donkerhoek

ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Groundwater	Change in groundwater levels due to dewatering	C	2	2	2	2	2	0,8	1,6	Groundwater and surface water levels should be monitored. Dirty surface run-off should be pumped to dirty water dams. These dams should be lined to ensure no future pollution of groundwater resources. Hazardous substances are to be stored in bunded areas and handled on impervious surfaces. Equipment which has the potential to leak oil or other chemicals are to be stored on impervious surfaces within bunded areas. Drip trays are to be provided where mobile equipment has the potential to drip oil. Implement spill prevention and emergency response procedure. A complaint register must be available to address any concerns of farmers for loss of water.	0,4	0,64
Groundwater	Change in groundwater quality	C	2	2	2	2	2	0,8	1,6	Groundwater and surface water levels should be monitored as per the monitoring programme and water use licence. Dirty surface run-off should be pumped to dirty water dams. These dams should be lined to ensure no future pollution of groundwater resources. Hazardous substances are to be stored in bunded areas and handled on impervious surfaces. Equipment which has the potential to leak oil or other chemicals are to be stored on impervious surfaces within bunded areas. Drip trays are to be provided where mobile equipment has the potential to drip oil. Implement spill prevention and emergency response procedure.	0,4	0,64
Groundwater	Change in groundwater levels due to dewatering	O	3	4	3,5	2	2,75	1	2,75	Groundwater and surface monitoring to include water levels and yields. Where loss of groundwater levels or yields are expected by nearby users a complaints process and investigation must be undertaken. Should the investigation show that the change in levels and yields is due to the dewatering of the mine the farmers impact must be mitigated through additional water supply or financial compensation	0,6	1,65
Groundwater	Change in groundwater quality	O	4	4	4	3	3,5	0,8	2,8	Groundwater and surface monitoring, as recommended in the Geohydrological Report and water use licence to be undertaken. Dirty surface run-off should be pumped to dirty water dams. These dams should be lined to ensure no future pollution of groundwater resources. ROM stockpiles to be lined. Pit footprints reduced to reduce pollution plume migration. Dewatering curtains or other seepage capturing methods to be implemented should the monitoring show plume affects near rivers	0,6	1,68

ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Groundwater	Generation of AMD and decant to the natural environment	PC	5	5	5	3	4	0,8	3,2	Increasing groundwater levels and groundwater quality should be monitored. Decant water should treated and discharged into the environment. Financial provision need to allow for funds to treat the water. Provision should be made for initial capital and operational costs.	0,8	2,56
Surface Water Resources	Modification of wetland hydrological function (opencast and underground mining)	C & O	4	5	4,5	3	3,75	1	3,75	Ensure that, as far as possible, all infrastructure is placed outside of the delineated watercourses. No use of clean surface water or any groundwater which potentially recharges the watercourses in the area should take place. Very strict control of water consumption must take place. Upstream dewatering boreholes should be considered to minimise the creation of dirty water and this clean water should be used to recharge the natural systems downstream of each of the focus areas. Permit only essential construction personnel within 100m of all riparian systems. Sensitive zones must be demarcated as no-go areas. Implement alien vegetation control program within wetland areas. Very clear and well managed clean and dirty water separation must take place. Pollution control dams must be adequately designed to contain a 1:50 24 hour storm water event. Limit the footprint area of the construction activity to what is absolutely essential. Ensure that all spills are immediately cleaned up. Ensure that all stockpiles have measures such as berms and hessian sheets to prevent erosion and sedimentation. Areas with concentrated flow must be managed (energy dissipating structures) in order to slow velocity of water flowing into the wetlands and measures to disperse the flow entering the wetlands must be ensured.	0,4	1,5
Surface Water Resources	Impact on surface water quality	C & O & PC	4	5	4,5	3	3,75	1	3,75		0,6	2,25
Surface Water Resources	Changes to the Wetland Geomorphological Processes (sediment balance, erosion and sedimentation) due to opencast and underground mining.	C & O & PC	4	5	4,5	3	3,75	1	3,75		0,55	2,0625
Surface Water Resources	Loss of wetland habitat and ecological integrity	C & O & PC	4	5	4,5	3	3,75	1	3,75		0,55	2,0625
Surface Water Resources	Loss of aquatic habitat	C & O & PC	3	4	3,5	3	3,25	0,8	2,6		0,6	1,56
Surface Water Resources	Loss of aquatic biota	C & O & PC	3	4	3,5	2	2,75	0,8	2,2		0,6	1,32
Surface Water Resources	Impact on wetland biota	C & O & PC	4	5	4,5	3	3,75	1	3,75		0,5	1,875
Biodiversity - Flora	Impact on Floral Diversity and Habitat (grassland and rocky habitat units)	C & O	4	5	4,5	3	3,75	1	3,75	Mitigation measures as detailed in the Floral Assessment Report and EMPr must be implemented. Prior to the commencement of construction activities, an Alien Invasive Plant (AIP) Management/Control Plan should be compiled for implementation. Prior to the commencement of construction activities on site, a rehabilitation plan should be developed. A detailed walk down of the footprint area must take place, during which all floral SCC should be identified and marked by a suitably qualified specialist approved by the MTPA. As a minimum, surveys in late November and early February should be undertaken. All areas of increased ecological sensitivity falling outside of the direct mine footprint should be designated as No-Go areas. The footprint and daily operation of all mining surface infrastructure areas must be strictly monitored to ensure that edge effects from the operational facilities do not affect the surrounding floral habitat.	0,4	1,5
Biodiversity - Flora	Impact on Floral species of conservation concern (grassland and rocky habitat units)	C & O	4	5	4,5	3	3,75	1	3,75		0,4	1,5

ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Biodiversity - Fauna	Impact on Faunal Diversity and Habitat (grassland, rocky and freshwater habitat units)	C & O	4	4	4	3	3,5	1	3,5	Where possible pockets of natural vegetation should be retained within the mining footprint to provide habitat for small faunal species such as insects and reptiles. Permits must be applied for the relocation of animal species where protected. Concurrent rehabilitation should take place and the re-establishment of animals species monitored post closure of this section	0,6	2,1
Biodiversity - Fauna	Impact on Faunal species of conservation concern (grassland, rocky and freshwater habitat units)	C & O	4	4	4	4	4	1	4		0,6	2,4
Air Quality	Increase in dust-fallout due to mining operations and vehicles transporting coal on haul roads	C & O	3	3	3	3	3	0,8	2,4	Dust suppression on the unpaved haul routes. Dust suppression to be undertaken in areas where dust emissions are problematic. A dust management plan will need to be developed for onsite activities. Control the number of trucks on the road, weight of trucks and the travelling speed. Implement strict vehicle speed limits (e.g. 20-40 km/h). Dust-fallout and PM10 ambient air quality monitoring should be undertaken.	0,85	2,04
Air Quality	Increase in PM10 and PM2.5 due to mining operations and vehicles on haul roads	C & O	3	3	3	3	3	0,8	2,4		0,8	1,92
Noise	Increase in noise levels for receptors within 600m of mining operations (daytime)	C	3	3	3	3	3	0,9	2,7	Undertake monitoring programme and negotiations to ascertain the need to relocate all noise sensitive receptors staying within 250m from the closest active mining areas. Use the available topsoil material to develop a berm between the active mining area and community. This berm should be as high as possible.	0,75	2,025
Noise	Increase in noise levels for receptorsdue to mining operations (night time)	C	4	3	3,5	3	3,25	1	3,25	Relocate all noise sensitive receptors staying within 600m from the closest active mining areas. Use the available topsoil material to develop a berm between the active mining area and community. This berm should be as high as possible.	0,7	2,275
Noise	Increase in noise levels (daytime)	O	3	3	3	3	3	0,6	1,8	With the implementation of the construction phase mitigation measures, no further mitigation is required.	0,6	1,08
Noise	Increase in noise levels (night time)	O	3	3	3	3	3	1	3	Use the available topsoil material to develop a berm between the active mining area and community. This berm should be as high as possible. These berms should only be developed during the daytime period. The mine should limit the simultaneous mining activities at sections closer than 3,000m from another mining section to minimise cumulative noise levels.	0,8	2,4

ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Topography	Change in landforms due to mining operations and associated infrastructure	C & O	3	3	3	2	2,5	1	2,5	Infrastructure to be removed at the end of the LOM. Financial provision to provide for decommissioning and closure activities.	1	2,5
Soils and Land capability	Soil erosion due to mining activities	C & O	3	3	3	3	3	1	3	The footprint of the proposed mining operation and related infrastructure areas should be clearly demarcated. Bare soils can be regularly dampened with water to suppress dust during the construction phase. All disturbed areas adjacent to the infrastructural areas can be re-vegetated with an indigenous grass mix. Temporary erosion control measures may be used to protect the disturbed soils during the construction phase until adequate vegetation has established. This is regarded as critical at the Donkerhoek proposed mining operation due to very steep topographic setting.	0,7	2,1
Soils and Land capability	Soil compaction due to mining activities	C & O	2	3	2,5	2	2,25	1	2,25	Laydown areas should be located within disturbed soils to avoid compaction of natural soils. If possible, vegetation clearance and commencement of construction and mining activities, can be scheduled to coincide with low rainfall conditions. Heavy equipment must be restricted in operating within wetland related soil boundary, as they are prone to compaction as a result of high clay content.	0,6	1,35
Soils and Land capability	Soil contamination due to mining activities	C & O	3	3	3	3	3	0,8	2,4	A spill prevention and emergency spill response plan should be compiled to guide the construction works. An emergency response contingency plan should be put in place to address clean-up measures. A clean water cut off drain should be constructed upslope of construction and operational areas, in order to re-direct clean water away to avoid chemical soil pollution and groundwater resources.	0,6	1,44

ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Soils and Land capability	Loss of agricultural land capability	C & O	3	3	3	3	3	1	3	During the decommissioning phase the footprint should be thoroughly cleaned, and all building material should be removed to a suitable disposal facility. The footprint should be ripped to alleviate compaction. Stored topsoil should be replaced (if any) and the footprint graded to a smooth surface. The landscape should be backfilled and reprofiled to mimic the natural topography. Slopes of the backfilled surface should change gradually since abrupt changes in slope gradient increase the susceptibility for erosion initiation. The topsoil should be ameliorated according to soil chemical analysis. The soil fertility status should be determined by soil chemical analysis after levelling (before seeding/re-vegetation. Soil amelioration should be done according soil analyses as recommended by a soil specialist, to correct the pH and nutrition status before revegetation. The footprint should be re-vegetated with a grass seed mixture as soon as possible.	0,7	2,1
Blasting	Impacts due to ground vibration and air blast	O	4	3	3,5	3	3,25	1	3,25	There are nine houses / settlements identified within 500 m. Consideration should be given to relocate these households, especially those within 250 m. The calculated minimum safe distance is 527 m and all people and animals within this radius should be evacuated during each blast. An assessment on the structural integrity and existing damage to surrounding structures within a 1 500 m radius must be undertaken prior to blasting commencing. Do blast design that considers the actual blasting and the ground vibration levels to be adhered to. Only apply electronic initiation systems to facilitate single hole firing. Do design for smaller diameter blast holes that will use fewer explosives per blasthole.	0,6	1,95
Blasting	Impacts due to fly rock	O	4	3	3,5	2	2,75	0,8	2,2	Specific blast design to be done, shorter blast holes, smaller diameter blast hole. The use of specific stemming materials to manage air blast, increased stemming lengths to reduce air blast effect. Use of specific stemming to manage fly rock. Re-design with increased stemming lengths.	0,6	1,32
Cultural Heritage	Disturbance of heritage sites and in particular graves found inside the development footprint	C	4	4	4	4	4	1	4	Change the development footprint to allow for the in situ preservation of these sites and graves.	0,6	2,4

ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
										Should preservation not be possible, a grave relocation process must be undertaken.		
Cultural Heritage	Disturbance of heritage sites and graves found outside the development footprint	C	3	3	3	3	3	1	3	Allow for the in situ preservation of these sites. Should this not be possible, a grave relocation process must be undertaken for sites that will be disturbed during mining activities.	0,6	1,8
Palaeontology	Disturbance of sites of palaeontological significance	C	4	4	4	4	4	0,8	3,2	The presence of palaeontological findings is likely. The ECO or environmental manager (EM) should undertake an awareness programme of what these sites could look like if unearthed. The ECO/EM need to inform a palaeontologist should any artefacts be found.	0,6	1,92
Air Quality - Cumulative	Cumulative increase in dust emissions due to existing sources at Maquasa operations	C & O	3	3	3	3	3	0,8	2,4	Dust suppression on the unpaved haul routes. Dust suppression to be undertaken in areas where dust emissions are problematic.	0,85	2,04

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ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Groundwater	Change in groundwater levels due to dewatering	C	2	2	2	2	2	0,8	1,6	Groundwater and surface water levels should be monitored. Dirty surface run-off should be pumped to dirty water dams. These dams should be lined to ensure no future pollution of groundwater resources. Hazardous substances are to be stored in bunded areas and handled on impervious surfaces. Equipment which has the potential to leak oil or other chemicals are to be stored on impervious surfaces within bunded areas. Drip trays are to be provided where mobile equipment has the potential to drip oil. Implement spill prevention and emergency response procedure.	0,4	0,64
Groundwater	Change in groundwater quality	C	2	2	2	2	2	0,8	1,6	Groundwater and surface water levels should be monitored. Dirty surface run-off should be pumped to dirty water dams. These dams should be lined to ensure no future pollution of groundwater resources. Hazardous substances are to be stored in bunded areas and handled on impervious surfaces. Equipment which has the potential to leak oil or other chemicals are to be stored on impervious surfaces within bunded areas. Drip trays are to be provided where mobile equipment has the potential to drip oil. Implement spill prevention and emergency response procedure.	0,4	0,64
Groundwater	Change in groundwater levels due to dewatering	O	3	4	3,5	3	3,25	1	3,25	Groundwater and surface monitoring to include water levels and yields. Where loss of groundwater levels or yields are expected by nearby users a complaints process and investigation must be undertaken. Should the investigation show that the change in levels and yields is due to the dewatering of the mine the farmers impact must be mitigated through additional water supply or financial compensation	0,6	1,95
Groundwater	Change in groundwater quality	O	3	4	3,5	2	2,75	0,8	2,2	Groundwater and surface monitoring, as recommended in the Geohydrological Report to be undertaken. Dirty surface run-off should be pumped to dirty water dams. These dams should be lined to ensure no future pollution of groundwater resources. ROM stockpiles to be lined.	0,8	1,76

ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Groundwater	Generation of AMD and decant to the natural environment	PC	4	4	4	3	3,5	1	3,5	Increasing groundwater levels and groundwater quality should be monitored. Decant water should treated and discharged into the environment. Financial provision need to allow for funds to treat the water. Provision should be made for initial capital and operational costs.	0,6	2,1
Surface Water Resources	Modification of wetland hydrological function (opencast and underground mining)	C & O	3	4	3,5	3	3,25	0,8	2,6	All disturbance footprints to be outside of the watercourses or wetlands unless authorised by a water use licence.	0,8	2,002
Surface Water Resources	Impact on surface water quality	C & O & PC	4	5	4,5	3	3,75	1	3,75	No use of clean surface water or any groundwater which potentially recharges the watercourses in the area should take place. Very strict control of water consumption must take place. Upstream dewatering boreholes should be considered to minimise the creation of dirty water and this clean water should be used to recharge the natural systems downstream of each of the focus areas. Permit only essential construction personnel within 100m of all riparian systems. Sensitive zones must be demarcated as no-go areas. Implement alien vegetation control program within wetland areas. Very clear and well managed clean and dirty water separation must take place. Pollution control dams must be adequately designed to contain a 1:50 24 hour storm water event. Limit the footprint area of the construction activity to what is absolutely essential. Ensure that all spills are immediately cleaned up. Ensure that all stockpiles have measures such as berms and hessian sheets to prevent erosion and sedimentation. Areas with concentrated flow must be managed (energy dissipating structures) in order to slow velocity of water flowing into the wetlands and measures to disperse the flow entering the wetlands must be ensured.	0,6	2,25
Surface Water Resources	Changes to the Wetland Geomorphological Processes (sediment balance, erosion and sedimentation) due to opencast and underground mining.	C & O & PC	3	4	3,5	3	3,25	0,8	2,6		0,7	1,82
Surface Water Resources	Loss of wetland habitat and ecological integrity	C & O & PC	4	5	4,5	3	3,75	0,8	3		0,6	1,8
Surface Water Resources	Loss of aquatic habitat	C & O & PC	4	4	4	3	3,5	1	3,5		0,6	2,1
Surface Water Resources	Loss of aquatic biota	C & O & PC	3	4	3,5	2	2,75	1	2,75		0,6	1,65
Surface Water Resources	Impact on wetland biota	C & O & PC	4	3	3,5	3	3,25	0,8	2,6		0,6	1,56
Biodiversity - Flora	Impact on Floral Diversity and Habitat (grassland and rocky habitat units)	C & O	4	4	4	3	3,5	0,8	2,8	Mitigation measures as detailed in the Floral Assessment Report and EMPr must be implemented. Prior to the commencement of construction activities, an Alien Invasive Plant (AIP) Management/Control Plan should be compiled for implementation. Prior to the commencement of construction activities on site, a rehabilitation plan should be developed. A detailed walk down of the footprint area must take place, during which all floral SCC should be identified and marked by a suitably qualified specialist	0,8	2,24

ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Biodiversity - Flora	Impact on Floral species of conservation concern (grassland and rocky habitat units)	C & O	4	4	4	3	3,5	0,8	2,8	approved by the MTPA. As a minimum, surveys in late November and early February should be undertaken. All areas of increased ecological sensitivity falling outside of the direct mine footprint should be designated as No-Go areas. The footprint and daily operation of all mining surface infrastructure areas must be strictly monitored to ensure that edge effects from the operational facilities do not affect the surrounding floral habitat.	0,6	1,68
Biodiversity - Fauna	Impact on Faunal Diversity and Habitat (grassland, rocky and freshwater habitat units)	C & O	4	3	3,5	3	3,25	0,8	2,6	Mitigation measures as detailed in the Faunal Assessment Report and EMPr must be implemented. It is recommended that a summer assessment be undertaken during the months of January and February to more accurately document the faunal communities. A walk through of the rocky habitat unit and grassland habitat units should be undertaken by a registered specialist prior to construction. Where possible pockets of natural vegetation should be retained within the mining footprint to provide habitat for small faunal species such as insects and reptiles.	0,7	1,82
Biodiversity - Fauna	Impact on Faunal species of conservation concern (grassland, rocky and freshwater habitat units)	C & O	4	4	4	3	3,5	1	3,5		0,75	2,625
Air Quality	Increase in dust-fallout due to mining operations and vehicles transporting coal on haul roads	C & O	3	3	3	3	3	0,8	2,4	Dust suppression on the unpaved haul routes. Dust suppression to be undertaken in areas where dust emissions are problematic. A dust management plan will need to be developed for onsite activities. Control the number of trucks on the road, weight of trucks and the travelling speed. Implement strict vehicle speed limits (e.g. 20-40 km/h). Dust-fallout and PM10 ambient air quality monitoring should be undertaken.	0,85	2,04
Air Quality	Increase in PM10 and PM2.5 due to mining operations and vehicles on haul roads	C & O	3	3	3	3	3	0,8	2,4		0,8	1,92

ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Noise	Increase in noise levels for receptors within 600m of mining operations (daytime)	C	3	3	3	3	3	0,9	2,7	Relocate all noise sensitive receptors staying within 600m from the closest active mining areas. Use the available topsoil material to develop a berm between the active mining area and community. This berm should be as high as possible.	0,75	2,025
Noise	Increase in noise levels for receptors due to mining operations (night time)	C	4	3	3,5	3	3,25	1	3,25	Relocate all noise sensitive receptors staying within 600m from the closest active mining areas. Use the available topsoil material to develop a berm between the active mining area and community. This berm should be as high as possible. The mine should limit the simultaneous development of an area if it is closer than 3,000m from another mining area to minimise cumulative noise levels;	0,7	2,275
Noise	Increase in noise levels (daytime)	O	3	3	3	3	3	0,6	1,8	With the implementation of the construction phase mitigation measures, no further mitigation is required.	0,6	1,08
Noise	Increase in noise levels (night time)	O	3	3	3	3	3	1	3	Use the available topsoil material to develop a berm between the active mining area and community. This berm should be as high as possible. These berms should only be developed during the daytime period. The mine should limit the simultaneous mining activities at sections closer than 3,000m from another mining section to minimise cumulative noise levels.	0,8	2,4
Topography	Change in landforms due to mining operations and associated infrastructure	C & O	3	3	3	2	2,5	1	2,5	Infrastructure to be removed at the end of the LOM. Financial provision to provide for decommissioning and closure activities.	1	2,5

ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Soils and Land capability	Soil erosion due to mining activities	C & O	3	3	3	3	3	1	3	The footprint of the proposed mining operation and related infrastructure areas should be clearly demarcated. Bare soils can be regularly dampened with water to suppress dust during the construction phase. All disturbed areas adjacent to the infrastructural areas can be re-vegetated with an indigenous grass mix. Temporary erosion control measures may be used to protect the disturbed soils during the construction phase until adequate vegetation has established.	0,7	2,1
Soils and Land capability	Soil compaction due to mining activities	C & O	2	3	2,5	2	2,25	1	2,25	Laydown areas should be located within disturbed soils to avoid compaction of natural soils. If possible, vegetation clearance and commencement of construction and mining activities, can be scheduled to coincide with low rainfall conditions. Heavy equipment must be restricted in operating within wetland related soil boundary, as they are prone to compaction as a result of high clay content.	0,6	1,35
Soils and Land capability	Soil contamination due to mining activities	C & O	3	3	3	3	3	0,8	2,4	A spill prevention and emergency spill response plan should be compiled to guide the construction works. An emergency response contingency plan should be put in place to address clean-up measures. An clean water cut off drain should be constructed upslope of construction and operational areas, in order to re-direct clean water away to avoid chemical soil pollution and groundwater resources.	0,6	1,44

ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Soils and Land capability	Loss of agricultural land capability	C & O	3	3	3	3	3	1	3	During the decommissioning phase the footprint should be thoroughly cleaned, and all building material should be removed to a suitable disposal facility. The footprint should be ripped to alleviate compaction. Stored topsoil should be replaced (if any) and the footprint graded to a smooth surface. The landscape should be backfilled and reprofiled to mimic the natural topography. Slopes of the backfilled surface should change gradually since abrupt changes in slope gradient increase the susceptibility for erosion initiation. The topsoil should be ameliorated according to soil chemical analysis. The soil fertility status should be determined by soil chemical analysis after levelling (before seeding/re-vegetation. Soil amelioration should be done according soil analyses as recommended by a soil specialist, to correct the pH and nutrition status before revegetation. The footprint should be re-vegetated with a grass seed mixture as soon as possible.	0,7	2,1

ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Blasting (without relocation)	Impacts due to ground vibration	O	4	3	3,5	3	3,25	1	3,25	There are houses / settlements identified within 500 m from the operations. Consideration should be given to relocate these households, especially those within 250 m. The calculated minimum safe distance is 527 m and all people and animals within this radius should be evacuated during each blast. An assessment on the structural integrity and existing damage to surrounding structures within a 500 m radius must be undertaken prior to blasting commencing. Do blast design that considers the actual blasting and the ground vibration levels to be adhered to. Only apply electronic initiation systems to facilitate single hole firing. Do design for smaller diameter blast holes that will use fewer explosives per blasthole.	0,8	2,6
Blasting (with relocation)	Impacts due to ground vibration	O	4	3	3,5	3	3,25	1	3,25	There are houses / settlements identified within 500 m from the operations. Consideration should be given to relocate these households, especially those within 250 m. The calculated minimum safe distance is 527 m and all people and animals within this radius should be evacuated during each blast. An assessment on the structural integrity and existing damage to surrounding structures within a 500 m radius must be undertaken prior to blasting commencing. Do blast design that considers the actual blasting and the ground vibration levels to be adhered to. Only apply electronic initiation systems to facilitate single hole firing. Do design for smaller diameter blast holes that will use fewer explosives per blasthole.	0,4	1,3

ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Blasting	Impacts due to air blast	O	4	3	3,5	3	3,25	0,8	2,6	Specific blast design to be done, shorter blast holes and smaller diameter blast hole. The use of specific stemming material to manage air blast as increased stemming lengths reduce the air blast effect.	1	2,6
Blasting	Impacts due to fly rock	O	4	3	3,5	2	2,75	0,8	2,2	Specific blast design to be done, shorter blast holes, smaller diameter blast hole. The use of specific stemming materials to manage air blast, increased stemming lengths to reduce air blast effect. Use of specific stemming to manage fly rock. Re-design with increased stemming lengths.	0,6	1,32
Cultural Heritage	Disturbance of heritage sites and in particular graves found inside the development footprint	C	4	4	4	4	4	1	4	Change the development footprint to allow for the in situ preservation of these sites and graves. Should preservation not be possible, a grave relocation process must be undertaken.	0,2	0,8
Cultural Heritage	Disturbance of heritage sites and graves found outside the development footprint	C	3	3	3	3	3	1	3	Allow for the in situ preservation of these sites. Should this not be possible, a grave relocation process must be undertaken for sites that will be disturbed during mining activities.	0,6	1,8
Palaeontology	Disturbance of sites of palaeontological significance	C	4	4	4	4	4	0,8	3,2	The presence of palaeontological findings is likely. The ECO or environmental manager (EM) should undertake an awareness programme of what these sites could look like if unearthed. The ECO/EM must inform a palaeontologist should any artefacts be found.	0,6	1,92
Air Quality - Cumulative	Cumulative increase in dust emissions due to existing sources at Maquasa operations	C & O	3	3	3	3	3	0,8	2,4	Dust suppression on the unpaved haul routes. Dust suppression to be undertaken in areas where dust emissions are problematic.	0,85	2,04

Balgarthen

ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Groundwater	Change in groundwater levels due to dewatering at pits	O	3	3	3	3	3	1	3	Groundwater and surface monitoring, as recommended in the Geohydrological Report to be undertaken. Dirty surface run-off should be pumped to dirty water dams. These dams should be lined to ensure no future pollution of groundwater resources.	1	3
Groundwater	Change in groundwater quality	O	3	4	3,5	2	2,75	0,8	2,2	Groundwater and surface monitoring, as recommended in the Geohydrological Report to be undertaken. Dirty surface run-off should be pumped to dirty water dams. These dams should be lined to ensure no future pollution of groundwater resources.	0,8	1,76
Groundwater	Generation of AMD and decant to the natural environment	PC	4	4	4	3	3,5	1	3,5	Increasing groundwater levels and groundwater quality should be monitored. Decant water should be appropriately managed.	0,5	1,75
Groundwater	Impact of mine polluting groundwater and surface water	PC	4	4	4	3	3,5	1	3,5	Groundwater and surface monitoring, as recommended in the Geohydrological Report to be undertaken. Decant water should be appropriately managed.	0,8	2,8
Surface Water Resources	Modification of wetland hydrological function (opencast and underground mining)	C & O	4	4	4	4	4	1	4	Ensure that, as far as possible, all infrastructure is placed outside of the delineated watercourses. No use of clean surface water or any groundwater which potentially recharges the watercourses in the area should take place. Very strict control of water consumption must take place. Upstream dewatering boreholes should be considered to minimise the creation of dirty water and this clean water should be used to recharge the natural systems downstream of each of the focus areas. Permit only essential construction personnel within 100m of all riparian systems. Sensitive zones must be demarcated as no-go areas. Implement alien vegetation control program within wetland areas. Very clear and well managed clean and dirty water separation must take place. Pollution control dams must be adequately designed to contain a 1:50 24 hour storm water event. Limit the footprint area of the construction activity to what is absolutely essential.	0,7	2,8
Surface Water Resources	Impact on surface water quality	C & O & PC	4	5	4,5	3	3,75	1	3,75		0,6	2,25
Surface Water Resources	Changes to the Wetland Geomorphological Processes (sediment balance, erosion and sedimentation) due to opencast and underground mining.	C & O & PC	4	4	4	4	4	1	4		0,7	2,8
Surface Water Resources	Loss of wetland habitat and ecological integrity	C & O & PC	4	5	4,5	3	3,75	1	3,75		0,8	3
Surface Water Resources	Loss of aquatic habitat	C & O & PC	4	4	4	3	3,5	1	3,5		0,7	2,45

ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Surface Water Resources	Loss of aquatic biota	C & O & PC	3	4	3,5	3	3,25	1	3,25	Ensure that all spills are immediately cleaned up. Ensure that all stockpiles have measures such as berms and hessian sheets to prevent erosion and sedimentation. Areas with concentrated flow must be managed (energy dissipating structures) in order to slow velocity of water flowing into the wetlands and measures to disperse the flow entering the wetlands must be ensured.	0,7	2,3725
Surface Water Resources	Impact on wetland biota	C & O & PC	4	4	4	3	3,5	1	3,5		0,8	2,8
Biodiversity - Flora	Impact on Floral Diversity and Habitat (grassland and rocky habitat units)	C & O	4	4	4	4	4	1	4	Mitigation measures as detailed in the Floral Assessment Report and EMPr must be implemented. Minimise loss of indigenous vegetation where possible through planning and suitable layouts. Prior to the commencement of construction activities, an Alien Invasive Plant (AIP) Management/Control Plan should be compiled for implementation. Prior to the commencement of construction activities on site, a rehabilitation plan should be developed. A detailed walk down of the footprint area must take place, during which all floral SCC should be identified and marked by a suitably qualified specialist approved by the MTPA. As a minimum, surveys in late November and early February should be undertaken. All areas of increased ecological sensitivity falling outside of the direct mine footprint should be designated as No-Go areas. The footprint areas of all surface infrastructure must be minimised to what is absolutely essential and within the designated and approved mine footprint boundary. The footprint and daily operation of all mining surface infrastructure areas must be strictly monitored to ensure that edge effects from the operational facilities do not affect the surrounding floral habitat.	0,8	3,2
Biodiversity - Flora	Impact on Floral species of conservation concern (grassland and rocky habitat units)	C & O	4	4	4	3	3,5	1	3,5		0,7	2,45
Biodiversity - Fauna	Impact on Faunal Diversity and Habitat (grassland, rocky and freshwater habitat units)	C & O	4	3	3,5	3	3,25	1	3,25	Mitigation measures as detailed in the Faunal Assessment Report and EMPr must be implemented. It is recommended that a summer assessment be undertaken during the months of January and February to more accurately document the faunal communities. A walk through of the rocky habitat unit and grassland habitat units should be undertaken by a registered specialist prior to construction. A formal avifaunal monitoring programme should be established. Where possible pockets of natural vegetation should be retained within the mining footprint to provide habitat for small faunal species such as insects and reptiles. A formal bat monitoring programme should be established.	0,8	2,6
Biodiversity - Fauna	Impact on Faunal species of conservation concern (grassland, rocky and freshwater habitat units)	C & O	4	4	4	4	4	1	4		0,8	3,2
Air Quality	Increase in dust-fallout due to mining operations and vehicles transporting coal on haul roads	C & O	3	3	3	3	3	0,8	2,4	Dust suppression on the unpaved haul routes. Dust suppression to be undertaken in areas where dust emissions are problematic. A dust management plan will need to be developed for onsite activities. Control the number of trucks on the road, weight of trucks and the travelling speed.	0,85	2,04

ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Air Quality	Increase in PM10 and PM2.5 due to mining operations and vehicles on haul roads	C & O	3	3	3	3	3	0,8	2,4	Implement strict vehicle speed limits (e.g. 20-40 km/h). Dust-fallout and PM10 ambient air quality monitoring should be undertaken.	0,8	1,92
Noise	Increase in noise levels (daytime)	O	3	3	3	3	3	0,6	1,8	With the implementation of the construction phase mitigation measures, no further mitigation is required.	0,6	1,08
Noise	Increase in noise levels (night time)	O	3	3	3	3	3	1	3	Use the available topsoil material to develop a berm between the active mining area and community. This berm should be as high as possible. These berms should only be developed during the daytime period. The mine should limit the simultaneous mining activities at sections closer than 3,000m from another mining section to minimise cumulative noise levels.	0,8	2,4
Topography	Change in landforms due to mining operations and associated infrastructure	C & O	3	3	3	2	2,5	1	2,5	Infrastructure to be removed at the end of the LOM. Financial provision to provide for decommissioning and closure activities.	1	2,5
Soils and Land capability	Soil erosion due to mining activities	C & O	4	3	3,5	3	3,25	1	3,25	The footprint of the proposed mining operation and related infrastructure areas should be clearly demarcated. Bare soils can be regularly dampened with water to suppress dust during the construction phase. All disturbed areas adjacent to the infrastructural areas can be re-vegetated with an indigenous grass mix. Temporary erosion control measures may be used to protect the disturbed soils during the construction phase until adequate vegetation has established. This is regarded as critical for the Balgarthen, and Donkerhoek proposed mining operation due to very steep topographic setting.	0,7	2,275

ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Soils and Land capability	Soil compaction due to mining activities	C & O	2	3	2,5	2	2,25	1	2,25	Laydown areas should be located within disturbed soils to avoid compaction of natural soils. If possible, vegetation clearance and commencement of construction and mining activities, can be scheduled to coincide with low rainfall conditions. Heavy equipment must be restricted in operating within wetland related soil boundary, as they are prone to compaction as a result of high clay content.	0,6	1,35
Soils and Land capability	Soil contamination due to mining activities	C & O	3	3	3	3	3	0,8	2,4	A spill prevention and emergency spill response plan should be compiled to guide the construction works. An emergency response contingency plan should be put in place to address clean-up measures. An clean water cut off drain should be constructed upslope of construction and operational areas, in order to re-direct clean water away to avoid chemical soil pollution and groundwater resources.	0,6	1,44
Soils and Land capability	Loss of agricultural land capability	C & O	3	3	3	3	3	1	3	During the decommissioning phase the footprint should be thoroughly cleaned, and all building material should be removed to a suitable disposal facility. The footprint should be ripped to alleviate compaction. Stored topsoil should be replaced (if any) and the footprint graded to a smooth surface. The landscape should be backfilled and reprofiled to mimic the natural topography. Slopes of the backfilled surface should change gradually since abrupt changes in slope gradient increase the susceptibility for erosion initiation. The topsoil should be ameliorated according to soil chemical analysis. The soil fertility status should be determined by soil chemical analysis after levelling (before seeding/re-vegetation. Soil amelioration should be done according soil analyses as recommended by a soil specialist, to correct the pH and nutrition status before revegetation. The footprint should be re-vegetated with a grass seed mixture as soon as possible.	0,7	2,1

ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Blasting	Impacts due to ground vibration	O	4	3	3,5	3	3,25	0,8	2,6	Consideration should be given to relocate households, especially those within 250 m of mining operations. The calculated minimum safe distance is 527 m and all people and animals within this radius should be evacuated during each blast. An assessment on the structural integrity and existing damage to surrounding structures within a 500 m radius must be undertaken prior to blasting commencing. Do blast design that considers the actual blasting and the ground vibration levels to be adhered to. Only apply electronic initiation systems to facilitate single hole firing. Do design for smaller diameter blast holes that will use fewer explosives per blasthole.	0,7	1,82
Blasting	Impacts due to air blast	O	4	3	3,5	3	3,25	0,8	2,6	Specific blast design to be done, shorter blast holes and smaller diameter blast hole. The use of specific stemming material to manage air blast as increased stemming lengths reduce the air blast effect.	1	2,6
Blasting	Impacts due to fly rock	O	4	3	3,5	2	2,75	0,8	2,2	Specific blast design to be done, shorter blast holes, smaller diameter blast hole. The use of specific stemming materials to manage air blast, increased stemming lengths to reduce air blast effect. Use of specific stemming to manage fly rock. Re-design with increased stemming lengths.	0,6	1,32

ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Air Quality - Cumulative	Cumulative increase in dust emissions due to existing sources at Maquasa operations	C & O	3	3	3	3	3	0,8	2,4	Dust suppression on the unpaved haul routes. Dust suppression to be undertaken in areas where dust emissions are problematic.	0,85	2,04

General Underground Mining

ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Groundwater	Change in groundwater levels in upper and lower aquifer	O,C & PC	3	4	3,5	3	3,25	0,8	2,6	Undertake monitoring of aquifer as mining progresses. The monitoring programme need to be reviewed annually to reflect the extent of underground mining. Notify landowners of potential impacts on groundwater levels and yields when underground mining is progressing towards their surface rights. Notify landowners of complaints register process and monitoring network. The groundwater dewatering model need to be calibrated and reviewed every two years until closure.	0,4	1,04
Groundwater	Change in groundwater quality	O,C	4	5	4,5	4	4,25	0,8	3,4	Undertake monitoring programme and review annually to represent the underground mining areas. Sampling of flooded shafts to be undertaken to assess the changes of the quality over time Groundwater pollution plume to be updated annually to assess extent of plume migration	0,8	2,72
Groundwater	Generation of AMD and decant to the natural environment	PC	4	5	4,5	4	4,25	0,8	3,4	Decant water need to be treated if the quality is above the background of the area and catchment objectives. Implement AMD management strategy and decant plan. AMD strategy and decant plan to be updated annually as part of the rehabilitation plans.	0,6	2,04
Surface Water Resources	Modification of wetland hydrological function specifically related to ingress to underground	O	4	4	4	4	4	0,6	2,4	The water flow in wetlands need to be monitored to assess any changes in the flow volumes outside of natural drivers Discharge of treated water need to take place back to the natural watercourses Dams outside of the underground mining footprint that are fed with rivers and watercourses within mining area need to be measured to assess if any flow volumes changes are taking place outside of natural drivers	0,8	1,92
Land Use and Capability	Subsidence of surface	O,C & PC	3	5	4	2	3	0,6	1,8	Pillars need to be in place during mining and can only be removed if the surface integrity is confirmed by a rock engineer. Should any subsidence take place the mine need to compensate the landowner for the loss of land use.	0,4	0,72

Overall Socio-Economic

ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Socio-Economic	Continued Employment of personnel from Maquasa operations	C & O	4	4	4	3	3,5	1	3,5	Employment of personnel to continue and agreements to be in place to support this commitment	1	3,5
Socio-Economic	Loss of agricultural land	O	3	4	3,5	2	2,75	1	2,75	Rehabilitation and redistribution of land to economical agricultural users	1	2,75
Socio-Economic	Loss of employment for agriculture due to loss of land use	C & O	4	4	4	2	3	0,6	1,8	Employment loss to be minimised through continued use agreement of land not being mined	1	1,8
Socio-Economic	Fallout dust affecting grazing and wool production	O	3	4	3,5	2	2,75	0,6	1,65	Dust suppression on the unpaved haul routes. Complaints register.	0,9	1,485
Socio-Economic	Increase in social pathologies (crime such as theft, alcohol abuse, spread of HIV, hawking) due to influx of persons	C & O	4	4	4	2	3	0,6	1,8	Kangra security to patrol haul road and perimeter of operations. Interaction and communication with local police to address issues. Kangra to join local farming initiatives to manage crime and also form part of farmers union.	0,8	1,44
Socio-Economic	Increase in vehicle accidents on public road	C & O	4	4	4	2	3	0,6	1,8	Kangra vehicles to be marked Haul trucks to operate during day time hours Interaction with local farmers union and neighbours to plan traffic congestion during peak farming times	0,8	1,44

11. SUMMARY OF SPECIALIST REPORTS

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
Groundwater Assessment (Gradient Groundwater Consulting, September 2019)	• Groundwater and surface water levels should be monitored. • It is recommended that the monitoring program as set out in this report should be implemented and adhered to. It is imperative that monitoring be initiated prior to any construction activities commence in order to establish a site background benchmark to be applied to serve as an early warning and detection system. • Dirty Water / Pollution Control Dams should be lined to ensure no future pollution of groundwater resources. • Monitoring results should be evaluated and reviewed on a bi-annual basis by a registered hydrogeologist for interpretation and trend analysis for submission to the Regional Head: Department of Water and Sanitation. • Newly proposed monitoring boreholes as set out in this report should be sited by means of a geophysical survey in order to target sub-surface lineaments and/or weathered zones acting as groundwater flow and contaminant transport mechanisms.	**X**	Impact Assessment Tables.

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	• Drilling of additional monitoring boreholes proposed should take place under the supervision of a competent person in order to execute borehole construction and development according to best practise guidelines. • Aquifer tests should be conducted on newly drilled monitoring boreholes to aid in determining aquifer parameter values. • The calibrated groundwater flow model should be updated on a biennial basis as newly gathered monitoring results become available. • Alternative remedial options to reduce pit backfill recharge and effective pit infiltration, which will lead to a decrease in decant volumes, should form part of the mine closure and rehabilitation strategy.		
Air Quality Specialist Study (Rayten Engineering Solutions, September 2019)	• Water sprays for material handling operations (e.g. wet material before excavating and offloading/loading trucks). • Water sprays for drilling, blasting and bulldozing activities. Long-range high-volume irrigation emitters are recommended. • Emissions due to blasting can be reduced by scheduling blasting to occur during calm wind conditions, wetting down entire blast area prior to blast and	**X**	Impact Assessment Tables.

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	implementation of measures that reduce blow-out of stemming material and fines from the blast hole (e.g. use of water cartridges or bullets and blasting balls). • Water spraying for stockpiles and material storage areas. Water spraying of topsoil stockpiles should be avoided to prevent contaminating or damaging topsoil that can be used for rehabilitation purposes. • Wind breaks at coal storage areas or fine material storage piles that are prone to dust emissions. • Use vegetation, topsoil and/or rock armour on large stockpiles and dumps that are prone to wind erosion. • Immediate clean-up of any material (i.e. coal, waste rock/overburden and topsoil) spillages. • Conduct regular site inspections to ensure the dust mitigation measures are being implemented. • A dust management plan will need to be developed for onsite activities. • All main hauling roads should be treated for dust suppression. A combination of a fixed irrigation system and use of water trucks are recommended. A fixed irrigation system can reduce operational costs associated with dust mitigation of haul roads.		

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	• Conduct regular cleaning/sweeping of paved road surfaces to prevent the accumulation of dust. • Control the number of trucks on the road, weight of trucks and the travelling speed. Implement strict vehicle speed limits (e.g. 20-40 km/h).		
Noise Impact Assessment (Enviro Acoustic Research, September 2019)	• Use the available topsoil material to develop a berm between the active mining area and community during the day-time period. This berm should be as high as possible. • The mine should plan to relocate the receptors living within 600m from the active mining area. • The mine should limit the simultaneous development of an area if it is closer than 3,000m from another mining area to minimise cumulative noise levels. • The mine should present the findings of this report to the local community, especially NSDs staying within areas where night-time noise levels will exceed 45 dB. • A quarterly noise monitoring program should be developed and implemented. • Ensure that equipment is well maintained and fitted with the correct and appropriate noise abatement measures.	**X**	Impact Assessment Tables.

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	• The operation should investigate the use of white-noise alarms instead of tonal reverse alarms on heavy vehicles operating on roads. • Quarterly noise monitoring to measure the ambient sound levels at the closest NSD. The community should receive feedback of the noise levels measured in the area. • All employees and contractors should receive Health and Safety induction that includes an environmental awareness component (noise). This is to allow employees and contractors to realize the potential noise risks that activities (especially night-time activities) pose to the surrounding environment. • The mine must implement a line of communication (i.e. a helpline where complaints could be lodged). All potential sensitive receptors should be made aware of these.		
Heritage Impact Assessment (Professional Grave Solutions, September 2019)	• Allow for the *in-situ* preservation of graves identified. • Should this not be possible, a grave relocation process must be undertaken for sites that will be disturbed during mining activities.	**X**	Impact Assessment Tables.

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
Palaeontological Desktop Study (Banzai Environmental, September 2019)	• An EIA level palaeontology report should be conducted to assess the value and prominence of fossils in the development area and the effect of the proposed development on the palaeontological heritage. The purpose of the EIA Report is to elaborate on the issues and potential impacts identified during the scoping phase. A Phase 1 field-based assessment will be conducted and research in the site-specific study area as well as a comprehensive assessment of the impacts identified during the scoping phase	**X**	Impact Assessment Tables.
Terrestrial Ecological Assessment - Flora (Scientific Terrestrial Services, September 2019)	• Design of infrastructure should be environmentally sound. The designs must adhere to all legislation such as Regulation GN704 and all possible precautions taken to prevent potential spills and /or leaks, as well as unnecessary clearance of vegetation. • Minimise loss of indigenous vegetation where possible through planning and suitable layouts. As far as possible no infrastructure should be placed within intermediate to highly sensitive habitat – especially where these areas coincide with CBAs (Donkerhoek and Twyfelhoek) and threatened ecosystems (all three focus areas).	**X**	Impact Assessment Tables.

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	• It is recommended that prior to the commencement of construction activities the entire construction servitude be fenced off and clearly demarcated to limit footprint creep and edge effects; • Prior to the commencement of construction activities on site, an AIP management plan and rehabilitation plan should be developed for implementation. • Prior to construction, a detailed walk down of the footprint area must take place, during which all floral SCC should be identified and marked by a suitably qualified specialist approved by the MTPA. Surveys should be overseen by MTPA and would need to be conducted within the correct flowering season for all potentially occurring SCC (late November and early February). • Marking and/or rescue and relocation activities would likely require surveys to take place several times to coincide with the flowering period of all potentially occurring SCC. • All areas of increased ecological sensitivity falling outside of the direct mine footprint should be designated as No-Go areas.		

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	• The footprint areas of all surface infrastructure must be minimised to what is absolutely essential and no additional must be disturbed. • Vehicles should be restricted to travelling only on designated roadways. • Permits from the relevant authorities, i.e. Mpumalanga Tourism and Parks Agency (MTPA) and Department of Agriculture, Forestry and Fisheries (DAFF), should be obtained before removal, cutting or destruction of protected species or floral SCC before any proposed mining activities may take place. • No illicit fires must be allowed during the construction and operational phases of the proposed mining development. • Rehabilitation of natural vegetation should proceed in accordance with a rehabilitation plan compiled by a suitable specialist. This rehabilitation plan should consider all development phases of the project indicating rehabilitation actions to be undertaken during and once construction has been completed, ongoing rehabilitation during the operational phase of the project as well as rehabilitation actions to be undertaken during mine closure;		

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
Terrestrial Ecological Assessment - Fauna (Scientific Terrestrial Services, September 2019)	• It is recommended that a summer assessment be undertaken during the months of January and February to more accurately document the faunal communities. • Upon approval a thorough walk through of the rocky habitat unit and grassland habitat units should be undertaken by a registered specialist for signs of Scelotes mirus (Montane Burrowing Skink, LC) and Harpactira hamiltoni (Highveld Baboon Spider, NE) prior to construction, if present the necessary permits should be applied for and appropriate relocation plans drafted. • It is recommended that a formal avifaunal monitoring programme be established. • Removal/ cutting down of large trees (>4m) should be avoided and where possible, pockets of natural vegetation should be retained within the mining footprint to provide habitat for small faunal species. • No poison is to be used in an effort to control rodent species as this will lead to the long-term poisoning of predatory birds, reptiles and small carnivorous species.		

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	• Downlighting, low frequency lights and red lighting should be used around infrastructure notably at night to minimise the attraction of insects and consequently bat species so as to minimise the risk of bat colliding with mine related infrastructure. It is further recommended that a formal bat monitoring programme be established and implements • Revegetation of disturbed areas should be carried out in order to improve historic habitat availability and minimise soil erosion and surface water runoff. • Where an SCC is encountered on site, all activities are to be halted and a suitably specialist is to be consulted as to the best way forward. • No hunting/trapping or collecting of faunal species is allowed. • Educate personnel about venomous snakes, scorpions and spiders and that these species are not to be harmed. Should any such species be encountered they are to be safely moved outside of the disturbance footprint by a suitably qualified person. • Ensure that no unnecessary clearing of faunal habitat occurs.		

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	• Where overhead cables or powerlines are located near the Woody Ravine or Freshwater habitats bird flappers are to be used in order to minimise the risk of bird strikes, notably as the mining area is located in an IBA. • Following heavy rains, PCDs, stormwater dams and access roads are to be inspected for signs of erosion, which if found must be immediately rectified through appropriate erosion control measures. • Monitor the success of rehabilitation efforts of the focus areas and access roads seasonally.		
Watercourse and Aquatic Ecological Assessment (Scientific Aquatic Services, September 2019)	• Ensure that, as far as possible, all infrastructure is placed outside of the delineated watercourses. A minimum buffer of 100m to be maintained around all wetland and riparian systems, in line with the requirements of Government Notice 704 as published in the Government Gazette 20119 of 1999. • No use of clean surface water or any groundwater should take place. In this regard specific mention is made of any water use which will affect the instream flow in the Assegaai River and the associated tributaries.	**X**	Impact Assessment Tables.

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	• Very strict control of water consumption must take place and detailed monitoring must take place and, where possible, all water usage must continuously be optimised. • Upstream dewatering boreholes should be considered to minimise the creation of dirty water and this clean water should be used to recharge the natural systems downstream of each of the focus areas; • Pollution control dams should be off stream and not within the natural drainage system of the area. • Permit only essential construction personnel within 100m of all riparian systems. • Keep all demarcated sensitive zones outside of the construction area off limits during the mining and associated construction phase of the proposed Kusipongo project. • Implement alien vegetation control program within wetland areas with special mention of water loving tree species. • Very clear and well managed clean and dirty water separation must take place in line with the requirements of GN704 as published in the Government Gazette 20119 of 1999.		

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	• Pollution control dams must be adequately designed to contain a 1:50 24 hour storm water event. • All pollution control facilities must be managed in such a way as to ensure that storage and surge capacity is available if a rainfall event occurs; • Limit the footprint area of the construction activity to what is absolutely essential. • Ensure that all spills are immediately cleaned up. • All hazardous chemicals must be stored on specified surfaces. • Ensure that all stockpiles are well managed and have measures such as berms and hessian sheets implemented to prevent erosion and sedimentation. • Prevent run-off from dirty water areas entering stream systems through ensuring clear separation of clean and dirty water areas. • Areas concentrated flow must be managed (energy dissipating structures) in order to slow velocity of water flowing into the wetlands and measures to disperse the flow entering the wetlands must be ensured.		

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
Traffic and Road Impact Assessment. (TTT Traffic and JG Afrika, September 2019)	• To minimise dust pollution, dust suppression of gravel roads will be required during both construction and operational phases. • During the construction phase, regular maintenance of gravel roads should be undertaken. • During the construction phase, staff and general trips can be spaced to occur outside of peak periods as far as possible. • Improved road signage to inform and warn drivers e.g. speed limit signs, intersection ahead sign. • Any widening and alignment changes should be undertaken by an engineer or geometric design professional. • Due to the multiple access roads leading to the Maquasa East plant, these roads can be used to alleviate congestion at the Maquasa East intersection should it be required. • Depending on the width of the ADT to be used to haul material, the width of the gravel roads should be wide enough to safely accommodate bi-directional traffic. These improvement requirements for haul roads are discussed in detail in the pavement report. • At intersections, good and clear sight-distance of at least 300 m is required to ensure that vehicles can safely turn into and out of the roadway.	**X**	Impact Assessment Tables.

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	• The road authority to be consulted at an early stage regarding road upgrades, accesses, tonnage restrictions, maintenance, the Siatentela initiative and their requirements and processes. • A formal risk assessment of the haulage operation be carried out at the correct level of engineering expertise. • Haul routes be refined, and alternatives investigated e.g. Balgarthan Adit 1 to Adit 2. • A haul simulation study be carried out taking the types of haul vehicles, slopes, curves and production rates into account. • An economic study be completed taking and Capex and Opex into account. • Material availability be investigated e.g. the suitability of overburden material.		
Hydropedology (The Biodiversity Company, September 2019)	• A blasting assessment has been recommended to determine the possibilities of cracks forming in the upper bedrock layer during blasting; • A subsidence risk assessment must be completed to determine the possibility of subsidence occurring. Subsidence could disrupt vadose zone properties and affect hillslope hydrology significantly. • A groundwater assessment/geochemical assessment has been recommended to determine the loss of flow from groundwater aquifers to the watercourse.	**X**	Impact Assessment Tables.

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
Blasting (Blast Management and Consulting, September 2019)	• The mine will need to apply for the necessary authorisations as prescribed in the various Acts, specifically the Mine Health and Safety Act Regulation 4.16 for all non-mining structures within 500 m from mining operations. • There are nine houses / settlements identified within 500 m from the proposed mining operations. Consideration should be given to relocate these households. • The option of a photographic survey of all structures up to 1500 m from the pit area is recommended. This will assist with any negotiations with regard to complaints from neighbours on structural issues due to blasting. • It is recommended not to blast too early in the morning when it is still cool or when there is a possibility of atmospheric inversion or too late in the afternoon in winter. Do not blast in fog or in the dark. • The use of minimum a 500 m exclusion zone is recommended, and it will be required that evacuation be negotiated when blasting is done. • A monitoring programme for recording blasting operations is recommended.	**X**	Impact Assessment Tables.

12. ENVIRONMENTAL IMPACT STATEMENT

12.1 SUMMARY OF KEY FINDINGS OF THE ENVIRONMENTAL IMPACT ASSESSMENT

The following have been identified as the key findings of the impact assessment:

12.1.1 Groundwater

A numerical groundwater flow and transport model was calibrated using the field results and various flow and transport scenarios were simulated to base the groundwater impact assessment on. The scenarios assume that concurrent backfilling of the opencast pits will occur, and the most likely case and preferred scenario assumes that the backfill material comprise mostly of non-carbonaceous material as was evident from the geochemical assessment. The results of the model simulations are included below:

Balgarthen B Pit

Groundwater flow model simulations suggest relatively low groundwater ingress volumes for Balgarthen pit with an average rate of 10.6 m3/d expected for the LOM operational period. Accordingly, no significant groundwater depression zone and/or water level drawdown is anticipated. Losses in baseflow discharge is also deemed insignificant. Expected decant volumes is also low and in the order of 10 m3/d, reaching a maximum concentration of 1320 mg/l. The simulated sulphate pollution plume is migrating towards a general north to north-eastern downstream direction and has an extend of approximately 0.57 km2 without any mitigation. The preferred mitigation scenario during operations (see Figure 12.1) and post closure (see Figure 12.2) reduces the plume extend to 0.28 km2, with an effective footprint reduction of ~ 50.0 %.

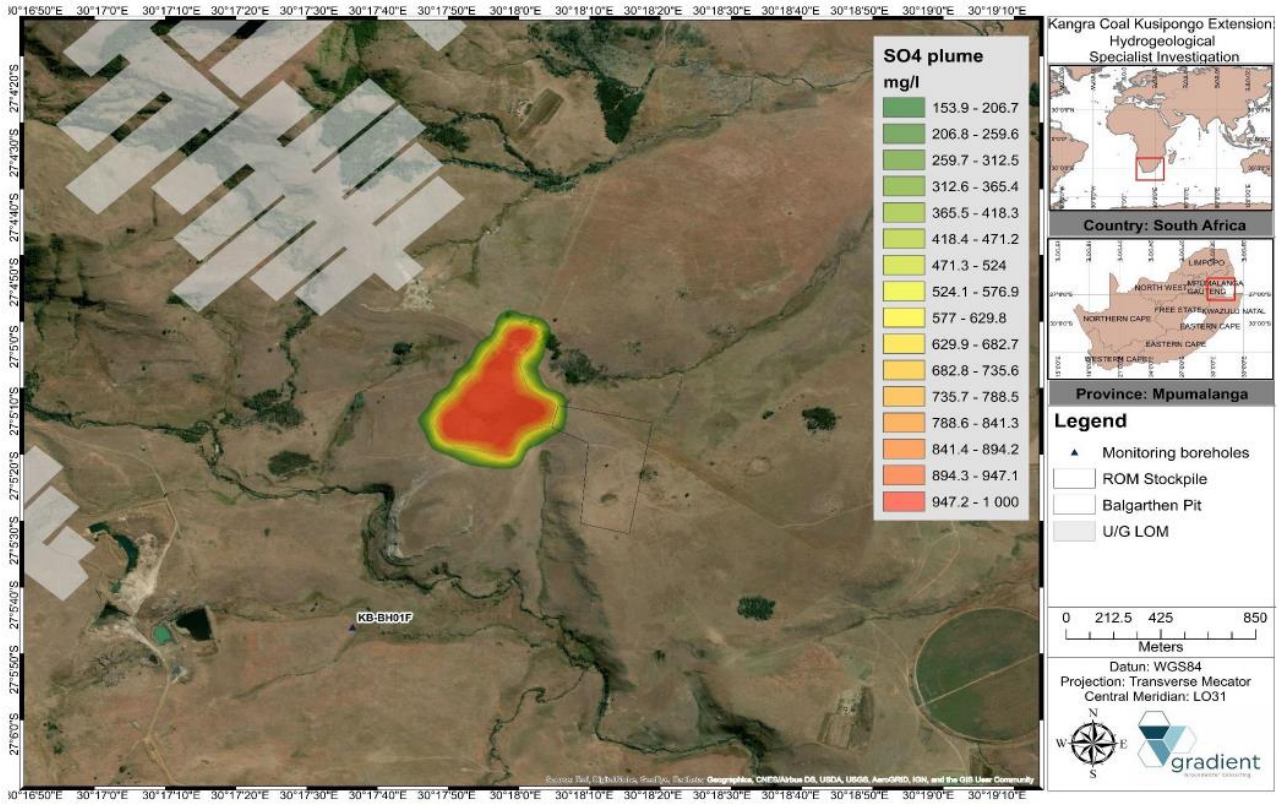

FIGURE 12-1: BALGARTHEN B PIT MITIGATED SCENARIO DURING OPERATIONS

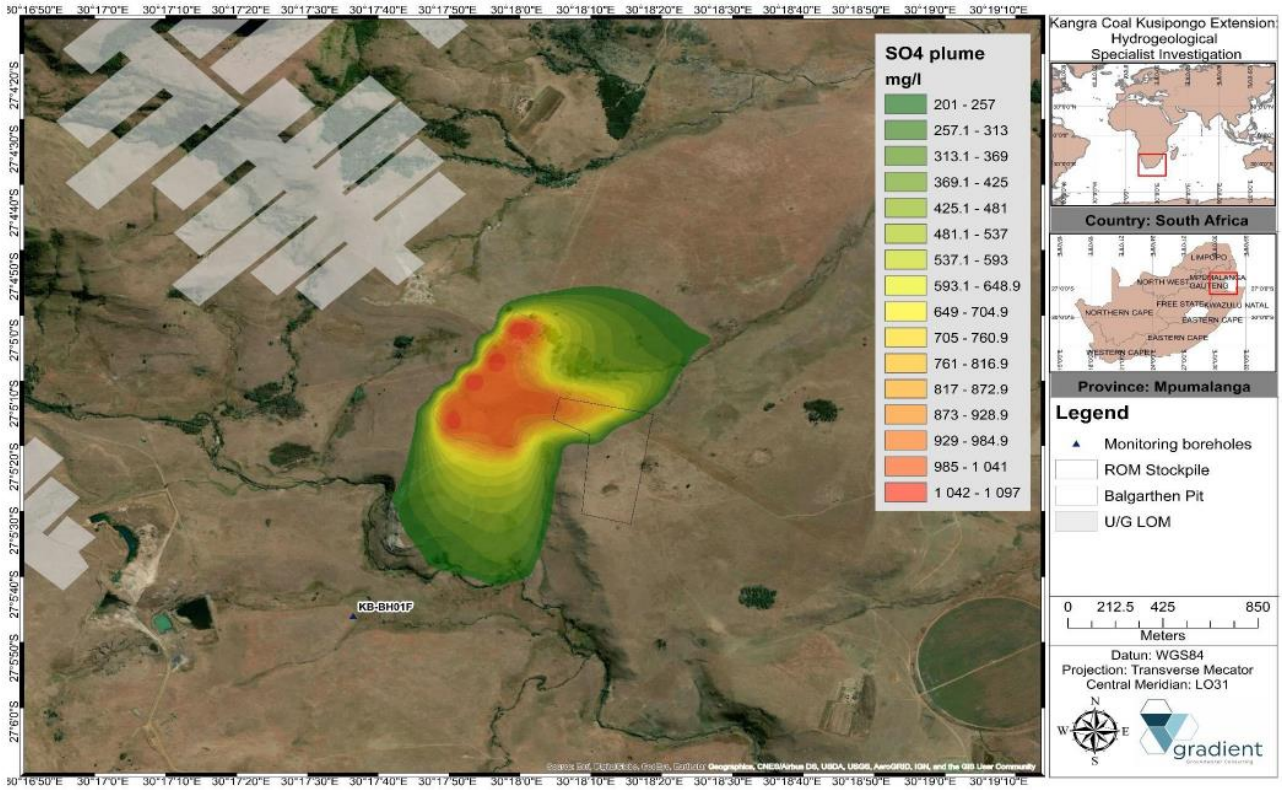

FIGURE 12-2: BALGARTHEN B PIT MITIGATED SCENARIO POST CLOSURE

Twyfelhoek Pits

Model simulations for Twyfelhoek pit indicate an average groundwater ingress volume of 408.0 m3/d and the influence of pit dewatering on baseflow discharge to local drainages account to an average of > 50% reduction during the operational period. The groundwater zone of depression footprint is approximately 0.78 km2 reaching a maximum distance of ~300.0 m towards the north-eastern perimeter while the groundwater drawdown ranges from ~ 9.0 mbsl to ~ 29.0 mbsl. The mine post-closure scenarios indicate that the local hydraulic head distribution will return to pre-mining conditions within a period of approximately 4.0 to 5.0 years after termination of pit dewatering and decant volumes will range from <13.0 m3/d to ~86.0 m3/d depending on recharge volumes. The simulated decant quality reaches a maximum sulphate concentration of ~1320 mg/l. The simulated sulphate pollution plume is migrating towards a general north to north-eastern downstream direction and has an extend of approximately 0.87 km2 without any mitigation. The preferred mitigation scenario during operations (see Figure 12.3) and post closure (see Figure 12.4) reduces the plume extend to 0.40 km2, with an effective footprint reduction of > 50.0 %.

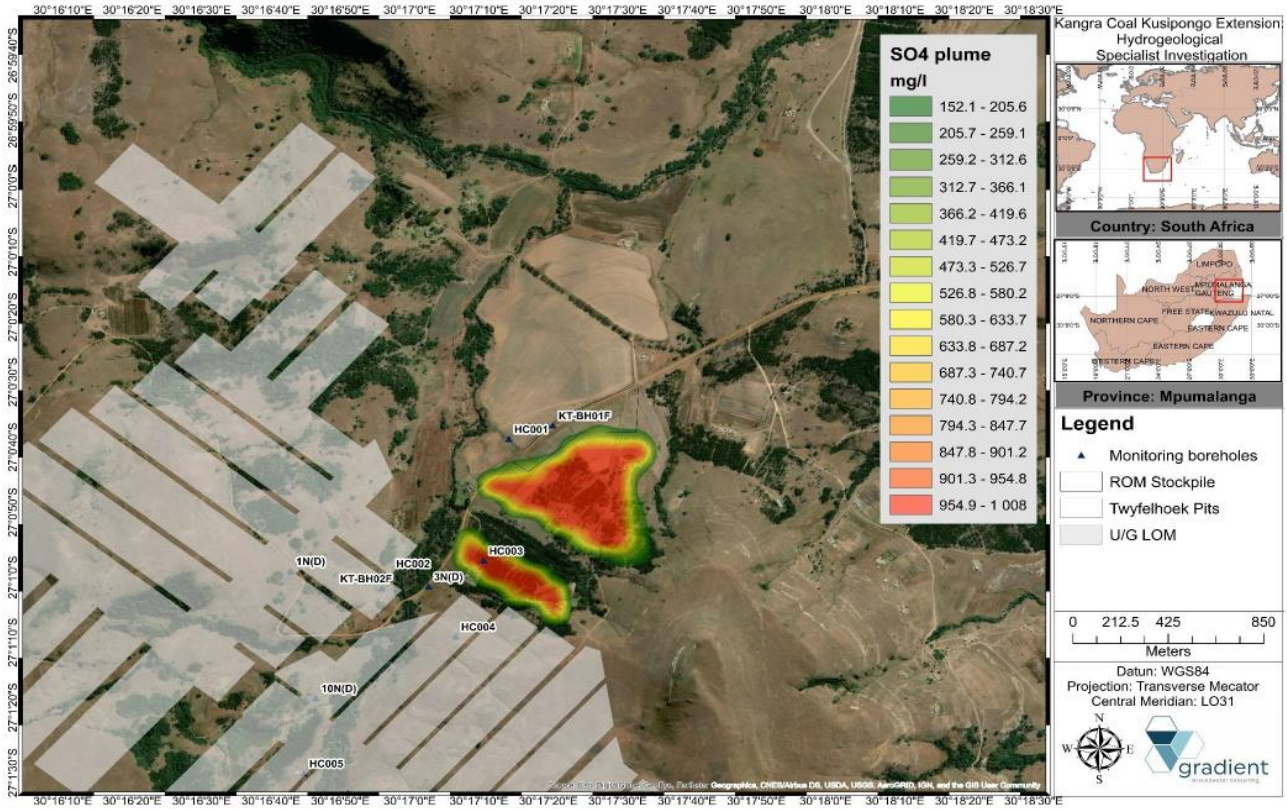

FIGURE 12-3: TWYFELHOEK PITS MITIGATED SCENARIO DURING OPERATIONS

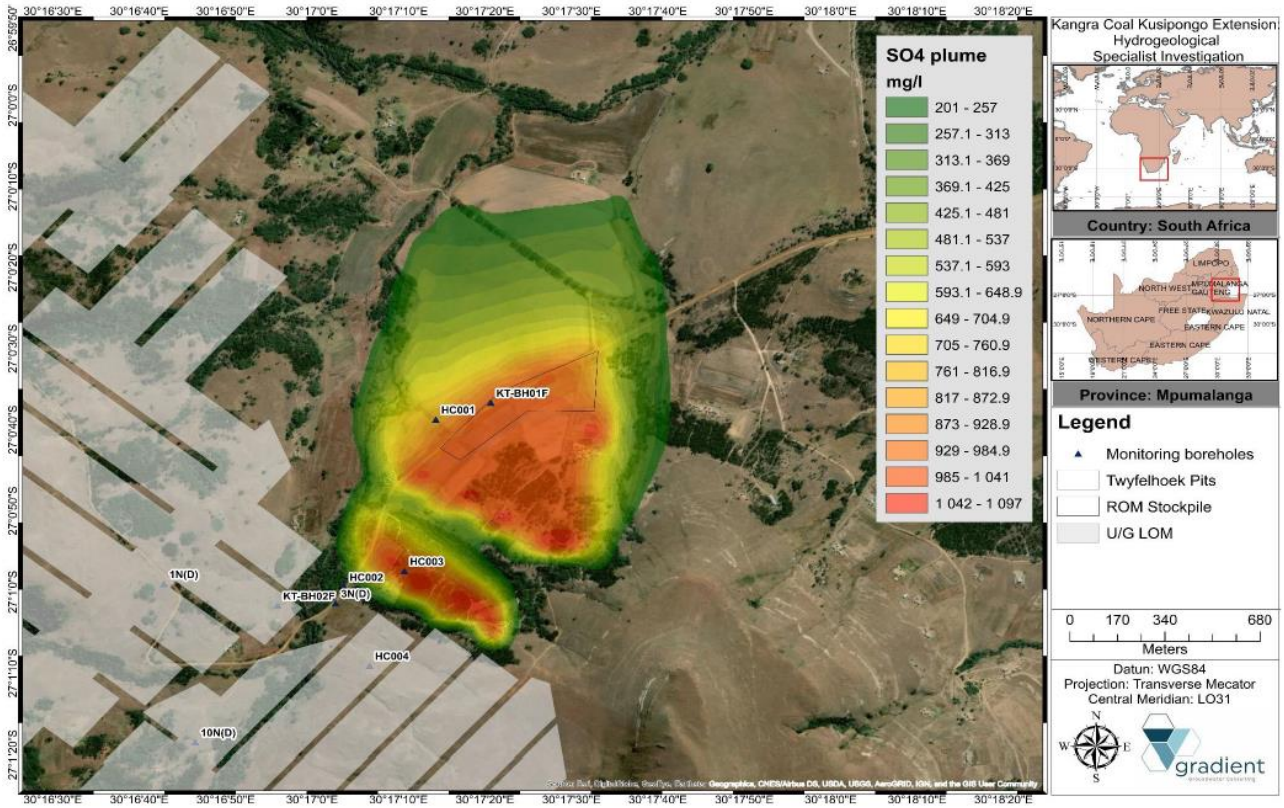

FIGURE 12-4: TWYFELHOEK PITS MITIGATED SCENARIO POST CLOSURE

Donkerhoek Pits

Model simulations for Donkerhoek pit indicate an average groundwater ingress volume of 487.0 m3/d and the influence of pit dewatering on baseflow discharge to local drainages account to < 10% reduction during the operational period. The groundwater zone of depression footprint is approximately 0.58 km2 reaching a maximum distance of ~230.0 m towards the south-western perimeter while the groundwater drawdown ranges from ~ 3.0 mbsl to ~ 24.0 mbsl. The mine post-closure scenarios indicate that the local hydraulic head distribution will return to pre-mining conditions within a period of approximately 4.0 to 7.0 years after termination of pit dewatering and decant volumes will range from ~15.0 m3/d to >100.0 m3/d depending on recharge volumes. The simulated decant quality reaches a maximum sulphate concentration of ~1500 mg/l. The simulated sulphate pollution plume is migrating towards a general north to north-eastern downstream direction and has an extend of approximately 0.77 km2 without any mitigation. The preferred mitigation scenario during operations (see Figure 12.5) and post closure (see Figure 12.6) reduces the plume extend to 0.57 km2, with an effective footprint reduction of ~ 25.0 %.

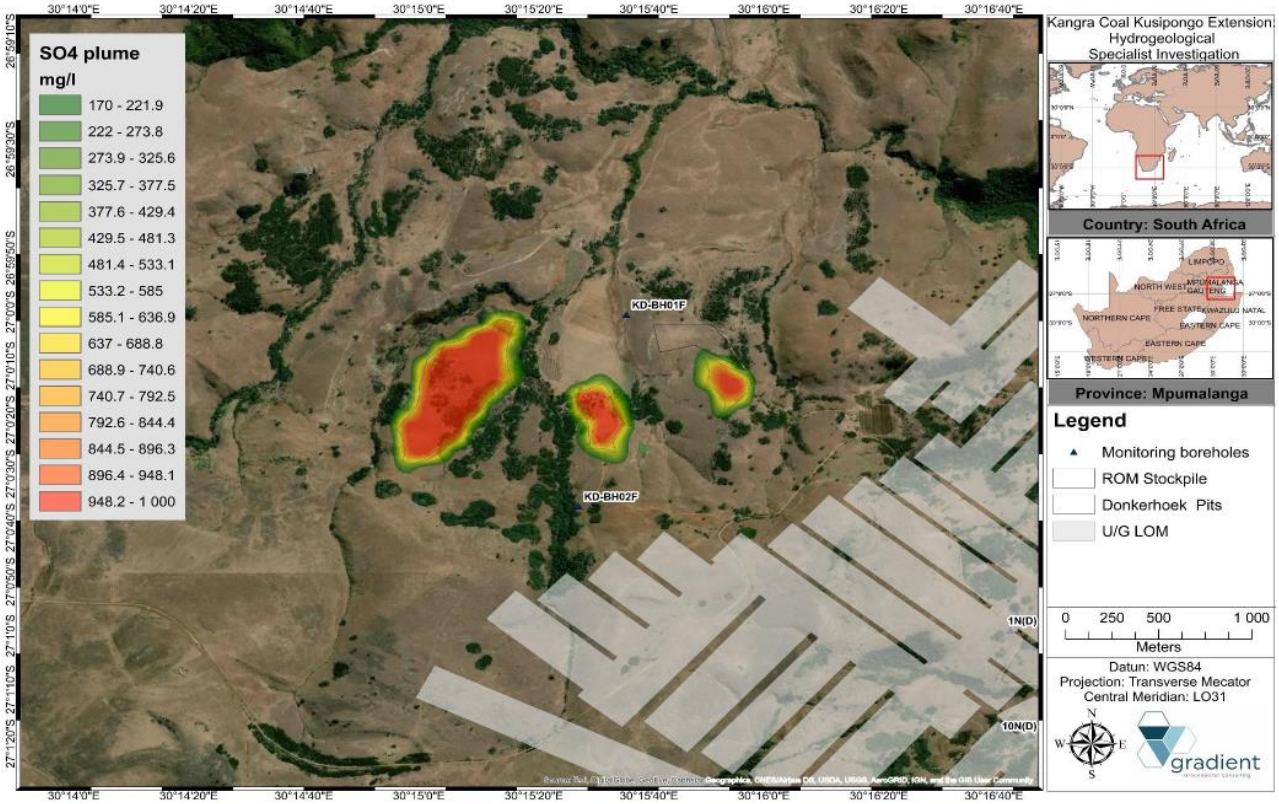

FIGURE 12-5: DONKERHOEK PITS MITIGATED SCENARIO POST CLOSURE

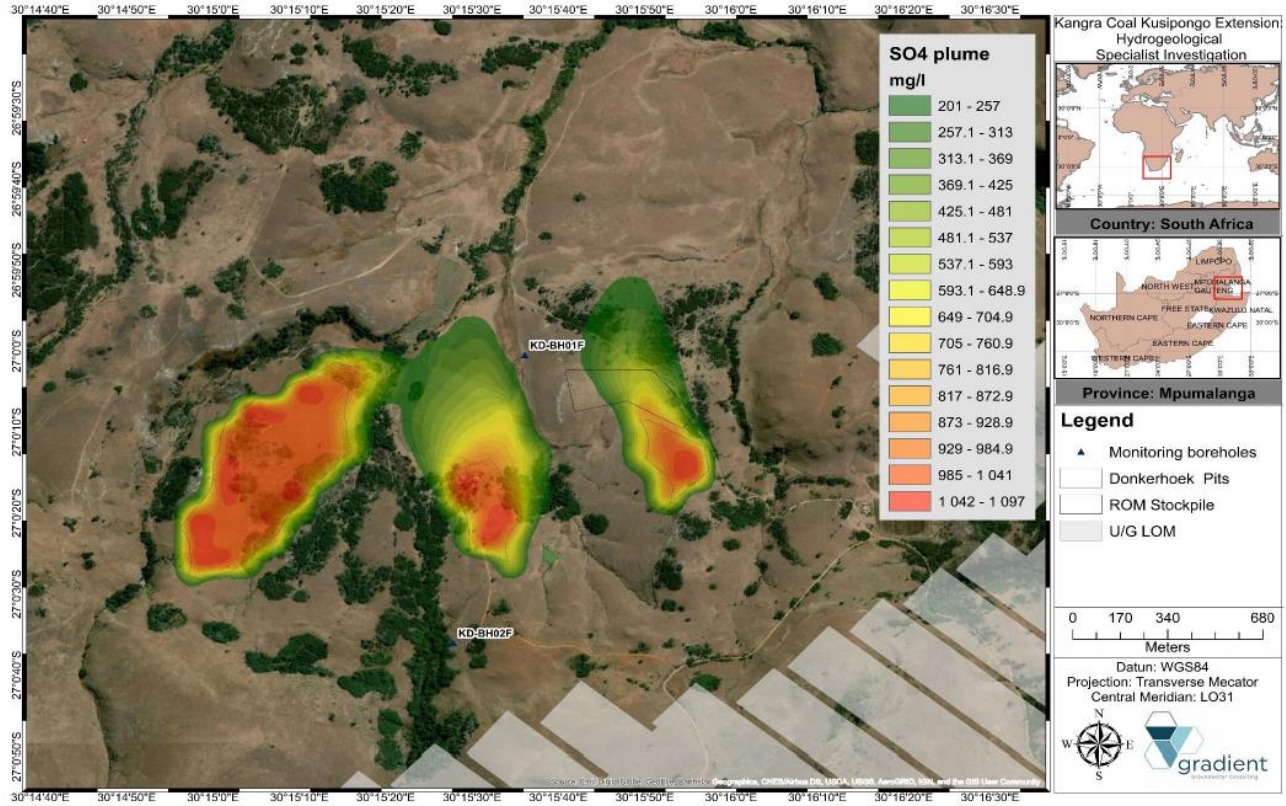

FIGURE 12-6: DONKERHOEK PITS MITIGATED SCENARIO POST CLOSURE

Underground Sections

Model simulations for the underground operations indicate average groundwater ingress volume of 968.0 m3/d (Balgarthen), 823.0 m3/d (Balgarthen A) and, Twyfelhoek, 2082 m3/d during the operational phases. Underground dewatering losses account a reduction of ~20% in baseflow discharge to local drainages. The groundwater zone of depression footprint is approximately 4.30 km2 (Twyfelhoek UG), 4.50 km2 (Balgarthen UG) and 3.04 km2 (Balgarthen A UG) with the groundwater drawdown ranging from ~ 4.0 mbsl to ~ 2.0 mbsl. The mine post-closure scenarios indicate that the local hydraulic head distribution will return to pre-mining conditions within a period of approximately 4.0 to 5.0 years after termination of shaft dewatering and decant volumes will range from ~5.0 m3/d to >65.0 m3/d depending on recharge volumes. The simulated decant quality reaches a maximum sulphate concentration of ~1400 mg/l. The simulated pollution plume migrates towards lower-lying, downstream direction, reaching a maximum distance of ~650 m towards the eastern and north-eastern perimeters while model post-closure simulations suggest the plume continues migrating in a down-gradient direction stretching to a distance of 1.50 km in a general eastern to north-eastern direction.

Alternative management and mitigation scenarios simulated included: (a) establishment of seepage capturing i.e. scavenger boreholes down-gradient of the waste facilities, (b) implementation of a sub-surface cut-ff trench and (c) which is the most likely case and preferred scenario, where the pits will be backfilled with material consisting mostly of non-carbonaceous material and the ROM stockpiles will be lined. Seepage capturing boreholes had a mitigatory impact on the pollution plume migration, reducing total pollution plume footprint to a certain extend whereas a sub-surface cut-off trench did not have a significant impact on the pollution plume migration. A reduction in the effective sulphate pollution plume extend of between 25.0% to > 50.0 % is simulated for the preferred mitigation alternative scenario.

The model results were incorporated into a risk rating matrix to determine the significance of potential groundwater related impacts as discussed below:
During the construction phase, minimal additional impacts in the groundwater system are expected. The main activities that could impact on groundwater in this phase include minor groundwater dewatering during overburden stripping and construction start of the OC pit and adit. The cone of depression will be localised. Wetlands in the direct footprint / vicinity of the planned opencast pit and adit will be destroyed.

For all three sites, the significance of this impact is very low for the river and aquifers and high for the wetlands.

During the operational phase (year 1 of the LOM) of the mining project, groundwater will seep into the opencast pits and adits at all sites (to access UG). This water will then be pumped out creating a cone of depression which may negatively impact on groundwater yield to the aquifers, the river and

the wetlands. Due to the extent and duration of the opencast pits and adits the cone of depression is localised though. For all three sites the significance of this impact is low for the rivers (drainages) and moderate the aquifers and wetlands. Water quality is expected to be more of a problem-post closure than during the operational phase of mining due to the fact that the dewatering cone will tend to limit the spread of any contamination. Due to the extent and duration of opencast mining and adits the significance of this impact is low for the river and aquifers and very low for the wetlands.

It is expected that dewatering of the underground workings may have an impact on the upper aquifers in the dolerite intrusion contact areas but that the extent of the dolerite sills will play more of a remedial role in the remainder of the site by creating a confining layer in places. The impact in loss in yield of baseflow contribution to the river will be minimal. The impact of the lowering water table or increasing extent of the cone of depression associated with underground mining is rated as very low for the river, low for the wetlands and high for the aquifers. As with opencast mining, water quality is expected to be more of a problem-post closure than during the operational phase of mining. The dewatering cone contribute to the localisation of contamination also. The significance of this impact is low for all receptors.

During post closure, the flooding of the mine is dependent on a number of factors including preferential flow zones such as geological lineaments. It is expected that poorer quality groundwater will be present on the mine horizon when total flooding is completed. Therefore, the decanting water can be of a poor quality. This will most probably impact on the streams and wetlands in the vicinity of the mine. The pre-mitigation rating for the aquifers, river and wetlands are rated as high because without decant control the quality impacts will be problematic, regardless of the receiving environment type. Post mitigation rating for all three are low.

Once mining operations have ceased it is expected that most pollution sources on site will be removed including the ROM stockpiles. It is expected that the operational phase impacts of the ROM stockpile area, without mitigation measures, i.e. lining of the stockpiles, may extend beyond the operational phase which may still result in high salt load to the downstream receptors. The pre-mitigation rating for all receptors is seen as high whereas the post-mitigation impact for all three is low.

After mining ceases, the underground workings will likely decant into the adits, thereafter the adits will decant into the environment. The pre-mitigation rating for the aquifers, river and wetlands are rated as high because without decant control the quality impacts will be problematic, regardless of the receiving environment type. Post mitigation rating for all three are low.

12.1.2 Waste

The aim of the waste assessment is to be able to design the storage facilities and water management measures related to the mineral waste and coal stockpiles. The waste assessment was conducted in terms of the Norms and Standards for the Assessment of Waste indicated that all samples (overburden and coal) are classified as Type 3 waste (low hazardous). These stockpiles will therefore require a Class C liner. The PCDs also contain Type 3 waste and will therefore require a Class C liner as well.

12.1.3 Air Quality

An increase in dust-fall, PM_{10} and $PM_{2.5}$ particles are anticipated air quality impacts and are emitted from the following sources:

- Drilling and blasting into overburden at the proposed opencast pit areas;
- Bulldozing;
- Materials handling operations (truck loading/offloading operations);
- Wind erosion from exposed areas, proposed opencast pits, exposed surfaces and stockpiles;
- Front-end loaders used to load trucks with coal;
- Vehicle dust entrainment on unpaved roads;
- Conveyor transfer points at adits and West Plant (outside Kusipongo mining right area, existing); and
- Primary and secondary crushing activity at West Plant (outside Kusipongo mining right area, existing).

These particles are also present as background dust and the development will not be the sole contributor to the impact. Predicted incremental dust-fall rates comply with the residential area standard of 600 mg/m^2/day and non-residential area standard of 1200 mg/m^2/day over most of the project area. Prior to mitigation, exceedances of the standards are limited to areas along the proposed haul routes and around the mine operational areas. Predicted incremental $PM_{2.5}$ concentrations are low over most of the project area, with higher concentrations (including some exceedances of the applicable limits) concentrated around the Donkerhoek and Balgarthen operational areas. Predicted incremental PM_{10} daily average concentrations are shown to be relatively high, with exceedances of the daily standard observed over most of the eastern parts of the project area and Kusipongo mining right area. Predicted incremental annual average concentrations comply with the annual standard over most of the project area with higher concentrations observed in close proximity to the emission source (mine operational areas and haul routes).

Mitigation measures have been proposed that include road wetting or stabilisation to achieve control efficiencies of 30% as well as sprayer systems at conveyor belts. With the implementation of mitigation measures the levels of dust is anticipated to be mitigated to acceptable levels. A dust particle monitoring plan has also been proposed for the mine to be able to regularly assess the success of the mitigation and adjust if needed.

12.1.4 Noise

The proposed mining activities will increase the noise levels and based on noise modelling undertaken, mining construction activities may start to change the potential ambient sound (quiet environment) levels up to 3,300m from activities. The significance of the daytime noise impact for construction was assessed as being medium, while the significance of the night-time noise impact as high.

During the operational phase of the proposed mining activities, the significance of the daytime noise impact was concluded to be low, following mitigation measures undertaken during the construction phase and the significance of the night-time noise impact may be moderate before and after mitigation.

In summary the proposed mining activities (worse case evaluated) will raise the noise levels at the closest potential sensitive receptor for all three sections. These noises will be disturbing mainly during nighttime but can be reduced with mitigation. It will however be required to relocate a number of the closest receptors should the noise continuously exceed night and/or daytime limits. The noise impacts (after mitigation) may have a medium significance during the night-time period, though mitigation exist that could reduce the significance to low.

12.1.5 Soils, Land Capability and Land-use

The areas where the proposed mining operation and related infrastructure are proposed are predominantly comprised of high potential agricultural soils. High impacts are foreseen on these soils from a land capability point of view before mitigation measures are implemented and moderate after mitigation has been carefully implemented during all phases of development.

The proposed mining operations and associated infrastructure is anticipated to result in loss of portions of agricultural land capability since the focus area is dominated by arable soils. These soils are currently of significant importance in supporting rural communities surrounding the Twyfelhoek and Donkerhoek focus areas, on both subsistence farming and small-scale commercial farming. The use of grazing will be affected in the Balgarthen section.

The land capability loss is anticipated to be medium-high during construction and operation as the dominant soils are considered ideal for cultivation, attributable to their deep well-drained nature and low erosion hazard. With effective mitigation and management of soils during operation the impact can be reduced, and post closure land uses continue. The loss of grazing capacity and crop production due to the direct loss of the footprints during construction, operation and closure until production is regained should be compensated for if the land is leased. The regional effect of the lost production due to the footprints is low.

12.1.6 Biodiversity

Based on the results of the floral assessment the proposed mining activities within the various focus area within the Kusipongo Mining Rights areas (MRA) has the potential to significantly impact on biodiversity locally, with the potential for regional-scale impacts. The Balgarthen and, to a lesser degree, the Donkerhoek focus area are still largely represented by natural, intact vegetation that are sensitive and ecologically important, i.e. primary grasslands and rocky habitat. There is limited disturbed areas in the Balgarthen and Donkerhoek focus areas to accommodate the placement of the mine infrastructure in areas that will have a low impact on the floral biodiversity of the region. In contrast to the Balgarthen and Donkerhoek focus areas, the Twyfelhoek focus area is mostly considered to be modified by cultivation, wattle proliferation and built-up areas and thus the overall significance of impact at the Twyfelhoek focus area is lower.

Apart from sensitive habitat occurring within the focus areas, several floral species of conservation concern (SCC) were recorded within each focus area.

There are areas of the Donkerhoek and Twyfelhoek focus areas that fall within Irreplaceable Critical Biodiversity Areas (CBAs) and most of the Balgarthen focus area falls within Ecological Support Areas (ESAs). Irreplaceable CBAs cannot be offset and therefore if the mining is approved within the focus areas, compensation for residual loss of primary grasslands will have to take place by conserving other important biodiversity aspects in acknowledgment of the loss of CBA habitat.

Probable Latent Impacts

The following points highlight the key latent impacts that have been identified:

- Loss of ecologically sensitive, irreplaceable faunal habitat causing the displacement of faunal SCC;
- Continued loss of faunal habitat diversity;
- Continued loss of and altered faunal species diversity;
- Loss of habitat and faunal species, notably avifaunal, will significantly compromise the overall conservation goals for the area in which the mine is located; and

Disturbed areas are highly unlikely to be rehabilitated to baseline levels of ecological functioning and significant loss of faunal habitat, species diversity and faunal SCC will most likely be permanent.

Concerns from a biodiversity resource management perspective include:

- Many rare or endemic species occur in grasslands and the current assessment of SCC for the focus areas is likely not a full representation of conservation important species that occur on site. A summer assessment is deemed essential and should ideally take place in both late November and early February to full saturation of the species lists developed as part of the study and to ensure the EMP is comprehensive in the management of SCC and robust to ensure appropriate execution.
- Limited rehabilitation potential. Due to the presence of sensitive habitats of high conservation value, it is preferred that all rehabilitated areas should be rehabilitated to a point where natural processes will allow the pre-development ecological functioning and biodiversity of the area to be re-instated through natural processes. Due to the location of the focus area in Irreplaceable CBAs and ESAs, opencast mining and quarrying are considered as a land-use that will compromise Mpumalanga's biodiversity objective and is thus not deemed permissible (MTPA, 2014). As far as is possible, the mine layout should not be located in sensitive habitat (as identified in the specialist reports) that coincide with CBAs and the footprints of the mining areas should be limited to the minimum to ensure feasible mining and optimal resource extraction.

Specialist recommendations

The findings of the specialist assessments undertaken recommended that strong consideration be given to the proposed layout to exclude sensitive habitat units or to opt for Alternative C (underground mining with access via adits only) at the Balgarthen and Donkerhoek focus areas. For these sites, it is recommended that Alternative C be further investigated as the potential impacts on floral habitat, diversity and SCC from mining activities associated with Alternative B are likely to be significant on a local and, potentially, regional scale.

A combination of Alternative B and C could be considered for the Donkerhoek focus area, provided that only secondary grassland and modified habitat be targeted for opencast mining. The proposed Alternative B mine layout for the Twyfelhoek focus area is considered acceptable but can be optimised from a floral biodiversity management perspective.

12.1.7 Surface Water Resources (including Wetlands)

The specialist assessment undertaken found that the aquatic and wetland features within the majority of the area are in a largely natural to natural condition, particularly within the Donkerhoek and Balgarthen focus area. Parts of the Twyfelhoek focus area were also found to be in a largely natural condition, but significant reliance on the systems by local communities in the area has resulted in significant modifications of the wetlands and to a lesser degree the rivers occurring within the area.

There are seven potential impacts that may have an effect on the overall ecological function of watercourses in the vicinity of the proposed Kusipongo project, four possible impacts on the wetland and riparian resources and three possible impacts on the aquatic resources.

Impacts identified are listed below:

- Modification of wetland hydrological function;
- Changes to wetland geomorphological processes;
- Loss of wetland habitat and ecological integrity;
- Impact on wetland biota;
- Impact on water quality;
- Loss of aquatic habitat; and
- Impact on aquatic biota.

The impacts on the wetland and riparian systems during all of the project phases range from medium-low to medium-high to high impacts. Mitigation measures available will minimise the impacts on the receiving wetland environment and impact significance can be reduced to medium-low. The impacts on the various aquatic tributaries are either high or medium-high significance. However, with mitigation, impacts may be reduced to mostly medium-low impact significance.

The specialist recommended that the infrastructure required to access the resource must be kept to the absolute minimum, particularly at the Balgarthen focus area.

The potential for post-closure impacts on water quality are of concern, therefore, unless it is considered economically feasible to treat and/or contain all potential sources of contaminated water which may affect the receiving environment to pre-mining water quality standards, post-closure in such a way as to support the Resource Quality Objectives of the local catchment and to ensure that no significant loss of wetland and aquatic biodiversity occurs, the project is regarded as posing a very high long term risk to the region. Risks to aquatic and wetland biodiversity are particularly pertinent to the Balgarthen and Donkerhoek project areas.

12.1.8 Traffic

The results of the assessment indicted that a total of 745 people will be employed, estimated to generate 80 inbound 34 outbound trips in the morning peak hours. The production trip generation analysis indicates that the maximum number of trips during the peak hour will be 9 trips. The intersection capacity analysis indicates that the two intersection will both operate adequately and with minimal delays. The existing traffic volumes are relatively low and provide plenty of spare capacity on the roads. The findings of the traffic assessment concluded that the increase in traffic associated with the mining operations will have little impact on the surrounding intersections and road network within the vicinity.

The road assessment also found the following:

- The trucks transporting coal may not be able to efficiently and safely negotiate the slopes for the haulage of coal;
- The structural capacity of the culvert and bridge structures along the routes will require assessment. Collapsed and eroded culverts were noted during the assessment. Given the age of the bridges, there will probably not be any design information available;
- Before any work is carried out on provincial roads, approval from the Mpumalanga Department of Public Works, Roads and Transport is required;
- There is a vehicle tonnage restriction on the access road to the Balgarthan Adit A. This should be discussed with the road authority as this effectively prohibits the haulage of coal.

In their current state, none of the roads can be used for the efficient and safe haulage of coal. Most roads will require substantial upgrades to the vertical alignment, horizontal alignment, pavement structure, drainage structures and road signs. In general, the road reserve widths do appear to be adequate for the construction and upgrading of a gravel road suitable for coal haulage. The recommended minimum road reserve width is 25 m with a 10 m wide road surface.

12.1.9 Heritage Sites

The assessment resulted in the identification of 19 archaeological and heritage sites. The following sites were identified:

- Burial grounds, graves and possible graves – nine sites
- Historic black homesteads where the risk exists for the presence of graves – four sites
- Historic black homesteads with graves and/or possible graves – two sites
- Late Iron Age stonewalled sites – one site
- Recent black homesteads where the risk exists for the presence of graves – one site
- Historic white farmsteads and structures – two sites

The sections below provide a summary of the sites identified in the Balgarthen A, Balgarthen B, Donkerhoek and Twyfelhoek opencast sections.

Balgarthen A Adit Section

No heritage sites were identified within or directly near the proposed development footprints.

Balgarthen B Adit Section

Two site of heritage importance were identified within or near the proposed development footprints. These site are reffered to as KCP 7 and KCP 8.

KCP 7

A cemetery comprising 13 rectangular stonepacked graves was identified at site KCP 7. The site is located 14m outside the development footprint area known as Balgarthen B Adit Dump.

KCP 8

The site comprises a rudimentary stone structure which may have formed part of a historic black homestead and can be associated with unmarked graves. It is located 8m from the proposed development footprint area known as Balgarthen B Adit Dump. The site is of Generally Protected B (GP. B) or Medium Significance.

Donkerhoek Section

Two site of heritage importance were identified within or near the proposed development footprints. These site are reffered to as KCP 17 and KCP 18.

KCP 17

A cemetery comprising two graves was identified at site KCP 17 located on the boundary of the eastern ROM stockpile. The two graves have stonepacked, oval-shaped grave dressings that are orientated along the east-west axis. No formal headstones or grave goods are visible. The size of both grave dressings suggest that the two graves are both for children. The graves are enclosed by a rectangular, stonepacked wall.

KCP 18

The site comprises a poorly preserved white farmstead and is located within the footprint of the central pit. The primary remaining elements of the original farmstead are two sandstone buildings. However, although these buildings are quite likely very old, they have both been extensively modified over the years. The farmstead is depicted on the First Edition of the 2730AB Topographic Sheet that was surveyed in 1969. This means that the site is at least 50 years old.

Both structures are older than 60 years, however, they have been extensively modified over the years and have very little heritage value. The site is of Generally Protected C (GP. C) or Low Significance.

Twyfelhoek Opencast (OC) Section

The Twyfelhoek OC section consist of a north and a south pit.

North Pit KCP 12

The site is located within the north pit footprint and comprises a currently occupied homestead with the possibility of unmarked stillborn graves. During fieldwork it could not be assessed of unmarked graves exists as the occupants of the homestead could not be consulted. The site is of Generally Protected B (GP. B) or Medium Significance but low if confirmation that no unmarked graves are present.

North Pit KCP 13

A poorly preserved historic black homestead and burial ground were identified a few meters from the north pit footprint. The burial ground is located within the homestead and consists of a total of six stonepacked graves. The tangible remains of the homestead include a thatched hut and a few other structures. Past experience has shown that in some cases unmarked stillborn babies were buried in close proximity to such black homesteads. These stillborn babies were frequently buried along the sides, or underneath, the parents' dwelling. As the site is not occupied anymore, no direct information with regards to the presence (or not) of such unmarked stillborn graves is currently available.

North Pit KCP 14

The site is located within the north pit footprint and comprises the poorly preserved remains of a white farmstead. All that remains of the original farmhouse are some of the stone foundations, a section of a brick wall and planted vegetation such as jacaranda trees. A small distance west of the farmhouse the circular foundation structure for a hut-type structure known vernacularly as a rondawel was identified. The site is at least 50 years old. The farmstead at site KCP 14 is poorly preserved. It is deemed to be of Generally Protected C (GP. C) or Low Significance.

North Pit KCP 15

A cemetery comprising six stonepacked graves for stillborn babies was identified within the north pit footprint. These graves were buried adjacent to a dwelling and is located within a homestead. According to the head of the household, Mr. Masango, no other graves, marked or unmarked, are buried within this homestead.

South Pit KCP 9

The site is located just outside the pit footprint and comprises the single grave of Mr. Albert Yete Ndlamenze and is located east of the homestead of the family. All graves have high levels of emotional, religious and in some cases historical significance.

South Pit KCP 10

A cemetery comprising 42 graves was identified at site KCP 10 inside the south pit footprint. These granite markers and upright stones indicate that the cemetery can be associated with the Masondo family. A recently erected granite dressing and headstone, which has not yet been officially unveiled and has a blanket covering it confirms this is an active cemetery.

South Pit KCP 11

The site is located just outside of the development footprint and comprises a single grave and is located east of the homestead of the family. All graves have high levels of emotional, religious and in some cases historical significance.

All graves have high levels of emotional, religious and in some cases historical significance and these sites are Generally Protected A (GP. A) or Medium to High Significance.

12.2 Final site map

Considering the assessment of the impacts and the recommendations made by the specialist studies a final layout plan has been developed. The final layout takes consideration of the anticipated impacts associated with each section separately due to the different environmental aspects and impacts anticipated.

- Where biodiversity areas are of high significance, sensitivity or conservation importance, the disturbance footprint has been adjusted or moved to a less sensitive area. Where no areas of less sensitivity were available the footprint was either removed or an environmental offset is required. Where any footprints intruded within a watercourse or wetland, it has been removed. Majority of footprints have been moved outside of the 100m buffer zones as well;
- Where there exists potential for groundwater pollution plumes to reach nearby watercourses the footprints have been reduced, removed or liner mitigations included;
- Where post closure decant points are within or near watercourses the footprint has been reduced to allow for the containment of the decant and subsequent treatment;
- Where sites of heritage or archaeological significance were identified on the periphery of a footprint, the footprint has been adjusted not to disturb the site;
- All footprints considered the use of existing disturbed areas such as roads, historical clearance, cultivation and utilising existing infrastructure at the Maquasa Mine section; and
- Where footprints can be moved which will negate the need for the consideration of relocation of people due to dust, noise and blasting, this has been done, this mainly relates to moveable footprints such as ROM stockpiles, offices, and roads.

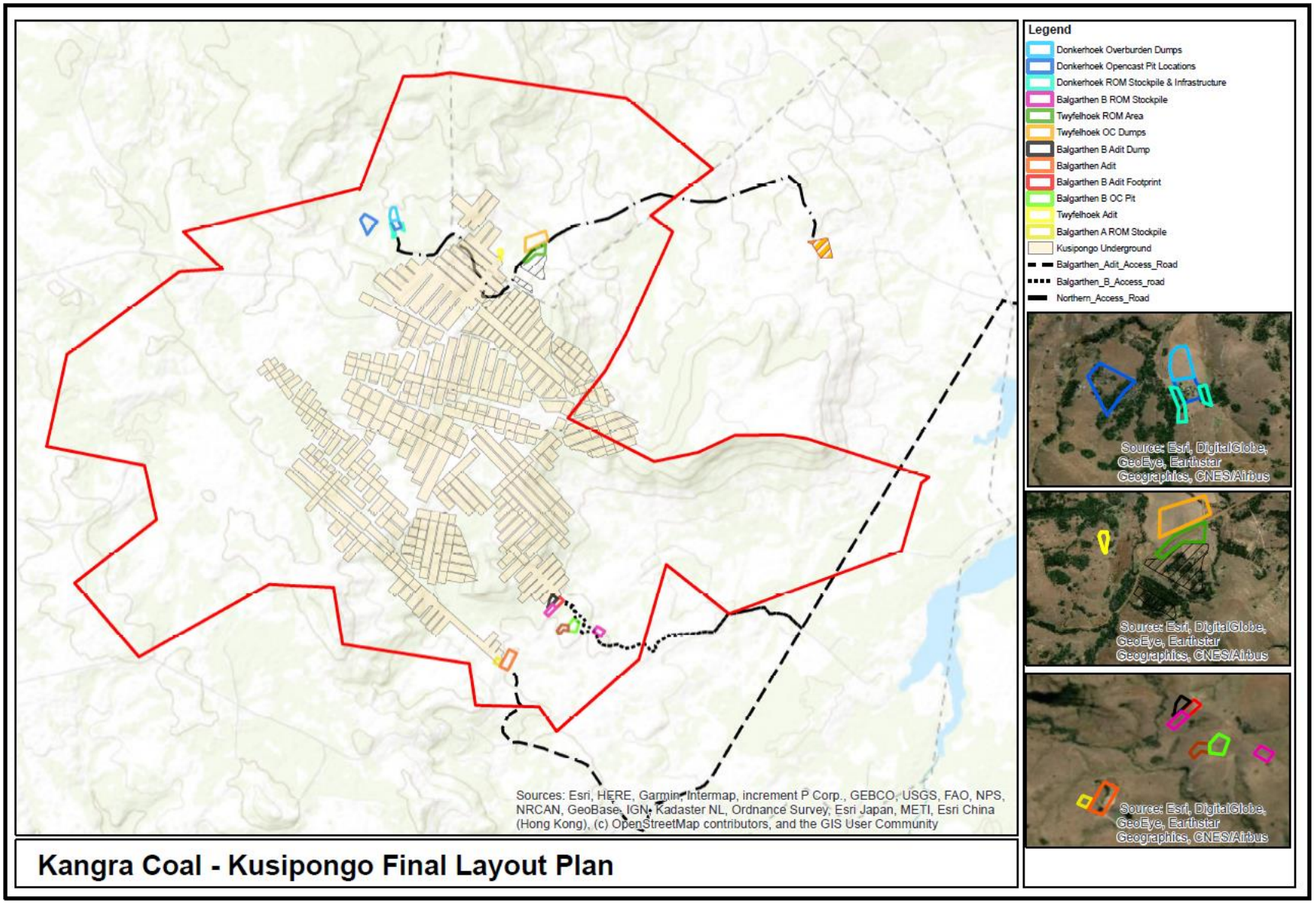

FIGURE 12-7: PREFERRED LAYOUT PLAN

12.3 Summary of the positive and negative implications and risks of the proposed activity and identified alternatives

The summary tables below contain all impacts that were rated as high significance and above for each section.

TABLE 12.1: SUMMARY OF KEY POSITIVE AND NEGATIVE IMPACTS IDENTIFIED FOR THE MITIGATED AND UNMITIGATED SCENARIOS

Donkerhoek

ASPECT	POTENTIAL IMPACT	PHASE	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
Groundwater	Generation of AMD and decant to the natural environment	PC	3,2	Increasing groundwater levels and groundwater quality should be monitored. Decant water should treated and discharged into the environment. Financial provision need to allow for funds to treat the water. Provision should be made for initial capital and operational costs.	2,56
Surface Water Resources	Modification of wetland hydrological function (opencast and underground mining)	C & O	3,75	Ensure that, as far as possible, all infrastructure is placed outside of the delineated watercourses. No use of clean surface water or any groundwater which potentially recharges the watercourses in the area should take place. Very strict control of water consumption must take place. Upstream dewatering boreholes should be considered to minimise the creation of dirty water and this clean water should be used to recharge the natural systems downstream of each of the focus areas. Permit only essential construction personnel within 100m of all riparian systems. Sensitive zones must be demarcated as no-go areas. Implement alien vegetation control program within wetland areas. Very clear and well managed clean and dirty water separation must take place. Pollution control dams must be adequately designed to contain a 1:50 24 hour storm water event. Limit the footprint area of the construction activity to what is absolutely essential. Ensure that all spills are immediately cleaned up. Ensure that all stockpiles have measures such as berms and hessian sheets to prevent erosion and sedimentation. Areas with concentrated flow must be managed (energy dissipating structures) in order to slow velocity of water flowing into the wetlands and measures to disperse the flow entering the wetlands must be ensured.	1,5
Surface Water Resources	Impact on surface water quality	C & O & PC	3,75		2,25
Surface Water Resources	Changes to the Wetland Geomorphological Processes (sediment balance, erosion and sedimentation) due to opencast and underground mining.	C & O & PC	3,75		2,0625
Surface Water Resources	Loss of wetland habitat and ecological integrity	C & O & PC	3,75		2,0625
Surface Water Resources	Impact on wetland biota	C & O & PC	3,75		1,875

ASPECT	POTENTIAL IMPACT	PHASE	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
Biodiversity - Flora	Impact on Floral Diversity and Habitat (grassland and rocky habitat units)	C & O	3,75	Mitigation measures as detailed in the Floral Assessment Report and EMPr must be implemented. Prior to the commencement of construction activities, an Alien Invasive Plant (AIP) Management/Control Plan should be compiled for implementation. Prior to the commencement of construction activities on site, a rehabilitation plan should be developed. A detailed walk down of the footprint area must take place, during which all floral SCC should be identified and marked by a suitably qualified specialist approved by the MTPA. As a minimum, surveys in late November and early February should be undertaken. All areas of increased ecological sensitivity falling outside of the direct mine footprint should be designated as No-Go areas. The footprint and daily operation of all mining surface infrastructure areas must be strictly monitored to ensure that edge effects from the operational facilities do not affect the surrounding floral habitat.	1,5
Biodiversity - Flora	Impact on Floral species of conservation concern (grassland and rocky habitat units)	C & O	3,75		1,5
Biodiversity - Fauna	Impact on Faunal Diversity and Habitat (grassland, rocky and freshwater habitat units)	C & O	3,5	Where possible pockets of natural vegetation should be retained within the mining footprint to provide habitat for small faunal species such as insects and reptiles. Permits must be applied for the relocation of animal species where protected. Concurrent rehabilitation should take place and the re-establishment of animals species monitored post closure of this section	2,1
Biodiversity - Fauna	Impact on Faunal species of conservation concern (grassland, rocky and freshwater habitat units)	C & O	4		2,4
Noise	Increase in noise levels for receptorsdue to mining operations (night time)	C	3,25	Relocate all noise sensitive receptors staying within 600m from the closest active mining areas. Use the available topsoil material to develop a berm between the active mining area and community. This berm should be as high as possible. The mine should limit the simultaneous development of an area if it is closer than 3,000m from another mining area to minimise cumulative noise levels;	2,275

ASPECT	POTENTIAL IMPACT	PHASE	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
Noise	Increase in noise levels (night time)	O	3	Use the available topsoil material to develop a berm between the active mining area and community. This berm should be as high as possible. These berms should only be developed during the daytime period. The mine should limit the simultaneous mining activities at sections closer than 3,000m from another mining section to minimise cumulative noise levels.	2,4
Soils and Land capability	Soil erosion due to mining activities	C & O	3	The footprint of the proposed mining operation and related infrastructure areas should be clearly demarcated. Bare soils can be regularly dampened with water to suppress dust during the construction phase. All disturbed areas adjacent to the infrastructural areas can be re-vegetated with an indigenous grass mix. Temporary erosion control measures may be used to protect the disturbed soils during the construction phase until adequate vegetation has established. This is regarded critical for the Balgarthen, and Donkerhoek proposed mining operation due to very steep topographic setting.	2,1

ASPECT	POTENTIAL IMPACT	PHASE	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
Soils and Land capability	Loss of agricultural land capability	C & O	3	During the decommissioning phase the footprint should be thoroughly cleaned, and all building material should be removed to a suitable disposal facility. The footprint should be ripped to alleviate compaction. Stored topsoil should be replaced (if any) and the footprint graded to a smooth surface. The landscape should be backfilled and reprofiled to mimic the natural topography. Slopes of the backfilled surface should change gradually since abrupt changes in slope gradient increase the susceptibility for erosion initiation. The topsoil should be ameliorated according to soil chemical analysis. The soil fertility status should be determined by soil chemical analysis after levelling (before seeding/re-vegetation. Soil amelioration should be done according soil analyses as recommended by a soil specialist, to correct the pH and nutrition status before revegetation. The footprint should be re-vegetated with a grass seed mixture as soon as possible.	2,1
Blasting	Impacts due to ground vibration and air blast	O	3,25	There are nine houses / settlements identified within 500 m. Consideration should be given to relocate these households, especially those within 250 m. The calculated minimum safe distance is 527 m and all people and animals within this radius should be evacuated during each blast. An assessment on the structural integrity and existing damage to surrounding structures within a 1 500 m radius must be undertaken prior to blasting commencing. Do blast design that considers the actual blasting and the ground vibration levels to be adhered to. Only apply electronic initiation systems to facilitate single hole firing. Do design for smaller diameter blast holes that will use fewer explosives per blasthole.	1,95
Cultural Heritage	Disturbance of heritage sites and in particular graves found inside the development footprint	C	4	Change the development footprint to allow for the in situ preservation of these sites and graves. Should preservation not be possible, a grave relocation process must be undertaken.	2,4
Cultural Heritage	Disturbance of heritage sites and graves found outside the development footprint	C	3	Allow for the in situ preservation of these sites. Should this not be possible, a grave relocation process must be undertaken for sites that will be disturbed during mining activities.	1,8
Palaeontology	Disturbance of sites of palaeontological significance	C	3,2	A Phase 1 field-based palaeontological assessment should be conducted prior to the commencement of construction activities.	1,92

Twyfelhoek

ASPECT	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
Groundwater	Change in groundwater levels due to dewatering	3,25	Groundwater and surface monitoring to include water levels and yields. Where loss of groundwater levels or yields are expected by nearby users a complaints process and investigation must be undertaken. Should the investigation show that the change in levels and yields is due to the dewatering of the mine the farmers impact must be mitigated through additional water supply or financial compensation	1,95
Groundwater	Generation of AMD and decant to the natural environment	3,5	Increasing groundwater levels and groundwater quality should be monitored. Decant water should treated and discharged into the environment. Financial provision need to allow for funds to treat the water. Provision should be made for initial capital and operational costs.	2,1
Surface Water Resources	Impact on surface water quality	3,75		2,25
Surface Water Resources	Loss of wetland habitat and ecological integrity	3		1,8
Surface Water Resources	Loss of aquatic habitat	3,5		2,1
Biodiversity - Fauna	Impact on Faunal species of conservation concern (grassland, rocky and freshwater habitat units)	3,5		2,625
Noise	Increase in noise levels for receptors due to mining operations (night time)	3,25	Relocate all noise sensitive receptors staying within 600m from the closest active mining areas. Use the available topsoil material to develop a berm between the active mining area and community. This berm should be as high as possible. The mine should limit the simultaneous development of an area if it is closer than 3,000m from another mining area to minimise cumulative noise levels;	2,275
Noise	Increase in noise levels (night time)	3	Use the available topsoil material to develop a berm between the active mining area and community. This berm should be as high as possible. These berms should only be developed during the daytime period. The mine should limit the simultaneous mining activities at sections closer than 3,000m from another mining section to minimise cumulative noise levels.	2,4

ASPECT	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
Soils and Land capability	Soil erosion due to mining activities	3	The footprint of the proposed mining operation and related infrastructure areas should be clearly demarcated. Bare soils can be regularly dampened with water to suppress dust during the construction phase. All disturbed areas adjacent to the infrastructural areas can be re-vegetated with an indigenous grass mix. Temporary erosion control measures may be used to protect the disturbed soils during the construction phase until adequate vegetation has established. This is regarded critical for the Balgarthen, and Donkerhoek proposed mining operation due to very steep topographic setting.	2,1
Soils and Land capability	Loss of agricultural land capability	3	During the decommissioning phase the footprint should be thoroughly cleaned, and all building material should be removed to a suitable disposal facility. The footprint should be ripped to alleviate compaction. Stored topsoil should be replaced (if any) and the footprint graded to a smooth surface. The landscape should be backfilled and reprofiled to mimic the natural topography. Slopes of the backfilled surface should change gradually since abrupt changes in slope gradient increase the susceptibility for erosion initiation. The topsoil should be ameliorated according to soil chemical analysis. The soil fertility status should be determined by soil chemical analysis after levelling (before seeding/re-vegetation. Soil amelioration should be done according soil analyses as recommended by a soil specialist, to correct the pH and nutrition status before revegetation. The footprint should be re-vegetated with a grass seed mixture as soon as possible.	2,1
Blasting (without relocation)	Impacts due to ground vibration	3,25	There are houses / settlements identified within 500 m from the operations. Consideration should be given to relocate these households, especially those within 250 m. The calculated minimum safe distance is 527 m and all people and animals within this radius should be evacuated during each blast. An assessment on the structural integrity and existing damage to surrounding structures within a 500 m radius must be undertaken prior to blasting commencing. Do blast design that considers the actual blasting and the ground vibration levels to be adhered to. Only apply electronic initiation systems to facilitate single hole firing. Do design for smaller diameter blast holes that will use fewer explosives per blasthole.	2,6

ASPECT	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
Blasting (with relocation)	Impacts due to ground vibration	3,25	There are houses / settlements identified within 500 m from the operations. Consideration should be given to relocate these households, especially those within 250 m. The calculated minimum safe distance is 527 m and all people and animals within this radius should be evacuated during each blast. An assessment on the structural integrity and existing damage to surrounding structures within a 500 m radius must be undertaken prior to blasting commencing. Do blast design that considers the actual blasting and the ground vibration levels to be adhered to. Only apply electronic initiation systems to facilitate single hole firing. Do design for smaller diameter blast holes that will use fewer explosives per blasthole.	1,3
Cultural Heritage	Disturbance of heritage sites and in particular graves found inside the development footprint	4	Change the development footprint to allow for the in situ preservation of these sites and graves. Should preservation not be possible, a grave relocation process must be undertaken.	0,8
Cultural Heritage	Disturbance of heritage sites and graves found outside the development footprint	3	Allow for the in situ preservation of these sites. Should this not be possible, a grave relocation process must be undertaken for sites that will be disturbed during mining activities.	1,8
Palaeontology	Disturbance of sites of palaeontological significance	3,2	The presence of palaeontological findings is likely. The ECO or environmental manager (EM) should undertake an awareness programme of what these sites could look like if unearthed. The ECO/EM must inform a palaeontologist should any artefacts be found.	1,92

Balgarthen

ASPECT	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
Groundwater	Change in groundwater levels due to dewatering at pits	3	Groundwater and surface monitoring, as recommended in the Geohydrological Report to be undertaken. Dirty surface run-off should be pumped to dirty water dams. These dams should be lined to ensure no future pollution of groundwater resources.	3
Groundwater	Generation of AMD and decant to the natural environment	3,5	Increasing groundwater levels and groundwater quality should be monitored. Decant water should be appropriately managed.	1,75
Groundwater	Impact of mine polluting groundwater and surface water	3,5	Groundwater and surface monitoring, as recommended in the Geohydrological Report to be undertaken. Decant water should be appropriately managed.	2,8
Surface Water Resources	Modification of wetland hydrological function (opencast and underground mining)	4	Ensure that, as far as possible, all infrastructure is placed outside of the delineated watercourses. No use of clean surface water or any groundwater which potentially recharges the watercourses in the area should take place. Very strict control of water consumption must take place. Upstream dewatering boreholes should be considered to minimise the creation of dirty water and this clean water should be used to recharge the natural systems downstream of each of the focus areas. Permit only essential construction personnel within 100m of all riparian systems. Sensitive zones must be demarcated as no-go areas. Implement alien vegetation control program within wetland areas. Very clear and well managed clean and dirty water separation must take place. Pollution control dams must be adequately designed to contain a 1:50 24 hour storm water event. Limit the footprint area of the construction activity to what is absolutely essential. Ensure that all spills are immediately cleaned up. Ensure that all stockpiles have measures such as berms and hessian sheets to prevent erosion and sedimentation. Areas with concentrated flow must be managed (energy dissipating structures) in order to slow velocity of water flowing into the wetlands and measures to disperse the flow entering the wetlands must be ensured.	2,8
Surface Water Resources	Impact on surface water quality	3,75		2,25
Surface Water Resources	Changes to the Wetland Geomorphological Processes (sediment balance, erosion and sedimentation) due to opencast and underground mining.	4		2,8
Surface Water Resources	Loss of wetland habitat and ecological integrity	3,75		3
Surface Water Resources	Loss of aquatic habitat	3,5		2,45
Surface Water Resources	Loss of aquatic biota	3,25		2,3725
Surface Water Resources	Impact on wetland biota	3,5		2,8
Biodiversity - Flora	Impact on Floral Diversity and Habitat (grassland and rocky habitat units)	4	Mitigation measures as detailed in the Floral Assessment Report and EMPr must be implemented. Minimise loss of indigenous vegetation where possible through planning and suitable layouts. Prior to the commencement of construction activities, an Alien Invasive Plant (AIP) Management/Control Plan should be compiled for implementation. Prior to the commencement of construction activities on site, a rehabilitation plan should be developed. A detailed walk down of the footprint area must take place, during which all floral SCC should be identified and marked by a suitably qualified specialist approved by the MTPA. As a minimum, surveys in	3,2

ASPECT	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
Biodiversity - Flora	Impact on Floral species of conservation concern (grassland and rocky habitat units)	3,5	late November and early February should be undertaken. All areas of increased ecological sensitivity falling outside of the direct mine footprint should be designated as No-Go areas. The footprint areas of all surface infrastructure must be minimised to what is absolutely essential and within the designated and approved mine footprint boundary. The footprint and daily operation of all mining surface infrastructure areas must be strictly monitored to ensure that edge effects from the operational facilities do not affect the surrounding floral habitat.	2,45
Biodiversity - Fauna	Impact on Faunal Diversity and Habitat (grassland, rocky and freshwater habitat units)	3,25	Mitigation measures as detailed in the Faunal Assessment Report and EMPr must be implemented. It is recommended that a summer assessment be undertaken during the months of January and February to more accurately document the faunal communities. A walk through of the rocky habitat unit and grassland habitat units should be undertaken by a registered specialist prior to construction. A formal avifaunal monitoring programme should be established. Where possible pockets of natural vegetation should be retained within the mining footprint to provide habitat for small faunal species such as insects and reptiles. A formal bat monitoring programme should be established.	2,6
Biodiversity - Fauna	Impact on Faunal species of conservation concern (grassland, rocky and freshwater habitat units)	4		3,2
Noise	Increase in noise levels for receptors due to mining operations (night time)	3,25	Relocate all noise sensitive receptors staying within 600m from the closest active mining areas. Use the available topsoil material to develop a berm between the active mining area and community. This berm should be as high as possible. The mine should limit the simultaneous development of an area if it is closer than 3,000m from another mining area to minimise cumulative noise levels;	2,28
Noise	Increase in noise levels (night time)	3	Use the available topsoil material to develop a berm between the active mining area and community. This berm should be as high as possible. These berms should only be developed during the daytime period. The mine should limit the simultaneous mining activities at sections closer than 3,000m from another mining section to minimise cumulative noise levels.	2,4
Soils and Land capability	Soil erosion due to mining activities	3,25	The footprint of the proposed mining operation and related infrastructure areas should be clearly demarcated. Bare soils can be regularly dampened with water to suppress dust during the construction phase. All disturbed areas adjacent to the infrastructural areas can be re-vegetated with an indigenous grass mix. Temporary erosion control measures may be used to protect the disturbed soils during the construction phase until adequate vegetation has established.	2,275

ASPECT	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
Soils and Land capability	Loss of agricultural land capability	3	During the decommissioning phase the footprint should be thoroughly cleaned, and all building material should be removed to a suitable disposal facility. The footprint should be ripped to alleviate compaction. Stored topsoil should be replaced (if any) and the footprint graded to a smooth surface. The landscape should be backfilled and reprofiled to mimic the natural topography. Slopes of the backfilled surface should change gradually since abrupt changes in slope gradient increase the susceptibility for erosion initiation. The topsoil should be ameliorated according to soil chemical analysis. The soil fertility status should be determined by soil chemical analysis after levelling (before seeding/re-vegetation. Soil amelioration should be done according soil analyses as recommended by a soil specialist, to correct the pH and nutrition status before revegetation. The footprint should be re-vegetated with a grass seed mixture as soon as possible.	2,1
Cultural Heritage	Disturbance of heritage sites and in particular graves found inside the development footprint	4	Change the development footprint to allow for the in situ preservation of these sites and graves. Should preservation not be possible, a grave relocation process must be undertaken.	2,4
Cultural Heritage	Disturbance of heritage sites and graves found outside the development footprint	3	Allow for the in situ preservation of these sites where they border the footprints. Should this not be possible, a grave relocation process must be undertaken for sites that will be disturbed during mining activities.	1,8
Palaeontology	Disturbance of sites of palaeontological significance	3,2	The presence of palaeontological findings is likely. The ECO or environmental manager (EM) should undertake an awareness programme of what these sites could look like if unearthed. The ECO/EM must inform a palaeontologist should any artefacts be found.	1,92

General Underground Mining

ASPECT	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
Groundwater	Change in groundwater quality	3,4	Undertake monitoring programme and review annually to represent the underground mining areas. Sampling of flooded shafts to be undertaken to assess the changes of the quality over time Groundwater pollution plume to be updated annually to assess extent of plume migration	2,72
Groundwater	Generation of AMD and decant to the natural environment	3,4	Decant water need to be treated if the quality is above the background of the area and catchment objectives. Implement AMD management strategy and decant plan. AMD strategy and decant plan to be updated annually as part of the rehabilitation plans.	2,04

General Socio-Economic

ASPECT	POTENTIAL IMPACT	IMPACT SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	IMPACT SIGNIFICANCE WITH MITIGATION
Socio-Economic	Continued Employment of personnel from Maquasa operations	3,5	N/A	3,5
Socio-Economic	Provision of coal for electricity generation	3,5	Mitigation measures as detailed for negative impacts due to mining activities.	3,5
Socio-Economic	Positive economic impact on Mpumalanga GDP	3,5	N/A	3,5
Socio-Economic	Loss of income due to loss of land for agriculture	2,2	Loss of surface use should be compensated for to the landowner affected based on his current use of the property	1,32
Socio-Economic	Fallout dust settling on pastures and wool sheep	3	Fallout dust need to be managed through dust suppression of the public road. Coal dust should not be able to spread from trucks. Truck trailers containing coal need to be covered when on public roads and any spillages of coal cleaned up.	2,4

ASPECT	POTENTIAL IMPACT	IMPACT SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	IMPACT SIGNIFICANCE WITH MITIGATION
			A complaints register must easily be available for the public. Kangra must be able to assess impacts of coal dust and loss of income if this complaint arises.	
Socio-Economic	Cumulative impacts of mining on surrounding landowners such as dewatering, blasting, noise, air quality and loss of grazing land.	3,25	Mitigations measures as detailed for negative impacts due to mining operations. The monitoring programmes considers agricultural uses such as water and air quality.	3,3
Socio-Economic	Increase in social pathologies (crime such as theft, alcohol abuse, spread of HIV, hawking) due to influx of persons	3	Develop a stakeholder engagement plan. Clear communication and engagement to public as to local procurement policies. Kangra need to play an active role in the area with security patrols within their work areas, transport of their employees and creating a communication channel to farmers in the locality should risks be identified. Risks can include fires, Kangra need to be able to contain any fires originating from their operations.	2,4

12.4 Proposed management objectives and the impact management outcomes for inclusion in the EMPr

Considering the impact hierarchy where impacts could not be avoided it will require mitigation measures. The objectives of the management plan are to reduce the impacts or rehabilitate the impacts identified due to the mining operations. Mitigation measures as detailed in **Table 12**.1 and the EMPr should be implemented in order to mitigate and manage the negative impacts associated with the proposed mining operations. Due to the size and nature of the project and the numerous potential impacts identified, all of the mitigation measures proposed in the impact assessment tables form part of the impact management outcomes and are included in the EMPr.

Where impacts cannot be mitigated it has been allocated rehabilitation objectives. Where impacts cannot be rehabilitated requirements to offset the impact is required.

A critical part of the management of the operation will be a concise environmental monitoring programme that can be implemented to swiftly address any impacts, pollution or concerns from nearby farmers, households and other activities such as schools. Adhering to the limits set in the monitoring programme will allow Kangra to operate within acceptable limits of environmental impacts and also allow local people to continue with their daily activities. Reporting compliance with the monitoring limits will confirm effective environmental management is being undertaken.

12.5 Final proposed alternatives

Based on the specialist assessments undertaken, the severity of the impacts identified, the probability of successfully mitigating the impacts, and the impact hierarchy, it is the opinion of the EAP that the final alternatives are as detailed below:

- **Twyfelhoek Opencast Pits and Associated Infrastructure:** The opencast pits and associated infrastructure can be developed as proposed in Alternative B, with adherence to all mitigation measures proposed. The footprints do require relocation of people and heritage artefacts prior to its establishment. The remainder of area where the proposed pits are to be located has been previously disturbed by cultivation activities and a large portion of the area where the proposed pits and associated infrastructure are located has a low or moderately low sensitivity for flora, mainly due to invasive wattle plantations. This option also considers the placement of the pit and associated infrastructure outside of the watercourses (including wetlands) and allowance has been made for a 100m buffer on the opencast pits.
- **Donkerhoek Opencast Pits and Associated Infrastructure:** This proposed development area consists of the three opencast pits sections with associated infrastructure. The areas are referred to as western, central and eastern pits.

The footprints of Alternative B have been optimised to remain mostly outside of the primary grasslands and rocky outcrops as discussed in the baseline environment. The revised footprints mainly overlay invasive wattle tree overgrowth. The eastern pit and its associated overburden could not be adjusted to be outside of the primary grasslands and was as such removed from the layout. The ROM stockpile and offices was removed from the eastern pit to the central pit section due to logistics and less disturbance with road construction. The adjustments also considered the wetlands, watercourses and allowed for a 100m buffer except in the case of the ROM stockpile and office options that will intrude the buffer but is within wattle plantations.

With the adjustments made the site remains vulnerable due to the edge effect and inability of including a buffer with the grasslands. The impact will remain moderately high but a rehabilitation plan to improve the biodiversity can allow for an improved biodiversity due to the removal of the wattle trees.

The pits will also generate a pollution plume during its life and post closure. There is a likelihood this plume will migrate to any of the numerous watercourses surrounding the pits. Mitigation confidence of pollution plume containment through scavenging boreholes is possible but not capable of containing all pollution. The sulphate plume will therefore reach the watercourses and increase the sulphide (likely EC and TDS) levels as well. The pit footprints have therefore been reduced to increase the buffer. This reduced footprint also allows for Kangra to implement a scavenger borehole system between the pit and watercourses should the sulphate levels raise a concern during monitoring.

Although the central pit pose the least threat to the environment it is recommended that a feasibility study be undertaken to firstly assess the viability of the central pit and footprints, including employment benefit, against the cost of undertaking decant management, pollution plume control and relocation of a household before it can be considered. The western pit can be moved to avoid majority of the sensitive habitat, but it will still affect a portion thereof and should be authorised only on condition of an offset strategy.

Considering the presence of other coal resources, it is recommended that the eastern pit not be mined due to the primary grasslands that cannot be avoided.

- **Balgarthen A Adit and Associated Infrastructure**: This adit was historically mined and a disturbed footprint exists. The site is mostly secondary grasslands with a less significant biodiversity value compared to the primary grassland surround the area. It is therefore recommended that the Balgarthen A adit be authorised with associated infrastructure footprints optimised on disturbed areas. The potential impacts can be mitigated and managed.

- **Balgarthen B Adit and Associated Infrastructure**: The adit is located within a sensitive biodiversity habitat and in close proximity to various watercourses and wetlands. The adit footprint need to be minimised to allow for only crucial infrastructure to access the underground coal resource. The coal handling area (including offices etc.) must be concentrated around the adit and in close proximity to existing roads. The adit area must be minimised as far as possible.
- **Balgarthen B Opencast Pit and Associated Infrastructure**: The pit footprint is located within a highly sensitive biodiversity area. This is based on the floral sensitivity within the primary grassland. On a local and regional scale, the proposed layout for Alternative B have large footprints within the sensitive Paulpietersburg Moist Grassland and the Wakkerstroom Montane Grassland floral communities. Significant impacts on floral ecology is anticipated for the Balgarthen B pit area that cannot be avoided with a development alternative within secondary grasslands, as these are not present.

  The footprint of alternative B was also cited to be located outside of any watercourses and wetland, including 100m buffer zones, but the groundwater pollution plume prediction still indicates that the sulphate plume will extend into the nearby watercourses. The sulphate plume modelling did however not exceed 420 mg/l of sulphates at the watercourses and with the consideration of the background d sulphates will likely not exceed the drinking water standards (SANS241). An increase in sulphates will impact on the aquatic biota in the watercourse and therefore the increased buffer and smaller pit footprint also serves as a precaution to the risk posed to the aquatic system. The increased buffer also allows for Kangra to be able to implement a scavenger borehole system between the watercourses and the pit should the sulphates be monitored to be higher than anticipated.

  Considering the key impacts and applying the precautionary principle, it is recommended that the footprint of this pit be reduced to create a greater buffer between the watercourse systems and the pit boundary. The pit footprint will however result in a total loss of the footprint biodiversity. Considering the presence of other coal resources, it is recommending this pit only be mined if the economic feasibility can justify the cost of offset and water management during and post closure.

- **Southern Section of underground Mining**: No alternative layout options are required for underground mining. The underground mining needs to ensure it implements all mitigation measures and monitoring the effects on surface processes (water, subsidence) as mining advances as per schedule in order to cease and mitigate any impacts that might arise. The mining method must ensure pillars can support the surface and stooping should be carefully investigated before being implemented.

12.6 Aspects for inclusion as conditions in the authorisation

The authorisation is subject to the recommendations contained in the EMPr and monitoring requirements as detailed therein. Key conditions to be included are:

- A detailed walk down of the footprint area must take place, during which all floral SCC should be identified and marked by a suitably qualified specialist. A walk through of the rocky habitat unit and grassland habitat units, within the development footprints, should be undertaken by a registered specialist for signs of *Scelotes mirus* (Montane Burrowing Skink, LC) and *Harpactira hamiltoni* (Highveld Baboon Spider, NE) prior to construction, if present the necessary permits should be applied for and appropriate relocation plans drafted;
- An Alien Invasive Plant (AIP) Management/Control Plan should be developed prior to construction;
- Mining activities and associated infrastructure must remain outside of the GN 704 regulated 100 m buffer from wetland areas, unless otherwise authorised;
- All pollution control dams should be lined to ensure no pollution of groundwater resources;
- Dust suppression to be undertaken as detailed in the EMPr and a dust management plan must be developed should complaints be received or exceedances with the limits in the EMPr be measured;
- It is anticipated that noise, dust and blasting from opencast pits will affect all households and schools within 600 m of mining activities. The monitoring network to be implemented needs to be concise and confirm when impacts cannot be mitigated. A relocation or mitigation strategy must then be agreed to with the affected parties, where required;
- Graves and heritage structures identified within the development footprint must be preserved *in-situ*, alternatively a grave relocation process or phase 2 excavation must be undertaken; and
- An offset strategy needs to be developed for should the development of the central Donkerhoek pit be authorised to improve the local biodiversity focussing on removal of the wattle stands;
- Agriculture within the mining right area must be able to continue and any negative effects due to mining mitigated immediately without jeopardising the economics of the land use;
- A community and farmers forum must be established and meet at least twice a year whereby the mine share and discuss the following information:
    - Results of monitoring (dust, water, biodiversity, blasting, noise)
    - Complaints received and investigated (a complaints register must also be available)
    - Safety and security
    - Status of mining

12.7 Description of any assumptions, uncertainties and gaps in knowledge

The outcomes of this EIA Report are based on the following assumptions, uncertainties and knowledge gaps:

- The impacts identified are as per the project description and described in Section 10.8.
- The proposed layouts are conceptual. Detailed design of such infrastructure is still to be undertaken. The final layout may differ from the conceptual layout plan. The principles as specified in the outcomes of the EIA Report will however be adhered to during final design.
- The EIA was undertaken at a specific time frame, according to current environmental legislation which may change over time.
- The floral and faunal assessments were confined to the three project focus areas within the Kusipongo MRA and do not include the neighbouring and adjacent properties nor the entire Kusipongo MRA;
- The floral field assessment took place outside of the flowering season of most species, such as geophytes, resulting in a less diverse species list than what is expected to occur on site. To account for these limitations the precautionary approach was taken.
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most faunal communities have been accurately assessed and considered and the information provided is considered sufficient to allow informed decision making to take place and facilitate integrated environmental management;
- All watercourses identified within 500 m of focus areas within the Kusipongo MRA were delineated in fulfilment of GN509 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) using desktop methods, however these watercourses were not assessed in detail with focus on the watercourses in closer proximity to the proposed mining operations. The general surroundings were considered in the desktop assessment of the proposed development;
- Due to the degree to which some parts of the focus areas have been modified, the watercourse delineations as presented in this report are regarded as a best estimate of the watercourse boundaries, based on the site conditions present at the time of assessment. Global Positioning System (GPS) technology is inherently inaccurate and some inaccuracies due to the use of handheld GPS instrumentation may occur however, the delineations as provided in this report are deemed accurate enough to fulfil the authorisation requirements as well as implementation of the mitigation measures provided. If more accurate assessments are required, the watercourses will need to be surveyed and pegged according to surveying principles;

- The data presented in the aquatic ecological report is based on a single site visit, the Balgarthen assessment was undertaken during the 20th – 22nd of May whereas the Donkerhoek and Twyfelhoek assessments were undertaken during the 25- 26th of July which fell within winter (low flow season). The effects of natural seasonal and long-term variation in the ecological conditions and aquatic biota found in the streams are, therefore, unknown at the time of writing this report. Ideally aquatic assessments should be undertaken, as a minimum, in the summer/high flow and winter/low flow seasons, to account for and define seasonal variability. However, consideration was given to local data on the DWS RQIS PES/EIS database. Said information assists in understanding variability in the system and thus ensures that observations and discussions on impacts are adequately understood to inform this study;
- Due to access restraints relating to terrain and personal safety concerns, limitations were experienced in site selection. Due to the limitations, some aspects of the aquatic ecology of the area, which may be important, may have been overlooked. However, based on the available desktop assessment reference and assessment results, it is deemed adequate to provide the required level of understanding of the systems for the study;
- The impact of the Twyfelhoek adit has not been assessed as part of this process. The cumulative impacts should be considered, specifically related to the impacts of blasting, noise and traffic on the nearby school and households;
- The soil survey conducted as part of the land capability assessment was confined within the focus area, which is considered adequate for the purpose of this investigation; and
- The heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the area, due to the subterranean nature of some archaeological sites, as well as the density of vegetation cover found in some areas.

12.8 Reasoned opinion as to whether the proposed activity should or should not be authorised

As detailed in Section 12.5, the opinion is based on the specialist assessments undertaken, the severity of the impacts identified and the probability of successfully mitigating the impacts. It is the reasoned opinion of the EAP that (with the implementation of the mitigation measures identified):

- **Twyfelhoek section:** The opencast pits be authorised with associated infrastructure with relocation of households and schools within the direct footprints and blast risk areas.
- **Donkerhoek section:** The central and western pit be authorised with the amended footprints and commitments to offset and AMD decant management. The eastern pit and associated infrastructure should not be authorised due to biodiversity sensitivity and no alternative locations available.
- **Balgarthen A adit**: Balgarthen A adit should be authorised as proposed in Alternative B.

- **Balgarthen B adit:** It is recommended that the adit footprint be minimised to the minimum required for underground access.
- **Balgarthen B opencast pit:** The impact on high value biodiversity, aquatic biota and decant generation post closure has resulted in a pit and dump footprint that has been significantly minimised to provide greater confidence in the control of the impacts. This pit and associated infrastructure also need to be subject to an offset strategy approved by the Department prior to mining.

12.9 Rehabilitation Objectives

12.9.1 Closure Vision, Objectives and Targets

The overall closure vision for the Kusipongo Project is to progressively re-instate the natural landscape areas to a safe, stable and non-polluting environment, mimicking some of the pre-mining land use, and managing the unavoidable residual mining impacts and/or disturbances. The closure vision is to leave behind a positive post-mining legacy.

The above closure vision is supported by the specific objectives and targets listed below. These objectives are stated qualitatively and become more specific as the actual rehabilitation and closure initiatives are planned and developed. The objectives apply to the mine site in its final closed state and not whilst it is transformed towards this state.

12.9.2 Physical stability

The closure vision is to ensure that all rehabilitated areas are left in a stable state. To facilitate the mines' planned final land use, all unavoidable mining residue, opencast areas, adits and surfaces infrastructure needs to be removed and/or stabilised. This would be achieved through implementation of the following rehabilitation initiatives:

- Concurrent rehabilitation of the opencast cuts should be undertaken during the operational phase through continuous backfilling and revegetation of mined voids. Rehabilitated areas should not be susceptible to erosion;
- Concurrently rehabilitated areas should be monitored to ensure that areas become self-sustaining;
- The final voids (if applicable) should be backfilled using the overburden dump from the initial cut and the disturbed areas should be revegetated to ensure stable landforms that are not susceptible to erosion.
- All infrastructure, that does not have a beneficiation potential, must be removed, dismantled and disposed of; and
- The natural vegetation should be re-established by ripping, shaping, and seeding of all remaining footprint areas;

- Roads that existed prior to commencement of mining activities should be retained for beneficial use;
- All infrastructure that is intended to be retained after closure of the mine should be left in a safe and stable state.

12.9.3 Environmental quality

The closure vision is to ensure that the surrounding environmental quality is not adversely affected by the potential chemical contamination and physical effects as a result of the mining operations. This can be achieved by:

- Backfilled areas should be designed to create free-draining conditions to allow clean surface water runoff to enter the natural hydraulic system;
- Rehabilitation designs should ensure that rehabilitated areas are not susceptible to erosion and will not cause siltation of water resources;
- Seed banks used for revegetation should include a mixture of seeds indigenous to the area;
- Wetlands that will be impacted on due to mining activities should be rehabilitated at closure to improve PES and EIS classification compared to pre-mining conditions;
- To ensure the protection of the surrounding environmental; including human and animal life, all contaminated land and hazardous waste needs to be effectively removed and managed. An appropriate procedure should be developed for this purpose;
- Regulatory standards should be used for contaminated sites to ensure mitigation is aligned with regulatory controls and best practice;
- The post closure environmental risk should be contained and managed during decommissioning to ensure secondary contamination is kept to a minimum;
- Dust generation during decommissioning of site infrastructure should be limited. This will ensure no health or nuisance related impacts affect surrounding communities and landowners;
- A contaminated land assessment must be undertaken to identify contaminated sites (if applicable) which need to be remediated to ensure protection of the receiving downstream environment;
- Local groundwater quality needs to be protected and preserved through the implementation of acceptable management measures to limit source contamination from operational areas.

12.9.4 Health and safety

Rehabilitated sites need to be secured to ensure no adverse risk to human or animals' health and safety, by:

- The perimeter of any remaining open voids or dumps should be isolated to ensure limited access to the site during the decommissioning phase of the mine;

- Thorough environmental monitoring of the potential impacts during the operational phase and continued post-closure. The environmental monitoring data record should be used to evaluate the impacts post-closure and ensure no contamination affects human and animal life;
- To ensure the protection of the surrounding environment; including human and animal life, contaminated land and hazardous waste needs to be effectively removed and manged;
- Dust generation during decommissioning of site infrastructure should be limited. This will ensure no health or nuisance related impacts affect surrounding communities and landowners.

12.9.5 Land capability/land-use

The closure vision is to re-instate pre-mining conditions as far as practically possible. Current data indicated that the Donkerhoek area falls within an area considered to be used for grazing purposes. Twyfelhoek and Balgarthan fall primarily within areas considered arable land suitable for crop production. The planned final land use will therefore need to sustain grazing at Donkerhoek. Rehabilitation initiatives at the Twyfelhoek and Balgarthan Sections should ensure that arable land capability be re-instated. The desired land-capability can be achieved through implementation of the following:

- Obtaining stakeholder consensus of desired final land use;
- Ensure that the desired land use is re-instated through proper management of soil resources according to best practice;
- Ensuring long-term stability of rehabilitated sites through ongoing monitoring and maintenance;
- The extent of contamination during the operational phase of the mine should be limited; and,
- Concurrent rehabilitation should be undertaken to limit stockpiling of soils. Ongoing rehabilitation will ensure that soils are directly replaced on mine-out areas which in turn prevents degradation of soil quality.

12.9.6 Aesthetic quality

The overall aesthetic appearance of the disturbed sites must be re-instated to acceptable levels to emulate pre-mining conditions. Rehabilitated areas should be re-shaped to successfully blend with the surrounding landscape and seed banks used for revegetation should include a mixture of seeds indigenous to the area.

12.9.7 Socio-economic aspects

A significant component of mine closure includes the management of socio-economic impacts on communities that have been established as a result of the mines' operation. These impacts should be managed considering the following:

- The mine must implement commitments contained in their Social and Labour Plan ("SLP")

- Ensure a transparent process during the closure phase and engage with stakeholders to plan and achieve sustainable scenarios post-closure.

12.10 Period for which the environmental authorisation is required

The Kusipongo mining right expires in 2027, the revised mining plan is however extending this period by a further two years until 2029. With rehabilitation envisioned for 2030 until 2034 it is required for the environmental authorisation to remain valid for 15 years.

13. FINANCIAL PROVISION

TABLE 13.1: FINAL AND PREMATURE CLOSURE COST 2019

Kangra Kusipongo Coal Mine Financial Provision 2019		
Date	8-Oct-19	
Assessor	Renier Ellis	
Reviewer	Divan vd Merwe	
Operation/ Section	**Premature Closure Cost**	**Final Closure Cost**
Balgarthen	10,227,800.05	11,827,144.81
Twyfelhoek	5,760,984.36	6,202,767.36
Donkerhoek	6,272,089.84	6,272,089.84
Sub Total 1	**R22,260,874.25**	**R24,302,002.01**
Multiplication factor 1.05	23,373,917.96	25,517,102.11
Prelimenary & General @6%	1,402,435.08	1,531,026.13
Contingency @10%	2,337,391.80	2,551,710.21
Sub Total 2	**R27,113,744.83**	**R29,599,838.45**
VAT @15%	4,067,061.73	4,439,975.77
Total	**R31,180,806.56**	**R34,039,814.22**

TABLE 13.2: LATENT IMPACT COSTS 2019

Residual and Latent Liability		
Sub-total for Water Treatment	13 835 916,00	13 835 916,00
Multiplication factor 1.05	14 527 711,80	14 527 711,80
Prelimenary & General @6%	871 662,71	871 662,71
Contingency @10%	1 452 771,18	1 452 771,18
Sub Total 2	**R16 852 145,69**	**R16 852 145,69**
VAT @15%	2 527 821,85	2 527 821,85
Total	**R19 379 967,54**	**R19 379 967,54**

13.1 Derivation of quantum

The basis of the methodology complies with the requirements detailed in the MPRDA Regulations, specifically 53 and 54, as well regulation 6 of the financial provision for prospecting, exploration, mining or production operations regulations (GNR 1147, November 2015) prescribed under NEMA. These regulations prescribe the required minimum content as follows: "a detailed itemisation of all activities and costs, calculated based on the actual costs of implementation of the measures required." The regulation further outlines that closure cost estimation must include the following:

1. An explanation of the closure cost methodology;
2. Auditable calculations of costs per activity or infrastructure;
3. Cost assumptions.

Cognisance has also been given to the Guidelines for Evaluation of the Quantum for Closure Related Financial Provision for a Mine issued by DMR (January 2005). The aim is however to align with the financial provision regulation in terms of NEMA to ensure future compliance and also to incorporate the latest requirements of legislation.

The quantum is a function of the quantity of a specific structure and cost associated with the demolition and rehabilitation thereof. The quantum has been developed using Microsoft Excel as a database and equation tool. The quantum does not provide an estimation of the current liability due to the project not being implemented at the time of this report, it does however provide for a final closure cost. The project was separated into numerous management areas. Costing calculations referred to the specific rehabilitation actions, areas and type of disturbance that requires rehabilitation.

The bill of quantities (BoQ) has been developed using a geographic information system to quantify area related to specific infrastructure. In addition, the volume estimations are either based details acquired from the mine planners of the project as all final closure liabilities relate to earthworks. The method employed is deemed acceptable for the level of accuracy required for a mine with a life exceeding 5 years and 10 years (70% to 80% as per Regulation).

A rate sheet has been developed and aligned to the specific infrastructure in the BoQ. The rates sheet has been developed using the following datasets:

1. DMR guidelines (2005)
2. Tender and pay rates from contractors that are available
3. Rates from operations recently evaluated by EXM
4. Associations and industry oversight entities average rate sheets

EXM revises its rates sheets annually using the above data sets. In addition, it considers actual rates where concurrent rehabilitation has taken place at a specific operation. Where rates are carried over from a previous year, 12 months, and where no current rate can be acquired the previous rate is inflated by the annual average of the preceding years consumer price index inflation (CPI) rate. The inflation rate is calculated using data from Statistics South Africa. CPI does however not consider competitiveness of tenders or industry role players. It is therefore imperative to also consider the building confidence index and civic confidence index to either adjust CPI up, down or keep it level.

13.1.1 Annual (Premature) Closure Provision

Premature Closure Provision amounts to R27 113 744.83 excl. VAT. and R19 379 967.54 excl VAT for latent water treatment costs. The total premature closure is estimated at R43 965 890,52.

13.2 Amount to be provided for from operating expenditure

The total quantum amounts to R43 965 890,52 at premature closure including latent and residual impact management related to water treatment.

14. DEVIATIONS FROM THE APPROVED SCOPING REPORT AND PLAN OF STUDY

14.1 Deviations from the methodology used in determining the significance of the potential environmental impacts and risks

Not applicable

14.2 Motivation for deviation

Not applicable

15. OTHER INFORMATION REQUIRED BY COMPETENT AUTHORITY

Not applicable

16. OTHER MATTERS REQUIRED IN TERMS OF SECTIONS 24(4)(A) AND (B) ON NEMA

Not applicable

17. UNDERTAKING

I, _____, the Environmental Assessment Practitioner responsible for compiling this report, undertake that:

- the information provided herein is correct;
- the comments and inputs from stakeholders and I&APs has been correctly recorded;
- information and responses provided to stakeholders and I&APs by the EAP is correct; and

- the level of agreement with I&APs and stakeholders has been correctly recorded and reported.

Report Sign-Off			
Name	**Designation**	**Signature**	**Date**
Divan van der Merwe	Director	DRAFT SIGNED	21 October 2019
Vivienne Vorster	Senior Environmental Scientist	DRAFT SIGNED	21 October 2019

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