mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

ENVIRONMENTAL IMPACT ASSESSMENT REPORT FOR THE PROPOSED DRIEFONTEIN MINE BY CANYON RESOURCES (PTY) LTD IN THE DISTRICT OF MIDDELBURG, MPUMALANGA

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

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IMPORTANT NOTICE

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

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

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

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

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

OBJECTIVE OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

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

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

Preface

This Environmental Impact Assessment Report (EIAR) has been compiled by uKhozi Environmentalists, based on the guidelines provided by the National Environmental Management Act, 1998 (Act no 107 of 1998), Environmental Impact Assessment Regulations, 2014, as amended. Full acknowledgement is made for use of these regulations and guidelines in compiling this report. This document includes uKhozi's own interpretation of the requirements of the National Environmental Management Act (Act 107 of 1998), the regulations, the guidelines and the integration with other statutory and best practice criteria. This report is the next step in the Mining Right and associated Environmental Authorisation and Waste License application process for the development of the proposed Driefontein Mine by Canyon Resources (Pty) Ltd.

Disclaimer

uKhozi Environmentalists (Pty) Ltd was appointed by Canyon Resources (Pty) Ltd to facilitate the Mining Right and Environmental Authorisation application process for the proposed Driefontein Mine. This Environmental Impact Assessment Report (EIAR) has been compiled to comply with the specific requirements of the National Environmental Management Act (No. 107 of 1998) (NEMA) Environmental Impact Assessment (EIA) Regulations (2014). The findings and recommendations presented in this report was based on the information supplied by the Applicant including but not limited to the project description, Mining Work Program (MWP), Social and Labour Plan (SLP) and layout plans as well as the findings of the site-specific specialist investigations competed during the EIA Phase. uKhozi accepts no liability for any incorrect data and/or information supplied by the Applicant on which any of the EIAR has been based.

COMMENTING PERIOD

The draft EIAR is available for a 30-day commenting period which will start on the 18th of July 2022 and end on the 18th of August 2022. A soft copy of the report has been emailed to all the registered IAPs that provided email addresses. A hard copy of the report will be available at the Middelburg Public Library.

Comments received during this period will be incorporated and addressed in the Final EIAR to be submitted to the DMRE for processing. Comments must be sent to the uKhozi Environmentalists (Pty) Ltd, at the following contact details:

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Executive Summary

Introduction and background

Canyon Resources (Pty) Ltd (Canyon) is a mining and exploration company with current operations in Mpumalanga and Gauteng. The company has four operational mines, Phalanndwa and Phalanndwa Extension in Delmas area, Ukufisa in Springs and Khanye in Bronkhorstspruit area, all four are opencast coal mines mined through the typical truck and shovel method and concurrent rehabilitation is done at the sites. Canyon also has one mine in rehabilitation phase, Singani Colliery, also situated in the Middleburg area, and one mine undergoing care and maintenance, Hakhano Colliery, in the Middleburg area.

Canyon plans to develop a new greenfields open cast coal mine referred to as the Driefontein Mine. The proposed mine will be located on Portion 6 of the farm Sterkstroom 400 JS, Portion 5 and a section of Portion 6 of the farm Driefontein 398 JS situated approximately 20km east of Middelburg, Mpumalanga Province.

The project requires a Mining Right in terms of the Mineral and Petroleum Resources Development Act (MPRDA), 2002 (Act 28 of 2002), Environmental Authorisation (EA) for triggering activities that fall under Listing Notice 1 (GNR325) and Listing Notice 2 (GNR327) of the National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA), as amended and a Waste License for triggering activities listed under GNR 921 & GNR 633 (Category B) of the National Environmental Management: Waste Act, 2008 (Act 59 of 2008) (NEM: WA).

The proposed project will also require a Water Use License from the Department of Water and Sanitation (DWS) in terms of Section 40 of the National Water Act, 1998 (Act 36 of 1998) A separate process as outlined in the Regulations Regarding the Procedural Requirements for Water Use License Applications and Appeals, March 2017 published by the Department of Water and Sanitation (DWS) will be followed.

Canyon appointed uKhozi Environmentalists (Pty) Ltd (uKhozi) as independent environmental consultants to facilitate the Mining Right and associated Environmental Authorisation and Waste License Applications for the proposed project. An integrated application for a Mining Right and associated Environmental Authorisation and Waste License will be followed with the Department of Mineral Resources and Energy (DMRE) Mpumalanga identified as the Competent Authority. A Scoping & Environmental Impact Assessment Process is required, as stipulated in GNR326 EIA Regulations 21 to 24, in support of the applications.

Project description

The project will involve the development of a new Greenfields opencast coal mining operation on Portion 6 of the farm Sterkstroom 400 JS, Portion 5 and a section of Portion 6 of the farm Driefontein 398 JS.

The proposed opencast coal mining will be conducted using the conventional truck and shovel rollover method. The mining operation will consist of two opencast pits referred to as the Northern and South-eastern Pits which will be mined through a phased approach with the aim to allow for farming activities to continue whilst mining takes place. Mining activity at the northern and south-eastern sections of the proposed mine will not take place concurrently. Concurrent rehabilitation will occur during the operational phase by means of the roll over method.

The project has an indicated resource of 7.286 million tonnes of coal that will be marketed to local markets. Production will start with 10 000 tons after site establishment and will increase with 20 000 tons per month to an average of 90 000 tons per month once in full production with the life of mine expected to be 7 years.

No wash plant will be established on site. Run of Mined (ROM) coal will be stockpiled at the designated stockpile areas and transported to the existing Hakhano Colliery washing plant situated approximately 3km south of the application area or other licensed site for processing via the existing gravel road (D1433) or sold raw.

The main access road will be constructed from the D1433 gravel road that runs between the R104 and R555.

Water will be sourced from boreholes, ground water inflow to the pit and water captured in the pollution control dams.

Key infrastructure planned includes:

- Two opencast pits (northern and south-eastern).
- Hard and soft overburden stockpiles.
- Topsoil stockpiles.
- Haul roads from pit to ROM stockpile areas.
- Haul roads from ROM stockpile areas to mine access point.
- ROM Stockpile Areas.
- Pollution Control Dams.
- Storm water drains, berms, cut of channels and culverts.
- Hardpark consisting of a workshop, fuel storage facility, offices, change house and a septic tank system.
- Guardhouse at mine access point.

Alternatives

For this specific application the site and proposed activity (coal mining) has already been selected. Therefor the alternatives will be assessed in terms of:

- Design or layout.
- Technology to be used.
- Operational aspects.
- No go Option.

Motivation for the project

South Africa's local energy resource base is dominated by coal mainly because of the availability of deposits that can be exploited at favourable costs. This has resulted in the development of a large coal mining industry in the country. Eskom currently relies on coal fired power stations to meet South Africa's primary energy needs and this will continue until alternative energy generation options can be implemented on a sufficiently large scale.

The coal mined at the proposed Driefontein Mine will be processed off site or sold raw. The greenfields area to be disturbed by the proposed development will be kept significantly smaller due to the fact that no coal processing will take place on site. Through the prospecting operation it was established that the proposed mining area measured a resource of 7.286 million tonnes of coal that can be mined and marketed to both local and export markets.

Extraction of the coal resource will contribute positively to the South African Economy but the benefits of the mining to the community largely centre on the Social and Labour Plan. It is expected the mine workforce will be recruited once the mining right is granted. The approximately 240 core business contractor employees will be appointed by the main mining contractor. The proposed mine will provide employment for locals and support services, as well as empowerment and skills transfer opportunities. Seen in the light of the current economic environment, having an income has a high impact on the quality of life of families, creating a positive effect.

Environmental Impact Assessment Process

Environmental Impact Assessment (EIA) is used to assess the potential implications, combining environmental, social, and economic considerations, of a project before the project commences. The EIA will focus on the aspects of the proposed mining project and their impacts on the natural and societal environment. The findings of the EIA guide the plan/development, implementation, and monitoring/evaluation of an Environmental Management Plan which will attempt to maximise human benefit and to minimise environmental degradation resulting from the proposed project.

The Environmental Impact Assessment Process is carried out in accordance with the NEMA EIA Regulations of 2014, as amended (GNR326). The report content is aligned with Appendixes 3 and 4 of these regulations.

The first phase of the Environmental Impact Assessment Process was the Scoping Phase which informed the Plan of Study for the EIA Phase. The Scoping Report was accepted by the DMRE on the 12th of October 2021. The Department granted extension to submit the Final Environmental Impact Report (EIR) in terms of Regulation 3(7) to complete the necessary specialist investigations, outlined in the Plan of Study of the approved Scoping Report. Subsequently the final EIR must be submitted on or before the 22nd of August 2022. The DMRE thereafter has 107 days to assess the information provided and make a decision on the application.

Public Participation

Public Participation has and will be conducted in both the Scoping and EIA Phases of the project in strict accordance with GNR 326. English will be primary medium for the stakeholder engagement process. The following steps were taken and are planned as part of the public participation process for the proposed project going forward:

- **Verifying existing and identify new internal and external stakeholders and development of a stakeholder database.**
- **Placement of newspaper and site notices informing the public about the project and inviting them to register as Interested and Affected Parties (IAPs).**
- **Written notice to key stakeholders (directly affected landowners, relevant authorities, surrounding landowners and occupiers, ward councillors).**
- **Dissemination of Draft Scoping Report (8th of March 2021 – 9th of April 2021) and Draft EIA Reports for stakeholder comment (18th of July 2022 – 18th of August 2022).**
- **Preparation of a Comment and Response Report, for inclusion in the Final Scoping and EIA Reports.**
- **Public meetings in order to give stakeholders an opportunity to obtain additional information on the project, engage with the Applicant, the EIA team, and to record any issues and concerns about the project.**
- **Focus group meetings with key stakeholders and communities to record any issues and concerns about the project.**
- **An updated list of internal and external stakeholders after completion of the stakeholder engagement process.**
- **Responding to comments and concerns submitted by stakeholders and relevant authorities.**
- **Notification and distribution of the decision on the Environmental Authorisation application to registered stakeholders.**

The issues and concerns raised during the public participation process will be included and addressed in the final EIAR.

Specialist studies

The specialist studies, as outlined in the Plan of Study of the accepted Scoping Report, were conducted to assess the baseline conditions of the site and the impact of the proposed activities during the construction, operation, decommissioning/rehabilitation and closure phases of the project. The specialists also provided mitigation/management measures to reduce and/or prevent the potential impacts identified.

An Economic Cost Benefit Analysis (ECBA) was conducted which did not form part of the Plan of Study of the approved Scoping Report. The ECBA measured the net benefits (including economic, social and environmental) to the broader community resulting from the proposed operations of the project over the long run of say 50 years. These net benefits were compared to the no-go option of the project, i.e., the continuation of current land –use without the project.

Baseline Environment

A summary of the baseline conditions per environmental aspect is provided below.

Aspect	Description
Geology	The application area is situated in the Witbank Coalfield in the northern Karoo Basin that extends over large areas of Gauteng and Mpumalanga. Towards the northern periphery of the basin where the project is located the coal-bearing rocks outcrop against pre-Karoo rocks predominantly comprising the rocks of the Transvaal Supergroup. The coal measures of the Witbank Coalfield are litho-stratigraphically confined to the Vryheid Formation of the Ecca Group (Middle Ecca) of the Karoo Supergroup.
Topography & Drainage	The general landscape is typical of the Highveld Grasslands in that it is of a gently undulating topography, with dispersed perennial and non-perennial streams. The study area is characterised by a gently undulating topography and in the area of the site the slope is more or less in the order of 1.5%. The project site is situated approximately 1620 – 1680 m above sea level: with increasing elevation towards the east. Locally drainage is towards the Keeromspruit and Selons River that flows from east to west and from southeast to northwest situated to the northeast and north of the site. On a regional scale, drainage occurs towards the generalised flow of the Klein-Olifants River which flows from southeast to northwest.
Meteorological conditions	The Mpumalanga region generally experiences a sub-tropical climate with warm, rainy summers and cold winters. Average monthly temperatures range from 9.1 – 20.2 ^{0}C. Highest temperatures are observed during the spring, summer and autumn months (September – April) and minimum temperatures are observed during the winter months (May – August). Relative humidity is higher at the end of summer (February) and in winter (i.e., May – July). The area receives most of its rainfall during the spring, summer and early autumn seasons during the months October - March. Little to no rainfall is observed during the mid-autumn and winter seasons from April to August.

Aspect	Description
	The predominant wind directions are observed from the east (~13.9% of the time), east-south-east (~9.72%) and north-west (~8.5%). Wind speeds are generally high during all seasons.
Soils, Land Capability and Use	The underlying geology is rock of the Ecca Formation. The soils that formed are yellow or red with sandy loam and sandy clay loam texture and with a single grain or poorly developed blocky structure. The Clovelly and Hutton soils that occur on most of the property have high sensitivity. The application area is a productive farming unit. The largest part of the proposed mining area is cultivated and is classed as high potential arable land. The main activity on the directly affected properties is maize and soya production. Depending on the season 7,5 to 10 tonnes maize grain or 2,8 tonnes of soybeans are harvested per hectare. The farmer utilises stover and hay to feed a cattle herd with 250 breeding cows. Approximately 907 ha are arable and planted to cash crops. Based on this figure the gross farm income generated from the MRA is R18,1 million per year and a net farm income of R7,4 million.
Vegetation (Flora)	The application area is located within the Grassland Biome of South Africa, which is represented within the study area by the Rand Highveld Grassland vegetation type. Three broad vegetation units, were identified in the application area, namely: • Natural Grassland Vegetation Unit consisting of: ➢ Open Grassland; and ➢ Degraded Natural Grassland. • Wetlands/ Moist Grassland Vegetation Unit • Modified Grassland Vegetation Unit consisting of: ➢ Agricultural Fields. ➢ Old Agricultural Fields; and ➢ Mining Area and Historical Infrastructure Areas. The majority of the study area comprises the Agricultural Fields vegetation unit. These areas have been extensively modified through cultivation practices and are currently utilized as agricultural areas (predominantly maize, soybeans and planted grass pastures), with little or no natural vegetation remaining. No floral SCC are indicated in the South African National Biodiversity Institute (SANBI) Botanical Database of southern Africa (BODATSA) and Plants of southern Africa (POSA) databases to occur within the QDGS 2529DA in which the application area is located. During the field assessment, no Threatened or Protected Species (TOPS species) in terms of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEMBA), International Union for Conservation of Nature (IUCN) and SANBI threatened species, or tree species protected in terms of the National Forests Act (Act No. 84 of 1998) were recorded. During the field assessment, the following plant species which are listed as Protected in terms of the Mpumalanga Nature Conservation Act (Act No. 10 of 1998) (MNCA), were encountered:

<table>
<tr><th>Aspect</th><th>Description</th></tr>
<tr><td></td><td>
<table>
<tr><th>Species</th><th>Common name</th><th>IUCN/ SANBI THREAT STATUS</th><th>Protected</th><th>Vegetation Unit</th></tr>
<tr><td>Gladiolus papilio</td><td>Butterfly gladiolus</td><td>LC</td><td>MNCA</td><td>Natural Grassland Vegetation Unit: Open Grassland</td></tr>
<tr><td>Crinum bulbispermum</td><td>Orange river lily</td><td>LC (Decreasing)</td><td>MNCA</td><td>Natural Grassland Vegetation Unit: Open Grassland</td></tr>
<tr><td>Kniphofia ensifolia subsp. ensifolia</td><td>Red hot poker/ torch lily</td><td>LC (Near Threatened (NT) in Mpumalanga Province)</td><td>MNCA</td><td>Wetland/ Moist Grassland Vegetation Unit.</td></tr>
</table>
</td></tr>
<tr><td>Animal life (Fauna)</td><td>Five habitat types were identified namely: agricultural fields (maize and soya beans), grasslands, patches of trees (wattle (Acacia mearnsii)), bare ground (roads) and highly disturbed areas (mining activities). These habitat types formed part of the three broad vegetation units.

No faunal SCC were recorded during the field assessment, but the DFFE Screening Tool indicated that three mammal species of conservation concern may occur in the study area namely: rough-haired golden mole (Chrysospalax villosus), Maquassie musk shrew (Crocidura maquassiensis) and oribi (Ourebia ourebi ourebi). According to MTPA, Three other mammal species that are listed as Near Threatened (NT) may occur in the area: serval (Leptailurus serval), brown hyena (Parahyaena brunnea) and South African hedgehog (Atelerix frontalis).

No avifaunal SCC was recorded during the survey. However, four avifaunal SCC, namely African grass owl (Tyto capensis), grey crowned crane (Balearica regulorum), southern bald ibis (Geronticus calvus), and the yellow-billed stork (Mycteria ibis) have been recorded within pentad 2540_2935 during the timeframe of the SABAP2 project (2007 – present). Three Near Threatened (NT) species, the blue crane (Anthropoides paradiseus), greater flamingo (Phoenicopterus ruber) and lesser flamingo (Phoenicopterus minor) have also been recorded for the pentad. Suitable grassland habitat for the African grass owl, is present within the Natural Grassland vegetation unit in the south of the study area and this species is likely to occur here. Other avifaunal SCC may utilise the grassland habitat as occasional foraging visitors.

Breyer’s long tailed seps (Tetradactylus breyeri) was the only reptile of SCC that has previously been recorded for the 2529 DA QDGS based on information from the MTPA.

No amphibian SCC has been recorded for the area, however, the data from the MTPA indicated that the Near-Threatened Giant Bullfrog (Pyxicephalus adspersus) has been recorded in the adjacent QDGSs 2529DA and 2529DC.</td></tr>
<tr><td>Surface water</td><td>The application area is situated on the northeastern boundary of quaternary catchment B12D in the Olifants water management area, with a small portion of the northern proposed opencast area located in quaternary catchment B12E, draining in a northern direction.

A watershed is formed along the northern boundary of Portion 5 of the farm</td></tr>
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Aspect	Description
	Driefontein 398JS. Runoff from the study area flows overland in a southern direction. Two fountains originate on the southern boundary of the study area on Portion 6 of the farm Driefontein 398JS, with a third fountain originating along the southern boundary of the study area on Portion 6 of the farm Sterkstroom 400JS. The streams and associated wetlands formed by these fountains flow in a south-western direction and forms one larger stream that can be described as a tributary of the Klein Olifants River. This tributary discharges into the Klein Olifants River approximately 13km downstream of the study area.
Wetlands	The study area transverses a non-FEPA and there are no Wetland FEPAs in close proximity to the study area. Several wetland areas, mainly associated within the three streams mentioned above occur along the southern boundary of the study area, with the Mpumalanga Highveld Wetlands dataset indicating an additional seep wetland to the west of the channelled valley bottom wetland on Portion 6 of the farm Sterkstroom 400JS. Four wetlands classified as follows were recorded on the study area: • Channeled Valley Bottom. • Unchanneled Valley Bottom. • Pan. The channeled and unchanneled valley bottom wetlands drain into the same unnamed tributary of the Klein-Olifants River. The wetlands scored low with regards to cultural benefits mostly due to the setting of the study site which is not accessible to the general public. Some direct human benefits include wetland areas used for cultivation and grazing. The dense vegetation cover of the wetlands is likely to produce regulating and supporting benefits such as water quality enhancement and flood attenuation. The wetlands score high with regard to biodiversity support as they provide specialized habitat for numerous significant species as recorded during the study site. The valley bottom wetland is also likely to be sensitive to changes in water quality. The area has a low human population density, and the surroundings are actively mined and/or used for forestry and are not accessible to the general public. The main impacts associated with the wetland system is current and historical agriculture and grazing practices which continues to impact on them through input of nutrients and pesticides and altered soil characteristics.
Groundwater	According to the 1:500 000 General Hydrogeological Map the Ecca Group and Selonsrivier Formation rocks typically act as secondary aquifers (intergranular and fractured rock aquifers). However, the multi-layered weathering system present on these rocks could prove to have up to two aquifer systems present in the form of a shallow, saprolitic aquifer with a weathered, intergranular soft rock base associated with the contact of fresh bedrock and the weathering zone: and a fractured bedrock aquifer.

Aspect	Description
	A hydrocensus was conducted within a 2 km radius of the proposed mining site as a site familiarisation exercise and collection of essential groundwater related data from the study area and surrounding environment. The hydrocensus was conducted in February 2019. Six (6) boreholes, one (1) spring and one (1) dam were found during the hydrocensus. During the hydrocensus, 4 boreholes were available for groundwater level measurement. The groundwater levels varied between a minimum of 8.6 m and a maximum of 14.03 m below ground level. The groundwater flow direction is from east to west; therefore, groundwater will flow from high relief areas east of the proposed site of mining towards the west. Water samples were collected from five (5) boreholes and one (1) surface water point around the planned site of mining during the investigation. The analytical results were compared with the maximum recommended concentrations for domestic use as defined by the South African National Standards (SANS) 241-1: 2015 target water quality limits. • Combined nitrate and nitrite exceed the SANS standard limit in DRIE-BH1 and DRIE-SPRING, indicating poor water quality. • Fluoride concentrations are elevated in DRIE-BH1 and DRIE-BH5 possibly due to the underlying geology. • Manganese concentrations are elevated in DFBH03 possibly due to the underlying geology. The average sulphate concentration prior to mining in the hydrocensus boreholes was found to be 1.08 mg/l. A 0% impact cannot be achieved as the planned opencast will be in the catchment of these wetlands. A reduction in flow of 6-18 % can be expected for the wetlands at the study area as the result of the planned opencast mine. Soil samples were collected from 2 newly drilled boreholes during the investigation. The samples were submitted for geochemical analysis. Based on the Net Acid Generation (NAG) pH results, the following can be concluded: • DFBH01 (6.34) – Non-Acid Generating Potential • DFBH02 (7.70) – Non-Acid Generating Potential Based on the Acid-Base Accounting (ABA) results, the following can be concluded: • DFBH01 – NNP=0.4-0.1=0.3 therefore NNP = Sample is potentially Acid Neutralizing • DFBH02 – NNP=30.31-0.725=29.6 therefore NNP = Sample is potentially Acid Neutralizing The Groundwater Decision Tool (GDT) calculated a vulnerability rating of 62% for the aquifer which is classified as medium. Based on information collected during the hydrocensus it can be concluded that the aquifer system in the study area can be classified as a "Minor Aquifer System based on the fact that the local population is not dependent on groundwater. A Groundwater Quality Management Index of 4 was estimated for the study area from the ratings for

Aspect	Description
	the Aquifer System Management Classification. According to this estimate a medium-level groundwater protection is required for the aquifer.
Air quality	The land use immediately surrounding the proposed Driefontein Mine consists mostly of grasslands, cultivated land, mining areas and plantations, with few built up residential areas. The towns of Middelburg and Belfast are located approximately 20 km south-west and 35km east of the proposed Driefontein Mine, respectively. The area is classified as rural in nature and is located in the Highveld Air Quality Priority Area (HPA). Existing key sources of airborne emissions surrounding the project site have been identified as follows: • Forestry/Plantation activity (surrounding areas). • Mining activity (north, east, south-east and south-west of the proposed mine). • Vehicle dust entrainment on unpaved roads (surrounding areas); and • Agricultural activity and potential biomass burning (surrounding areas).
Noise	Noise in the area is restricted to routine traffic to and from the surrounding farms and adjacent mining operations conducted by Hakhano Colliery and Bankfontein Colliery as well as other coal mines. The most important route in terms of calculable sound intensity levels is the R555 which can attain highway speeds. Further smaller routes are featured with their contributions minimal in terms of calculable acoustics. No significant railway or air transportation networks were identified. A small railway line does exist, however has been discontinued/derelict. Agricultural activities such as the cultivation of lands and harvesting of crops also contribute a low scale source of noise to the ambient level.
Visual	Even though the intrinsic value of the Mpumalanga Highlands is largely based on ecological characteristics, the values of the subject property and its immediate surroundings are largely based on the agricultural industry. The site is visible from the R555 district road and from the existing gravel road (D1433) connecting the R555 and R104. The R555 runs along the northern boundary of the application area and the D1433 gravel road runs along the eastern boundary. Within a 3km radius of the proposed mine the land use consists of agricultural, forestry, transportation, natural grassland and mining. The accumulation of mines within the region has contributed to a visually unappealing environment. The broader study area is mainly a rural natural grazing and cultivated farmland area. The surrounding area has scattered clusters of farm homesteads especially towards the west. Theses isolated farm homesteads do not intrude highly on the landscape.
Heritage	Thirteen burial grounds and graves are present within the application area but situated outside the proposed development footprint. Burial grounds and graves have high heritage significance and are given a Grade IIIA significance rating. No historical structures were identified. The proposed development is primarily underlain by the Vryheid Formation (Ecca Group, Karoo Supergroup), According to the PalaeoMap on the South African Heritage Resources Information System (SAHRIS) database, the

Aspect	Description
	Palaeontological Sensitivity of the Vryheid Formation (Ecca Group, Karoo Supergroup) is Very High (Almond and Pether 2008, SAHRIS website). However, no visible evidence of fossiliferous outcrops was identified, although there is a high possibility that fossils do exist in the application area.
Socio Economic	The project is in the Nkangala District Municipality ("NDM") and Ward 9 of the Steve Tshwete Local Municipality (STLM) of the Mpumalanga Province. The ward is large, but sparsely populated with a few small settlements. Agricultural land around the STLM area is increasingly under threat, due to the need for urban expansion, mining development and electricity generation. This competing land use amongst sectors that cause a strain on local economic development is particularly relevant between the mining sector and agriculture, which poses a huge food security challenge. As a result of migration to the STLM (jobseekers), a significant portion of the population growth is between 20 and 34 years of age and approximately 50% of the labour force is youth. In 2011, 27% of the youth group was unemployed. In Ward 9, however, the percentage of children below 14 years and pensioners older than 65 years of age are higher than in the broader STLM. It is clear that the limited employment opportunities in Ward 9 discourage the economic active population to settle here. There is a definite need to bridge the study-work divide in order to equip youth with the necessary skills, and this project, through the SLP initiatives, has the potential to address this gap. STLM's economy contributes about 14,7% towards the Mpumalanga economy with an estimated growth of about 4% from 2011 until 2016 (STLM IDP). Manufacturing, mining and finance are the main drivers of the STLM economy and, despite other key economic sectors being on the decline, mining continuous to grow (STLM IDP). Agriculture's contribution to the economy is relatively low compared to other sectors.
Traffic	The surrounding road network consist of the R104, R555 and D1433. The traffic volumes on R104 are generally low, in the order of 120 vehicles per hour per direction, while the volumes on R555 are approximately 100 vehicles per hour per direction. The D1433 that links the R555 to the R104 are mainly be used by trucks – the road typically carries volumes less than 10 vehicles per hour per direction. The R555 and the R104 situated north and south of the proposed development respectively, are in a fairly good condition – with a paved surface and visible road signs and lane markings. The D1433 situated to the east of the proposed development is unpaved and narrow. In terms of public transport infrastructure provision, no formal taxi bays were observed at the external road network on the R104, R555 and D1433 close to the application area.
Blasting	Infrastructure was identified with the area of influence, within 3 500m radius from the mine boundary. The closest structures observed are the R555 road, Buildings/Structures, Hydrocensus Boreholes, Graves, Dams, Reservoir and Railway Line.

Anticipated Impacts

As part of the scoping phase, significant issues which require further investigation were identified. Issues that are identified as having a potentially significant impact are carried forward into the Environmental Impact Assessment phase and subsequently the Environmental Management Phase. These impacts and additional impacts identified as part of the EIA Phase have been further refined and assessed by conducting the specialist investigations outlined in the Plan of Study of the approved Scoping Report. The impacts are assessed and quantified according to uKhozi's quantitative impact assessment methodology which determines the significance of the impacts by evaluating the consequence (extent, duration, and severity) and likelihood (probability) of each impact. A summary of the highly significant positive and negative impacts (pre mitigation) along with proposed mitigation measures and significance rating post mitigation are provided below.

Potential Impact Description	Aspect	Phase	Significance Rating (Pre-Mitigation)	Mitigation measures	Significance Post Mitigation
Disturbance of the geological profile	Geology	Construction & Operation	High	Mining must be conducted strictly according to the MWP submitted to the DMRE. Optimally exploit the resource in terms of tonnage of rock mined and cost as provided for in the mine plan. Comply with the recommendations made by the blasting and vibration specialist.	High
Subsidence of the rehabilitated area	Topography	Decommissioning, rehabilitation, and closure	High	Conduct on-going monitoring for subsidence and or cracking to surface. Where needed, implement backfilling of cracks and landscaping of collapsed areas.	Medium
Loss of soil quality	Soils, land capability and use	All phases	High	Unnecessary land clearance must be avoided. Stockpile different soil horizons in different areas, keep inventory, and revegetate stockpiles. The slope of the topsoil stockpiles must not be more than 15% in order to limit erosion from the stockpiles. Trucks, equipment, and other vehicles must park on designated parking areas and not create additional areas at risk of soil erosion by parking outside of the demarcated areas. The stormwater management plan should be followed in order to protect surrounding land from erosion that	Medium

Potential Impact Description	Aspect	Phase	Significance Rating (Pre-Mitigation)	Mitigation measures	Significance Post Mitigation
				may occur during thunderstorms. Vehicles and equipment must travel within demarcated areas and not outside of the operational footprint. Develop a designated parking area for coal trucks that will be queuing to collect coal in order to avoid trucks parking in nearby agricultural areas. Use specific tracks for the tipping trucks when restoring the topsoil, to diminish the compacted soil area. Rip replaced soils when it reaches a depth of 500 mm, and again once all soil has been replaced. Maintenance must be undertaken regularly on all vehicles and operational machinery to prevent hydrocarbon spills. Drip trays must be used when working on vehicles to avoid contamination. Ensure drivers follow required safety precautions and road rules Clean-up of hydrocarbon spills if it occurs, test soils for contamination and perform best clean up method. Any waste generated during operation, must be stored into designated containers and removed from the site	

Potential Impact Description	Aspect	Phase	Significance Rating (Pre-Mitigation)	Mitigation measures	Significance Post Mitigation
				by registered contractors. Reduce coal dust blowing on stockpiles, by minimizing dust generation from roads (by keeping them moist) and limiting dust from blasts. Soil pollution monitoring must be conducted bi-annually around all possible sources of soil contamination on site such as the ROM stockpiles, PCDs and along the haul roads. Manage dirty and polluted water on site through storage and treatment with suitable infrastructure such as pollution control dams. Stockpile soils per horizon (not mixing different soil horizons) and vegetate stockpiles. Preventing wind blowing coal dust onto stockpiles, by minimizing dust generation through implementation of mitigation measures listed under air quality. Soil should be spread, treated with fertilizer or ameliorants (if required) and re-vegetated, naturally or with indigenous seeds (as required). Remove all unwanted infrastructure including haul roads.	

Potential Impact Description	Aspect	Phase	Significance Rating (Pre-Mitigation)	Mitigation measures	Significance Post Mitigation
				Conduct on-going monitoring for subsidence and or cracking to surface. Where needed implement backfilling of cracks and landscaping of collapsed areas. Implement proposed soil management plan and closure plan (ENVASS, 2022)	
Loss of high potential cultivated land and crop production		Operation, Decommissioning, rehabilitation and closure	High	Implement mitigation measures listed above for loss of soil quality. Implement mitigation measures under soil erosion, compaction and pollution listed above. If required, appoint an independent Valuer to determine the market value of the land and to ensure fair compensation for land acquired for mining purposes or compensate the farmer for annual loss of income during the life of mine. The following measures must be implemented during concurrent rehabilitation: - Topsoil and subsoil should be replaced in the correct sequence on soft overburden material to ensure that subsurface limiting layers are not created. - Reshaping of footprint area to allow for naturally free draining topography. - Soil should be spread, treated with fertilizer or	Medium

Potential Impact Description	Aspect	Phase	Significance Rating (Pre-Mitigation)	Mitigation measures	Significance Post Mitigation
				ameliorants (if required) and revegetated, naturally or with indigenous seeds (as required), in one consecutive operation, to reduce the potential for soil loss to wind and water erosion. Crop yields of the adjoining fields should be monitored and compared to land further away to assess the impact of dust and air pollution caused by the mine activities.	
Loss of grazing land and animal production		Operation, Decommissioning, rehabilitation and closure	High	The area utilized for mining must be kept to the minimum needed for the successful implementation of the operation. The mine should provide watering facilities where the mining operation prevents cattle from watering points. Fence the mining area to restrict access and prevent injuries to livestock. Water quality should be monitored and measured against criteria of DWS and SABS regarding suitability for livestock health.	Medium
Changes in hydrological function	Wetlands	Operation	High	Development should include measures to ensure that the flow paths and storage mechanisms in the soil should be disturbed as little as possible, to sustain hydrological and biogeochemical connectivity. A wetland offset strategy should be formulated should loss of hydrological zonation be detected in downslope	Medium

Potential Impact Description	Aspect	Phase	Significance Rating (Pre-Mitigation)	Mitigation measures	Significance Post Mitigation
				wetlands Implement a SWMP whereby clean storm water runoff is diverted to the natural drainage lines and dirty storm water runoff is contained and recycled.	
Sedimentation and siltation			High	Maintain buffer zones in which no activities can take place to trap sediments. Make use of a single access road during operations. Implement a program whereby diverted storm water runoff is contained and recycled. If any water is released into the receiving environment the velocity of storm water must be attenuated and spread by making use of trench breakers and gabion structures. Adapt mining process to ensure continuous rehabilitation during operational phase by rehabilitating all areas as soon as they are not required for further operations for the life of the mine. Prevent runoff from the haul roads from entering the receiving environment. Monitoring should be done to ensure that sediment pollution is timeously addressed.	Medium

Potential Impact Description	Aspect	Phase	Significance Rating (Pre-Mitigation)	Mitigation measures	Significance Post Mitigation
Introduction and spread of alien vegetation			High	An alien vegetation eradication programmed should be implemented on the site to remove the alien vegetation from the wetland areas as priority. Monitor the establishment of alien invasive species within the areas affected by the operation and take immediate corrective action where invasive species are observed to establish. Rehabilitate or re-vegetate disturbed areas throughout the life of mine.	Medium
Loss and disturbance of watercourse habitat and fringe vegetation			High	Apply and maintain the recommended buffer zones around wetlands. If surface water monitoring shows that the surrounding watercourses are affected by mine dewatering, discharge of clean water into the tributaries should be considered. Loss of wetland habitat resulting from loss of shallow interflow must be offset through improvements to downslope wetlands. Regular monitoring for wetland integrity and function should be undertaken in the long-term.	Medium
Change in water quality			High	Runoff water from the overburden dumps, ROM stockpiles and any other contaminated stormwater should be channelled into PCDs.	Medium

Potential Impact Description	Aspect	Phase	Significance Rating (Pre-Mitigation)	Mitigation measures	Significance Post Mitigation
				Seepage drains should be maintained and channelled into the PCDs. Bunded areas must be connected to the PCD system. Implement and maintain a closed sewage reticulation system. Ensure waste management is done within good practice guidelines. Implement good housekeeping in terms of hazardous materials storage. Spill kits must be stored on site: In case of accidental spills of oil, petroleum products etc., good oil absorbent materials must be on hand to allow for the quick remediation of the spill. Vehicles must be kept in good working order and leaks must be fixed immediately on an oil absorbent mat. No maintenance (including refuelling) or storing of machinery near the aquatic areas. Domestic waste must be collected in waste bins that are located on site. The collected waste must be disposed of at a municipal landfill facility.	

Potential Impact Description	Aspect	Phase	Significance Rating (Pre-Mitigation)	Mitigation measures	Significance Post Mitigation
				The waste bins must be marked clearly indicating what waste must be disposed of in what bin. Employees must be encouraged to re-use, recycle, and reduce waste where possible. The runoff should be routinely monitored for acidity and salinity as an early warning for potential increases in salinity or acidic drainage water. Water quality should be routinely monitored at aquatic ecosystems associated with the mining activities.	
Aquifer contamination caused by polluted water migrating away from the mining area (pollution plume)	Groundwater	Decommissioning, rehabilitation and closure	High	The acid producing material must be placed as low in the pits as possible, followed by the non-acid generating material. All mined areas should be flooded as soon as possible to minimize oxygen from reacting with the remaining pyrite. The final backfilled opencast topography should be engineered such that runoff is directed away from the mining areas. The final layer (just below the topsoil cover) should be as clayey as possible and compacted if feasible, to reduce recharge to the decommissioned mines. Natural berms must be constructed to allow free	Medium

Potential Impact Description	Aspect	Phase	Significance Rating (Pre-Mitigation)	Mitigation measures	Significance Post Mitigation
				drainage of surface water around the rehabilitated pit. Surface and groundwater quality and quality monitoring should be continued until a steady state is reached.	
Deterioration of visual quality and sense of place for sensitive receptors within 500m of the project area.	Visual	Operation	High	The design of the slopes should be as gradual as possible. Keep stockpile heights as low as possible (<20m) Trees and shrubs can be used to screen structures and break stark contrasting lines if carefully planned and positioned. Introduce landscaping measures such as vegetated berms. Maintain the landscape to a high aesthetic standard to retain a high visual quality for visitors and observers. Start the rehabilitation of disturbed areas as soon as practically possible in order to restrict long stages of exposed soil and possible erosion.	Medium
Damage to burial grounds and graves	Heritage	Construction & Operation	High	Demarcate sites with at least a 100m buffer and avoid them. A Grave Management Plan should be developed for the graves, to be implemented during the construction and operation phases (which needs approval by SAHRA	Very low

Potential Impact Description	Aspect	Phase	Significance Rating (Pre-Mitigation)	Mitigation measures	Significance Post Mitigation
				BGG). All work must cease immediately, if graves or burial grounds are uncovered, within the development footprint. If theses can't be avoided, the graves could be relocated after completion of a detailed grave relocation process, that includes a thorough stakeholder engagement component, adhering to the requirements of s36 of the NHRA and its regulations as well as the National Health Act and its regulations.	
Damage to fossil resources		Construction & Operation	High	In the event that fossil remains are discovered, either on the surface or exposed by fresh excavations the Chance Find Protocol must be implemented.	Medium
Ground vibration causing structural damage and/or nuisance at the following POI's: • Mine activity (POI 1) • Dam (POI 2, 3 and 4) • R555 (POI 5, 6, 7, 8, 9) • Building/structures (POI 10)	Blasting & vibration	Operation	High	Specific blast design must be done, using shorter and smaller diameter blast holes. Use electronic initiation instead of shock tube systems to obtain single hole firing. Implement specific mitigation measures recommended by blasting specialist for problematic POIs. Do not blast during the following times: - too early in the morning or too late in the afternoon in winter. - When there is fog and/or low overcast clouds.	Medium

Potential Impact Description	Aspect	Phase	Significance Rating (Pre-Mitigation)	Mitigation measures	Significance Post Mitigation
				- In the dark. - When wind is blowing strongly in the direction of an outside receptor.	
Loss of high potential farmland	Socio Economic	Operation	Very high	Engage with the landowners to draw up a map with no-go areas to minimize negative impacts on current land use. Reduce the project area and development footprint to the smallest area possible; locate the ROM stockpile and contractor's yard as close as possible to the mining area. Implement all the mitigation and management measures as proposed in the Geohydrological Report and Air, Visual and Noise Impact Assessments to address intrusion and pollution impacts that could result in degradation of agricultural land. Potential negative impacts because of the mine (dust, noise, land invasions, security issues, etc.) should be addressed pro-actively, to avoid it having an impact on land values. Ensure that all surrounding landowners are familiar with the procedures to lodge complaints and attend to the issues at hand expediently.	High
Loss of access to livelihoods		Operation	High		Medium
Income generated through		Construction	High	If required, appoint an independent Valuer to determine	Medium

Potential Impact Description	Aspect	Phase	Significance Rating (Pre-Mitigation)	Mitigation measures	Significance Post Mitigation
the sale of agricultural land for mining purposes				the market value of the land and to ensure fair compensation for land acquired for mining purposes.	
Change to the sense of place		Operation	High	Clearly identify all sensitive receptors of ground vibration and sound; and survey the quality of the housing and infrastructure prior to blasting activities commencing. Implement all recommendations made by the Blasting Specialist. Consult with the affected parties on the most effective ways that blasting schedules be communicated to them (notice boards, text messages, verbal notifications, etc.). Notify affected parties in advance. Conduct ongoing engagements, to ensure that blasting for the project occurs in a manner that has the least impact on people and the environment. Ensure that locals are aware of the channels to raise complaints (complaints' register at the entrance to the Project Area/Surface Layout Area, Environmental Monitoring Committee, etc.) Where relevant install silencers on machinery and trucks.	Medium
Utilization of new HDSA		Operation	Medium +	Maximise the number of locals sourced for SMME	High +

Potential Impact Description	Aspect	Phase	Significance Rating (Pre-Mitigation)	Mitigation measures	Significance Post Mitigation
supplies, SMME and other small businesses as a result of local procurement				development, local procurement and local supporting industries. Give preference to local communities and gradually extend the labour sending area to the wider municipality, district and province.	

Discussion of potentially significant positive impacts
Extraction of the coal resource will contribute positively to the South African Economy but the benefits of the mining to the community largely centre on the Social and Labour Plan. The socio-economically depressed and geographically marginalised communities would benefit directly from the commissioning of the mine.

During the construction phase, limited employment opportunities will become available as workers will be sourced from existing labour sending areas. Some SMME and small business opportunities may manifest as a result of procurement and service requirements. During the operational phase (7 years) positive local economic impacts of medium to high overall significance is possible as a result of:

- Job creation of approximately 250 employees.
- Local procurement, small business and SMME development.
- Employment equity of HDSA's, especially women and youth.
- General local economic impacts for the broader municipality; and
- LED project investments in the STLM.

The positive outcome of these impacts will increase if the number of locals to be considered for the above opportunities are maximised. Canyon is committed to ensuring the growth of HDSA suppliers and its targets, as reflected in the Driefontein SLP, are based on the new Mining Charter Scorecard, 2018. Skills development, training and capacity building is another positive output for the STLM as a result of this project.

Discussion of potentially significant negative impacts
The intrusive nature of opencast mining will result in several negative impacts on the environment during the operational and decommissioning, rehabilitation, and closure phase. The key negative impacts are summarised below per environmental aspect:

Geology
By the nature of mining projects, the geology is exploited for the target minerals therefore the impact of the proposed project on the target ore body and the overburden and rock above this ore body is necessary for the project and unavoidable. As indicated on the preliminary layout plan the MRA will be divided into two (2) open pits. The disturbance of the geological profile over these areas is definite and non-reversible as the mineral resource will be removed from the geology. The impact can't be mitigated so the Applicant must aim to optimally exploit the resource in terms of tonnage of rock mined and cost as provided for in the mine plan. Mining must be conducted strictly according to the MWP and comply with the recommendations made by the blasting and vibration specialist.

Topography
Opencast mining and earthworks inside the MRA will ultimately result in the alteration/modification of the surface topography. This negative impact is unavoidable but can be mitigated during the operational phase and reversed after mining. The aim during decommissioning/rehabilitation is to restore the natural topography in such a way as to allow the natural drainage lines to return as close as practically possible to its pre-mining state. The impact post closure will be positive if this occurs as surface water drainage is restored and topography

returned to functioning state. However, bulking of the reinstated materials or possible subsidence are realistic conditions of rehabilitation that will result in the ponding of surface water if the compaction of the materials and final landscaping are not well managed and implemented. Ponding will result in inundation of low-lying areas by surface water (clean and possibly dirty) which will potentially sterilise, contaminate, or salinize the soils, and render the land unusable for any natural functions. The impact will be highly significant and will in turn affect the future land use and capability of the area negatively. If this impact occurs the area must be graded again in order to achieve the post mining objectives before applying for closure.

Soils, land use and capability

The largest part of the proposed mining area is cultivated and is classed as high potential arable land which is currently operated as a productive farming unit. The cultivated land is 907 hectares of which 471 ha will be directly disturbed by the proposed mining activities. In terms of the grazing land, 177 ha could be potentially transformed from rangeland to mining land. The significance of the potential impacts is moderate to high post mitigation because based on the current mine layout the loss of high potential land cannot be mitigated. In consultation with the landowner and through correct implementation of the recommended mitigation and management measures the Applicant must ensure that agricultural activities can continue on the adjacent farmland situated within the MRA throughout the Life of Mine.

Agricultural production could resume in the areas not directly affected by mining after year 7 (436 hectares) while the 471 ha within the mining area must be rehabilitated to grazing land potential from year 9 to year 20 after which it could return to current agricultural yields. In order for this to be achieved, the Applicant must develop and implement a soil management plan throughout the life of mine and ensure that rehabilitation is done according to the Closure Plan (ENVASS, May 2022) to restore the soil and land capability to its present condition. Should this happen the loss of high potential agricultural land will not be permanent.

Wetlands

Significant impacts to the wetlands resulting from the proposed coal mining are expected to be related to loss of recharge areas upslope of the wetlands. Both construction and operational phases of the opencast mine in close proximity to wetlands fall in the Medium risk category. Activities which fall within this category should be authorised through a Water Use Licence and therefor it is recommended that a hydropedological assessment is conducted as part of the WULA process to confirm whether significant regional interflow supports the downslope wetlands.

Changed runoff characteristics will further alter hydrological and geomorphological processes as the topography becomes altered when the site is mined. Potential pollution of wetlands may compromise water quality however with the implementation of the recommended buffer zones and other mitigation measures the significance of the potential impacts can be reduced to medium - low. If independent monitoring highlight possible loss of wetland habitat it should be addressed through offsetting.

Groundwater

Following closure of the mine, the groundwater within the mined areas is expected to deteriorate due to chemical interactions between the geological material and the groundwater. The resulting groundwater pollution plume is expected to commence with downstream movement. Based on the numerical flow and transport modelling performed, the following hydrogeological impacts were identified:

- **Contamination from the Northern Opencast is expected to affect the tributary of the Keeromspruit north of pit with expected concentration increases of up to 200 mg/L with regards to Sulphate. The Northern opencast is expected to rebound within 35 years. No decant is predicted.**
- **Contamination from the South-eastern Opencast is expected to affect DFBH1 and DRIE-BH1 with expected concentration increases of up to 200 mg/L with regards to sulphate. The South-eastern pit is expected to rebound within 40 years. Decant from this mine is expected to take place to the south-west of the pit, at a rate of 1-2 l/sec.**

The significance level of the potential impacts can be reduced to low – medium through the implementation of the mitigation measures and recommendations by the groundwater specialist.

Visual

Visual impacts will occur from construction through to decommissioning/rehabilitation and closure phases of the project. More specifically, impacts will result from the earth work activities, establishment of the northern and southern overburden dumps, ROM stockpiling, opencast pits, transportation of ROM coal to Hakhano Colliery for processing resulting in dust pollution. The visual disturbance of the proposed Driefontein Mine does not lie over any main tourist routes and the existing Bankfontein Colliery act as a screen from the R555, reducing the visual impact from this road. The visual disturbance will however affect the permanent residents in the immediate vicinity. The establishment of the proposed mine is expected to contribute to the change in the sense of place of the local area by transforming the project area from agricultural land to mining, resulting in a visually unappealing environment. It is recognised that the expected visual impact of the opencast mine would be negative in nature, but the impacts can be reduced to a medium – low significance level if the recommended mitigation measures are implemented.

Heritage

A total of thirteen (14) burial grounds and graves (DFN-01, DFN-02, DFN-03, DFN-04, DFN-05, DFN-06, DFN-07, DFN-08, DFN-09, DFN-10, DFN-11, DFN-12, DFN-13, DFN-14) were identified. However, five (5) of the previously identified burial grounds (DFN-01, DFN-02, DFN-07, DFN-09 and DFN-10) have been destroyed by ground clearing and deforestation activities in the area as well as newly established maize fields, since the initial survey in 2019.

Burial grounds and graves have high heritage significance and are given a Grade IIIA significance rating and should be retained and avoided by establishing a 100m no-go buffer as per SAHRA guidelines. The pre-mitigation impact significance is rated as high but with the implementation of the required mitigation measures the post-mitigation impact will be very low considering the mine layout plan in relation to the identified burial grounds and graves.

In terms of Palaeontology, no visible evidence of fossiliferous outcrops was found. However, the proposed mining development is underlain by the Vryheid Formation (Ecca Group, Karoo Supergroup) which according to the SAHRIS PalaeoMap has a Very High Palaeontological Sensitivity and therefor the possibility of finding fossils below the surface is high. A moderate Palaeontological Significance is thus allocated to the development (post mitigation) with the implementation of the recommended Chance Find Protocol.

Blasting and vibration

Ground vibration levels predicted ranged between 0.1 mm/s and 1757.9 mm/s for structures surrounding the pit areas. The expected levels of ground vibration for some of these structures are high and will require specific mitigations in the way of adjusting charge mass per delay to reduce the levels of ground vibration. Ground vibration at structures and installations other than the identified problematic structures is well below any specific concern for inducing damage.

Air blast predicted showed the same concerns for opencast blasting. High levels may contribute to effects such as rattling of roofs or door or windows with limited points that are expected to be damaging and others could lead to complaints. Damages are only expected to occur at levels greater than 134dB therefor the current accepted limit on air blast is 134 dBL. It is maintained that if stemming control is not exercised this effect could be greater with greater range of complaints or damage. The pits are located such that “free blasting” – meaning no controls on blast preparation – will not be possible. On charges considered it is expected that air blast will be greater than 134 dB at a distance of 86 m and closer to pit boundaries. Infrastructure at the pit areas such as roads, heritage sites and Hydrocensus boreholes are present, but air blast does not have any influence on these installations

An exclusion zone for safe blasting was also calculated as fly rock remains a concern at blasting operations. The exclusion zone was established to be at least 402 m. The use of the normal practice observed in mines of 500 m exclusion zone will include the Buildings/Structures, Boreholes, Graves and the R555 road which all falls within the Pit Areas. The use of minimum 500 m exclusion zone is rather recommended, and it will be required that evacuation be negotiated when blasting is done.

Specific actions will be required for the pit area such as Mine Health and Safety Act requirements when blasting is done within 500 m from structures and mining with 100 m for structures.

Closure of roads and considering the farming community around the pit area must also be considered.

The pit areas are located such that specific concerns can be addressed through the implementation of the recommended mitigation measures.

Socio Economic

The largest part of the proposed mining area is cultivated and is classed as high potential arable land. A large portion will be lost to the mining activities and the following negative socio-economic related impacts are foreseen:

- Assuming that the agricultural income loss will be on the full MRA (907ha) since agricultural activities will most likely not proceed due to the fragmentation of agricultural land within the 7-year Life of Mine and the uncertainly regarding future land-use within the MRA a gross income of R18,1 million per year and a net farm income of R7,4 million, after depreciation and overhead costs will be lost. It is the intent of Canyon Resources to subdivide and purchase the affected portions for mining purposes and implement a sequence approach to mining which could allow agricultural activities to continue alongside operations. This will be largely dependent on the adherence to correct mitigation and management measures and whether the landowner will be willing to continue farming on the MRA, but should agricultural activities continue alongside mining the economic impact will be significantly reduced to R9,595 million gross and R3,05 million net farm income lost.
- If required, appoint an independent Valuer to determine the market value of the land and to ensure fair compensation for land acquired for mining purposes or compensate the farmer for annual loss of income during the Life of Mine.
- The loss in productive agricultural land will result in approximately 65% job losses. At present the farmer employs 21 workers and approximately 13 to 14 employees could be retrenched once the mine is operational.
- A loss of access to livelihoods for the farmer, workers and their families are thus imminent, and could further be impacted by potential ground and surface water pollution, affecting domestic water, livestock and crops; dust generation that damages crops and affecting livestock and human health; an increase in stock theft (security impacts) as a result of the influx of jobseekers and jobless people; and livestock being killed due to speeding and negligent driving on access and haul roads.
- Impacts on land values due to fragmentation of agricultural land (subdivisions).
- Mining related activities such as increases in traffic and large vehicles; potential influx of workers and erection of illegal structures; blasting activities; safety and security issues; pollution of air and groundwater resources; as well as loss of livelihoods will undoubtedly impact negatively on sense of place.

Whilst it is possible to mitigate most of the negative socio-economic impacts associated with the mining operation to be less significant, the impacts will still manifest.

<u>Residual risks</u>

Loss of land capability and land use potential
The proposed Driefontein mine presents an inability to maintain defined land capabilities due to the loss of available soil resources which could manifest as surface erosion and/or gully formation across the envisioned rehabilitated arable landscape.

Depressions on back-filled spoils and opencast areas generally develop due to underlying differential settlement, resulting in seasonally or permanently saturated areas on the rehabilitated landscape (adopted from Coaltech, 2019). This reduces the arable potential of the land as agricultural machinery required for high productivity cropping cannot operate on undulating, waterlogged topographies. The waterlogged conditions may also inhibit vegetation growth suitable for grazing and pasture-related land uses.

The growth and the associated yield of the established vegetation cover will affect the manner and intensity of which the rehabilitated landscape can be used. The loss of established vegetation and or cultivated lands could result from excessive/unmitigated animal grazing and/or movement across the rehabilitated landscape, diffusion and/or capillary rise of salts from underlying spoils into placed cover soil. Possible modelling or specialist investigations to help quantify this long-term risk could include:

- Soil erosion modelling linked to a soil (cover) balance.
- Vegetation surveys.
- Post-rehabilitation land capability assessments linked to the relinquishment criteria.
- Assessment of landform topography design criteria and conformance to this plan to assess probability of secondary subsidence.

Loss of surface water yield (change in hydrological regime)
Surface settlement on rehabilitated soils and opencast areas could increase the recharge rate of water through the backfilled open pit spoils, in particular if a free draining landscape is not achieved. Subsequently, the water ingress results in the reduction in local catchment yield as surface water that should have been routed towards local water resources is now constricted by surface ponding and spoil ingress also possibly leading to AMD.

Predictive groundwater and pollution plume modelling and or associated specialist investigations to help quantify this long-term risk includes post-rehabilitation land capability assessments (specifically on cover integrity), assessment of landform topography design criteria and monitoring data analysis of actual water quantities manifesting at decant locations, as compared to modelled volumes (adopted: Coaltech, 2019)

Water availability for desired land use/s
This residual risk could manifest due to the following events:

- Unpredicted/unplanned deterioration or variance of groundwater qualities as potential groundwater plumes migrate outside of the rehabilitated pit boundaries.
- Lack of control of natural groundwater recharge rates, or variances from predicted rates, affecting the ability to maintain predefined land capabilities.
- Unmitigated/unplanned use of groundwater by either upstream or downstream water users that affects the mine's planned/predicted water use/s (qualities and quantities).

Predictive ground water and or pollution plume modelling and/or specialist investigations to help quantify this long-term risk includes geohydrological modelling, over time (continually calibrated with monitoring data) - to define and monitor the probable extent of the pollution plume and its likely pollutant content as well as pump tests of remaining (non-rehabilitated) boreholes (of both monitoring and functional boreholes).

Environmental Management Programme

An EMPr has been developed as part of the Environmental Impact Assessment Report (EIAR) to ensure mitigation of the potential impacts on the biophysical, cultural, and socio-economic environment are far as possible. The implementation of the EMPr is a requirement in terms of NEMA and will be a condition of the Environmental Authorisation, issued by the Competent Authority. The Applicant and contractors must therefore familiarise themselves with the contents of this document because failure to comply with the commitments made will constitute an offence which can lead to penalties and/or legal action. It should further be noted that the EMPr is not static, as allowances have been made for it to evolve in the future. Such a characteristic is seen to be important as key factors and processes may change through the life of mine. It is therefore necessary to alter proposed mitigation and monitoring methodologies in order to determine the best approach to deal with such changes.

Conclusion & Recommendation

The main aspects assessed as part of Environmental Impact Assessments are the social, the economic, and the environmental aspects. These aspects must be in balance and that if one outweighs another, good reasoning be sought to ensure the balance is restored

The positive impacts of the proposed project centres around the economic benefits of exploiting the coal reserve inside the MRA which will assist the ongoing development of the socio-economic structure in the area.

Whilst emphasis is often placed on the economic advantages of a mining project, many negative long-term impacts may manifest. Mining has the potential to pollute water and soil, resulting in negative impacts on ecosystems and violating the rights to life and a healthy environment. Provided that all the environmental management measures described in the EMPr are applied diligently, the proposed Driefontein Mine is not expected to have any unacceptable permanent environmental impacts.

However, there is concern over the marginal Net Present Value (net benefit stream) advantage that the new (higher risk) mining activity holds over existing land-use in the area under the worst-case scenario (loss of cultivated land within entire MRA). This is due to the short timespan for the planned mining activity as well as the relatively high agricultural yields associated with farms particular to this project.

The Applicant plans to implement a sequence approach to mining with the aim to allow agricultural activities to continue alongside mining. As shown in the Economic Cost Benefit Analysis, the continuation of agricultural production on the MRA that is not mined (best case scenario) will significantly improve the Net Present Value of the proposed mine which underlines the need to mitigate against the loss of agricultural production across the entire MRA during mining operations. Therefore, the granting of the environmental authorisation of Driefontein mine is recommended if the risk of losing high value agricultural land within the entire MRA is effectively mitigated. In addition to the implementation of the recommended mitigation measures this will further involve land use arrangements with the farm owner which will only be investigated during the sale agreement of the land.

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List of abbreviations

ABA	Acid Base Accounting
ABET	Adult Basic Education and Training
AEL	Air Emissions License
AGIS	Agriculture Geographic Information System
AMD	Acid Mine Drainage
AMSL	above mean sea-level
ANC	Acid Neutralizing Capacity
ALD	Anoxic Limestone Drains
ASGI-SA	Accelerated And Shared Growth Initiative For South Africa
AQIA	Air Quality Impact Assessment
AQMP	Air Quality Management Plan
BID	Background Information Document
CARA	Conservation of Agricultural Resources Act (No. 43 Of 1983)
CBA	Critical Biodiversity Area
CEC	Cation Exchange Capacity
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CVB	Channelled valley bottom wetland
CPI	Consumer Price Index
CR	Critically Endangered
CS	Community Survey
DALRRD	Department of Agriculture, Land Reform and Rural Development
DEA	Department of Environmental Affairs
DEM	Digital Elevation Model
DFFE	Department of Forestry, Fisheries and the Environment
DMRE	Department Of Mineral Resources and Energy
DRDLR	Department of Rural Development and Land Reform
DWS	Department Of Water And Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EAPASA	Environmental Assessment Practitioners Association of South Africa
EC	Ecological Category
ECO	Environmental Control Officer
ECBA	Economic Cost Benefits Analysis
EEP	Environmental Emergency Plan
EHA	Environmental Health Areas
EIA	Environmental Impact Assessment

EIAR	Environmental Impact Assessment Report
EIS	Environmental Importance and Sensitivity
ELM	Emfuleni Local Municipality
EMPR	Environmental Management Programme
EMS	Environmental Management Systems
EN	Endangered
EPP	Emergency Preparedness Plan
ESA	Ecological Support Area
ETS	Ecosystem Threat Status
FRAI	Fish Response Assessment Index
FTP	Feed to plant
GDP	Gross Domestic Product
GDT	Groundwater Decision Tool
GHG	Greenhouse Gas
GIS	Geographic Information System
GNR	Government Notice
GTIS	Gross Coal Resource in situ Tonnage
GQM	Groundwater Quality Management
HDSA	Historically Disadvantaged South Africans
HIA	Heritage Impact Assessment
HPA	Highveld Priority Area
HSE	Health, Safety and Environment
IAP	Interested and Affected Parties
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
IUCN	International Union for Conservation of Nature
IWULA	Integrated Water Use License Application
IWWMP	Integrated Water And Waste Management Plan
KOP	Key Observation Points
KPA	Key Performance Area
KPI	Key Performance Indicator
LED	Local Economic Development
LSU	Livestock Unit
LOM	Life of Mine
MAE	Mean Annual Evaporation
MAMSL	Meters Above Mean Sea Level
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
MBSP	Mpumalanga Biodiversity Sector Plan
MRA	Mining Right Area
MNCA	Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998)
MPRDA	Minerals And Petroleum Resources Development Act, 1998 (Act No. 28 Of 2002)
MTPA	Mpumalanga Tourism and Park Agency
MWP	Mining Work Programme
NAG	Net Acid Generation
NAAQS	National Ambient Air Quality Standards
NAEIS	National Atmospheric Emissions Inventory System

NBA	National Biodiversity Assessment
NCR	Noise Control Regulations (GN R154 of 1992)
NDA	National Department of Agriculture
NFA	National Forest Act (No. 84 of 1998)
NFEPA	National Freshwater Ecosystem Priority Areas
NGL	Natural Ground Level
NGDB	National Groundwater Database
NHRA	National Heritage Resources Act (No. 25 of 1999)
NDM	Nkangala District Municipality
NEM: AQA	National Environmental Management: Air Quality Act, 2004 (Act No. 39 Of 2004)
NEM:BA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 Of 2004)
NEMA	National Environmental Management Act, 1998 (Act No. 107 Of 1998)
NEMPAA	National Environmental Management: Protected Areas Act (No. 57 of 2003)
NEM: WA	National Environmental Management: Waste Act, 2008 (Act 59 of 2008) (NEM: WA)
NIA	Noise Impact Assessment
NPAES	National Protected Areas Expansion Strategy
NPV	Net Present Value
NT	Near Threatened
NWA	National Water Act, 1998 (Act No. 36 Of 1998)
OHSA	Occupational Health And Safety Act, 1993 (Act No. 85 Of 1993)
ONA	Other Natural Areas
PAC	Potentially Affected Communities
PCD	Pollution Control Dam
PCLU	Post closure land use
PES	Present Ecological State
POI	Points of Interest
PPP	Public Participation Processes
PSEDS	Potential Spatial Economic Development Strategy
ROM	Run-Of-Mine
SABS	South African Bureau of Standards
SANBI	South African National Biodiversity Institute
SANS	South African National Standards
SANRAL	South African National Roads Agency Limited
SAHRA	South African Heritage Resource Agency
SAHRIS	South African Heritage Resources Information System
SAPAD	South African Protected Areas Database
SACAD	South African Conservation Areas Database
SAPS	Successive Alkalinity Producing Systems
SCC	Species of Conservation Concern
SDF	Spatial Development Framework
SEIA	Socio-Economic Impact Assessment
S&EIR	Scoping & Environmental Impact Report
SHE	Safety, Health, and Environment

SHEQ	Safety, Health, Environment and Quality
SLP	Social and Labour Plan
SMME	Small, Medium And Micro-Sized Enterprises
SP	Significant Points
STLM	Steve Tshwete Local Municipality
TWQR	Target Water Quality Range
TDS	Total Dissolved Solids
TOPS	Threatened or Protected Species
UVB	Unchanneled valley bottom wetlands
USBM	United States Bureau of Mines
VEGRAI	Vegetation Response Assessment Index
VU	Vulnerable
WF	Weighing Factor
WMA	Water Management Area
WML	Waste Management Licence
WUL	Water Use License
WULA	Water Use License Application

1 Project Background

Canyon Resources (Pty) Ltd is a mining and exploration company with current operations in Mpumalanga and Gauteng. The company has four operational mines, Phalanndwa and Phalanndwa Extension in Delmas area, Ukufisa in Springs and Khanye in Bronkhorstspruit area, all four are opencast coal mines mined through the typical truck and shovel method and concurrent rehabilitation is done at the sites. Canyon also has one mine in rehabilitation phase, Singani Colliery, also situated in the Middleburg area, and one mine undergoing care and maintenance, Hakhano Colliery, in the Middleburg area.

Canyon has an existing prospecting right over the farm Driefontein 398 JS, Myburg 404 JS, Rietspruit 402 JS, Sterkstroom 490 JS and Rietpan 408 JS. Canyon subsequently embarked on an exploration programme to determine the coal resource availability and quality. The exploration programme continued up to the point where the resource could be delineated with confidence and the qualities and quantities were accurately determined which warranted the development of a viable mining project. The viable coal resource is located in the northern part (portion 6 of Sterkstroom 400 JS and Portion 5 of Driefontein 398 JS) and south-eastern corner (Portion 6 of Driefontein 398 JS) of the application area. Canyon proposes to mine two seams from the Ecca Group of the Karoo Supergroup that correlate to the seams in the Witbank Coalfield.

The project requires a Mining Right in terms of the Mineral and Petroleum Resources Development Act (MPRDA), 2002 (Act 28 of 2002) from the Department of Mineral Resources and Energy (DMREE), Mpumalanga Province, for coal mining over the following properties:

- Sterkstroom 409 JS; and
- Driefontein 398 JS.

The project also requires Environmental Authorisation (EA) for triggering activities that fall under Listing Notice 1 (GNR325) and Listing Notice 2 (GNR327) of the National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA), as amended. In addition, a Waste License is required for triggering activities listed under GNR 921 & GNR 633 (Category B) of the National Environmental Management: Waste Act, 2008 (Act 59 of 2008) (NEM: WA).

An integrated application for a Mining Right and associated Environmental Authorisation and Waste License will be followed with the DMRE Mpumalanga identified as the Competent Authority. A Scoping & Environmental Impact Assessment Process is required, as stipulated in GNR326 EIA Regulations 21 to 24, in support of the applications.

The proposed project will also require a Water Use License from the Department of Water and Sanitation (DWS) in terms of Section 40 of the National Water Act, 1998 (Act 36 of 1998) (NWA) for triggering water uses that requires authorisation. An Integrated Water Use License Application (WULA) will be submitted for the Section 21 water uses that will be triggered by the proposed Driefontein Mine. A separate process as outlined in the Regulations Regarding the Procedural Requirements for Water Use License Applications and Appeals, March 2017 published by the Department of Water and Sanitation (DWS) will be followed.

Canyon appointed uKhozi Environmentalists (Pty) Ltd (uKhozi) as independent environmental

consultants to conduct the Mining Right and associated Environmental Authorisation and Waste License Applications for the proposed project. The final Environmental Impact Assessment Report (EIAR), inclusive of all the specialist reports, will be submitted to the DMRE for processing. The DMRE is responsible to assess the information provided and in writing:
(a) grant environmental authorisation in respect of all or part of the activity applied for; or
(b) refuse environmental authorisation.

2 Purpose and Scope of EIA Process

Environmental impact assessment is used to assess the potential implications, combining environmental, social, and economic considerations, of a project before the project commences. The main objectives of Environmental Impact Assessments are to:

- Understand the consequences or impacts (effects) of the proposed development (causes) on the environment.
- Identify ways in which the impacts of the development can be improved. These could include ways to minimize negative impacts and ways to enhance its benefits.
- Provide this information to IAPs and decision-makers.

Ultimately, the aim of an environmental assessment is to prevent significant damage to the environment. The EIA will focus on the aspects of the proposed mining project and their impacts on the natural and societal environment. The findings of the EIA guide the plan/development, implementation, and monitoring/evaluation of an Environmental Management Plan which will attempt to maximize human benefit and to minimize environmental degradation resulting from the proposed project. The report content will align with Appendices 3 and 4 of EIA Regulations.

2.1 Environmental Impact Assessment Process

The Environmental Impact Assessment Process is carried out in accordance with the EIA Regulations. The first phase of the Environmental Impact Assessment Process was the Scoping Phase which informed the Plan of Study for the EIA Phase. The Scoping Report was accepted by the DMRE on the 12th of October 2021. The Applicant requested uKhozi to put all specialist investigations on hold until the feasibility of underground mining has been investigated since it would result in significant changes to the proposed layout and activities planned. The full geological data was received in February 2022 confirming that underground mining is not feasible, and that the proposed Driefontein Mine will be exclusively opencast. uKhozi requested extension from the DMRE in terms of Regulation 3(7) to complete the necessary specialist investigations, outlined in the Plan of Study of the approved Scoping Report. The DMRE granted extension until the 22nd of August 2022 for the final Environmental Impact Assessment Report (EIAR) to be submitted. The DMRE thereafter has 107 days to assess the information provided and make a decision on the application. The EIA and EMPr reports content will align with Appendix 3 and Appendix 4 of the EIA Regulations.

The figure below provides a process flow diagram indicating the key tasks carried out during the Environmental Impact Assessment Process.

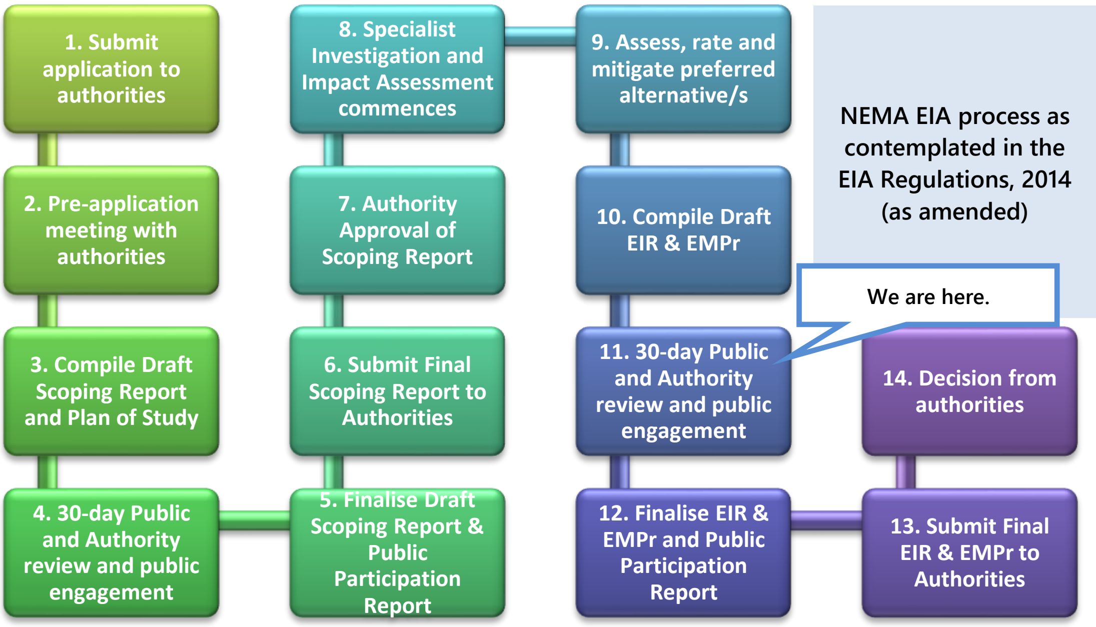


Figure 1: NEMA EIA process as contemplated in the EIA Regulations, 2014 (as amended)

3 Contact Person and Correspondence Address

Canyon appointed uKhozi Environmentalists (Pty) Ltd (uKhozi) as independent environmental consultants to facilitate the Integrated Environmental Application Process for the proposed project.

3.1 Details of the Environmental Assessment Practitioner

The names and contact details of the Environmental Assessment Practitioners (EAP) that formed part of the project team are provided in the Table below.

Table 1: Contact details of EAP

Name	Role	Telephone	Fax	Email
Thomas Olivier	Project Manager	082 521 8870	087 767 8072	tommy@ukhozi-enviro.co.za
Inus de Wit	Alternate Project Manager	082 451 1615	087 767 8072	inus@ukhozi-enviro.co.za

3.1.1 Expertise of the EAP

The qualifications and professional affiliations of the project team is provided in the Table below.

Table 2: Qualifications and professional affiliations

Name	Qualifications	Proffesional Affiliations	Years Experience
Thomas Olivier	Bachelor of Science (BSc) Degree in Ecology BSc Honours degree in Environmental Management and Analysis	EAPASA *Registered EAP (Number: 2020 2020/1162)*	12
Inus de Wit	Bachelor of Science (BSc) Degree in Ecology BSc Honours degree in Environmental Management and Analysis Master of Science (MSc) Degree in Water Management	EAPASA *Registered EAP (Number: 2019/417)*	10

3.1.2 Summary of the EAP's past experience

Thomas Olivier has been working at uKhozi Environmentalists (Pty) Ltd from 2010. He has ten years' experience in conducting feasibility studies; Basic Assessments (BA's); Scoping and Environmental Impact Assessments (S & EIA's); Environmental Management Programmes (EMPr's), Water Use Licence applications (WULa's); Integrated Water and Waste Management Plans (IWWMP's); Waste Management Licences (WML); Closure Reports and Environmental Liability Quantum for mines, planning and executing Public Participation Processes (PPP); EMPr and WULa compliance auditing; compiling project proposals, training and awareness material; environmental and water monitoring and liaising with clients in both the private and public sectors.

Below please see a list of the EAPs involvement in similar projects (Refer to Appendix 1 for abbreviated CV and list of projects):

- Project Manager for the S22 Mining Right, Environmental Authorisation and Waste License application for the Springfield Mining Project situated on various portions of the Farms Kookfontein 545 IQ, Damfontein 541 IQ, Smaldeel 542 IQ, Waldrift 599 IQ, and Vlakfontein 546 IQ in the Magisterial District of Vereeniging, Gauteng Province (Ref No: GP10084MR) Applicant – Glubay Coal (Pty) Ltd.
- Project Manager for the S22 Mining Right and Environmental Authorisation application for the Phalanndwa Extension Colliery situated on a Section of the Remaining Extent (R/E) and a Section of Portion 7 of the Farm Schoongezicht 225 IR, Delmas, Mpumalanga (Ref No: MP 10164 MR). Applicant – Miniandante (Pty) Ltd.
- Project Manager for the S22 Mining Right and Environmental Authorisation application for Schoongezicht Mining Project situated on Portion 10 and 11 of the Farm Schoongezicht 225 IR, Delmas, Mpumalanga (Ref No: MP 10114 EM). Applicant – Antobiz (Pty) Ltd
- Project Manager Full Scoping EIA Process for the refurbishment of the defunct Kwasa Colliery in the Piet Retief District (Ref No: 17/2/3 GS-222). Applicant - Siphiwo Investments (Pty) Ltd.
- Project Manager for the S22 Mining Right and Environmental Authorisation application for the proposed coal mining operation on the farm Goedehoop 169 HT, situated in the Magisterial District of Piet Retief, Mpumalanga, DMRE Ref No: MP 10098 EM. Applicant – Jindal Mining SA (Pty) Ltd.

3.2 Details of Specialists

The specialists that formed part of the project team are listed in Table 3 below. Refer to the reports attached in Appendix 6 for a description of each specialist's qualifications and professional affiliations.

Table 3: Specialist Team

Area of responsibility	Proposed team member	Organization	Appendix
Agricultural Potential Assessment	Dr A Gouws	Index	6.1
Terrestrial Fauna and Flora Assessment	Dr Pieter Olivier	MAPS Scientific Services	6.2
Wetland delineation and aquatic assessment	Lorainmari Den Boogert	Iggdrasil Scientific Services	6.3
Groundwater Impact Assessment	Morne Burger	Geo Pollution Technologies	6.4
Heritage and Paleontological Assessment	W Fourie	PGS Heritage	6.5
Air quality impact assessment and baseline fallout dust monitoring	Mike Brugman	Rayten Environmental and Engineering Consultants (Pty) Ltd	6.6
Socio Economic Assessment	Marchelle Terblanche	CHEMC Environmental	6.7

Area of responsibility	Proposed team member	Organization	Appendix
Visual Impact Assessment	Tommy Olivier	uKhozi Environmentalists	6.8
Traffic impact Assessment	Claire Birungi	Koleko Solutions	6.9
Noise Impact Assessment	Shaun Weinberg	Acoustech	6.10
Blasting and Vibration Impact Assessment	JD Zeeman	Blast Management and Consulting	6.11
Decommissioning, Rehabilitation and Closure Plan	E van Druten	ENVASS	6.12
Cost Benefit Analysis	An Kritzinger	Southern Economic Development	6.13

3.3 Full Particulars of Applicant

The Applicant's contact details as well as the relevant contact person are contained in Table 4 below.

Table 4: Applicant Contact Details

Item	Contact Details
Company Name	Canyon Resources (Pty) Ltd
Responsible Person	S Wanless
Designation	Head of Environmental Compliance
Tel no.	011 783 7996
E-mail Address	sw@menar.com
Contact Person	T Rankali
Designation	Project Manager
Tel no.	011 783 7996
Cell no.	073 474 9366
E-mail Address	t.rankali@canyoncoal.com
Physical Address	Fredman Towers, 7th Floor 13 Fredman Drive Sandown 2196
Postal Address	PO Box 2632 Saxonworld 2132

4 Project Location

The Mining Right Area (MRA) is located 20km east of Middelburg within the Nkangala District Municipality ("NDM") and Ward 9 of the Steve Tshwete Local Municipality (STLM) of the Mpumalanga Province. The MRA is roughly bordered in the north by the R555 roadway which runs between Middelburg and Stofberg.

4.1 Property Description

The proposed mine will be located on Portion 6 of the Farm Sterkstroom 400 JS, Portion 5 and a section of Portion 6 of the Farm Driefontein 398 JS. The application area is 1150ha, but the extent of the area required for mining and associated infrastructure is approximately 471ha. The viable coal reserve is divided in two separate sections found in the northern part (portion 6 of Sterkstroom 400 JS and portion 5 of Driefontein 398 JS) and south-eastern corner (Section of Portion 6 of Driefontein 398 JS) of the application area. Refer to Table 5 below for the project location details.

Table 5: Project Location Details

Farm Name:	Portion 5 and a Section of Portion 6 of Driefontein 398 JS Portion 6 of Sterkstroom 400 JS
Application area (Ha)	1150 hectare
Magisterial district:	Middelburg
Distance and direction from nearest town	20km east of Middelburg
21-digit Surveyor General Code for each farm portion	Driefontein 398 JS - T0JS00000000039800005 Driefontein 398 JS - T0JS00000000039800006 Sterkstroom 400 JS - T0JS00000000040000006

Please see Table 6 below for the surface right holder's information.

Table 6: Landowner information

Farm Name and portion	Surface Right Holder	Size	Portion of land included in Mining right Application
Driefontein 398 JS Portion 5	Driefontein 398 Trust	162 Ha	162Ha
Driefontein 398 JS Portion 6	Jan Hendrik Roux	1 397 Ha	563Ha
Sterkstroom 400 JS Portion 6	Johanna Christina Roux	425 Ha	425Ha

4.2 Locality map

Please refer to the locality map in Figure 2 below. The figure indicates the nearest urban area which is the town of Middelburg as well as the main roads in the surrounding area (R104, R555 and the N4 Highway). A Regulation 2(2) plan developed in terms of the Minerals and Petroleum Resources Development Regulations is included in Figure 3 below. The plan contains the following:

- **the co-ordinates and spheroid (Clarke 1880 / Cape Datum, WGS84 / WGS84, WGS94 / Hartebeesthoek94) of the land to which the application relates.**
- **the north point.**
- **the scale to which the plan has been drawn.**
- **the location and where applicable, the name and number of the land to which the application relates.**
- **the extent of the land to which the application relates:**
- **the boundaries of the land to which the application relates:**
- **surface structures and registered servitudes where applicable; and**
- **the topography of the land to which the application relates.**

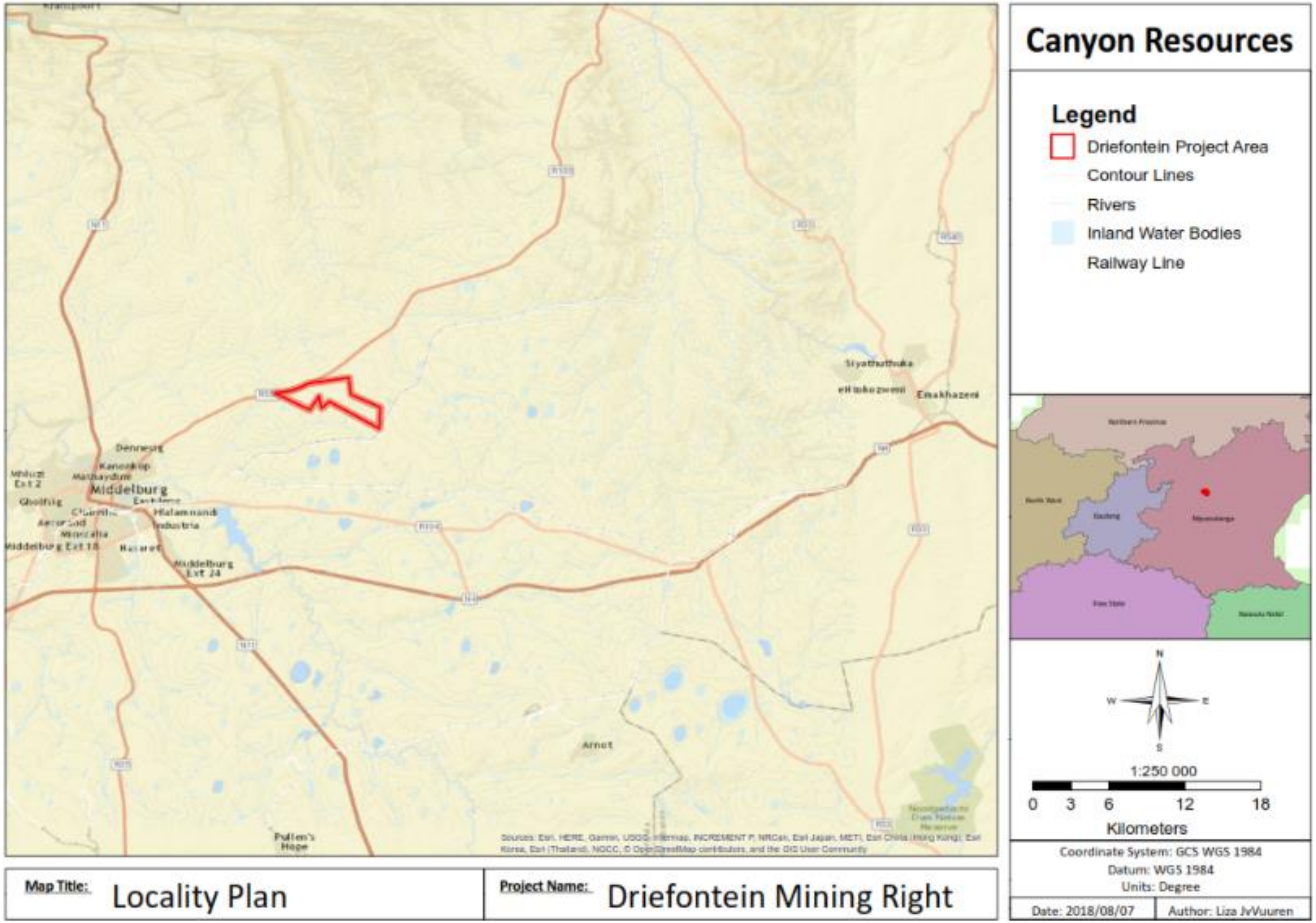
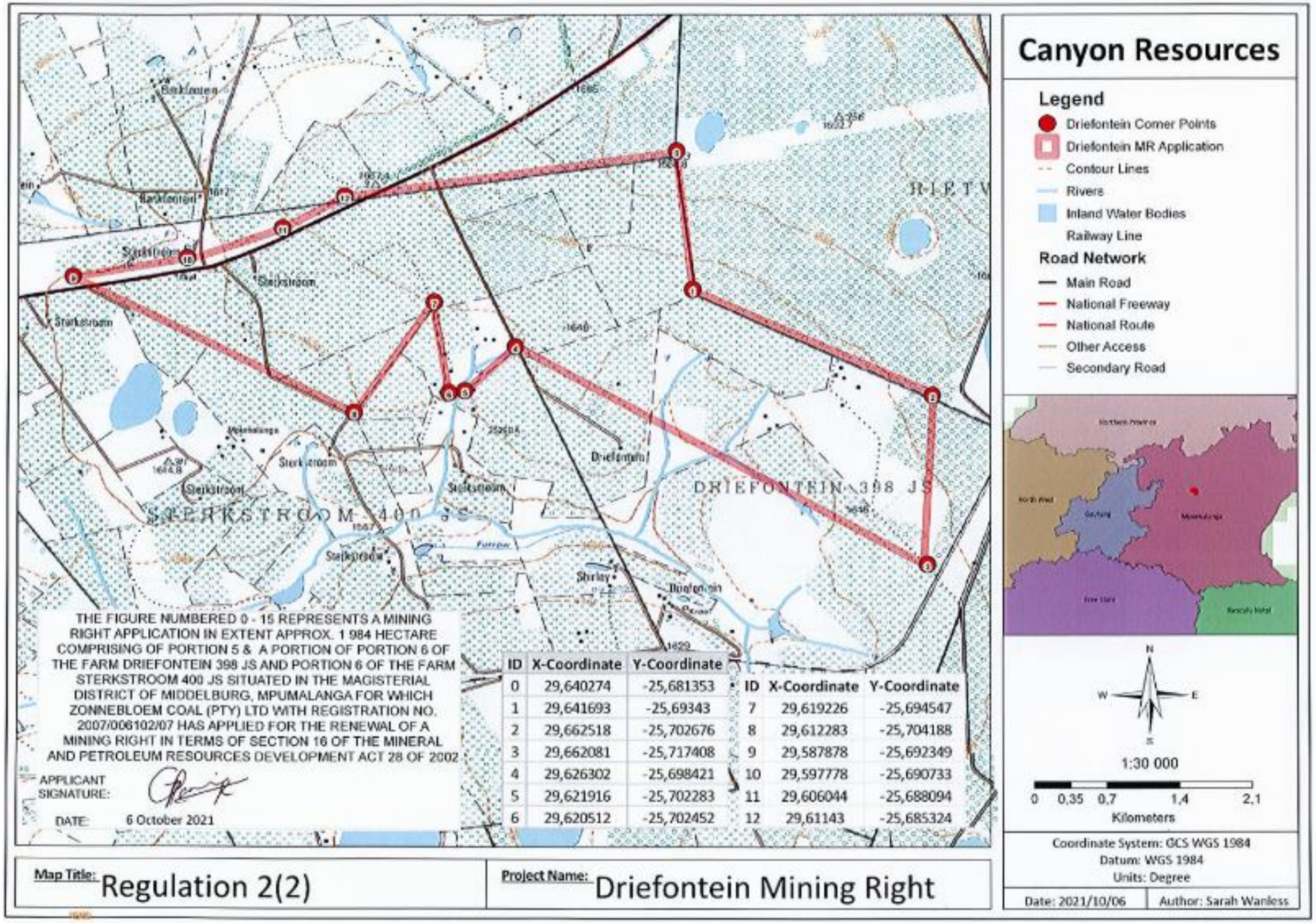


Figure 2: Locality Map



ID	X-Coordinate	Y-Coordinate
0	29,640274	-25,681353
1	29,641693	-25,69343
2	29,662518	-25,702676
3	29,662081	-25,717408
4	29,626302	-25,698421
5	29,621916	-25,702283
6	29,620512	-25,702452

ID	X-Coordinate	Y-Coordinate
7	29,619226	-25,694547
8	29,612283	-25,704188
9	29,587878	-25,692349
10	29,597778	-25,690733
11	29,606044	-25,688094
12	29,61143	-25,685324

Figure 3: Regulation 2(2) Plan

4.3 Land Tenure and Use

According to the South African National Land Use database (2014), the current land use within the study area is predominantly cultivated commercial fields, with limited grassland areas and small wooded areas occurring in the vicinity of the three watercourses originating close to the southern boundary of the study area. The application area in general consists of mixed cultivated land and livestock grazing. The surrounding land uses are as follows:

- Forestry to the east.
- Mining to the north and east.
- Cultivated land south and west.

Refer to Figure 4 below for an aerial image of the application area showing the affected properties.

4.4 Surface Infrastructure and Servitudes

The study area is bordered by the R555 roadway to the north, with the R104 roadway located approximately 7km to the south. The Pan railway siding is located about 5km to the south of the application area and the Shirley Railway track runs along parts of the southern and eastern boundary of the application area. Infrastructure forming part of the existing Bankfontein Colliery is located inside the MRA along the northern boundary. northern boundary of the within the northwestern portion of the study area.

No other infrastructure except for gravel roads is found inside the application area. The closest farming homestead is that of the landowner Mr Jan Roux which is located 200m – 300m from the southern boundary of the application area.

4.5 Zoning

The property is currently zoned for agriculture. A rezoning application must be submitted by the Applicant, to STLM. The application will only be made if the necessary enviro legal authorisations are obtained by the Applicant.

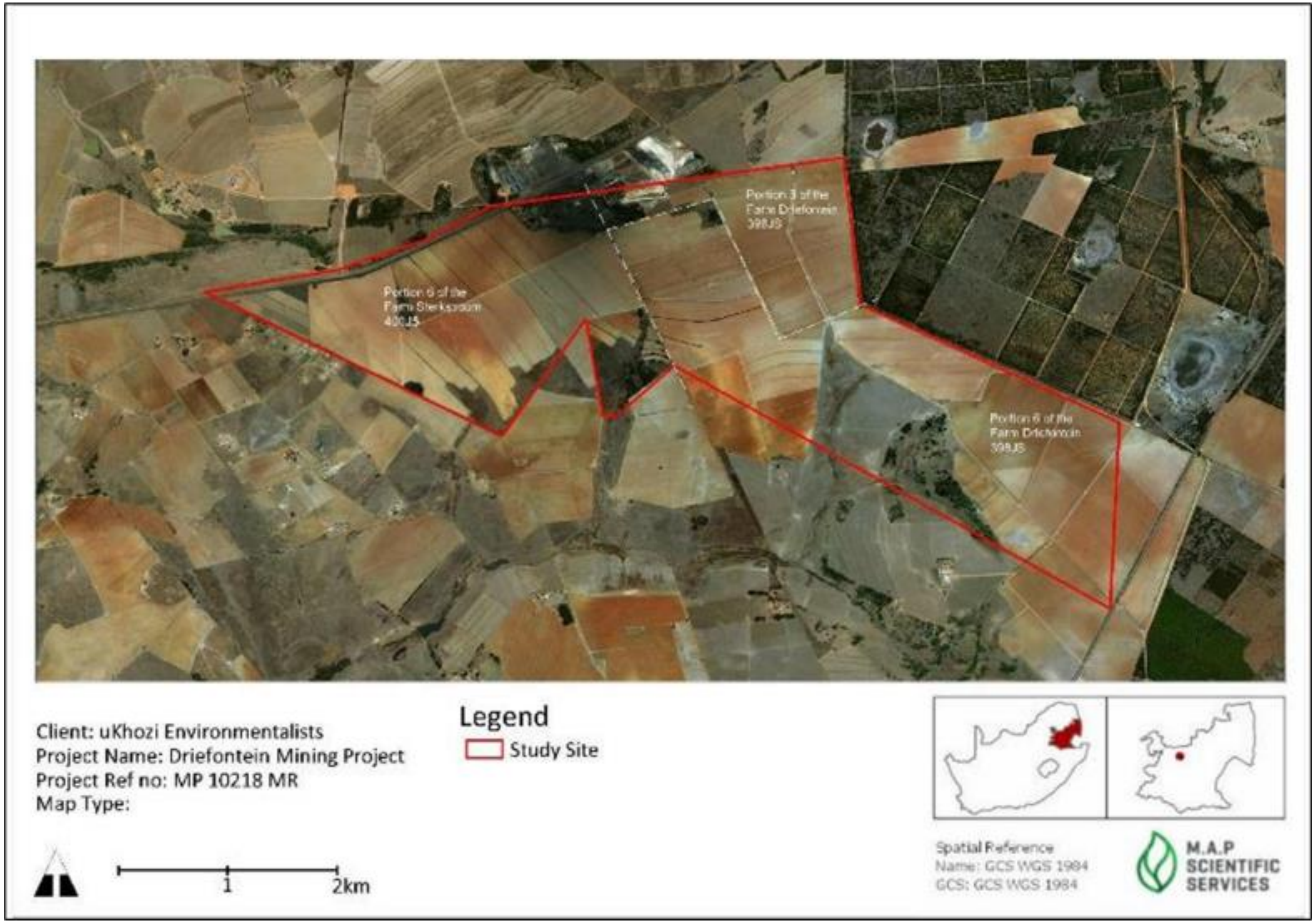


Figure 4: Aerial Image of Application Area indicating the affected properties

5 Project description

The project will involve the development of a new Greenfields opencast coal mining operation on Portion 6 of the farm Sterkstroom 400 JS, Portion 5 and a section of Portion 6 of the farm Driefontein 398 JS. The viable coal reserve is divided in two separate sections found in the northern part (portion 6 of Sterkstroom 400 JS and portion 5 of Driefontein 398 JS) and south-eastern corner (a Portion of Portion 6 of Driefontein 398 JS) of the application area.

The project has an indicated resource of 7.286 million tonnes of coal that will be marketed to local markets. Production will start with 10 000 tons after site establishment and will increase with 20 000 tons per month to an average of 90 000 tons per month once in full production with the life of mine expected to be 7 years.

The project is referred to as the proposed Driefontein Mine.

5.1 Scope of the proposed overall activity

The proposed opencast coal mining will be conducted using the conventional truck and shovel rollover method. The mining operation will consist of two opencast pits referred to as the Northern and South-eastern Pits which will be mined through a phased approach with the aim to allow for farming activities to continue whilst mining takes place. Mining activity at the northern and south-eastern sections of the proposed mine will not take place concurrently.

Mining and logistical services will be provided by contractors. The Applicant will appoint managers to ensure efficient and effective operation of services. As with the Applicant's other operational mines, all the mining employees will arrive on site, conduct their duties, and depart from the site upon completion of their shifts. Ablution/change house facilities will be provided by Canyon. In order to reduce the environmental impact on the area, it is recommended that portable containers are used for the offices, guard houses, change houses, and workshops. The costing for infrastructure and associated labour requirements have been included in the Capital Estimate of the Mining Works Programme (MWP).

5.1.1 Mining Method

Coal mining will be undertaken by conventional truck and shovel operations opencast methods. Topsoil and subsoil will be stripped using an excavator and will be stored in separate stockpile areas on the mining area. Drilling and blasting will be employed for the hard overburden or bedrock to expose the coal seams. Once blasted, the hard overburden will be excavated and stockpiled separately for rehabilitation. The mined coal from the open pit will be transported via the haul roads and stored on the Run of Mine (ROM) stockpile areas. Opencast mining is carried out using diesel-powered equipment and hauling trucks. A stepped approach is provided below:

<u>Step 1</u>: Remove a minimum of 1 metre of topsoil and place directly on levelled soil.

Step 2: Remove soft overburden with an excavator and trucks to 2 metres above the hard rock. The 2 metres of soft rock above the hards provides stemming length for the blast holes. By doing this the explosives column can be optimized to fragment the hard rock without incurring excessive fly rock and air blast.
Step 3: Drill and blast and remove the remaining overburden to expose the Top Seam. Some overburden will heave beyond the coal edge and therefore will not need to be excavated.
Step 4: Mine the Top Seam and the parting to the Lower Seam as well as the Lower Seam (if feasible proceed to Step 6, if not able to mine parting simultaneously refer to Step 5).
Step 5: Remove the inter burden with a dozer push over operation to within 2 to 2.5 metres of the Lower Seam. Use an excavator and truck operation to expose the coal. Mine the Lower Seam.
Step 6: The cycle is started again.

Concurrent rehabilitation will occur during the operational phase by means of the roll over method.

5.1.2 Coal handling and processing

No wash plant will be established on site. Run of Mined (ROM) coal will be stockpiled at the designated stockpile areas and transported to the existing Hakhano Colliery washing plant situated approximately 3km south of the application area or other licensed site for processing via the existing gravel road (D1433) or sold raw.

5.1.3 Access roads

The main access road will be constructed from the D1433 gravel road that runs between the R104 and R555.

Photo Plate 1: D1433 (Preferred access road)

5.1.4 Electricity requirements

Mining is carried out using diesel-powered equipment and therefore no power reticulation is anticipated for this area. Generators will be used where electricity is required.

5.1.5 Infrastructure required

Key infrastructure planned includes:

- Two opencast pits (northern and south-eastern).
- Hard and soft overburden stockpiles.
- Topsoil stockpiles.
- Haul roads from pit to ROM stockpile areas.
- Haul roads from ROM stockpile areas to mine access point.
- ROM Stockpile Areas.
- Pollution Control Dams (PCDs).
- Storm water drains, berms, cut of channels and culverts.
- Hardpark consisting of a workshop, fuel storage facility, offices, change house and a septic tank system.
- Guardhouse at mine access point.

5.1.6 Water requirements

5.1.6.1 Potable water requirements

As the life of the mine is only 7 years, with not a significant number of staff on site, domestic water will be obtained from boreholes. Also due to this, a plastic conservancy tank is proposed with approved Contractors removing the sewage to a suitable municipal sewage treatment works.

5.1.6.2 Processing water requirements

Process water is required for dust suppression purposes.

Water from the pits will be pumped and run-off water from the contaminated area (stockpile area and workshops) will be diverted towards the Pollution Control Dams (PCDs). This water will be re-used for dust suppression purposes on the haul roads.

5.1.6.3 Wastewater treatment post closure

It is predicted that the south-eastern pit will start decanting after mine closure and allowance has been made by Canyon to establish a water treatment plant. Active treatment of the decant may be viable, however all passive methods should be investigated first during the operational phase of the mine. Further investigations will be conducted as part of the WULA.

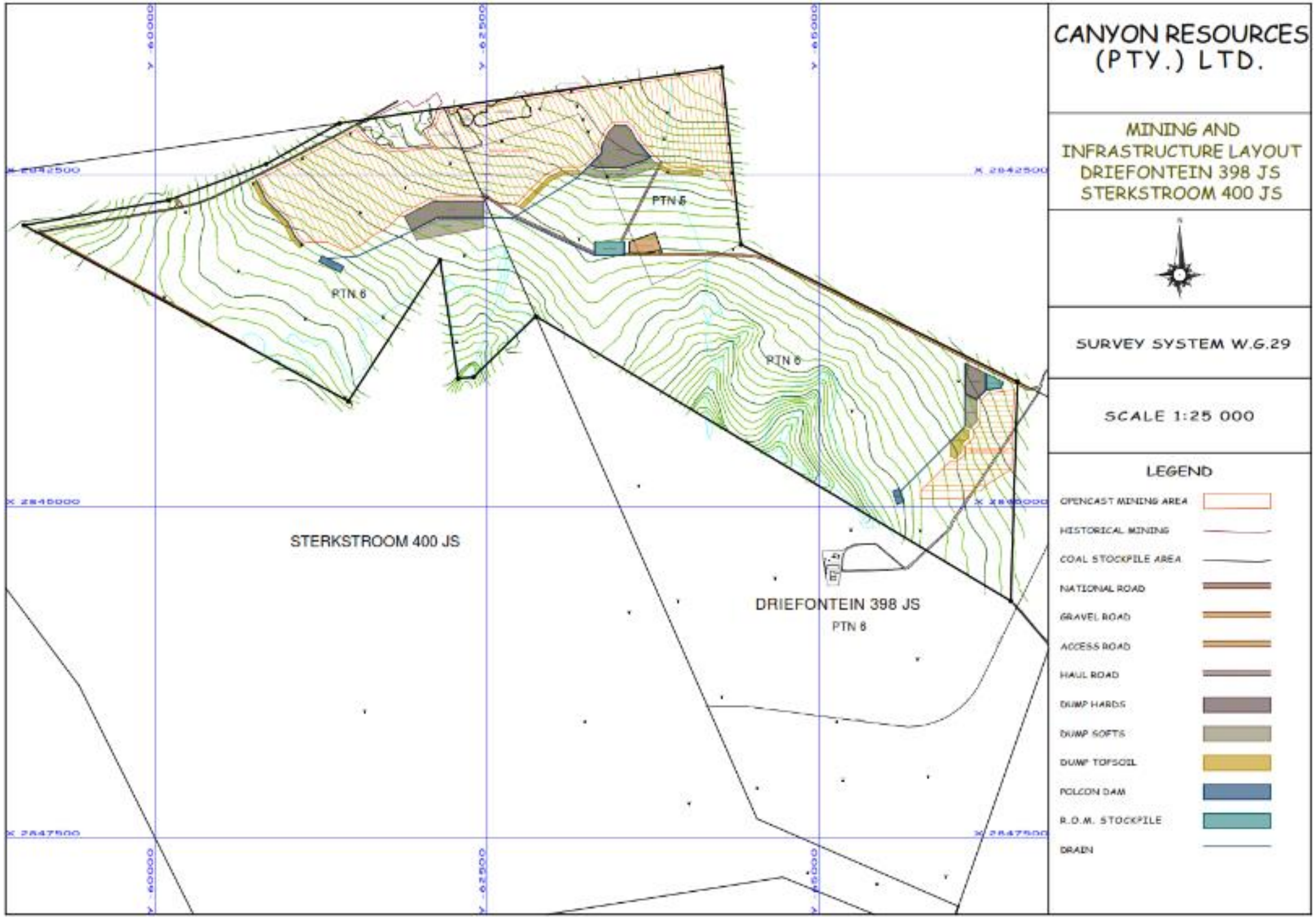


Figure 5: Preliminary Layout Plan

5.2 Phased Description of the Activities to be undertaken

The activities proposed by Canyon for the proposed Driefontein Mine will occur in three phases:

- Construction phase – The construction phase will prepare the site for mining which will include opening the box cut and setting up the required infrastructure.
- Operational phase – Mining activities will commence with the operational phase. All related mine operations, including coal removal, stockpiling, transportation as well as concurrent rehabilitation forms part of this phase.
- Decommissioning, rehabilitation, and closure phase – This phase will involve the implementation of the rehabilitation plan (attached as Appendix 6.12) which will be updated throughout the life of the mine.

The timeframe and scheduling of the Life of Mine (LoM) for the proposed mine is presented below in Table 7.

Table 7: Timeframe and Scheduling of the Life of Mine Phases for Driefontein

Implementation phase	Life of Mine (Years)						
	1	2	3	4	5	6	7 onwards
Construction							
Operational phase - Ramp up							
Operational phase – steady state production							
Decommissioning, rehabilitation, and closure							

Table 8: Phase and associated activities to be undertaken as part of the proposed Driefontein Mine

Activity	Description
Construction Phase	
Site clearance	This will involve the vegetation clearance in areas designated for surface infrastructure, stockpile areas, and the initial box cuts.
Soil stripping and stockpiling	Stripping and stockpiling of soil in areas designated for surface infrastructure, stockpile areas, and the initial box cut. The topsoil and subsoil recovered during stripping will be stockpiled separately.
Opening of initial box cut through blasting and excavation of overburden material	The initial box cut along with the access ramp will be established. This will involve drilling and blasting activities along with the removal of the hard overburden.
Construction of infrastructure:	The associated mining infrastructure that will be constructed is described below:
• Upgrading and establishment of access and haul roads	Roads in the operational area will be constructed to facilitate on-site vehicle movement. The upgrading and establishment of the access and haul roads will involve clearing vegetation and or crops from the route areas. In terms of internal circulation, internal roads will be provided to allow accessibility to loading areas. All internal roads will be provided with sufficient width and turning radius to allow for movements and manoeuvring of trucks.
• ROM coal stockpile areas	The ROM stockpile areas will be compacted, and a lining system established based on the requirements of DWS.
• Overburden dump areas	The overburden dump areas will be compacted, and a lining system established based on the requirements of DWS.
• Pollution control dams (PCDs)	Pollution Control Dams to contain dirty water runoff from the mining area and water pumped from the open pits. The aquifer will be separated from the facilities through the establishment of a lining system based on the requirements of DWS.
• Storm water infrastructure incl. clean and dirty water channels and diversion berms	All clean water channels will be grassed lined and divert the clean water runoff away from the proposed polluted areas and be released into the natural veld via energy dispersion erosion control type structures. All dirty water channels will be concrete/soilcrete lined and divert the dirty run-off water from the dirty areas such as the ROM stockpile to the PCDs via silt traps. Temporary berms/contour banks will be constructed along the contours above the initial box cuts, which will be moved as the box cuts progress during the operational phase.
• Workshop areas and contractor yards.	The areas will be compacted and fenced. The workshops will consist of an impermeable surface area with a zinc roof and portable containers will be brought to site to use for warehousing, offices etc.
• Bulk fuel storage facility	Above ground diesel storage tanks will be established in a bunded area at the contractor’s yard and workshop.

Activity	Description
• Hard park, offices, and guard houses	The parking area will be compacted, and portable container offices/security guard houses will be brought to site.
• Sewage management system	A plastic conservancy tank system will be constructed. Chemical toilets will be used during construction until the system has been established. Approved Contractors will remove the sewage to a suitable municipal sewage treatment works.
General and hazardous waste management	General and hazardous waste will be generated during the construction phase. General waste may comprise concrete, rubble, glass, plastics and recyclable metals and hazardous waste could include used oils, oily rags, paint, and chemicals containers etc. Domestic and hazardous waste generated by the project will be collected, handled, and temporarily stored on site before being removed on a regular basis for disposal at appropriately licenced facilities. The different type of waste bins will be located at the contractor's yard.
Construction vehicle movement and increased human activity in and around MRA	The activities listed above will involve the operation of construction equipment which will consists of trucks, excavators, dumpers, compactors, and pick-ups. The construction phase will involve the constant movement of contractors and mining employees in and around the area.
Appointment of employees and contractors	The Applicant will appoint employees, contractors, and sub-contractors to assist with the construction activities.
Operational Phase	
Opencast mining and earth work activities	Mining will involve drilling, blasting and excavation of the hard overburden material. The roll-over method of mining is used, implying that the overburden stripped from the initial cut is stockpiled. Rollover mining is undertaken by creating an initial box cut, this cut is mined out and the overburden and topsoil stockpiled. The 2nd cut is then created and mined out using a portion of the 2nd cut's overburden to backfill the initial box cut. This process continues as mining moves forward and finally the overburden from the box cut is used to backfill the final cut.
Ongoing vegetation clearance, soil stripping and stockpiling	Removal of crops and other vegetative cover within the areas earmarked for immediate opencast mining. As per the construction phase, the soils excavated will be separately pre-stripped as topsoil or subsoil and stockpiled separately in a designated area for use during rehabilitation.
Dewatering of opencast pits	Dewatering is required to ensure stability of mine walls and optimise production. Groundwater and underground water inflow as well as surface water runoff into the opencast pits will be pumped to the PCDs to enable the proposed mining activities to commence.
Overburden stockpiling	The overburden material will consist of hard and soft dumps which will be stockpiled in designated areas.
ROM Coal handling and stockpiling	ROM Coal will be road hauled to the designated stockpile areas for temporary stockpiling before it is transported of site.
Storm water management	Storm water will be managed by isolating the mining area from the surrounding hydrological system

Activity	Description
	through the series of clean and dirty water channels. The clean water channels will divert all clean water runoff away from the proposed opencast pits and polluted areas and release clean water into the surrounding streams via energy dispersion erosion control type structures. The dirty water channels will divert all dirty water runoff from the polluted areas to the PCDs via concrete silts traps. The temporary berms/contour banks above the box cuts will be moved as the box cuts progress to prevent storm water from entering the pits.
Operation of bulk fuel storage facility	Diesel will be stored in above ground bunded storage tanks with concrete flooring to prevent spillages from seeping into the underlying aquifer.
Operation of workshop areas	Various machinery will be repaired, washed, and stored at the workshop areas. Oil traps and drums will be present to contain oil waste and spills.
Sewage management	Disposal of human sewage using the plastic conservancy tank system. Approved Contractors will remove the sewage to a suitable municipal sewage treatment works.
Operational vehicle and increased human activity in and around the MRA	The operational phase will involve the constant movement of vehicles, machinery, contractors, and mining employees in and around the area.
General and hazardous waste management	General and hazardous waste as defined under National Environmental Management: Waste Act will be generated at the proposed mine operation. General waste will comprise concrete, rubble, glass, plastics and recyclable metals and hazardous waste will include used oils, oily rags, paint, and chemicals containers etc. Temporary waste storage facilities will be constructed for hazardous and general waste within the mine infrastructure area. A facility for the bailing and sorting of waste will be provided for within the temporary storage areas. No permanent disposal of general or hazardous waste will take place at the mine; such waste will be transported off-site for disposal at suitably licenced facilities. The different type of waste bins for the temporary storage of waste will be located at the contractor's yard.
Implementation of the Social and Labour Plan (SLP)	Canyon has prepared and submitted a Social and Labour Plan for the proposed Driefontein Coal Mine, as part of the process for applying for a Mining Right as required of the Mining Charter and the Mineral and petroleum Resources Development Act 28, 2002. The objectives outlined in the SLP will be implemented during the operational phase.
Concurrent rehabilitation	Concurrent rehabilitation will occur during the operational phase by means of the roll over method. From the rehabilitation perspective, the key factors to consider during the operational phase are to minimise the area affected by the development, minimise potential future contact of toxic or polluting materials with the environment, and to maximise the recovery and effective storage of those mining profile materials that will

Activity	Description
	be most useful during the rehabilitation process.
Decommissioning, rehabilitation, and closure phase	
Final backfill of open pit and closing of the final void	The overburden of the initial box cut will be used to backfill the final void (hard overburden at the bottom and soft overburden at the top).
Dismantling and removal of mining infrastructure	Following cessation of mining, it is planned that all infrastructures will be decommissioned and removed from site in a systematic and regulated manner. Mining infrastructure such as the fuel storage facility, workshop, offices, change houses, fences, etc. will be removed from site. All material recovered from the demolition of buildings and/or structures will either be transported to a permitted disposal site, sold as scrap or made available to the local community as building materials (provided they are in a satisfactory condition following demolition).
Rehabilitation of compacted areas	The stockpile areas, haul roads and other compacted areas will be ripped and re-vegetated with indigenous vegetation.
Rehabilitation of the PCDs and associated infrastructure	The PCDs along with the storm water management infrastructure will only be demolished should the area proof to be free draining with no pollution potential after rehabilitation. The areas will be cleaned, filled, and landscaped during decommissioning.
Cleaning, landscaping, and replacement of soils over the disturbed area	Coal waste will be removed from site and the pre-stripped topsoil will be replaced over the disturbed area. This will be followed by the re-vegetation of the site surface as part of the rehabilitation process with the aim to rehabilitate the area as close as possible to the pre mining state.
Waste generation and disposal	Large quantities of waste, including scrap metal and used oil, will be produced during the demolition of infrastructure and the operation of equipment used during decommissioning. No disposal of general or hazardous waste will take place on site; such waste will be transported off-site for disposal at suitably licenced facilities.
Retrenchment	Mine closure will result in the retrenchment of a number of employees. Only employees and contractors involved in the decommissioning activities will remain employed.
Wastewater treatment	It is predicted that the pit will start decanting after mine closure and allowance has been made by Canyon to establish a water treatment plant.

5.3 Listed and specified activities

As mentioned under the project background description, the proposed mine will follow an Integrated Environmental Application Process and therefor all the relevant activities which require authorisation in terms of NEMA and NEM: WA have been included in Table 9 below.

Table 9: Listed activities applied for as part of the Environmental Authorisation application

Description of Activity (quoted from Listing Notice 1, 2 and 3)	Applicability to this Project	Aerial Extent of the Activity Ha Or m^2	Activity Number
Listing Notice 1 (GNR 327, 07 April 2017)			
The development and related operation of infrastructure exceeding 1 000 meters in length for the bulk transportation of sewage, effluent, process water, wastewater, return water, industrial discharge or slimes – (i) with an internal diameter of 0,36 meters or more; or (ii) with a peak throughput of 120 liters per second or more; excluding where— (a) such infrastructure is for the bulk transportation of sewage, effluent, process water, wastewater, return water, industrial discharge or slimes inside a road reserve or railway line reserve; or (b) where such development will occur within an urban area.	Dirty water channels, exceeding the stipulated threshold, will be established for the transportation of dirty storm water to the PCDs.	2 200m^2	Activity 10
The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres.	Construction of a fuel storage facility with the capacity to store more than 80m^3 but less than 500m^3 of diesel in aboveground storage tanks.	0.005ha	Activity 14
The development of a road— (ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is	Development of haul roads wider than 8m inside the operational area to transport ROM coal to the access point.	3ha	Activity 24 Sub activity (ii)

Description of Activity (quoted from Listing Notice 1, 2 and 3)	Applicability to this Project	Aerial Extent of the Activity Ha Or m²	Activity Number
wider than 8 m but excluding a road— (a) which is identified and included in activity 27 in Listing Notice 2 of 2014. (b) where the entire road falls within an urban area; or (c) which is 1 kilometre or shorter.			
The development and related operation of facilities or infrastructure for the treatment of effluent, wastewater or sewage with a daily throughput capacity of more than 2 000 cubic metres but less than 15 000 cubic metres.	It is predicted that the pit will start decanting after mine closure and allowance has been made by Canyon to establish a water treatment plant.	TBC	Activity 25
The clearance of an area of 1 hectare or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for— (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan	Potentially more than 1ha of the indigenous vegetation will be cleared during site establishment.	5ha	Activity 27
Residential, mixed, retail, commercial, industrial, or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development: (i) will occur inside an urban area, where the total land to be developed is bigger	The farmland affected by the mine area will be acquired by Canyon Coal changing the land use from agriculture to mining.	471 ha	Activity 28 Sub Activity (ii)

Description of Activity (quoted from Listing Notice 1, 2 and 3)	Applicability to this Project	Aerial Extent of the Activity Ha Or m²	Activity Number
than 5 hectares; or *(ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare.* *excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes.*			
Listing Notice 2 (GNR 325, April 2017)			
The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent, excluding— *(i) activities which are identified and included in Listing Notice 1 of 2014.* *(ii) activities which are included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies.* *(iii) the development of facilities or infrastructure for the treatment of effluent, polluted water, wastewater or sewage where such facilities have a daily throughput capacity of 2 000 cubic metres or less: or*	The ROM Stockpile areas and Pollution Control Dams (PCDs) require a Water Use License in terms of Section 21 (g) because it has the potential to negatively affect surrounding water resources.	5.20 ha	Activity 6

Description of Activity (quoted from Listing Notice 1, 2 and 3)	Applicability to this Project	Aerial Extent of the Activity Ha Or m^2	Activity Number
(iv) where the development is directly related to aquaculture facilities or infrastructure where the wastewater discharge capacity will not exceed 50 cubic metres per day.			
Any activity including the operation of that activity which requires a mining right as contemplated in section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including— (a) associated infrastructure, structures and earthworks, directly related to the extraction of a mineral resource; or (b) the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing; but excluding the secondary processing of a mineral resource, including the smelting, beneficiation, reduction, refining, calcining or gasification of the mineral resource in which case activity 6 in this Notice applies. but excluding the secondary processing of a mineral resource, including the smelting, beneficiation, reduction, refining, calcining or gasification of the mineral resource in which case activity 6 in this Notice applies.	The proposed Driefontein Mine, consisting of two opencast pits referred to as the Northern and South-eastern Pits, requires a Mining Right in terms of Section 22 of the MPRDA	230 ha	Activity 17
List of waste management activities (GNR 921, as amended)			

Description of Activity (quoted from Listing Notice 1, 2 and 3)	Applicability to this Project	Aerial Extent of the Activity Ha Or m^2	Activity Number
The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right, exploration right or production right in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002). [Category B Activity 11 ins by reg 3 of GoN R633 in G. 39020.]	Overburden stockpiling (Hard & Soft dumps) within the MRA for re-use during rehabilitation.	50.30 ha	Category B Activity 11
The disposal of any quantity of hazardous waste to land.	Overburden stockpiling (Hard dumps)		Category B Activity 7
The disposal of general waste to land covering an area in excess of 200m2 and with a total capacity exceeding 25 000 tons.	Overburden stockpiling (soft dumps).		Category B Activity 8

****Please note, the Environmental Authorisation application form has been amended in line with the above table as new information became available during the application process. Refer to Appendix 5 for the amended application form.**

6 Policy and Legislative Context

This EIAR has been compiled strictly in accordance with the template provided by the DMRE for mining related EIARs. This is in accordance with the MPRDA as well as the guidelines provided by the National Environmental Management Act, 1998 (Act no 107 of 1998) and Environmental Impact Assessment Regulations of 2014.

6.1 Legislative context

Table 10 outlines the legislation, guidelines, policies, and frameworks applicable to the proposed Driefontein Mine. The table lists the most applicable pieces and indicates how the proposed mine will comply with these.

Table 10: Policy and Legislative Context

Applicable Legislation, Guidelines, Policies and Frameworks	Reference where Applied	How does this Development Comply
Constitution of South Africa Act 108 of 1996.	In terms of Section 24 of the Constitution of the Republic of South Africa (108 of 1996), everyone has the right to an environment that is not harmful to their health or well-being and to have the environment protected, for the benefit of present and future generations, through reasonable legislation and other measures that prevent pollution and ecological degradation, promote conservation and secure ecologically sustainable development, and use of natural resources while prompting justifiable economic and social development.	The needs of the environment, as well as affected parties, will be integrated into overall project management. The Applicant is committed to implementing the management/mitigation measures identified in the EMPr in order to avoid, reduce and/or minimise the significant environmental impacts.
MPRDA, 2002 (Act 28 of 2002) MPRDA, 2002 (Act 28 of 2002): MPRDA Regulations, 2004	Section 22 of the MPRDA and Regulation 10 of the MPRDA Regulations, GNR 527 (23 April 2004). In terms of the MPRDA a mining right is required and amongst others a Social and Labour Plan (SLP) must accompany the	A mining right application was accepted by the DMRE on the 24th of February 2021 (Ref No: MP 10247 MR). As part of the mining right application a SLP and MWP were also submitted. As an EMPR is a requirement for a Mining Right the DMRE does not

Applicable Legislation, Guidelines, Policies and Frameworks	Reference where Applied	How does this Development Comply
	application for a mining right.	process applications for a mining right without being provided with the required environmental authorization in terms of the NEMA. As such the granting of the Mining Right will depend on the issuance of the other authorizations.
	Regulation 67. Blasting, vibration and shock management and control (1) A holder of a right or permit in terms of the Act must comply with the provisions of the Mine Health and Safety Act, 1996, (Act No. 29 of 1996), as well as other applicable law regarding blasting, vibration and shock management and control. (2) An assessment of impacts relating to blasting, vibration and shock management and control, where applicable, must form part of the environmental impact assessment report and environmental management programme or the environmental management plan, as the case may be.	As part of Environmental Impact Assessment (EIA), Blast Management & Consulting (BM&C) was contracted to perform a review of possible impacts from blasting operations and specifically for the proposed Driefontein Mine. Ground vibration, air blast and fly rock are some of the aspects that result from blasting operations and the study considered the possible influences that blasting may have on the surrounding area in this respect. The findings of the report have been incorporated in the EIAR and the full report is attached as Appendix 6.11.
Mine Health and Safety Act (No. 29 of 1996) Mine Health and Safety Regulations	The importance of the Act lies in its numerous regulations, many of which will be relevant to the proposed coal mine. This cover, among other issues, noise, lighting, emergency preparedness, management of dust and handling, storage, and transportation of hazardous materials.	The safety of employees must be the Applicant's number one priority. To ensure that the goal of Zero Harm is reached, much of the proposed mine's focus will be placed on safety risk management training across the organisation. In terms of the MPRDA the proposed Driefontein Mine needs to ensure compliance to the Mine Health and Safety Act (No 29 of 1996), some of the applicable environmental responsibilities include: - Air quality management and control.

Applicable Legislation, Guidelines, Policies and Frameworks	Reference where Applied	How does this Development Comply
		- Location of waste dumps. - Hazardous substances. - Fire prevention. - Noise management and control. - Blasting, vibration, and shock management control. The guidelines and safe blasting criteria applied in the Blast Impact Assessment are as per internationally accepted standards, and specifically the United States Bureau of Mines (USBM) criteria for safe blasting for ground vibration and the recommendations on air blast. The current pit layout indicates that private installations may be in close proximity of the planned pit areas. The Mine Health and Safety Act has specific requirements regarding blasting within 500m from private installations which must be addressed through the implementation of the mitigation measures provided in this report which was based on the recommendations in the Blast and Vibration Impact Assessment.
NEMA, 1998 (Act 107 of 1998) NEMA EIA Regulations of 2014, as amended in April 2017 (GNR324, GNR325, GNR326 and GNR327).	In terms of Section 24(2) of the NEMA, the Minister of the Department of Environmental Affairs (DEA) may identify activities that may not commence without prior authorisation and make regulations in accordance with the procedures required for such authorisations. Activities identified were published in Government Notice Regulation (GNR) 324, 325	An application for Environmental Authorisation was submitted along with the Mining Right Application for the listed activities triggered by the proposed project. This integrated S&EIR process is required as part of the Environmental Authorisation application for the listed activities identified in Section 5.3 above.

Applicable Legislation, Guidelines, Policies and Frameworks	Reference where Applied	How does this Development Comply
	and 327 (7 April 2017), and the EIA Regulations outlining the procedures required for authorisation published in GNR 326 (7 April 2017).	The submission of this draft EIAR is the next step in the EA Process.
	Section 28 – Duty of care and remediation of environmental damage	The Applicant will be required to comply with the mitigation, management and monitoring measures recommended in the EMPr in order to reduce or avoid the potential environmental impacts of the proposed mine.
National Environmental Management: Waste Act (No. 59 of 2009) GNR 921 (9 November 2013)	All organizations that wish to commence, undertake, or conduct a waste management activity must apply for a waste management license. In terms of Section 19 of the NEM: WA the DEA may publish a list of waste management activities which may not commence without prior authorisation. Activities identified were published in GNR 921 (9 November 2013). As from 2 June 2014, residue deposits and residue stockpiles, as defined in the MPRDA, are no longer excluded from the provisions of NEM: WA. All residue deposits and stockpiles, as defined, are deemed hazardous waste until proven otherwise in accordance with the Waste Classification and Management Regulations (23 August 2013).	This integrated S&EIR process is conducted in order to obtain the required waste license and assess the potential risks associated with the proposed Driefontein Mine for the listed activities triggered in GNR921. The ROM stockpile pads and hards overburden stockpiles are conservatively assumed to be Type 3 waste therefor requiring a Class C liner and the softs overburden stockpiles to be Type 4 waste type, therefor requiring a Class D liner. The assumption is based on the waste classification done for Hakhano Colliery.
National Norms and Standards for Waste Storage GNR 926 (29 November 2013)	The National Norms and Standards for Waste Storage GNR 926 (29 November 2013) impose several requirements pertaining to “waste storage areas”	GNR 926 is applicable to all hazardous waste storage areas with a capacity to store more than 80m^3 and general waste storage areas that can hold more than 100m^3. A waste license is applied for as part of the Environmental Authorisation application

Applicable Legislation, Guidelines, Policies and Frameworks	Reference where Applied	How does this Development Comply
		(refer to Section 5.3 above indicating the listed activities applied for)
NWA, 1998 (Act No.36 of 1998)	In terms of the Section 40 of the National Water Act (No. 36 of 1998) (NWA), each party proposing a water use, as defined in Section 21 of the Act, must apply to the Department of Water and Sanitation (DWS) for authorisation before such water use can commence. The following Section 21 water uses are applicable to the development of the proposed Mine: *(a) Taking water from a water resource* *(c) Impeding or diverting the flow of water in a watercourse.* *(f) Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit.* *(g) Disposing of waste in a manner which may detrimentally impact on a water resource* *(i) Altering the bed, banks, course or characteristics of a watercourse.* *(j) Removing, discharging or disposing of water found in the opencast if it is necessary for the efficient continuation of an activity or for the safety of people*	An Integrated Water Use License Application (WULA) will be submitted for the Section 21 water uses that will be triggered by the proposed Driefontein Mine. The process outlined in the Regulations Regarding the Procedural Requirements for Water Use License Applications and Appeals, March 2017 published by the Department of Water and Sanitation (DWS) will be followed.
GNR 704 (4 June 1999)	The intention of GNR 704 (4 June 1999) is mainly the following: • To prevent the flooding of mine workings, both underground and opencast, that could cause the loss of life or the	A Stormwater management plan to separate clean and dirty water will be developed and flood lines determined for all watercourses (as defined) and mapped on the surface maps. The pollution potential of all material will be determined as part of the WULA and if pollution potential is evident exemption must be obtained from the provisions of

Applicable Legislation, Guidelines, Policies and Frameworks	Reference where Applied	How does this Development Comply
	sterilisation of the mineral resource. • To minimise the quantity of clean water contaminated by either the mixing with dirty water or the contamination thereof by the activity. In this way the volume of clean water that can be diverted to the natural resource is maximised. • To prevent the pollution of the groundwater resource.	GNR 704 as part of the WULA. The water license must reflect it as a condition.
NEMA Financial Provision Regulations (FPR) (GNR 1147) 2019 - Regulations pertaining to the Financial Provision for the Rehabilitation, Closure and Post Closure for Prospecting, Exploration, Mining or Production Operations	An applicant or holder of a right or permit must determine and make financial provision to guarantee the availability of sufficient funds to undertake rehabilitation and remediation of the adverse environmental impacts of prospecting, exploration and mining or production operations, as contemplated in the Act and to the satisfaction of the Minister responsible for mineral resources.	The 2022 Driefontein Rehabilitation, Decommissioning and Closure Plan assessment produced the required documentation as specified in the FPR and determined the financial provision through a detailed itemisation of all activities and costs, calculating the cost based on actual costs of implementation of the measures required for: (a) Rehabilitation and remediation (b) Final rehabilitation, decommissioning and closure activities (c) Remediation and management of latent or residual environmental impacts. The Refer to the Decommissioning, Rehabilitation and Closure Plan attached as Appendix 6.12.

Applicable Legislation, Guidelines, Policies and Frameworks	Reference where Applied	How does this Development Comply
National Environmental Management: Air Quality Act (Act No. 39 of 2004) GNR 893 (22 November 2013)	The NEM: AQA, has shifted the approach of air quality management from source-based control to receptor-based control. The main objectives of the Act are to: • protect the environment by providing reasonable measures for— i. the protection and enhancement of the quality of air in the Republic. ii. the prevention of air pollution and ecological degradation; and iii. securing ecologically sustainable development while promoting justifiable economic and social development; and • generally, to give effect to section 24(b) of the Constitution in order to enhance the quality of ambient air for the sake of securing an environment that is not harmful to the health and wellbeing of people. The Act makes provisions for the setting and formulation of National Ambient Air Quality Standards for "substances or mixtures of substances which present a threat to health, well -being or the environment". More stringent standards can be established at the provincial and local levels.	The fact that coal stockpiles will not be located outside the approved mining right boundaries exempts the project from having to apply for an Atmospheric Emission License (AEL) and therefore excluded from the scheduled activities under NEM: AQA. Although Canyon will not require an AEL for the proposed operation it will have to operate within the NAAQS and the National Dust Control Regulations.

Applicable Legislation, Guidelines, Policies and Frameworks	Reference where Applied	How does this Development Comply
	The NEM: AQA requires all persons undertaking listed activities in terms of Section 21 of the Act to obtain an AEL. The listed activities and associated minimum emission standards were issued by the DEA on 31 March 2010 (Government Gazette No. 33064 of 31 March 2010) and were last amended in 2020 (Government Gazette No. 43174 of 27 March 2020).	
National Atmospheric Emissions Inventory System (NAEIS)	South Africa launched an online National reporting system, referred to as the National Atmospheric Emissions Inventory System (NAEIS). The NEM: AQA requires all emission source groups identified in terms of the National Atmospheric Emission Reporting Regulations (Government Gazette No. 38633 of 02 April 2015), to register and report emissions on the NAEIS. Mines are classified as Group C emitters and thus are required to report annually and comply with the National Atmospheric Emission Reporting Regulations.	Once operational, the proposed Driefontein Coal Mine must register on the NAEIS and report on their fugitive dust emissions annually before the 31 March each year.
National Ambient Air Quality Standards (NAAQS)	National Ambient Air Quality Standards (NAAQS), including permitted frequencies of exceedance and compliance timeframes, were issued by the Minister of Water and Environmental Affairs on 24 December 2009. National standards for $PM_{2.5}$ were established by the Minister of Water and Environmental Affairs on 29 June 2012.	The project area falls within the Highveld Nationally Declared Air Quality Priority Area (HPA) and must therefore comply with the requirements of the HPA Air Quality Management Plan GNR 1241 (21 November 2008).

Applicable Legislation, Guidelines, Policies and Frameworks	Reference where Applied	How does this Development Comply
	The HPA was declared a priority area by the Minister of Environmental Affairs and Tourism on 23 November 2007 under the National Environmental Management Air Quality Act (Act No. 39 of 2004) (NEM: AQA) (Government Gazette, No. 30518 of 23 November 2007). A Priority Area is usually associated with elevated ambient concentrations of criteria air pollutants such as PM_{10}, $PM_{2.5}$, SO_2, and NO_x. Generally, a high number of emitters (industrial and non-industrial) are also concentrated in these areas. In order to meet the requirements of the NEM: AQA, an Air Quality Management Plan (AQMP) was compiled for the HPA and provides a management tool that can be used and implemented by departments and industry to ensure effective air quality management within the area. The primary aim of the AQMP is to provide a framework including short to long term strategies and programs that can be used to work towards achieving and maintaining compliance with the National Ambient Air Quality Standards within the HPA.	
National Dust Control Regulations (1 November 2013)	The purpose of the regulations is to prescribe general measures for the control of dust in all areas. The regulations prohibit activities which give rise to dust in such quantities and concentrations that the dust-fall at the boundary or beyond the boundary of the	Should the proposed Driefontein Mine exceed the dust-fall standard it will be required, within three months after submission of a dust-fall monitoring report, to develop and submit a dust management plan to the air quality officer for approval which must be implemented within a month of the date of

Applicable Legislation, Guidelines, Policies and Frameworks	Reference where Applied	How does this Development Comply
	premises where it originates exceeds: a) 600 $mg/m^2/day$ averaged over 30 days in residential areas measured using reference method ASTM D1739. b) 1 200 $mg/m^2/day$ averaged over 30 days in non-residential areas measured using reference method ASTM D1739. Updated draft National Dust Control Regulations were published on 25 May 2018. The regulations prescribe the method that should be used for undertaking dust-fall monitoring, which includes the use of dust bucket stations with a wind shield.	approval.
National GHG Emission Reporting Regulations (Government Gazette No. 40762 of 3 April 2017).	The Regulations were published by the DEA. A person identified as a Category A data provider in terms Annexure 1 of these regulations, must register their facilities by filling in the form under Annexure 2 of these regulations and must submit a GHG emissions inventory and activity data in the required format given under Annexure 3 of these regulations on an annual basis. All data must be provided annually, by the 31 March of the following year. Data providers are required to register on the NAEIS and report on their direct GHG emissions on an annual basis and comply with the reporting requirements as detailed in the National GHG Emission Reporting Regulations. Coal mining falls under category 1B1a (i.e., Coal	The proposed Driefontein Mine will be required to register and report on their GHG emissions by the 31 March of every year.

Applicable Legislation, Guidelines, Policies and Frameworks	Reference where Applied	How does this Development Comply
	Mining and Handling) in terms of Annexure 1 of the National GHG emission reporting regulations (Government Gazette No. 40762 of 3 April 2017). All facilities conducting this activity (i.e., Coal Mining and Handling) are required to register and report on their GHG emissions by the 31 March of every year.	
Carbon Tax Act No. 15 of 2019 (23 May 2019)	The Carbon Tax Act No. 15 of 2019 was promulgated on the 23 May 2019 and is implemented using a phased approach, allowing emitters time to transition to cleaner and more efficient technologies resulting in lower GHG emissions. Phase One is effective from 1 June 2019 to 31 December 2022. Any person, company or entity who undertakes an activity (above a certain threshold) and is responsible for the release of GHG emissions is required to report on their emissions to the DEA by the 31 March each year and pay tax on those emissions by July each year. The tax rate is R120 per tonnes of CO 2-eq (carbon dioxide equivalent) emitted by the generation facility or entity for the relevant reporting period. The carbon tax rate will increase by CPI + 2% during the first phase and thereafter by CPI. However, there are tax-free allowances that apply that can make the overall effective tax rate much lower between	Should the GHG emission be above a certain threshold the proposed Driefontein Mine will be required to pay tax on those emissions by July each year.

Applicable Legislation, Guidelines, Policies and Frameworks	Reference where Applied	How does this Development Comply
	R6 and R48 per tonnes of $CO_{2\text{-eq}}$ emitted.	
Nkangala District Municipality: Air Quality Management By-Law (Provincial Gazette No. 2701 of 10 June 2016).	The purpose and objective of the by-law is to enable the council and its local municipalities to protect, intervene, regulate and control activities which emit emissions and promote the long-term health, well-being and safety of people and environment within its jurisdiction area.	The proposed Driefontein Mine is located within the Nkangala District Municipality and will result in dust emission therefor it must comply with the by-law specifically relating to air quality management.
National Environmental Management: Biodiversity (Act No.10 of 2004) National List of Threatened Ecosystems (2011)	The National Environmental Management: Biodiversity Act, 2004 (NEMBA; Act No. 10 of 2004) provides for a national list of ecosystems that are threatened and in need of protection, in one of four categories: 'Critically Endangered (CR)', 'Endangered (EN)', 'Vulnerable (VU)' or 'Protected'. Threatened ecosystems are listed in order to reduce the rate of ecosystem and species extinction by preventing further degradation and loss of structure, function and composition of threatened ecosystems.	The study area is located within the original extent of the Rand Highveld Grassland Ecosystem, which is classified as Vulnerable (VU) due to irreversible loss of natural habitat throughout its extent and whereby the remaining natural habitat is less than 60% of the original area of the ecosystem. VU ecosystems are defined as ecosystems with a high risk of undergoing significant degradation of ecological structure, function or composition as a result of human intervention, although they are not CR or EN ecosystems. Large parts of the application area have already been transformed by agricultural activities. The remaining natural areas must be excluded from the development footprint area in line with the current proposed mine layout, and appropriate measures (as described in the EMPr) be put in place to protect the various watercourses and associated wetland habitat traversing the study area.
NEMBA Alien and Invasive Species Regulations (2020)	The NEMBA Alien and Invasive Species Regulations (2014) aims to: • Prevent the unauthorised introduction and	A list of alien and invasive floral species noted during the terrestrial biodiversity assessment is included in Section 10.5.5 below.

Applicable Legislation, Guidelines, Policies and Frameworks	Reference where Applied	How does this Development Comply
	spread of alien and invasive species to ecosystems and habitats where they do not naturally occur. • Manage and control alien and invasive species, to prevent or minimise harm to the environment and biodiversity; and • Eradicate alien and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats. The NEMBA Alien and Invasive Species Lists (2020) include national lists of invasive species to be read together with the Alien and Invasive Species Regulations (2020).	Listed alien species within the study area has to be controlled throughout all development phases of the proposed project.
Threatened or Protected Species Regulations (2015)	Chapter 4, Part 2 of NEMBA provides for listing of Threatened or Protected Species (TOPS). If a species is listed as threatened, it must be further classified as CR, EN or VU. In addition to these categories, Protected Species are defined as “any species which is of such high conservation value or national importance that it requires national protection”. Species listed in this category will include, among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).	Certain activities, referred to as Restricted Activities, are regulated on listed species using permits by a special set of regulations published under the Act. Restricted activities regulated under the act are keeping, moving, having in possession, importing and exporting, and selling. No Threatened or Protected Species (TOPS species), International Union for Conservation of Nature (IUCN) and SANBI threatened species, were recorded within the study area during the Terrestrial Biodiversity Assessment. Should the mining layout change, or any floral SCC be recorded within the mining footprint area in future, it is recommended that these species be relocated to suitable habitat within the study area

Applicable Legislation, Guidelines, Policies and Frameworks	Reference where Applied	How does this Development Comply
		under the supervision of a qualified ecologist.
National Forest Act (No. 84 of 1998)	An updated list of protected tree species was published under section 12(1) (d) of the National Forests Act (Act No. 84 of 1998) on 6 December 2019. In terms of section 15(1) of this Act, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any product derived from a protected tree, except under a license or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated.	No tree species protected under the National Forest Act (Act No. 84 of 1998) were encountered within the study area during the Terrestrial Biodiversity Assessment. No protected tree species will be removed during the mining operation without the necessary permits.
National Environmental Management: Protected Areas Act (Act No. 57 of 2003)	The Act provides for the protection and conservation of ecologically viable areas representative of South Africa’s biological diversity and its natural landscapes and seascapes; for the establishment of a national register of all national, provincial and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas; and for matters in connection therewith.	No protected areas, defined in terms of this Act, have been identified within a 10km radius of the application area.
The National Protected Areas Expansion Strategy (NPAES; 2010)		According to the National Protected Areas Expansion Strategy (NPAES) database, the study area is not located within an NPAES Focus Area.
South African Protected Areas Database (SAPAD, 2021) and South Africa Conservation Areas Database (SACAD, 2021)	The primary function of protected areas is to ensure the conservation of habitats, environmental processes and species occurring within these ecosystems. The South African Protected Areas Database (SAPAD) and the	No formally or informally Protected or Conservation Areas are indicated by the South African Protected Areas database (2021) of the South African Conservation Areas Database (2021) to be located within or in the vicinity of the study area.

Applicable Legislation, Guidelines, Policies and Frameworks	Reference where Applied	How does this Development Comply
	South African Conservation Areas Database (SACAD) are Geographic Information System (GIS) inventories of all Protected and Conservation areas in South Africa. The Protected and Conservation Areas (PACA) database also includes data on privately owned protected areas. This Register comprises of all data required for the Register of Protected Areas (legally declared) as well as data on Conservation Areas (areas responsibly managed for biodiversity conservation but not legally declared as Protected Areas).	According to the National Biodiversity Assessment (NBA) database, the study area is not affected by formally or informally protected areas.
Mpumalanga Biodiversity Sector Plan (MBSP; 2014): Terrestrial CBAs	The MBSP (2014) terrestrial assessment is based on a systematic biodiversity planning approach to identify spatial priority areas that meet both national and provincial targets in the most efficient way possible, while trying to avoid conflict with other land-uses.	According to the MBSP (2014) Terrestrial CBA database, the study area falls within the following areas: • Heavily modified: all areas associated with existing agricultural fields, which comprises the majority of the study area. • Moderately modified: all areas associated with old agricultural fields, along the northern and southern boundaries of the study area. • Other Natural Areas (ONAs): ONAs are indicated to occur along the north-western boundary of the study area, within the vicinity of the active mining areas in the north, and within the natural grassland areas associated with watercourses along the southern boundary of the study area. • Critical Biodiversity Area (CBA) Optimal: one CBA Optimal area is indicated along the

Applicable Legislation, Guidelines, Policies and Frameworks	Reference where Applied	How does this Development Comply
		southern boundary of the study area, also associated with a natural grassland and watercourse The EMPr considered the desired management objectives, as well as the land use guidelines as outlined in the Mpumalanga Biodiversity Sector Plan Handbook.
Mining and Biodiversity Guideline (2012)	The guideline distinguishes between four biodiversity priority areas where biodiversity may limit the potential for mining: (1) Legally Protected Areas (2) Highest Biodiversity Importance (3) High Biodiversity Importance (4) Moderate Biodiversity Importance	The Mining and Biodiversity Guidelines (2012) indicates areas, mainly around the periphery of the study area, to fall within areas indicated to be of Highest Biodiversity Importance – Highest Risk for Mining and Moderate Biodiversity Importance – Moderate Risk for Mining. The remaining natural areas to the south must be excluded from the development footprint area in line with the current proposed mine layout, and appropriate measures (as described in the EMPr) be put in place to protect the various watercourses and associated wetland habitat traversing the study area.
Conservation of Agricultural Resources Act (No. 43 Of 1983)	Amendments to regulations under the CARA (Act No. 43 of 1983) provide for the declaration of weeds and invader plants, with weeds regarded as alien plants with no known useful economic purpose, while invader plants may serve useful purposes as ornamentals, as sources of timber and may provide many other benefits, despite their aggressive nature. Declared weeds are described as Category 1	The proposed mining operation must implement an alien species management programme during all phases to eradicate/control identified alien species within the proposed mining area and surrounding natural areas.

Applicable Legislation, Guidelines, Policies and Frameworks	Reference where Applied	How does this Development Comply
	plants, while declared invader plants with a commercial or utility value are described as Category 2 plants and ornamental species as Category 3 plants. CARA indicates that Category 1 weeds are prohibited, and that Category 2 and 3 plants must be controlled.	
Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998)	The Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998) (MNCA), controls the picking, donation, sale, export or removal purchase, import, receipt, possession, acquisition, and handling of indigenous plant species, as well as Protected and Specially Protected plant species.	Protected and Specially Protected plant species, listed for the Mpumalanga Province in terms of the MNCA (Act No. 10 of 1998) are listed in Appendix A of the Terrestrial Biodiversity Assessment. Should any floral Protected and Specially Protected plant species, listed for the Mpumalanga Province in terms of the MNCA (Act No. 10 of 1998) be identified during mining it is recommended that these species are relocated to the remaining natural areas falling outside the development footprint under the supervision of a qualified ecologist. Where required, and upon consultation with the relevant specialist, permits should be obtained to do so from the local authorities.
National Freshwater Ecosystem Priority Areas (NFEPA) (2011)	NFEPA is a database developed by SANBI to define the aquatic ecology of the rivers systems of ecological importance in the country.	Non-perennial streams are located along the southern border of the application area. Mining will occur outside the 1:100-year flood lines or more than 100m from all watercourses (whichever is greatest). Two NFEPA wetlands were identified approximately 4km south of the application area. These will not be affected by the proposed mining operation.
GN 320 of the Government Gazette 43110 – Procedures for the assessment and minimum criteria for reporting on	The Department of Environmental Affairs published Government Notice 320 of the	According to the screening tool, the site has mostly a high sensitivity theme in terms of agricultural

Applicable Legislation, Guidelines, Policies and Frameworks	Reference where Applied	How does this Development Comply
identified environmental themes in terms of Section 24 (5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation	National Environmental Management Act in March 2020 that describes the minimum criteria for reporting on identified environmental themes when applying for environmental authorisation. The assessment requirements of this protocol are associated with a level of environmental sensitivity determined by the national web-based environmental screening tool for specific environmental themes.	resources which is based on the most recent land capability evaluation as provided by the Department of Agriculture, Land Reform and Rural Development (DALRRD). A site assessment conducted by the agricultural specialist found that the delineation of sensitivity according to the tool is accurate. Only small portions are wetlands or shallow soils that are incorrectly graded. Highly sensitive land, according to GNR320, should be assessed in detail through an agro-ecosystem statement (see Section 8.2 of the Agricultural Potential Assessment attached as Appendix 6.1).
		The Department of Forestry, Fisheries and the Environment (DFFE) Screening Tool indicated the majority of the study area to fall within an area of Low Sensitivity in terms of the Relative Plant Species Theme while a small portion within the east is indicated as having Medium Sensitivity.
		The DFFE Screening Report indicated that three mammal and four avifauna SCC may occur in the study area. All of these species have a low (<25%) or unlikely (<50%) probability of occurring in the area.
Noise Control Regulations (GN R154 of 1992)	No noise control legislation within the Mpumalanga province exists, with reference to the National GN R154 National Noise Control Regulations. The National legislation has set pieces for industrial and controlled areas,	With mitigation measures implemented the project will comply to GN R154 legislation.

Applicable Legislation, Guidelines, Policies and Frameworks	Reference where Applied	How does this Development Comply
	residential or business areas. The National noise control legislation defines the following: Section 1: - Ambient sound level - means the reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes, after such meter had been put into operation. - Disturbing noise - means a noise level which exceeds the zone sound level or, if no zone sound level has been designated, a noise level which exceeds the ambient sound level at the same measuring point by 7-dBA or more. - Noise nuisance - means any sound which disturbs or impairs or may disturb or impair the convenience or peace of any person. - Controlled area is as follows – ○ c) industrial noise in the vicinity of an industry - ○ (i) the reading on an integrating impulse sound level meter, taken outdoors at the end of a period of 24 hours while such meter is in operation, exceeds 61 dBA: or ○ (ii) the calculated outdoor equivalent	

Applicable Legislation, Guidelines, Policies and Frameworks	Reference where Applied	How does this Development Comply
	continuous W-weighted sound pressure level at a height of at least 1,2 metres, but not more than 1,4 metres, above the ground for a period of 24 hours, exceeds 61 dBA.	
SANS Guidelines: SANS 10103:2008, the Measurement and Rating of Environmental Noise with Respect to Annoyance, and to Speech Communication. SANS 10328:2008, Methods for environmental noise impact assessments. SANS10210:2004, Calculating and predicting road traffic noise. The document defines the prediction and measurement relating to road traffic noise.	The SANS 10103:2008 provides noise levels that are expected in various areas (Rating Level). These are used by the Noise Regulations as limits of noise in the various areas. The acceptable rating levels for various districts are given, being the maximum noise level that is acceptable at the boundary of the property for any district. The SANS 10328:2008 document sets out the methodology to compile a comprehensive Environmental Noise Impact Assessment. Stipulations include methodologies and minimum requirements, as well as various noise sources for investigations. The SANS10210:2004 document defines the prediction and measurement relating to road traffic noise.	The procedures, as detailed in SANS 10328:2008 and SANS10103:2008 have been applied to the noise measurements and assessments made in the Noise Impact Assessment attached as Appendix 6.10 of this report.
National Heritage Resources Act, 1999	The NHRA is utilized as the basis for the identification, evaluation, and management of heritage resources and in the case of Cultural Resource Management (CRM) those resources specifically impacted on by development as stipulated in Section 38 of NHRA. Applicable	A Heritage and Palaeontological Impact Assessment was conducted as part of the EIA phase. The following mitigation/management measures have been included in the EMPr in order to ensure compliance with Section 34 – 36 and Section 38 of the NHRA:

Applicable Legislation, Guidelines, Policies and Frameworks	Reference where Applied	How does this Development Comply
	sections include: Protection of Heritage Resources – Sections 34 to 36; and Heritage Resources Management – Section 38	• A buffer of at least 100 meters must be put in place around the identified burial grounds and graves. If not possible, the graves must be relocated after completion of a detailed grave relocation process. If this is not possible, the graves could be relocated after completion of a detailed grave relocation process, that includes a thorough stakeholder engagement component, adhering to the requirements of s36 of the NHRA and its regulations as well as the National Health Act and its regulations. • Implement a chance to find procedures in case where possible heritage finds are uncovered.
Hazardous Substances Act (No. 15 of 1973)	The Hazardous Substances Act (No. 15 of 1973) provides for the control of substances that may cause injury, ill health, or death to human beings.	Hazardous substances in the form of fuel will be stored at the proposed mine. The management of hazardous substances during all the phases of the project will be governed by the HAS.
Western Cape Department of Environmental Affairs & Development Planning: Guideline for Involving Visual and Aesthetic Specialists in EIA Processes Edition 1 (CSIR, 2005)	The Guideline document also seeks to clarify instances when a visual specialist should get involved in the EIA process. The Western Cape Guidelines are the only official guidelines for visual impact assessment reports in South Africa and can be regarded as best practice throughout the country.	Although the guidelines were specifically compiled for the Province of the Western Cape, they provide guidance that is appropriate for any EIA process. The guideline was used to compile the Visual Impact Assessment (VIA), attached as Appendix 6.8, for the proposed Driefontein Mine.
Restitution of Land Rights Act, 1994 (Act No. 22 of 1994), as amended in 2014	Land Claims	The Commission on Restitution of Land Rights confirmed that there are no land claims on the affected portions of Driefontein 398 IS and Sterkstroom 400 IS. Refer to a copy of the letter

Applicable Legislation, Guidelines, Policies and Frameworks	Reference where Applied	How does this Development Comply
		attached as Appendix 4.
Steve Tshwete Local Municipality: Integrated Development Plan (IDP) and Spatial Development Framework (SDF)	The Integrated Development Plan (IDP) is the principal strategic planning instrument which guides and informs all planning, budgeting, management and decision-making processes in the municipality. The purpose of the IDP is to ensure the effective use of scarce resources; helps to speed up delivery and attract additional funds from all the spheres of government and the private sector; helps to overcome the legacy of apartheid by lobbying for integrated rural and urban areas and to extend services to the poor and lastly promotes co-ordination between local, provincial, and national government. The SDF provides for focusing of development on areas of potential as a catalyst towards improvement of lives of communities. Areas of potential or nodal points should be prioritized for infrastructure investment. The development of the municipal SDF took into consideration proposals of the National Spatial Development Perspective (NSDP)	The development of the proposed mine is in line with the Key Performance Area (KPA) 3: Local Economic Development (promote economic growth and job creation) of the IDPs Strategic goals and priority areas.

Applicable Legislation, Guidelines, Policies and Frameworks	Reference where Applied	How does this Development Comply
Nkangala District Municipality Spatial Development Framework (SDF)	The SDF for the Nkangala District Municipality comprises a multi-disciplinary range of development proposals, including proposals pertaining to the natural environment, conservation, social and economic infrastructure, engineering services, residential, business, and industrial development, as well as tourism development and agriculture/farming. Essentially, the plan is based on ten development principles (*Nkangala IDP, 2017/18 – 2021/22*).	The proposed development is in line with the following development principles of the Nkangala SDF: Principle 1: *To optimally utilise the mining potential in the District without compromising the long-term sustainability of the natural environment*. The application area falls within the area identified for continues coal development. Principle 6: *To achieve a sustainable equilibrium between urbanisation, biodiversity conservation, mining, industry, agriculture, forestry, and tourism related activities within the District, by way of effective environmental and land use management.* The District has considerable mining potential. The regeneration of power stations, as well as the new Kusile power station could serve as catalyst to increased demand for coal reserves in the NDM area. Principle 7: *To concentrate industrial and agro-processing activities at the higher order nodes in the district where industrial infrastructure is available.* The Applicant has an operational colliery situated approximately 3km to the south of the application area where the ROM Coal will be processed. The proposed development will contribute to promoting the industrial potential of Middelburg to the west and Belfast to the east due to its strategic location in relation to the major transport network.

7 Need and desirability

South Africa's local energy resource base is dominated by coal mainly because of the availability of deposits that can be exploited at favourable costs. This has resulted in the development of a large coal mining industry in the country. Eskom currently relies on coal fired power stations to meet South Africa's primary energy needs and this will continue until alternative energy generation options can be implemented on a sufficiently large scale.

Canyon Resources (Pty) Ltd is a mining and exploration company with current operations in Mpumalanga and Gauteng. The company has four operational mines, Phalanndwa and Phalanndwa Extension in Delmas area, Ukufisa in Springs and Khanye in Bronkhorstspruit area, all four are opencast coal mines mined through the typical truck and shovel method and concurrent rehabilitation is done at the sites. Canyon also has one mine in rehabilitation phase, Singani Colliery, also situated in the Middleburg area, and one mine undergoing care and maintenance, Hakhano Colliery, in the Middleburg area.

Through the prospecting operation it was established that the proposed mining area measured a resource of 7.286 million tonnes of coal that can be mined and marketed to both local and export markets.

7.1 Products and Markets

Coal mined at the proposed Driefontein Mine is destined for both the export and local (Eskom) markets. Exports can occur through the nearby Rietkuil siding 20km from the project site (to Richard's Bay Coal Terminal) or Pan Siding some 11km from the project site (to Richard's Bay Coal or Maputo Coal Terminals). The potential local market includes Eskom as well as sugar and paper mills in other parts of the country. The latter can also be serviced by utilising road trucks or rail through Pan siding while the transport of coal to local Eskom power stations will be via the local road network (*Canyon Coal MWP, 2020)*.

7.2 Social and Labour Plan

Extraction of the coal resource will contribute positively to the South African Economy but the benefits of the mining to the community largely centre on the Social and Labour Plan. The socio-economically depressed and geographically marginalised communities would benefit directly from the commissioning of the mine. The impact here would be long term, past the life of the mine itself. The planned labour compliment, once the mine is fully operational, is expected to be 250 employees (mine and core business contractor employees) of which nine (9) will be permanent Driefontein Mine employees. Of the nine permanent employees, two will be directors, one mine manager, one engineer, one financial & HR manager, one accountant, two weighbridge operators & one Safety, Health and Environmental (SHE) officer.

It is expected the mine workforce will be recruited once the mining right is granted. The approximately 240 core business contractor employees will be appointed by the main mining contractor. The core business contractors will be required to honour the commitments made in the SLP in line with Section 101 of the MPRDA and in compliance to the Mining Charter's BEE requirements. The current business requirements and manpower plan foresee contractors to be employed within the following core business areas:

(1) Coal Handling and Loading: 18 employees
(2) Services: 18 employees
(3) Railway siding: 18 employees
(4) Transport: 36 employees
(5) Opencast Mining: 150

(a) A target of 30% would be drawn from the Local Municipal Area, as the direct sending region.
(b) A target of 35% would be drawn from the Mpumalanga sending region; and
(c) A target of 35% would be drawn from other sending regions in South Africa.

As outlined above the proposed mine will provide employment for locals and support services, as well as empowerment and skills transfer opportunities. Seen in the light of the current economic environment, having an income has a high impact on the quality of life of families, creating a positive effect. This can therefore be considered a significant benefit.

Even though the life of mine is short (7 years) the Applicant will subscribe to sustainable projects in the form of local economic development (LED) objectives to provide sustainable enterprise development and livelihood opportunities. The LED project will focus on the areas of improving the quality of lives of people living in the communities together with creating sustainable job opportunities by the enhancement of existing jobs and developing potential for more jobs. An estimated amount of R1,3 million is allocated towards LED as part of the mine's Corporate Social Responsibility over the next 5 years. It should be noted that these assumptions are based on current business plans, the associated market and economic conditions surrounding the mining operations. Canyon Resources received an interim LED project for city surveillance from the STLM. The project entails installation of CCTV devices and procurement of response cars for the response officers. However, approval of the project will be finalised upon intensive research and issuance of the Mining Right. A project of this nature is considered as an ad hoc and not mainstream. After the Mining Right has been granted and the mine has started, discussions will continue to be held with the local community committee and the District Municipal Forum regarding the needs of the community.

Furthermore, small, micro and medium enterprise (SMME) development around a mining operation is generally a natural result of the primary activity. Canyon's business model addresses the promotion of this group of enterprises in the development and operation of the mine, together with the community projects. The intention is for the mine committee to purchase the required equipment, provide materials to start operations, set up the necessary systems and recruit and employ community members to operate the community projects.

7.3 Comparative Economic Cost Benefit Assessment

A comparative Economic Cost Benefit Assessment (ECBA) of the proposed Driefontein opencast mine and the no-go option, i.e., the continuation of existing agricultural livestock and crop-farming activities within the project area was conducted during the EIA phase. This section summarises the findings of this assessment. Refer to Appendix 6.13 for a copy of the report.

7.3.1 Identification of existing land-use and potential loss of land-use due to mining activities

The development of the proposed Driefontein Mine will have an impact with respect to the site's agricultural potential especially considering that the largest part of the proposed mining area is cultivated and is classed as high potential arable land (*Index, 2022*). According to the agricultural assessment report the MRA consists of 907 ha of cultivated land (dryland agriculture – maize and soya) and 177 ha of grazing land supporting 250 breeding cows.

While the mining area only consists of 471 ha the agricultural activities could possibly not proceed due to the fragmentation of agricultural land within the 7-year LoM and the uncertainly regarding future land-use within the MRA. The farmer also indicated that the land within the mine footprint area is the most productive agricultural land within the MRA.

Environmental management in South Africa advocates for a precautionary principle that implies a risk-averse and cautious approach, as outlined in NEMA section 2. Considering the uncertainty about the potential effect of sequencing of the mining operations on the sterilization of the agricultural land and following the precautionary principle, the ECBA therefor assessed two scenarios:

(1) A worst-case scenario that implies that all agricultural activities taking place on the MRA (907 ha) will cease to exist.
(2) A best-case scenario that implies that agricultural activities will continue alongside mining and only the area directly affected by mining (471ha) will be impacted.

7.3.1.1 Worst case scenario

The total agricultural loss for the 7 years LoM is estimated to be R16,2 million annual income from crop production and R1,97million annual income from animal production. No loss of farming infrastructure will take place as a result of mining. The handling facilities and farm buildings are located on another part of the property (*Index, 2022*).

It is assumed that agricultural production will resume in the areas not directly affected by mining after year 7 (436 hectares) while the 471 ha within the mining area will be rehabilitated to grazing land potential from year 9 to year 20 after which it should return to current agricultural yields, implying zero agricultural losses after year 20.

7.3.1.2 Best case scenario

The Applicant plans to implement a sequence approach to mining with the aim to allow agricultural activities to continue alongside mining. This will be largely dependent on the adherence to correct mitigation and management measures as well as arrangements in terms of continued agricultural practises with the current landowner. A best-case scenario is assumed to be a loss of only 471 hectares of cultivated land if agricultural activities could continue on the remaining MRA that will not be mined. Income losses from the 471 hectares of cultivated land is estimated at R9,5m per annum (*Index, 2022*). The Applicant plans to implement a phased approach to mining therefor should agricultural activities continue alongside mining income losses per annum will only be over the area being mined at the time.

It is assumed that the 471 ha within the mining area will be rehabilitated to grazing land potential from year 9 to year 20 after which it should return to current agricultural yields, implying zero agricultural losses after year 20.

7.3.2 External environmental costs related to the proposed Driefontein Mine

External costs refer to social and environmental costs related to a production activity (i.e., Driefontein mine) that is not included in the production costs of the developer. External costs imply costs that has to be carried by a third party (unrelated to the production process) such as damage costs to roads due to more heavy trucks using the roads, lower water availability and quality that implies purification costs or increase in pumping costs. These costs could effectively lower the income levels of affected parties and hence decrease the net economic benefits of the project.

With increased legislation for mining activities in South Africa, external costs related to mining are increasingly becoming internalised in the production costs of mining projects, e.g., requirements for liners for tailings dams, legal requirements to mitigate environmental impacts identified through the EIA process. While the ‘polluter pay’ principle applies to external costs, some external costs are not so easily identified for compensation purposes, e.g. social costs due to increase in traffic volumes, increased greenhouse emissions.

For the proposed Driefontein mine the likelihood of different types of external costs were based on potential environmental impacts before and after mitigation as identified by the different specialist reports that formed part of this EIAR. For the purposes of the analysis the ECBA considered both external costs before and after mitigation of the relevant environmental risks.

Table 11 below shows the identified potential external costs anticipated for the proposed project based on information supplied by the different specialist studies:

Table 11: Potential external costs for the proposed Driefontein Mine

Potential external costs		Impact before mitigation	Impact after mitigation
1.	**Costs associated with a change in water availability and quality**	Medium-High	Medium
2.	**Costs related to blasting damage**	Medium	Low
3.	**Costs related to increased traffic in the local area**	Low	Very Low
4.	**Costs related to devaluation of properties (sense of place)**	Medium-High	Medium

Refer to Section 2.5 of the ECBA attached as Appendix 6.13 for a detailed explanation of how the external costs were determined.

7.3.3 Summary of the comparative analyses of economic costs and benefits from different land uses

7.3.3.1 Worst-case scenario

The results of the ECBA (8% discount rate) under the assumptions of the worst-case scenario (loss of cultivated land within entire MRA) are summarised in the table below:

Table 12: ECBA results for proposed Driefontein Mine before Risk Mitigation (worst-case)

DRIEFONTEIN OPENCAST MINE (BEFORE MITIGATION)	NPV (50 years) R'000 000	TOTAL (2022 prices) R'000 000
DRIEFONTEIN MINE REVENUES (Including sale of assets after mine closure)	1 622	2 222
TOTAL BENEFITS/REVENUE	**1 622**	**2 222**
MINING COSTS		
MINING COST (Mining Cost proportional)	1 156	1 581
TECHNICAL SKILLS COST (SKILLED AND SEMISKILLED)	85	115
TOTAL UNSKILLED COSTS	5	6
REGULATORY REQUIREMENTS	9	11
ENVIRONMENTAL COST (ONLY ACQUISITION OF LAND AND REHAB)	43	46
SOCIAL AND LABOUR PLAN COST	6	8
CAPITAL AND OTHER	30	34
LOSS OF NET INCOME FROM EXISTING LAND-USE (OPPORTUNITY COSTS)	51	82
MINING EXTERNAL COSTS:		
LOSS OF GROUND AND SURFACE WATER AVAILABILITY	2	5
BLASTING DAMAGE COSTS ADJACENT STRUCTURES	2	2
TRAFFIC COSTS	8	11
LOSS OF INCOME IN PROPERTY VALUES	1	1
TOTAL COSTS	**1 397**	**1 904**
NET BENEFITS	**225**	**318**

Table 13: ECBA results for proposed Driefontein Mine after Risk Mitigation (worst case)

DRIEFONTEIN OPENCAST MINE (BEFORE MITIGATION)	NPV (50 years) R'000 000	TOTAL (2022 prices) R'000 000
DRIEFONTEIN MINE REVENUES	1 628	2 232
TOTAL BENEFITS/REVENUE	**1 628**	**2 232**
MINING COSTS		
MINING COST (Mining Cost proportional)	1 156	1 581
TECHNICAL SKILLS COST (SKILLED AND SEMISKILLED)	85	115
TOTAL UNSKILLED COSTS	5	6

REGULATORY REQUIREMENTS	9	11
ENVIRONMENTAL COST (ONLY ACQUISITION OF LAND AND REHAB)	48	52
SOCIAL AND LABOUR PLAN COST	6	8
CAPITAL AND OTHER	30	34
LOSS OF NET INCOME FROM EXISTING LAND-USE (OPPORTUNITY COSTS)	51	82
MINING EXTERNAL COSTS:		
TRAFFIC COSTS	8	11
LOSS OF INCOME IN PROPERTY VALUES	1	1
TOTAL COSTS	**1 399**	**1 902**
NET BENEFITS	**229**	**330**

Table 14: ECBA results for the Existing (Mixed) Agriculture Land-Use (worst-case)

CURRENT LAND-USE	**NPV (50 years) R'000 000**	**TOTAL (2022 prices) R'000 000**
CURRENT REVENUE FROM AGRICULTURE (NO MINING)	237	967
TOTAL BENEFITS/REVENUE	**237**	**967**
NON-LABOUR COSTS	140	571
UNSKILLED LABOUR COSTS	1	5
TOTAL COSTS	**141**	**575**
NET BENEFITS	**96**	**392**

As indicated in the tables above, the mining project is expected to generate a higher larger Net Present Value (NPV) (net benefit stream) over the 50-year period (R225m) compared to the no-go option- even before negative environmental impacts are mitigated (R96m). The cost benefit ratio of the existing land-use (no-go option) is however higher than the proposed mining activities at Driefontein mine, i.e., 1,68 compared to 1,16 and 1,17 of Driefontein Mine before and after mitigation.

A sensitivity analyses shows that if the price of coal would decline to R300/ton (2022 prices) that the net benefits of the no-go option (existing agricultural activities) would be higher than mining activities.

7.3.3.2 Best-case scenario

The results of the ECBA (8% discount rate) under the assumptions of the best-case scenario (continuation of agricultural production on the MRA that is not mined) are summarised in the table below:

Table 15: ECBA results for Proposed Driefontein Opencast Mine before Risk Mitigation (best case)

DRIEFONTEIN OPENCAST MINE (BEFORE MITIGATION)	**NPV (50 years) R'000 000**	**TOTAL (2022 prices) R'000 000**
DRIEFONTEIN MINE REVENUES (Including sale of assets after mine closure)	1 622	2 222
TOTAL BENEFITS/REVENUE	**1 622**	**2 222**
MINING COSTS		
MINING COST (Mining Cost proportional)	1 156	1 581
TECHNICAL SKILLS COST (SKILLED AND SEMISKILLED)	85	115
TOTAL UNSKILLED COSTS	5	6
REGULATORY REQUIREMENTS	9	11
ENVIRONMENTAL COST (ONLY ACQUISITION OF LAND AND REHAB)	43	46
SOCIAL AND LABOUR PLAN COST	6	8
CAPITAL AND OTHER	30	34

DRIEFONTEIN OPENCAST MINE (BEFORE MITIGATION)	NPV (50 years) R'000 000	TOTAL (2022 prices) R'000 000
LOSS OF NET INCOME FROM EXISTING LAND-USE (OPPORTUNITY COSTS)	23	38
MINING EXTERNAL COSTS:		
LOSS OF GROUND AND SURFACE WATER AVAILABILITY	2	5
BLASTING DAMAGE COSTS ADJACENT STRUCTURES	2	2
TRAFFIC COSTS	8	11
LOSS OF INCOME IN PROPERTY VALUES	1	1
TOTAL COSTS	**1 369**	**1 860**
NET BENEFITS	**253**	**362**

Table 16: ECBA results for Proposed Driefontein Mine after Risk Mitigation (best case)

DRIEFONTEIN OPENCAST MINE (BEFORE MITIGATION)	NPV (50 years) R'000 000	TOTAL (2022 prices) R'000 000
DRIEFONTEIN MINE REVENUES (Including sale of assets after mine closure)	1 628	2 232
TOTAL BENEFITS/REVENUE	**1 628**	**2 232**
MINING COSTS		
MINING COST (Mining Cost proportional)	1 156	1 581
TECHNICAL SKILLS COST (SKILLED AND SEMISKILLED)	85	115
TOTAL UNSKILLED COSTS	5	6
REGULATORY REQUIREMENTS	9	11
ENVIRONMENTAL COST (ONLY ACQUISITION OF LAND AND REHAB)	48	52
SOCIAL AND LABOUR PLAN COST	6	8
CAPITAL AND OTHER	30	34
LOSS OF NET INCOME FROM EXISTING LAND-USE (OPPORTUNITY COSTS)	23	38
MINING EXTERNAL COSTS:		
TRAFFIC COSTS	8	11
LOSS OF INCOME IN PROPERTY VALUES	1	1
TOTAL COSTS	**1 371**	**1 858**
NET BENEFITS	**257**	**374**

Table 17: ECBA results for the Existing (Mixed) Agriculture Land-Use (best case)

CURRENT LAND-USE	NPV (50 years) R'000 000	TOTAL (2022 prices) R'000 000
CURRENT REVENUE FROM AGRICULTURE (NO MINING)	117	480
TOTAL BENEFITS/REVENUE	**117**	**480**
NON-LABOUR COSTS	77	315
UNSKILLED LABOUR COSTS	1	3
TOTAL COSTS	**78**	**318**
NET BENEFITS	**40**	**163**

As indicated in the tables above, the mining project is expected to generate a much higher larger Net Present Value (net benefit stream) over the 50-year period (R257m) compared to the no-go option- even before negative environmental impacts are mitigated (R 40m). The cost benefit ratio of the existing land-use (no-go option) is however still higher than the proposed mining activities at Driefontein mine, i.e., 1,5 compared to 1,2 of Driefontein Mine before and after mitigation.

A sensitivity analyses however shows that if the price of coal would decline to R300/ton (2022 prices) that the net benefits of the no-go option (existing agricultural activities) would still be lower than mining activities.

8 Description of the process followed to reach the proposed preferred site

The consideration of alternatives is an integral part of the EIA process. In terms of Regulation 50 (d) of the MPRDA Regulations R. 527 under the Mineral and Petroleum Resources Development Act, Act 28 of 2002, an environmental impact assessment report must include inter alia the following:
"(d) A comparative assessment of the identified land use and development alternatives and their potential environmental, social and cultural impacts."

The goal of evaluating alternatives is to find the most effective way of meeting the need and purpose of the proposal, either through enhancing the environmental benefits of the proposed activity, or through reducing or avoiding potentially significant negative impacts. Identification of alternative should take place during the scoping phase in order to determine the most suitable alternatives to consider and assess during the EIA phase. Constraints that must be considered when identifying alternatives for the proposed project include environmental, social, and financial issues which will be discussed below. Evaluation must focus on identifying the advantages and disadvantages of the identified alternatives and indicate which alternative is considered feasible in terms of technical, financial, and environmental aspects.

Alternatives considered for the proposed project are discussed under the headings below.

8.1 Details of the development footprint alternatives considered

8.1.1 The property on which or location where it is proposed to undertake the activity

No alternative properties are considered for this project because mining can only take place in the area on which the Mining Right is granted. The Mining Right application area has been identified through an extensive prospecting operation which identified the location of the viable coal resource. The viable coal resource is located in the northern part (portion 6 of Sterkstroom 400 JS and portion 5 of Driefontein 398 JS) and South-Eastern corner (portion 6 of Driefontein 398 JS) of the application area.

8.1.2 The type of activity to be undertaken

As previously mentioned, the proposed MRA has been cultivated. Therefor an alternative activity to coal mining was not considered other than the No Go Option which will result in the current land use remaining the same.

8.1.3 The design or layout of the activity

The following alternatives in terms of the design and layout of the activity have been considered:

- Mining Sequence.
- Location of Infrastructure.

8.1.3.1 Mining Sequence

The viable coal resource is located in two separate areas within the application area (northern reserve and south-eastern reserve). Both areas can be mined simultaneously or independently. The direction of mining will differ at the northern and south-eastern reserve due to the formation of the coal reserve. The northern pit can be mined from the east to west or west to east and the south-eastern pit from the north to the south or south to the north. The direction of mining will not have a significant effect on the potential impacts identified and assessed as part of this EIA.

8.1.3.2 Location of ROM stockpile and Hard Park (Northern Opencast Pit)

The location of the mine infrastructure is dependent on the final location of the pits where the coal will be accessed and where the overburden dumps are stored. The preferred locations have been identified and is shown in Figure 5 above.

The preferred alternative is to establish the ROM stockpile and hard park at the northern pit next to the main haul as indicated in Figure 5 above. An alternative option is to move the ROM stockpile and hard park to the end of the main haul adjacent to the northern pit's overburden dumps. The size of the disturbed area will remain the same but by moving the ROM stockpile and hard park closer to the northern pit it could allow farming to continue in the area between the main haul road and northern pit.

8.1.4 The technology to be used in the activity

No technology alternatives were considered for the project because no coal processing will take place on site.

8.1.5 The operational aspects of the activity

The operational aspects of the activity and potential alternatives are discussed below:

8.1.5.1 Mining Method

The choice of mining method is largely determined by the geology and depth of the coal deposit. There exist several alternative mining methods, including opencast and underground mining. The Applicant investigated the feasibility of underground mining, but the geological data confirmed that it is not feasible.

Opencast mining involves the removal of overburden to access the coal. The overburden is stockpiled on site for later use during backfilling of the mined-out void. The acceptable ratio of coal to overburden is broadly governed by prevailing economic factors, linked to the value of the coal set against the cost of extraction. Opencast mining ensures a quick build-up of production, large quantum of production and maximum possible recovery of coal. The constraint to the application of opencast mining is the economic limits of stripping ratio and the damage to the surface environment.

For the Driefontein Mine it is proposed that mining is undertaken by the conventional opencast truck and shovel rollover method mainly due to the depth of the coal deposit and the flexibility of the method. This mining method is a proven method that has been implemented by the Applicant at its other operational collieries and therefor alternative mining method were not considered.

8.1.5.2 Water Supply

There exist a number of alternative options in terms of water supply. For potable water supply a borehole can be drilled (subject to the approval from the DWS), water can be sourced off site from adjacent landowners (if an agreement can be reached) or the municipality. The impact of sourcing water from water resources will be assessed during the Water Use License Application (WULA).

In terms of process water, the underground/pit water can be pumped out and used for dust suppression during the dry winter months. Water from the pit and run-off water from the contaminated area (stockpile area and workshops) are directed towards the pollution control dam on site. This water will be used for dust suppression.

8.1.5.3 Transport

The truck and shovel method will be used to extract coal from the pits and from there road hauled to the ROM stockpile area. The other alternative transport option is via conveyor belts. However due to the size of the mining area and the short life of mine (7 years) it does not make economic sense to construct expensive conveyor belts and therefor this alternative was not considered.

8.1.6 The option of not implementing the activity

The No Go Option will entail not mining the coal reserve and the status quo of the MRA will remain the same. The potential social, economic, and the environmental impacts associated with the development of the mine (as described in Section 13 below) will not occur and the existing agriculture activities will continue unaltered. As indicated in the tables above, the existing agricultural activities is expected to generate R96 million (NPV) over the 50-year period.

On the other hand, should the project not go ahead, the local economic development programs, skills programs and employment opportunities would not be realised. The coal reserves would remain unutilized resulting in the loss of R225 million (NPV) over the 50-year period unless another application for a mining right is made. Should the government not declare the area off limits for mining and protected, then the mining houses can continue to apply to mine the coal reserve.

9 Public Participation Process

Public Participation is a legal requirement, where the potential exists for individuals and/or parties to be affected by a proposed activity. According to the principles of Integrated Environmental Management (IEM), these individuals and/or parties should be involved in the decision-making process from an early stage in the project, with regards to any relevant issues and concerns complementing the information on which the Regulating Authorities would base their decision. Through the public participation process the Interested and Affected Parties (IAPs) are offered an opportunity to voice their opinions and concerns with regards to the application and have them formally recorded and registered as such to be considered by the Authorities in the decision-making process.

The term "Public Participation" is defined by the International Association for Public Participation (IAP2) as "*any process that involves the public in problem-solving or decision-making and that uses public input to make better decisions*".

This application is subject to legislation stipulated in the GN R326 of NEMA with regards to public participation, and the EIA Regulations of 2014 Regulation 41-44. These regulations stipulate the public participation process that must be conducted in order to provide the IAPs the opportunity to form part of the process. The focus of the public participation process is to involve the public in the decision-making process from an early stage in the project, with regards to any relevant issues and concerns complementing the information on which the Regulating Authorities would base their decision. Steps that have and will be taken throughout the EIA Process will include:

- Notification of the public in writing and through the press and site notices (of meetings and the availability of reports and information).
- Stakeholder meetings (one-on-one and focus group meetings with key stakeholders).
- Public meetings.
- Make information containing all relevant facts in respect of the application available to potential IAPs.
- Provide IAPs a reasonable opportunity to comment on the application.
- Open and maintain an IAP Register of issues and concerns.
- Provide the registered IAPs the opportunity to comment on all reports.
- Record all comments of IAPs in the reports and plans and ensure that written comments, including responses to such comments and records of meetings, are attached to the reports and plans that are submitted to the competent authority.

A combined public participation process will be conducted in accordance with Regulations 41-44 of the GNR326 as part of the Mining Right, Environmental Authorisation, Waste License and Water Use License Applications (WULA). The information presented in this section was taken from the Public Participation Report which is attached as Appendix 4 to this report. Reference is made to the following supporting information attached as Annexure A – F of the Public Participation Report:

- Annexure A: Notification Documentation
- Annexure B: Proof of Written Notification
- Annexure C: Note for the Record & Attendance Registers of Meetings
- Annexure D: Completed IAP Datasheets, written comments and EAP Responses

- Annexure E: Title Deeds
- Annexure F: Proof of availability of draft reports

9.1 Scoping Phase

9.1.1 Stakeholder Identification and IAP Registration

The Scoping Phase is regarded as the initiation of the consultation process. Stakeholders were identified using the existing database generated during the previous applications, consulting with the landowners and representatives of the communities and searching on the windeed system. The public was invited to register with the public participation office and will continue to be given an opportunity to participate in the process and express their points of view.

Additional Interested and potentially Affected Parties (IAPs) will be progressively identified throughout the application process.

The IAP Register is provided in Section 9.3 below.

9.1.2 Notification

The steps that were taken to notify the public of the proposed project are explained in detail below.

9.1.2.1 Fixing a notice board on site

No alternative sites are considered as part of this application therefor the site notices were only placed in and around the proposed site. Four site notices were placed around the application area. Refer to Appendix 4 – Annexure A.1 for the proof of placement of these notices.

9.1.2.2 Written notice of the proposed project

In line with Regulation 41(2) b) the following people were informed through a written notification which included a notification letter and Background Information Document (BID) (refer to Appendix 4 - Annexure A.2 for a copy of the notification letter and BID):

- Landowners.
- Adjacent landowners.
- Adjacent Mining Right Holders.
- Commenting Authorities and Relevant Organs of State including:
- Nkangala District Municipality
- Steve Tshwete Local Municipality and Ward Councillor (Ward 9)
- Dept of Agriculture, Land Reform and Rural Development (DALRRD)
- South African Heritage Resources Agency
- Department of Water and Sanitation (DWS)
- Mpumalanga Tourism and Park Agency (MTPA)

All the IAPs on the IAP Register of the previous application also received written notification of the new application.

Please refer to proof of written notification in Appendix 4 – Annexure B.

9.1.2.3 Placing an advertisement

A press notice was placed in the local newspaper (Middelburg Observer), notifying the public of the proposed project as well as the intention of the Applicant to apply for a Mining Right, Environmental Authorisation and Water Use License Application (WULA). The notice also informed the public that the draft scoping report is available for comment from the 8th of March 2021 to the 9th of April 2021. The notice also requested the public to register as an IAP with the Public Participation Office in order to receive all future correspondence regarding this project. Refer to the proof of placement in Appendix 4 - Annexure A.3.

9.1.3 Meetings

The following meetings were held during the Scoping Phase of the current and previous application. Issues and concerns raised at these meetings were considered during the EIA Phase. Refer to the Note for the Record and attendance registers of these meetings in Appendix 4 - Annexure C.

9.1.3.1 Focus Group Meetings with directly affected landowners

A focus group meeting was held with the directly affected landowners namely Mr Jan Roux and Mr Willem Roux on the 2nd of October 2018. During the meeting with Mr Willem Roux, he confirmed that they are leasing Portion 6 of Sterkstroom 400 JS to Mr Jan Roux.

9.1.3.2 Focus group meeting with three adjacent landowners

A focus group meeting was held with three of the adjacent landowners, Mr L Jacobs, Mr C Erwee and Mr J Erwee on the 22nd of April 2021.

9.1.3.3 Public Meeting

A public meeting was held on the 8th of November 2018 from 16:00 – 18:00 at the Middelburg Country Club.

9.1.3.4 Authority Meetings

No meetings have been held with the authorities to date. The following meetings are planned in the future:

Meetings with the Competent Authority (DMRE Witbank) will be held upon request throughout the application process.

A pre application meeting will be held with DWS before submitting the WULA.

9.1.4 Access to information

9.1.4.1 Notification Letter and Background Information Document (BID)

A Notification Letter and Background Information Document (BID) was sent to the IAPs listed in Table 18 below. Refer to Appendix 4 - Annexure A.2 for a copy of the notification letter and BID.

9.1.4.2 Draft and Final Report

The draft scoping report was made available for comment from the 8th of March 2021 to the 9th of April 2021. The IAPs were notified that the Final Scoping Report was submitted to the DMRE on the 12th of April 2021 and provided with a copy of the report. Proof of availability is attached in Appendix 4 - Annexure F.

9.2 EIA Phase

The registered IAPs received written notification that the Scoping Report was accepted on the 12th of October 2021 and that the DMRE granted extension until the 22nd of August 2022 for the final Environmental Impact Assessment Report (EIAR) to be submitted. Refer to Appendix 4 – Annexure A for a copy of this letter and proof of written notification in Appendix 4 – Annexure B.

9.2.1 Notification and availability of the draft EIA/EMPr

Proof of notification and availability of the draft EIA/EMPr will be included in the final report.

9.2.2 Meetings

The following meetings were held during the EIA Phase of this application. Issues and concerns raised at these meetings are summarised in the Comments and Response Table in Section 9.3 below. Refer to the Note for the Record and attendance registers of these meetings in Annexure C.

9.2.2.1 Focus group meeting with the directly affected landowner

A focus group meeting will be held with the directly affected landowner during the commenting period.

9.2.2.2 Focus group meeting with three adjacent landowners

A focus group meeting was held with three of the adjacent landowners, Mr L Jacobs, Mr C Erwee and Mr J Erwee on the 12th of May 2022.

9.2.2.3 Public Meetings

A public meeting will be held during the commenting period and the final EIAR updated accordingly.

9.2.2.4 Authority Meetings

No authority meetings have been held at the time of writing.

9.3 IAP Register

A register of IAPs is presented in Table 18 below.

Table 18: IAP Register

<table>
<tr><th rowspan="2">Name</th><th rowspan="2">Farm Name / Organisation / Department</th><th rowspan="2">Tel No/Fax No.</th><th rowspan="2">Cell No.</th><th>Postal /</th><th rowspan="2">Notification Date</th></tr>
<tr><th>E-mail address</th></tr>
<tr><td colspan="6">Landowners/Lawful Occupiers</td></tr>
<tr><td>Driefontein 398 Trust – Jan Hendrik Roux</td><td>Driefontein 398 JS Portion 5</td><td></td><td rowspan="2">082 388 3722</td><td rowspan="2">janhroux@gmail.com

PO Box 1147
Middelburg
1050</td><td rowspan="2">Telephonic conversation on the 2nd of March 2021.

Notification letter and BID sent on the 5th of March 2021.

Draft Scoping Report emailed on the 8th of March 2021.</td></tr>
<tr><td>Jan Hendrik Roux</td><td>Driefontein 398 JS Portion 6</td><td></td></tr>
<tr><td>Johanna Christina Roux
Willem Roux</td><td>Sterkstroom 400 JS Portion 6</td><td></td><td>082 383 2469 (JC Roux)
082 388 3711 (Willem Roux)</td><td>rouxwp@yahoo.com</td><td>Telephonic conversation on the 2nd of March 2021.

Notification letter and BID sent on the 5th of March 2021.

Draft Scoping Report emailed on the 8th of March 2021.</td></tr>
<tr><td colspan="6">Adjacent Landowners/Lawful Occupiers/Registered IAPs</td></tr>
<tr><td>Hendrik Frederik Prinsloo</td><td>Sterkstroom 400 JS Portion 3, 5 and 8</td><td></td><td>082 445 9634</td><td>frikprinsloo@vodamail.co.za</td><td>Notification letter and BID sent on the 5th of March 2021.</td></tr>
</table>

Name	Farm Name / Organisation / Department	Tel No/Fax No.	Cell No.	Postal / E-mail address	Notification Date
					Draft Scoping Report emailed on the 8th of March 2021.
Sterkpan Bdy (Jan Wijma)	Sterkstroom 400 JS Portion 7 and 9	013 244 2444	082 555 0014	vw4@mweb.co.za	Notification letter and BID sent on the 5th of March 2021. Draft Scoping Report emailed on the 8th of March 2021.
Mariane Andorette Putter	Sterkstroom 400 JS Portion 10 and 13	013 245 1687 / 013 249 6234		dputter@vodamail.co.za	Notification letter and BID sent on the 5th of March 2021. Draft Scoping Report emailed on the 8th of March 2021.
Truter Poolman	Sterkstroom 400 JS Portion 16		074 274 5340	truter.poolman@yahoo.com	Notification letter and BID sent on the 5th of March 2021. Draft Scoping Report emailed on the 8th of March 2021.
J C L Erwee CC – Johannes Andreas du Preez	Sterkstroom 400 JS Portion 14 and 17	0178613755	0836020149	jerwee@mweb.co.za PO Box 11223 Aerorand Middelburg	Notification letter and BID sent on the 5th of March 2021. Draft Scoping Report

Name	Farm Name / Organisation / Department	Tel No/Fax No.	Cell No.	Postal / E-mail address	Notification Date
				1070	emailed on the 8th of March 2021.
C Erwee	Sterkstroom 400 JS Portion 19		082 574 0429	xsamic@isat.co.za PO Box 11800 Middelburg 1050	Notification letter and BID sent on the 5th of March 2021. Draft Scoping Report emailed on the 8th of March 2021.
Leon Jacobs	Sterkstroom 400 JS Portion 21		083 625 7169	Elja.boerdery@gmail.com	Notification letter and BID sent on the 5th of March 2021. Draft Scoping Report emailed on the 8th of March 2021.
Willie Lange	Sterkstroom 400 JS Portion 22	0131705019	082 480 0301	willie@pesolutions.co.za	Notification letter and BID sent on the 5th of March 2021. Draft Scoping Report emailed on the 8th of March 2021.
Catharina Jacomina du Preez	Sterkstroom 400 JS Portion 23	013 245 1446	084 547 6598	fanaticp@gmail.com	Notification letter and BID sent on the 5th of March 2021. Draft Scoping Report emailed on the 8th of

Name	Farm Name / Organisation / Department	Tel No/Fax No.	Cell No.	Postal / E-mail address	Notification Date
					March 2021.
G J Grove	Sterkstroom 400 JS Portion 24		083 462 6679	Gerhard.grove@joyglobal.com PO Box 8839 Kanonkop 1050	Notification letter and BID sent on the 5th of March 2021. Draft Scoping Report emailed on the 8th of March 2021.
Johannes Michell Pretorius	Sterkstroom 400 JS Portion 24		076 734 2096/4	Ianlogistics2012@gmail.com	Notification letter and BID sent on the 5th of March 2021. Draft Scoping Report emailed on the 8th of March 2021.
Wyk Andries Van	Bankfontein 375 JS Portion 19 and 47	0132454378	0829281613	andriesvanwyk@lantic.net PO Box 4607 Middelburg 1050	Notification letter and BID sent on the 5th of March 2021. Draft Scoping Report emailed on the 8th of March 2021.
Komatiland Forests – C Foster and Sizwe Gama	Gemsbokfontein 411 JS Portion 1 and 2	013 754 2700		cfoster@safcol.co.za sizwe@safcol.co.za	Notification letter and BID sent on the 5th of March 2021. Draft Scoping Report

Name	Farm Name / Organisation / Department	Tel No/Fax No.	Cell No.	Postal / E-mail address	Notification Date
					emailed on the 8th of March 2021.
Beestepan Boerdery (Pty) Ltd – Peter Kane-Berman	Brummersheim 409 JS (Portion 0)	Fax: 013 246 7118	082 388 3503	peterkb@beestepan.co.za P/Bag x251836 Middelburg 1050	Notification letter and BID sent on the 5th of March 2021. Draft Scoping Report emailed on the 8th of March 2021.
Sipho Nzuza	B3N Projects (Pty) Ltd - Director		082 534 3242/ 073 226 5536	b3nprojects@gmail.com	Registered as an IAP on 10 March 2021. Notification Letter, BID and Draft Scoping Report emailed on 10th March 2021.
Zakhele Malindisa	Sibakhanyisile (Pty) Ltd - Director		071 620 2602	sibakhanyisileptyltd@gmail.com	Registered as an IAP on 10 March 2021. Notification Letter, BID and Draft Scoping Report emailed on 10th March 2021.

Name	Farm Name / Organisation / Department	Tel No/Fax No.	Cell No.	Postal / E-mail address	Notification Date
Adjacent Mining Right Holders and Applicants					
Anglo American (Christopher Harding) & Wilda Meyer	Rietvlei 397 JS Portion 0		071 167 9041	Christopher.harding@angloamerican.com wilda.meyer@angloamerican.com	Notification letter and BID sent on the 5th of March 2021. Draft Scoping Report emailed on the 8th of March 2021.
Jaco Kleynhans	Zyntha Consulting on behalf of Rietvlei Colliery	013 243 7110	082 417 6901	jaco@zyntha.co.za admin@zyntha.co.za	Registered as IAP on 2022/04/22.
Bankfontein Colliery (owned by the Joe Singh Group (Pty) Ltd is a division of Just Coal (Pty) Ltd) – Jorrie Jordaan (mine manager)	Bankfontein 375 JS Portion 4 (RE), Portion 6, Portion 37, Portion 44 and Portion 48	(013) 282 5742	084 818 2050	jorriejordan@jsgroup.co.za PO Box 22928 Middelburg 1050	Notification letter and BID sent on the 5th of March 2021. Draft Scoping Report emailed on the 8th of March 2021.
Boipelo Motlhatlhedi Kenneth Singo L Siqwasi Stanley Rakhadani	Singo Consulting	Tel: 083 473 8300 Fax: 086 5144 103		boipelo@singoconsulting.co.za	Notification letter and BID sent on the 5th of March 2021. Draft Scoping Report emailed on the 8th of March 2021.

Name	Farm Name / Organisation / Department	Tel No/Fax No.	Cell No.	Postal / E-mail address	Notification Date
Allan Duroy	Tala Coal		071 125 8794	allanduroy@gmail.com	Notification letter and BID sent on the 5th of March 2021. Draft Scoping Report emailed on the 8th of March 2021.
Commenting Authorities and Relevant Organs of State					
Mr Frans Krige & Lorraine Oosthuizen	Mpumalanga Tourism and Parks Agency (MTPA)	011 759 5561	084 232 2901	franskrige@telkomsa.net frans@mtpa.co.za Komilla.Knarasoo@mtpa.co.za Lorraine.Oosthuizen@mtpa.co.za N4 National Highway Halls Gateway, Block G, Room 25 Mbombela, 1200	Notification letter and BID sent on the 5th of March 2021. Draft Scoping Report emailed on the 8th of March 2021.
Mr Mervyn Lotter	Mpumalanga Tourism and Parks Agency (MTPA)			Mervyn.lotter@mtpa.co.za	Notification letter and BID sent on the 5th of March 2021. Draft Scoping Report emailed on the 8th of March 2021.

Name	Farm Name / Organisation / Department	Tel No/Fax No.	Cell No.	Postal / E-mail address	Notification Date
Maliaga Nditsheni Samuel & Ms N Mcineka	Department of Water and Sanitation (DWS) - Olifants Proto CMA: Water Quality Management	013 591 8951	082 978 5381	MalobaM@dws.gov.zaMaliagaN@dws.gov.za McinekaN@dws.gov.za	Notification letter and BID sent on the 5th of March 2021. Draft Scoping Report emailed on the 8th of March 2021.
Linah Malatjie	Nkangala District Municipality	Tel: 013 249 2000 Fax: 013 249 2087		vanbuuresmp@nkangaladm.org.za	Notification letter and BID sent on the 5th of March 2021. Draft Scoping Report emailed on the 8th of March 2021.
J Skhosana	Steve Tshwete Local Municipality Ward Councillor (Ward 9)		072 106 9677	johannesskosana77@gmail.com	Notification letter and BID sent on the 5th of March 2021. Draft Scoping Report emailed on the 8th of March 2021.
Pearl Moswathupa (Environmental Officer)	Steve Tshwete Local Municipality	013 249 7814	073 465 3997/ 064 691 4896	pearlm@stlm.gov.za	Notification letter and BID sent on the 5th of March 2021. Draft Scoping Report emailed on the 8th of March 2021.

Name	Farm Name / Organisation / Department	Tel No/Fax No.	Cell No.	Postal / E-mail address	Notification Date
Ms. N.S. Masoka (Acting Director: Nkangala District)	Department of Agriculture, Land Reform and Rural Development (DALRRD)	(013) 947 2551		nsylvia706@gmail.com sam.nkosi@drdlr.gov.za	Notification letter and BID sent on the 5th of March 2021. Draft Scoping Report emailed on the 8th of March 2021.
Nkangala Regional Services Mr A Mkhabela	Dept of Economic Development and Tourism			nokubonga@mpg.gov.za	Notification letter send 19 Apr 2022
Jenna Lavin	South African Heritage Resources Agency	Fax: 021 462 4502		jlavin@sahra.org.za www.sahra.org.za 111 Harrington Street PO Box 4637 Cape Town 8000 South Africa	The project requires a Heritage Impact Assessment by SAHRA. The report will be submitted on the SAHRA online application system, SAHRIS (www.sahra.org.za) during the EIA Phase.
Local Community Members					
There are no community or farm workers living on the application area. The Ward Councillor has been notified about the project and will further be consulted as part of the EIA Phase.					

9.4 Comments and Responses

The over-riding objective during this consultative process has been to create an atmosphere conducive to sharing knowledge with the stakeholders to ensure that issues identified are used in a positive and constructive manner. All parties will be given the opportunity to raise their issues – be they fact or perception. The number and frequency with which issues are raised, and the extent to which they are debated gives a direct indication of the following:

1. The success of the participative process.
2. The perceived significance of the issues; and
3. A measure of the sustainability of the outcome/solution.

All issues and comments raised by I&APs during the various phases of the EIA process to date have been captured in a Comments and Response Report included in Appendix 4. The issues and comments raised are summarised below:

- *The coal reserve as indicated on the preliminary layout plan falls over high potential agricultural soil and if they can't continue to plant those areas they might as well stop farming on the entire MRA.*
- *Totally against the mining of the south-eastern corner as indicated on the preliminary layout. This area also has high agricultural potential soils, it is situated at the farm entrance, and it is close to the homestead.*
- *The contractor's yard location takes up a large part of cultivated land. The contractor's camp must be moved closer to the open pit or even established on an area that does not have high potential agricultural soils like along the northern boundary of the application area.*
- *What happens with the land after mining because it will never be able to regain its pre mining potential?*
- *The impact on the groundwater quantity and quality is a major concern because the farming practises and residents in and around the MRA is depended on existing supply boreholes. What will the impact of the proposed mine be on ground water availability and quality of the boreholes?*
- *Dust pollution and the increased noise caused by mining activities is a major concern.*
- *The wetlands need to be delineated with a 100m buffer and avoided by mining activities. If the wetlands cannot be avoided and negative effects from open cast mining such as dewatering, and destruction of habitat and sources are envisaged which cannot be mitigated the company must apply for a wetland offset strategy.*
- *The grassland sections of the Rand Highveld Grassland Veld Type and CBA Optimal areas must be avoided.*
- *Blasting could cause damage to buildings/structures, increase dust and noise levels*
- *Value of property – the mining operations is likely to cause the value of adjacent properties to decrease.*
- *Increase traffic on the D1433 and impact that will have on road conditions and road users.*
- *Decreased quality of life due to an increase in noise, poor air quality and security risk that comes with the influx of people.*

- ***The purification of mine water after decommissioning must be done in corporation with DWS and the 2007 Best Practice Guideline. Driefontein Colliery must ensure that clean water is returned into the environment.***

10 Description of the Baseline Environment

The objective of this section is to describe the type of environment that will be affected by the proposed activity in terms of the existing biophysical, cultural, and socio-economic aspects. The baseline information presented below will be used to determine protection, remedial measures, and mitigation measures. The specialist studies that were used to describe the baseline environment are listed in Section 3 above.

10.1 Geology

The application area is situated in the Witbank Coalfield in the northern Karoo Basin that extends over large areas of Gauteng and Mpumalanga. Towards the northern periphery of the basin where the project is located the coal-bearing rocks outcrop against pre-Karoo rocks predominantly comprising the rocks of the Transvaal Supergroup. The coal measures of the Witbank Coalfield are litho-stratigraphically confined to the Vryheid Formation of the Ecca Group (Middle Ecca) of the Karoo Supergroup.

The geology of the proposed Driefontein Coal Mine, near Middelburg in Mpumalanga is shown on the 1:250 000 Pretoria 2528 Geological Map (1978) (Council of Geoscience, Pretoria) (Figure 6). Recent Shape files produced by the Council of Geosciences (Pretoria) indicates that the proposed mining development is underlain by the Vryheid Formation (Pe) of the Ecca Group (Karoo Supergroup). Refer to Figure 7 below.

Most of the coal mined in South Africa originates in the Permian Vryheid Formation (Table 19). The depth of the Vryheid Formation in the main Karoo Basin varies from 70 m to 500 m near Vryheid and Newcastle in Kwazulu-Natal, where the basin was at its deepest. The main seams in the area are numbered 1-5, with one at the bottom and 5 at the top, while seams 2 and 4 are usually thicker than the rest (Snyman, 1998). Generally, Seam 5 is approximately 15 to 45 m below the surface. The overburden must be removed before the opencast mining can commence.

Table 19: Ecca Group and Formations. (Modified from Johnson et al, 2006).

Period	Supergroup	Group	Formation West	Formation East of	Formation Free

<table>
<tr><th></th><th></th><th></th><th>of 24^{o} E</th><th>24^{o} E</th><th>State / KwaZulu Natal</th></tr>
<tr><td rowspan="7">Permian</td><td rowspan="7">Karoo Supergroup</td><td rowspan="7">Ecca Group</td><td>Waterford Formation</td><td>Waterford Formation</td><td rowspan="2">Volksrust Formation</td></tr>
<tr><td>Tierberg / Fort Brown Formation</td><td>Fort Brown Formation</td></tr>
<tr><td>Laingsburg / Rippon Formation</td><td>Rippon Formation</td><td>Vryheid Formation</td></tr>
<tr><td>Collingham Formation</td><td>Collingham Formation</td><td rowspan="3">Pietermaritzburg Formation</td></tr>
<tr><td>Whitehill Formation</td><td>Whitehill Formation</td></tr>
<tr><td rowspan="2">Prince Albert Formation</td><td rowspan="2">Prince Albert Formation</td></tr>
<tr><td>Mbizane Formation</td></tr>
</table>

The Vryheid Formation comprises mudrock, rhythmite, siltstone and fine- to coarse-grained sandstone (pebbly in places). The Formation contains up to five (mineable) coal seams. The different lithofacies are mainly arranged in upward-coarsening deltaic cycles (up to 80m thick in the southeast). Fining-upward fluvial cycles, of which up to six are present in the east, are typically sheet-like in geometry, although some form valley-fill deposits. They comprise coarse-grained to pebbly, immature sandstones - with an abrupt upward transition into fine-grained sediments and coal seams (Hancox and Götz, 2014).

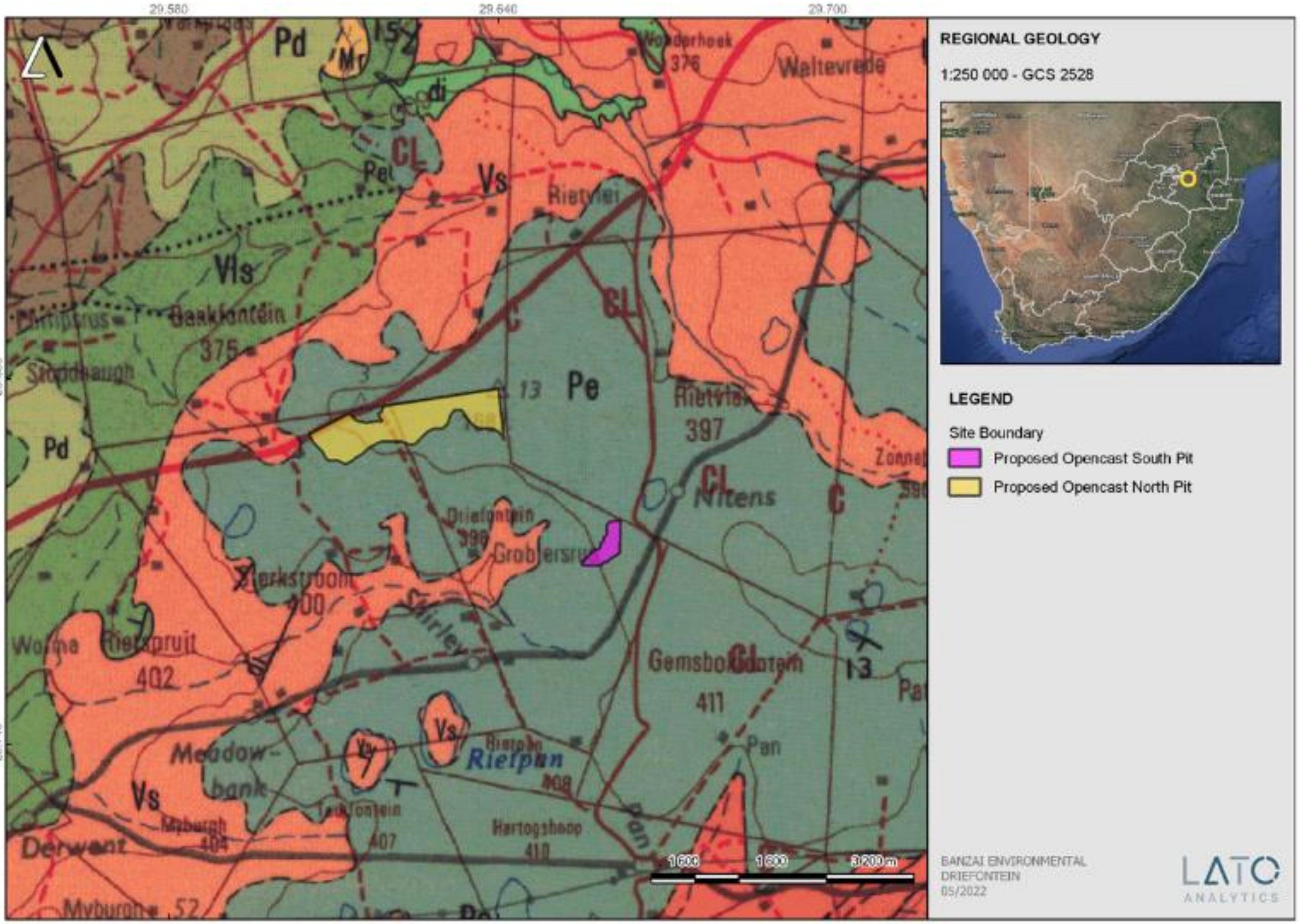


Figure 6: Extract of the 1:250 000 2528 Pretoria Geological Map (1978) (Council of Geoscience, Pretoria) indicating the geology of the proposed development in yellow and purple

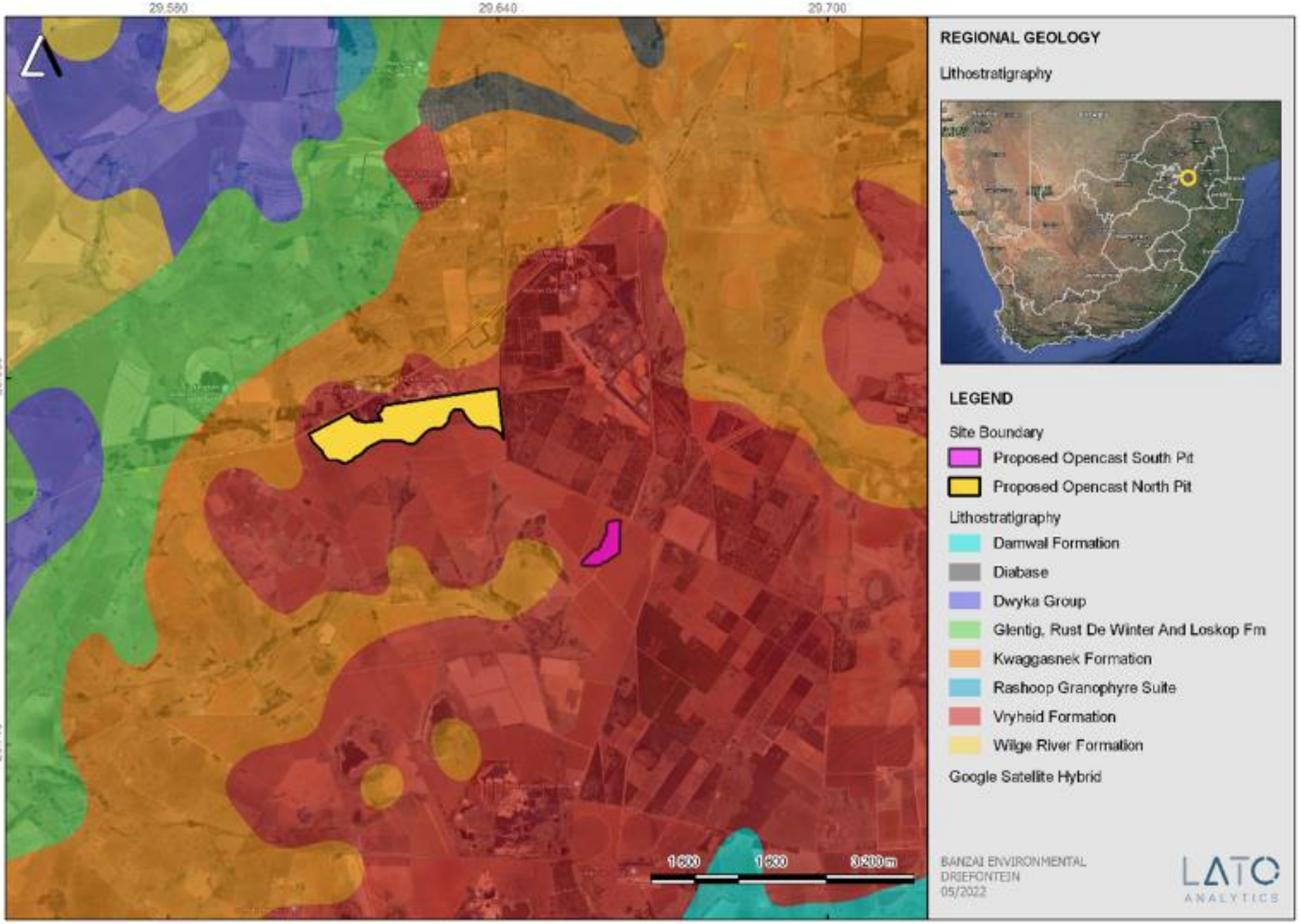


Figure 7: Recent Shape files produced by the Council of Geosciences (Pretoria) indicates that the proposed development is underlain Vryheid Formation of the Ecca Group (Karoo Supergroup)

10.2 Topography

The general landscape is typical of the Highveld Grasslands in that it is of a gently undulating topography, with dispersed perennial and non-perennial streams. The topography surrounding the application area is shown in Figure 8. Surrounding elevations range from 856 – 2020 m above sea level. The project site is situated approximately 1620 – 1680 m above sea level: with increasing elevation towards the east.

The study area is characterised by a gently undulating topography (as shown in Figure 9) and in the area of the site the slope is more or less in the order of 1.5%.

Locally drainage is towards the Keeromspruit and Selons River that flows from east to west and from southeast to northwest situated to the northeast and north of the site. On a regional scale, drainage occurs towards the generalised flow of the Klein-Olifants River which flows from southeast to northwest.

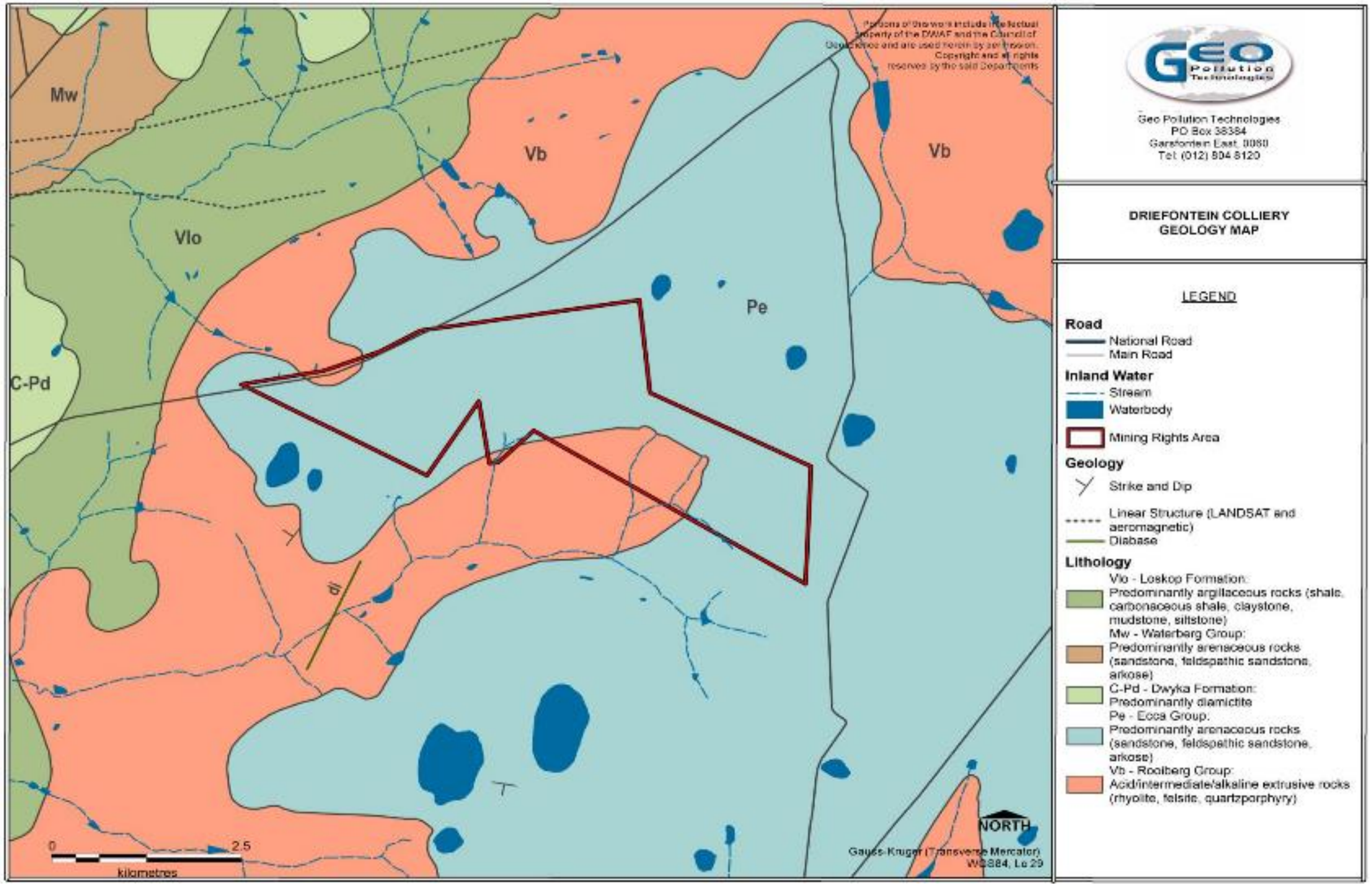


Figure 8: Geological map of application area

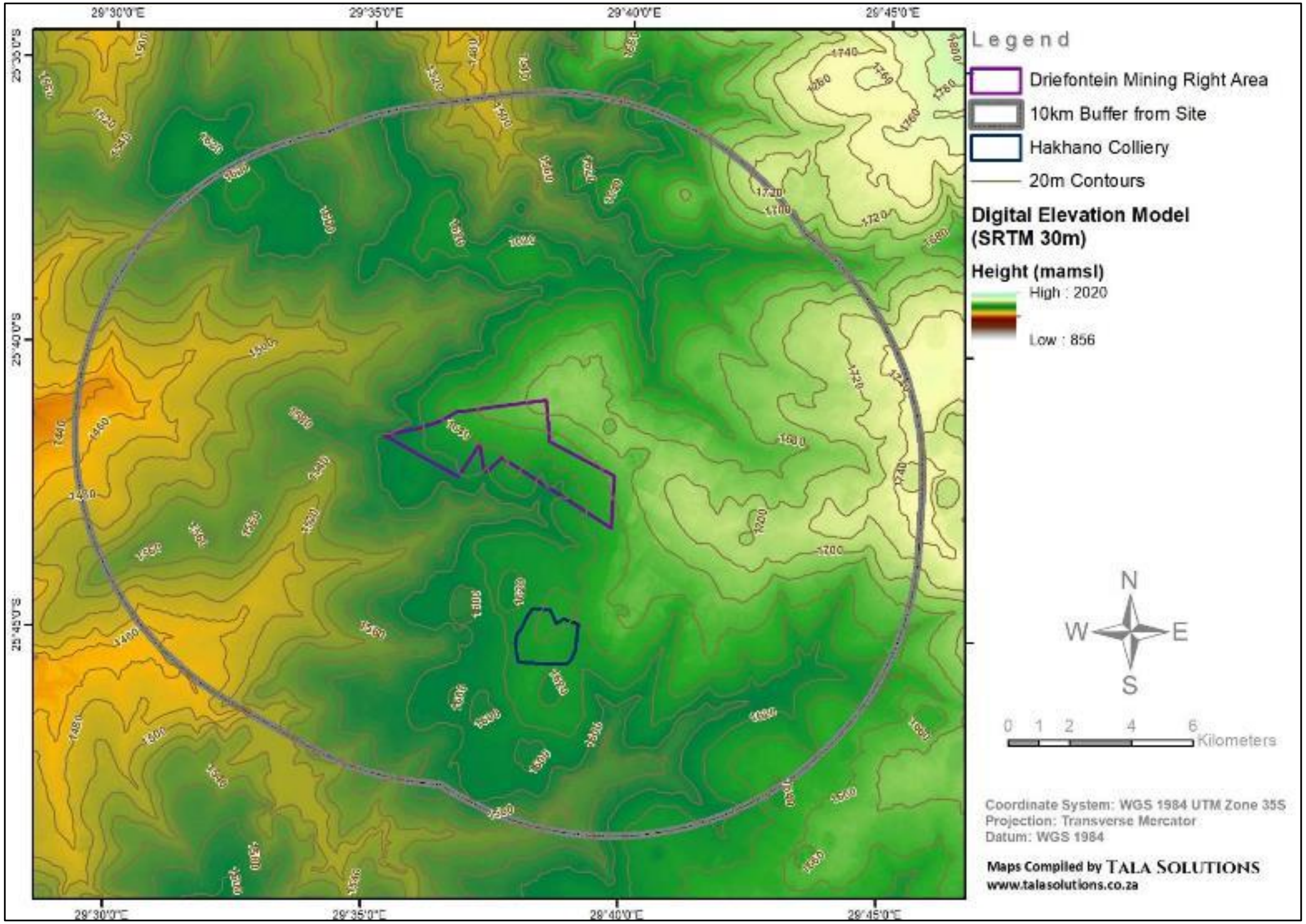


Figure 9: Topography of surrounding area

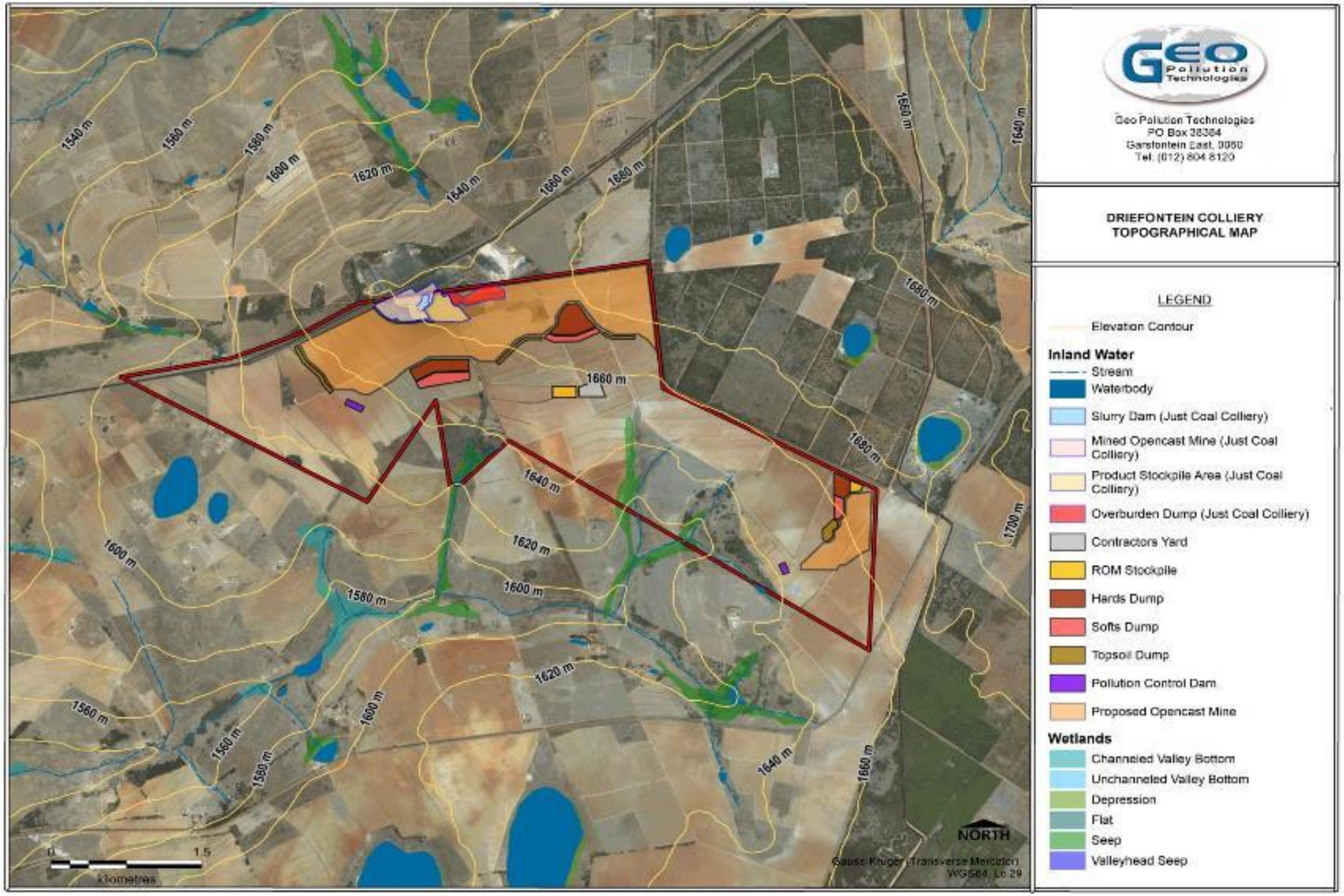


Figure 10: Topography of the study area

10.3 Meteorological Overview

MM5 modelled meteorological data was used for the project area. MM5 meteorological data was obtained from Lakes Environmental for the period January 2016 to December 2018. The meteorological data is representative of recent prevailing weather conditions that will likely be experienced at the project site.

10.3.1 Temperature and relative humidity

The Mpumalanga region generally experiences a sub-tropical climate with warm, rainy summers and cold winters. Monthly average temperatures and relative humidity profiles at the project site for the period January 2016 to December 2018 are presented in Figure 11 below. Average monthly temperatures range from 9.1 – 20.2 ^{0}C (Table 20). Highest temperatures are observed during the spring, summer and autumn months (September – April) and minimum temperatures are observed during the winter months (May – August). Relative humidity is higher at the end of summer (February) and in winter (i.e., May – July).

Table 20: Hourly Minimum, Maximum and Monthly Average Temperatures for January 2016 – December 2018.

MINIMUM, MAXIMUM AND MONTHLY AVERAGE TEMPERATURES (°C)												
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Minimum	8.1	11.2	7.1	4.5	3.1	0.4	0.5	0.9	2.1	3.6	5.1	9.6
Maximum	30.8	28.9	27.1	26.6	20.5	19.2	18.1	23.5	26.1	29.1	28.9	31.1
Average	19.6	19.7	18.8	16.0	11.7	9.7	9.1	12.0	16.0	16.9	18.5	20.2

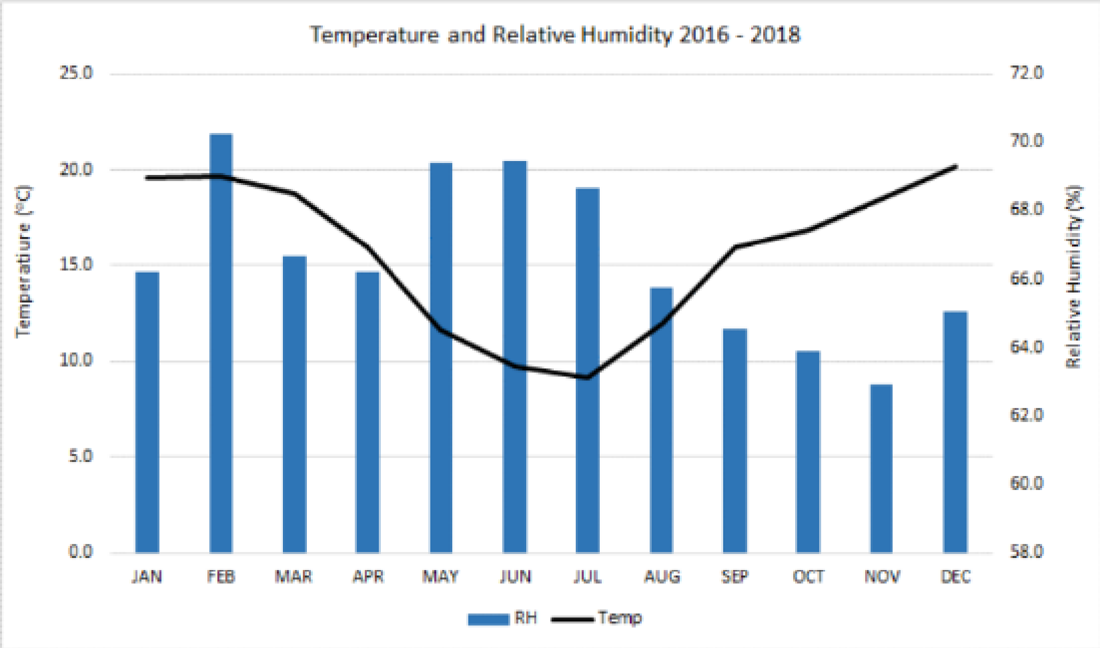


Figure 11: Monthly Average Temperature and Relative Humidity profiles for the proposed Driefontein Mine for January 2016 - December 2018

10.3.2 Precipitation

Monthly total rainfall at the project site for the period January 2016 to December 2018 is presented in Figure 12. The area receives most of its rainfall during the spring, summer and early autumn seasons during the months October - March. Little to no rainfall is observed during the mid-autumn and winter seasons from April to August (Table 21).

Table 21: Total Monthly Rainfall for January 2016 - December 2018

TOTAL MONTHLY RAINFALL (mm)												
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	190.5	68.6	95.5	21.6	0.8	0	11.4	11.7	39.9	70.4	158.2	262.1
2017	162.7	150.1	26.9	6.1	5.6	0	0	0.5	35.3	142.0	81.0	84.6
2018	173.5	208.0	128.5	16.0	4.6	0	0.3	30.0	41.4	55.6	79.2	121.9

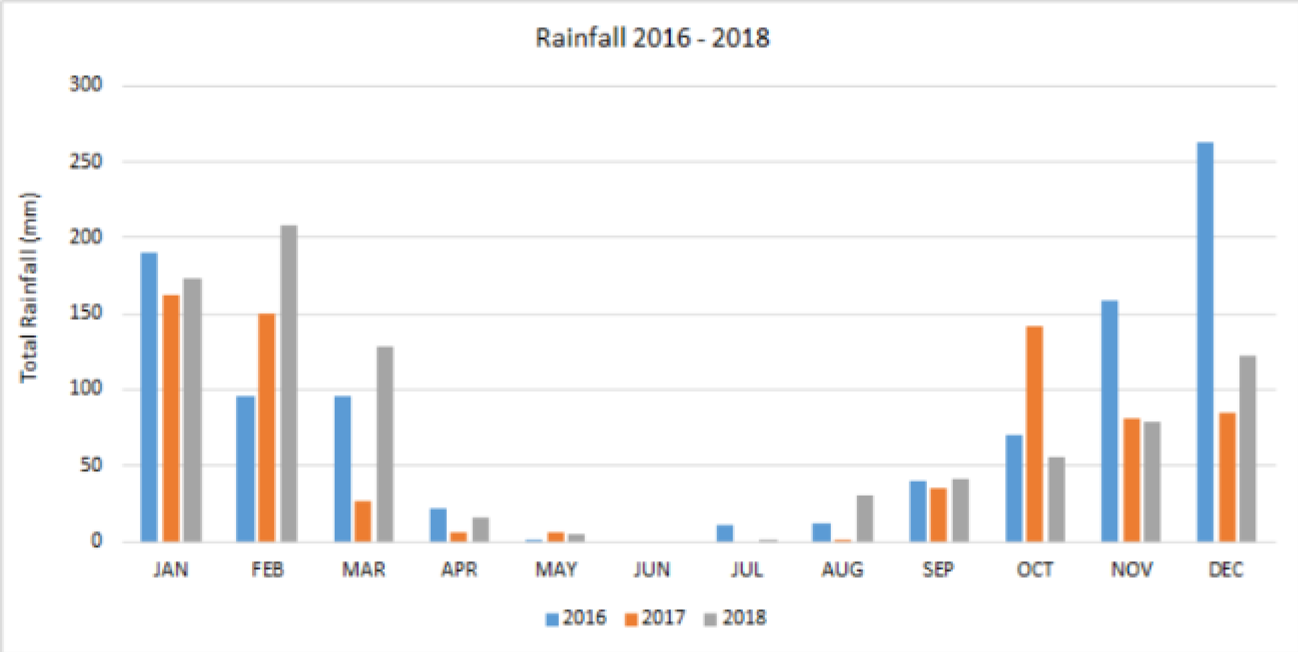


Figure 12: Total Monthly and Average Rainfall (mm) for the proposed Driefontein Coal Mine for the period January 2016 - December 2018

10.3.3 Local wind field

Figure 13 below provides the period wind rose plot for the proposed Driefontein Mine for the period January 2016 to December 2018. The predominant wind directions for the period are observed from the east (~13.9% of the time), east-south-east (~9.72%) and north-west (~8.5%). Wind speeds for the three-year period were generally moderate to fast with calm conditions, defined as wind speeds less than 1 m/s, observed for 6.94 % of the time (Figure 13).

The morning (AM) and evening (PM) period wind rose plots for the period January 2016 to December 2018 are given in Figure 14 below and show diurnal variation in the wind field data. During the morning (AM) period, high frequency winds are observed from the east, east-south-east and north north-east; as opposed to the evening (PM) period, where winds are predominantly observed from the north-west, west-north-west and east (Figure 14). Seasonal variation in winds at the proposed Driefontein Mine is shown in Figure 15 below. There is variation in the wind field over the different seasons. During summer, prevailing easterly, east-north-easterly and north-north-easterly winds were observed; while during spring, north-north easterly, north-westerly and northerly winds prevail. During autumn and winter, prevailing winds are easterly and east-north-easterly. Winter seasons are also characterised by less frequent north westerly winds.

Wind speeds were generally high during all seasons.

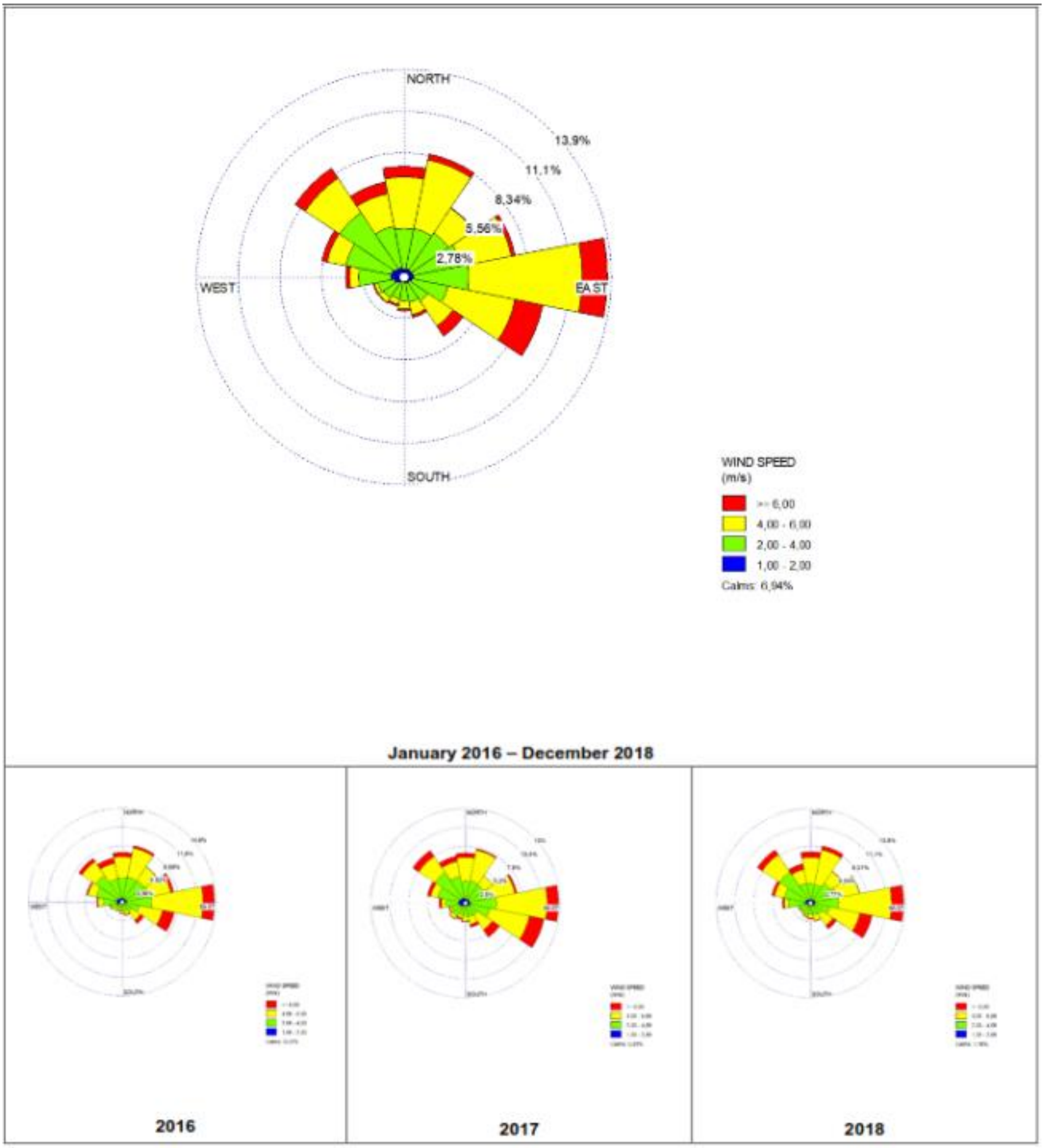


Figure 13: Period Wind Rose Plots for the proposed Driefontein Mine for the period January 2016 - December 2018

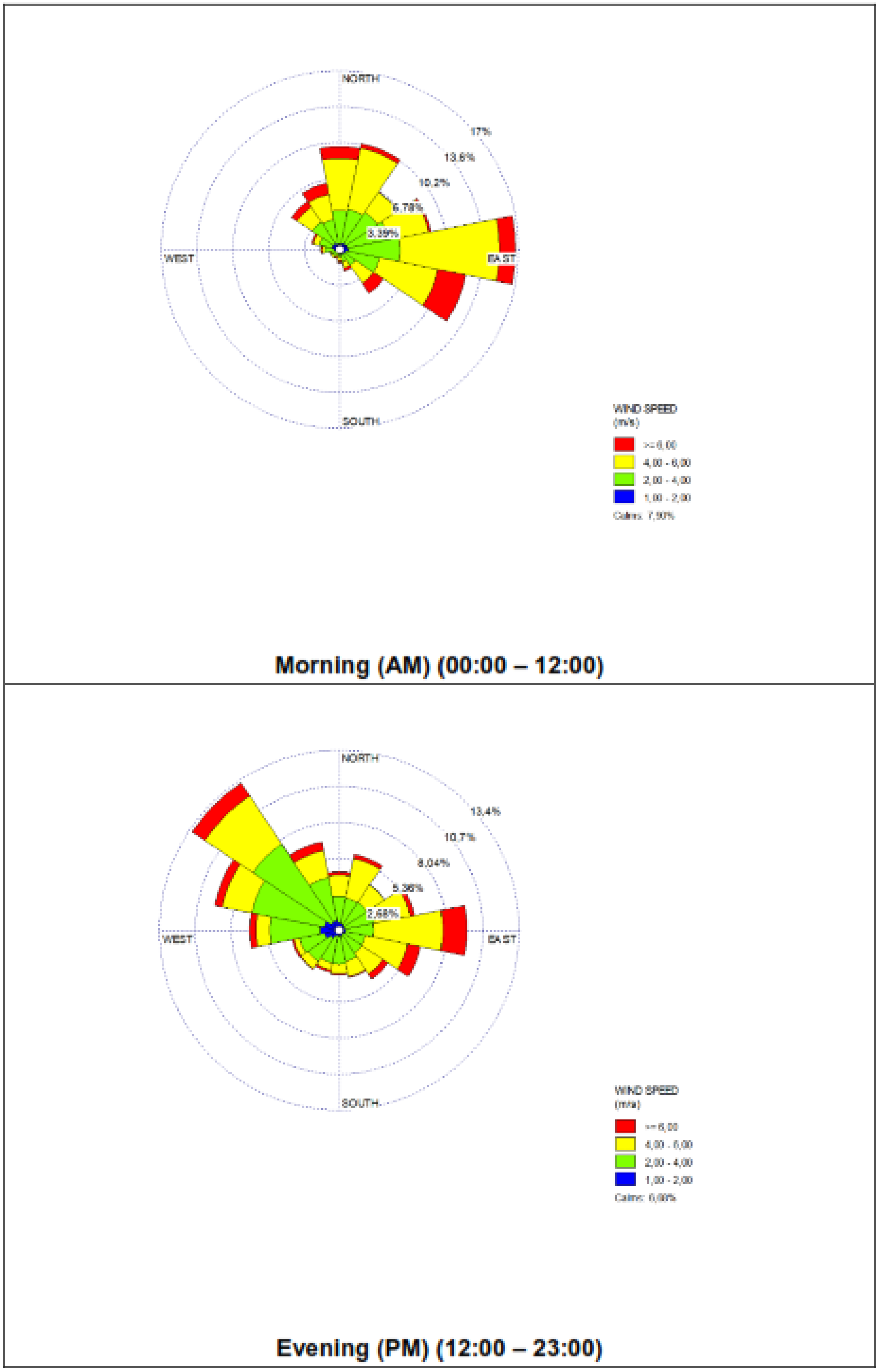


Figure 14: Morning (AM) (00:00 - 12:00) and Evening (PM) (12:00 - 23:00) Period Wind Rose Plots for proposed Driefontein Mine for the Period January 2016 - December 2018

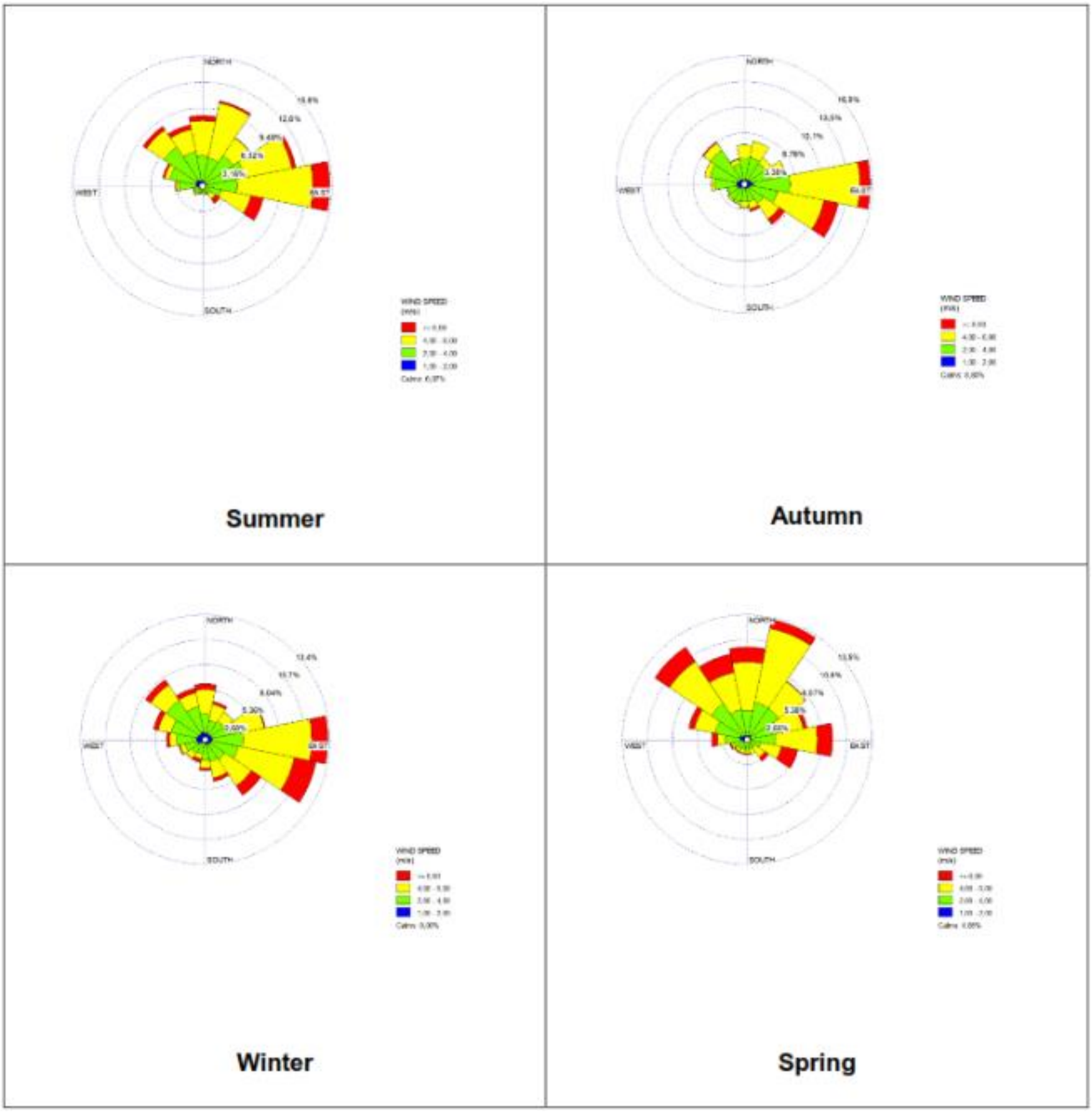


Figure 15: Seasonal Variation of Winds for the proposed Driefontein Mine for the Period January 2016 - December 2018

10.4 Soils, land use and capability

10.4.1 Soils

The underlying geology is shale, sandstone, grit or conglomerate of the Ecca Formation. The soils that formed are yellow or red with sandy loam and sandy clay loam texture and with a single grain or poorly developed blocky structure. Ten soil types were identified. The location of the different soil type within the study area is illustrated in Figure 16 and Table 22 below provides a description of each soil type.

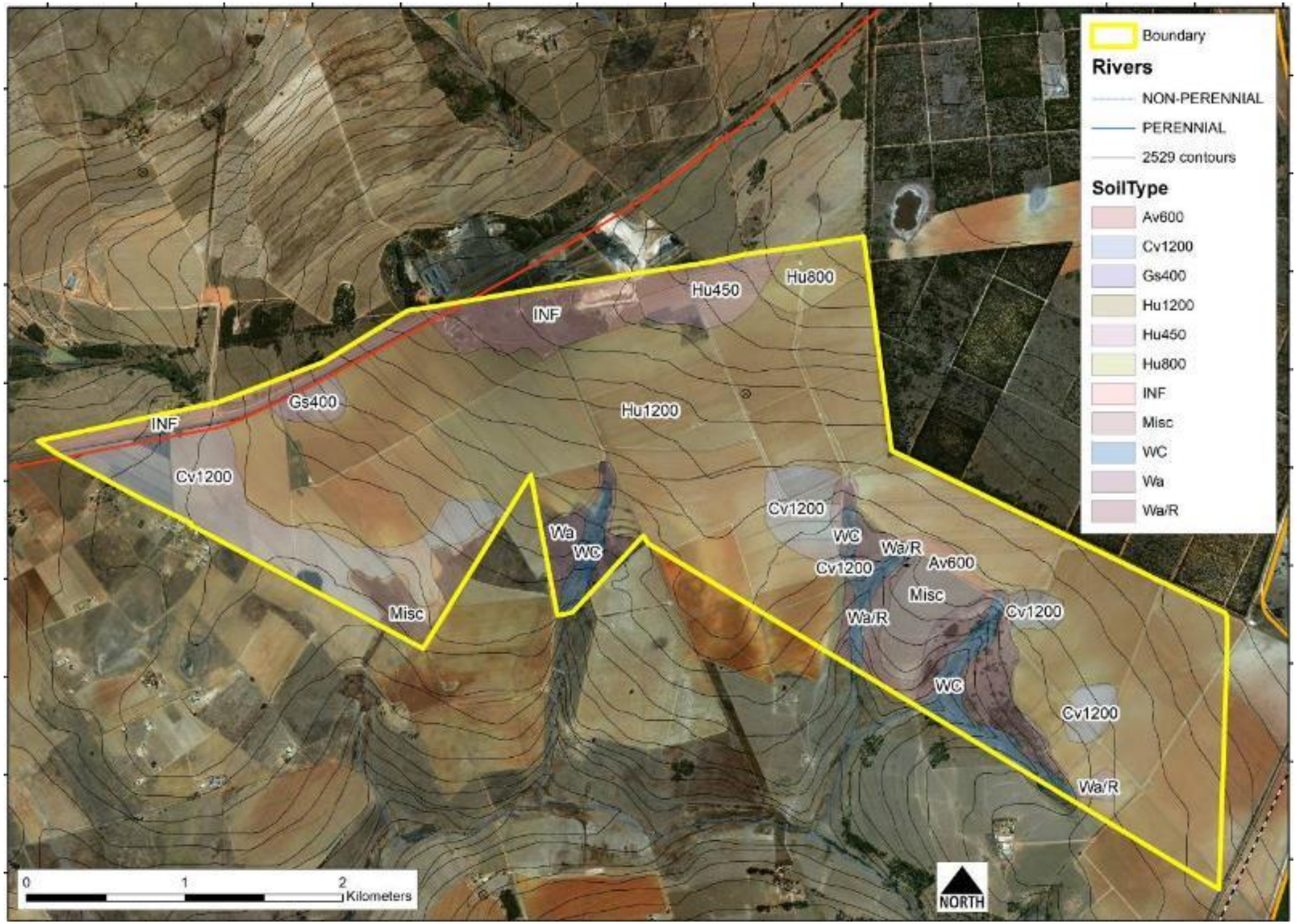


Figure 16: Soil map

Table 22: Types, potential and land use capability of soils on the property

Soil	Description	Potential	Capability	Area (ha)
Cv1200	Very deep, dark yellowish brown sandy loam topsoil with a grainy structure that is free of course fragments. The subsoil is yellowish brown, free of mottles with many fine roots. The dominant soil types are Clovelly and Hutton,	High	Class i	136.8
Hu1200	Very deep reddish brown sandy, clay loam topsoil with poorly developed blocky structure that overlies red subsoil. The dominant soil types are Hutton, Shortlands and Clovelly.	High	Class i	721.4
Hu800	Deep or moderately deep reddish brown sandy, clay loam topsoil with poorly developed blocky structure that overlies red subsoil. The dominant soil types are Hutton and Shortlands.	High	Class ii	20.8
Hu450	Shallow reddish brown sandy, clay loam topsoil with poorly developed blocky structure that overlies red subsoil. Ferricrete and rock fragments occur in the deeper subsoil that limits soil depth. The dominant soil types are Hutton, Glencoe and Clovelly.	Moderate	Class iv	26.0
Av600	Moderately deep dark brown sandy topsoil that overlies yellowish brown subsoil. The deeper subsoil id soft plintite, with an abundance of brown nodules.	Moderate	Class iii	6.3
Gs400	Shallow yellowish brown sandy, clay loam topsoil with poorly developed blocky structure that overlies yellow subsoil. Ferricrete and rock fragments occur in the deeper subsoil that limits soil depth. The dominant soil types are Glencoe and Clovelly.	Moderate	Class iv	9.5
Wa/R	Plinthic soil types of varying soil depth. The soils are generally shallow with hard plintite or nodules that impedes root development. The dominant soil types are Wasbank, Avalon, Escourt and Kroonstad	Low	Class vi	80.9
Misc	Various plinthic soil types of varying soil depth. The soils are generally shallow with abundance of pebbles or nodules that impedes rood development.	Low	Class vi	50.4
INF	Mining land and road infrastructure.	Very low	Class viii	77.6
WC	Watercourses.	Very low	Class viii	46.0
Total				**1 175.6**

10.4.2 Land use

In general, the land is mixed cultivated land and livestock grazing. The land uses on the affected properties are described below and indicated in Figure 17:

- **The main activity is rainfed cropping; maize and soya are produced in rotation. Depending on the season 7, 5 to 10 tons maize grain or 2,8 tons of soybeans are harvested per hectare.**
- **Hay is produced and is the main source of fodder. This is supplemented by stover during the late winter when the grazing is dormant.**
- **Cattle are produced in conjunction with the crops; a breeding herd of 250 cows is reared in a weaner production system. Approximately 180 hectares of the 1 175**

hectares that comprise the proposed mining area is grazing land. Land outside of the proposed mining area is also utilized by the farmer.

- **Infrastructure forming part of the existing Bankfontein Colliery is located within the north-western portion of the study area.**
- **There are three non-perennial streams on the property.**

Table 23: Land uses on the application area

Land use	Area (ha)
Cultivated	907,5
Fallow/grazing	176,7
Mining	43,6
Other	14
WC (watercourses)	33,6
Total area	**1 175,4**

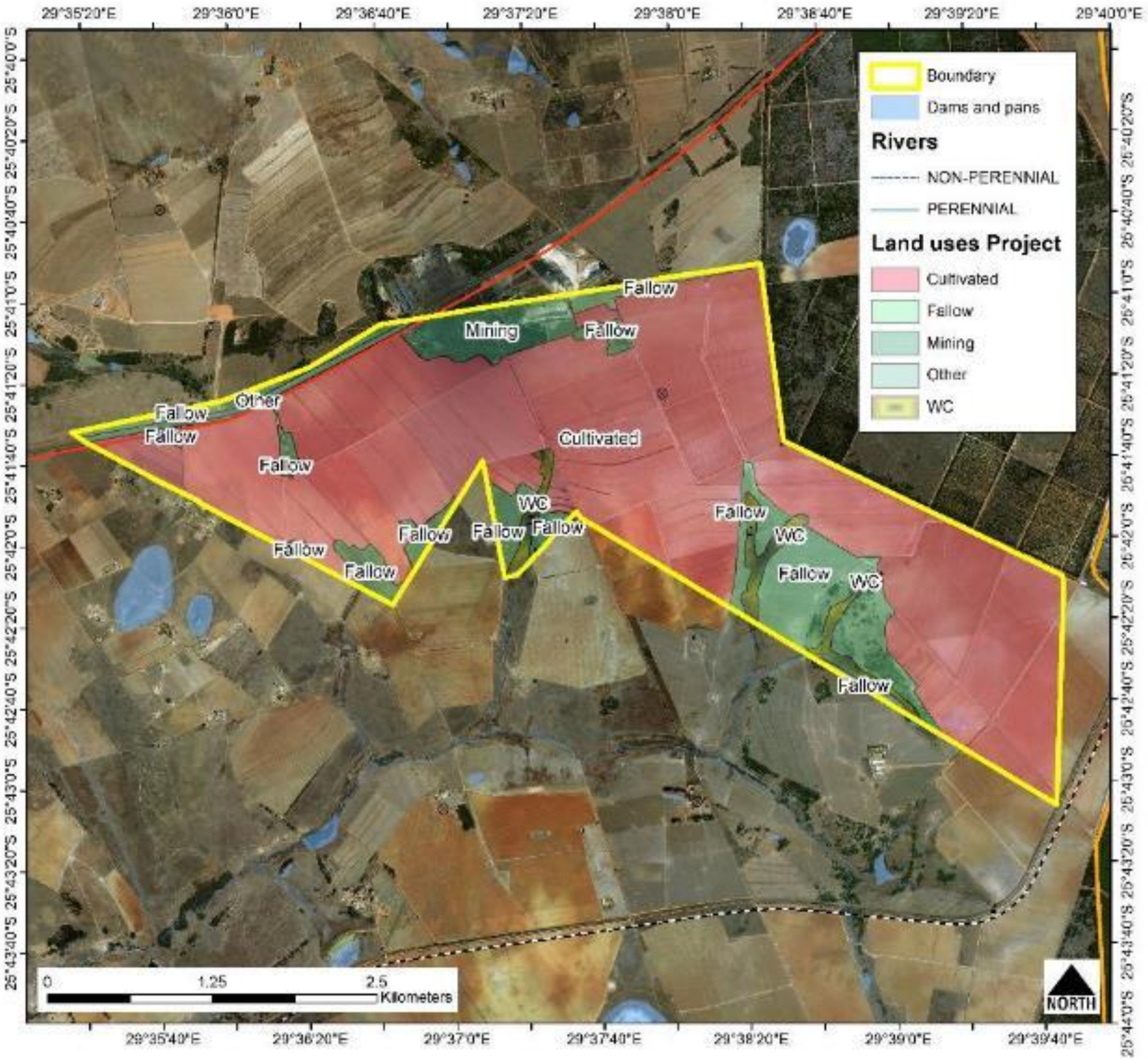


Figure 17: Present land uses

Photo 1. Aerial view of cultivated land

Photo 2. Aerial view of cultivated land

Photo 3. Livestock on grazing land

Photo 4. Soya production

Photo 5. Fallow land with mining on the adjacent farm

Photo 6. Maize production: 10t/ha yield expected

Figure 18: Photographs of present land uses

10.4.3 Land capability

The soil on the property is arable but no water is available for irrigation. According to the agricultural potential map of the National Department of Agriculture (NDA), the land is arable.

Land capability classes are interpretive groupings of land with similar potential and limitations or similar hazards. Land capability involves consideration of difficulties in land use owing to physical land characteristics, climate and the risks of land damage from erosion and other causes. The classic eight-class land capability system (Klingebiel & Montgomery, 1961) was adapted for use by the South African Department of Agriculture in their Agriculture Geographic Information System (AGIS). Land capability is classified according to guidelines published by the National Department of Agriculture in AGIS. Land Capability is determined by the collective effects of soil, terrain and climate features and shows the most intensive long-term use of land. At the same time, it indicates the permanent limitations associated with the different land-use classes (refer to Table 24).

- Order A: Arable land – high potential land with few limitations (Classes i and ii).
- Order B: Arable land – moderate to severe limitations (Classes iii and iv).
- Order C: Grazing and forestry land (Classes v, vi and vii).
- Order D: Land not suitable for agriculture (Class viii).

Table 24: Land capability classes – intensity of land uses

LAND CAPABILITY			Wildlife	Grazing and Forestry			Crop production			
Order		Class		Forestry	Veld	Pastures	Limited	Moderate	Intensive	Very intensive
Arable	A	i								
		ii								
	B	iii								
		iv								
Non arable	C	v								
		vi								
		vii								
	D	viii								

* Note: the shaded area indicates the suitable land use

10.4.4 Capability classification

Guidelines published on the AGIS website of the NDA were used to determine the capability of soils and their agricultural potential (Department of Agriculture, 2019). These guidelines are discussed below.

Soil properties will determine the soil capability for different intensity of use. This is combined
with terrain factors and climate to determine the land use capability.

The matrix of qualifications is indicated below:

Table 25: Terrain and soil classes constituting soil capability classes i to viii

Soil Capability class	Terrain		Soil factors				
	Flooding Hazard	Erosion hazard	Soil depth	Soil texture	Internal drainage	Mechanical limitations	Acidity
i	F1, F2	E1; E5	D1	T1	W2, W3	MB0	P1
ii	F1-F3	E1,E2; E5	D1,D2	T1,T2	W2, W3	MB0	P2
iii	F1-F4	E1-E3; E5	D1-D3	T1-T3	W1-W4	MB0-MB1	P2
iv	F1-F4	E1-E4; E5	D1-D4	T1-T3	W1-W4	MB0-MB1	P2
v	F1-F5	E1-E5	D1-D4	T1-T3	W1-W5	MB0-MB1	P2
vi	F1-F5	E1-E6	D1-D4	T1-T3	W1-W5	MB0-MB3	P2
vii	F1-F5	E1-E7	D4-D5	T1-T3	W1-W5	MB2-MB4	P2
viii	F1-F5	E1-E8	D4-D5	T1-T3	W1-W5	MB2-MB4	P2

10.4.4.1Soil factors

The criteria to determine the soil capability for each soil factor are as follows (see Figure 19 for details):

- Soil depth, texture, internal drainage is based on soil types, and mechanical limitations.

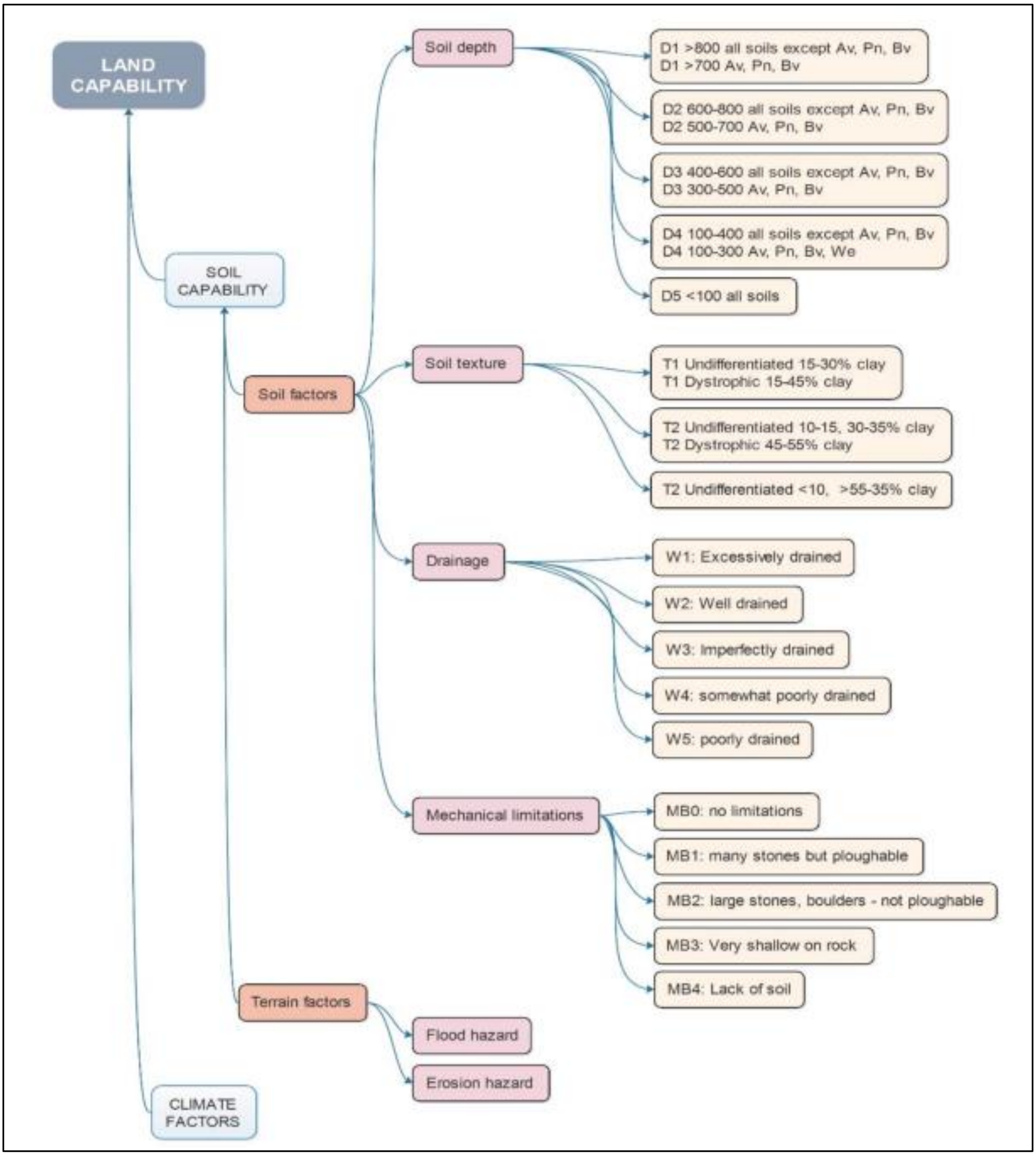


Figure 19: Land capability criteria

10.4.4.2 Terrain factors

Flooding Hazard

The streams are classified as channelled valleys according to the HGM system employed by the Department of Water Affairs. There are no streams or rivers that could result in flooding.

Erosion Hazard Criteria

Erosion susceptibility is a function of soil properties and rainfall characteristics. The farm is contoured and therefore, not prone to erosions. From a soil's perspective, the erosion hazard of the cultivated lands is E2.

10.4.4.3 Climatic factors

The parameters used are length of growing season, temperature and hazards related to hail and frost. Climate conditions are favourable for rainfed cropping and will not affect the land use capability.

10.4.5 Land use capability of application area

10.4.5.1Department of Agriculture

According to the Department of Agriculture's Comprehensive Atlas the land capability of the proposed site is classified as High potential arable land.

10.4.5.2 Site based capability

Capability provides a general guideline for what the land is suitable. The following factors
decided the land use capability of the site:

- Soil properties.
- Watercourses.
- Land with mining and road infrastructure.

Following the same guidelines as discussed in Section 10.4.4 above, the deep sandy loam soils are arable with a high potential for cropping. Specifically, regarding classification of the subject site:

- Class i and ii (high potential land) is deeper than 600mm with no stones or rock that impedes cultivation. Approximately 879 hectares falls into this class.
- Class iii/iv is medium potential soil has a depth of between 400 and 600mm with stones and concretions that may affects arability. The soil properties and soil depth are such that crop yield is low and the risk of production due to climatic variability, high. There are 32 hectares that falls into this class.
- Class v to viii is non-arable land. The size of the non-arable classes is 255 hectares.

In summary, the land capability according to class is as follows:

- High potential: 879 ha.
- Moderate potential: 32.3 ha.
- Low potential: 132.3 ha.
- Very low: 123.6 ha.

Refer to the land use capability map in Figure 20 and the land use capability Table below.

Table 26: Land use capability table

Soil Type	Area (ha)	Capability	Description	Limitation class
Cv1200	136.8	i	High	D1,T1,W1,MB0,F1
Hu1200	721.4	i	High	D1,T1,W1,MB0,F1
SUB-TOTAL	**858.2**			
Hu800	20.8	ii	High	D2,T1,W1,MB0,F1
SUB-TOTAL	**20.8**			
Av600	6.3	iii	Moderate	D3,T1,W2,MB1,F1
Hu450	26.0	iv	Moderate	D3,T1,W1,MB0,F1
SUB-TOTAL	**32.3**			
Wa/R	80.9	vi	Low	D5,T2,W3,MB0,F1
Misc	50.4	vi	Low	D4,T2,W3,MB2,F1
INF	77.6	viii	Very low	-
WC	46.0	viii	Very low	-
SUB-TOTAL	**254.9**			
TOTAL	**1 175.6**			

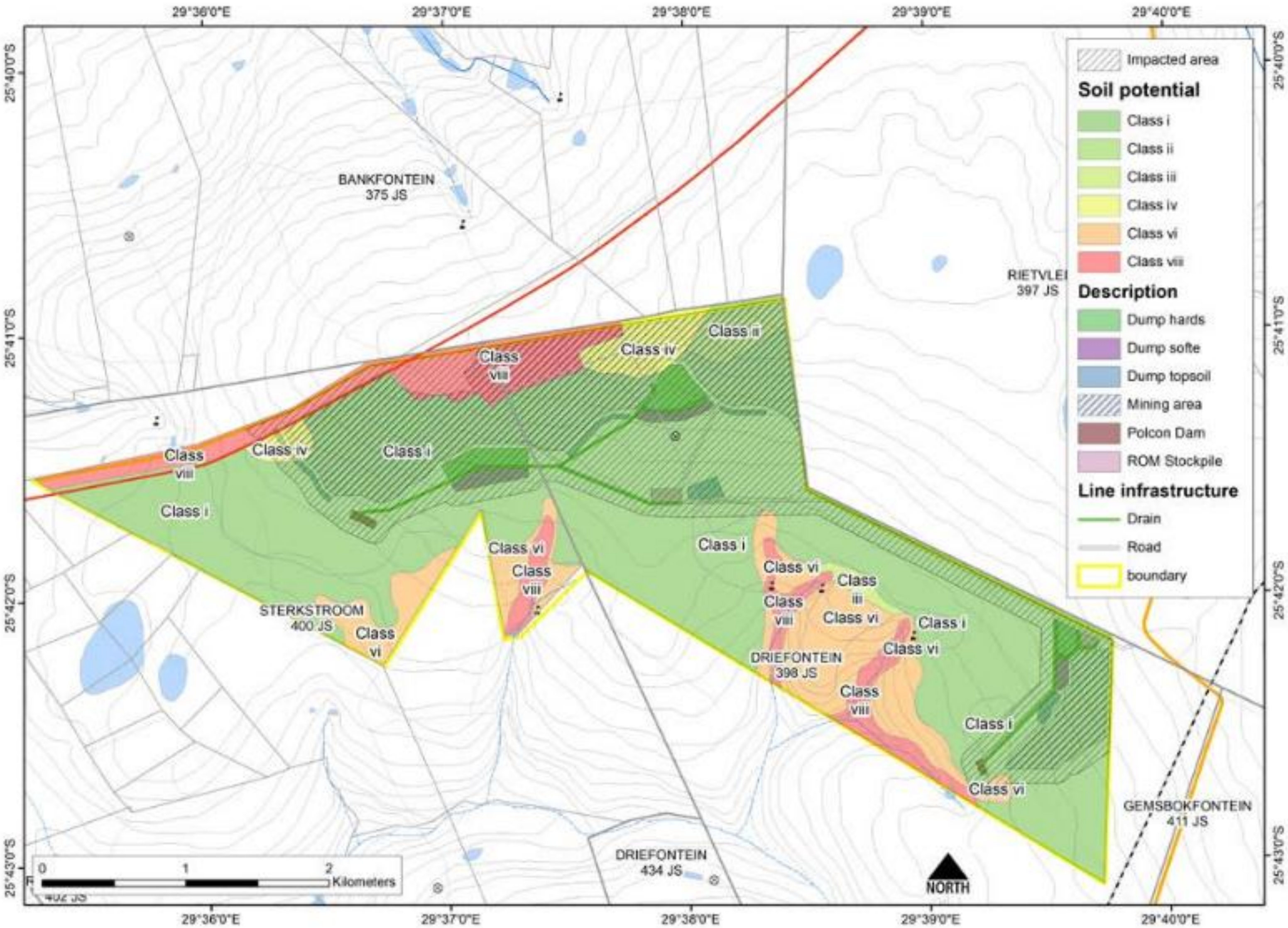


Figure 20: Land use capability map

10.5 Vegetation (Flora)

10.5.1 Rand Highveld Grassland

The study area is located within the Grassland Biome of South Africa, which is represented within the study area by the Rand Highveld Grassland vegetation type (Figure 21). This vegetation type occurs in the Gauteng, North-West, Free State and Mpumalanga Provinces. This vegetation type has also previously been defined as the Bankenveld veld type (*Acocks, J.P.H. 1988. Veld Types of South Africa. Memoirs of the Botanical. Survey of South Africa, No. 40*) and as Rocky Highveld Grassland vegetation (*Bredenkamp, G. & Van Rooyen, N. 1996a. Rocky Highveld Grassland. In: Low, A.B. & Rebelo, A.G. (eds). Vegetation of South Africa, Lesotho and Swaziland. Department of Environmental Affairs and Tourism, Pretoria*).

Rand Highveld Grassland occurs in areas between rocky ridges from Pretoria to Witbank, extending onto ridges in the Stoffberg and Roossenekal regions, as well as west of Krugersdorp centred in the vicinity of Derby and Potchefstroom, extending southwards and northwards from there. It occurs at an altitude of between 1,300 and 1,635m but reaches 1,760m in places.

The vegetation type is considered to be Endangered, with a conservation target of 24%, however only 1% thereof is conserved. Small patches are protected in statutory reserves (Kwaggavoetpad, Van Riebeeck Park, Bronkhorstspruit, Boskop Dam Nature Reserve) and in private conservation areas (e.g., Doornkop, Zemvelo, Rhenosterpoort and Mpopomeni). Almost half has been transformed mostly by cultivation, plantations, urbanisation and dam-building. Cultivation may also have had impacts on additional portions of the surface area of the vegetation type where old lands are currently classified as grasslands in land-cover classifications and poor land management has led to degradation of significant portions of the remainder of this vegetation type. Scattered aliens (almost prominently Acacia mearnsii) occur in about 7% of this unit. Only about 7% has been subjected to moderate to high erosion levels (*Mucina, L. & Rutherford, M.C. (Eds.) 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria*).

The landscape associated with Rand Highveld Grassland is highly variable with extensive sloping and a series of ridges slightly elevated over undulating surrounding plains. The vegetation is species-rich, wiry, sour grassland alternating with low, sour shrub land on rocky outcrops and steeper slopes. Most common grasses on the plains belong to the genera Themeda, Eragrostis, Heteropogon and Elionurus. High diversity of herbs, many of which belong to the Asteraceae, is also a typical feature. Rocky hills and ridges carry sparse (savannoid) woodlands with Protea caffra subsp. caffra, Protea welwitschii, Senegalia (Acacia) caffra and Celtis africana, accompanies by a rich suite of shrubs among which the genus Searsia (S. magalismonata) is most prominent (*Mucina, L. & Rutherford, M.C. (Eds.) 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria*). Dominant floral species associated with this vegetation type are included as Appendix B of the Terrestrial Biodiversity Assessment attached as Appendix 6.2 to this report.

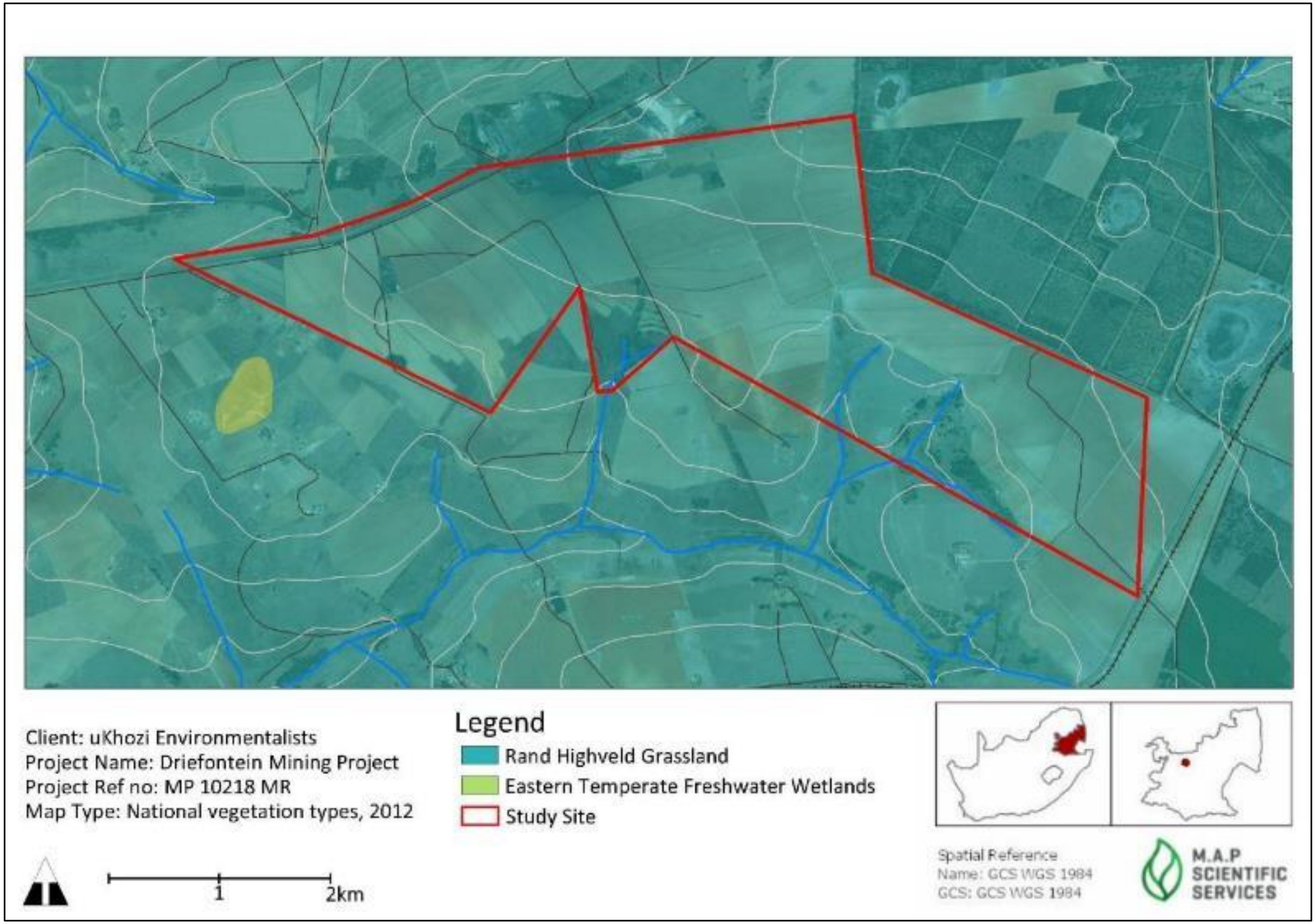


Figure 21: Vegetation types associated with the study area (Mucina & Rutherford 2006)

10.5.2 Vegetation units identified within the study area

Three broad vegetation units, based on species composition and vegetation structure, topographical position in the landscape, and the degree of anthropogenic impact and disturbance, were identified in the study are, namely:

- **Natural Grassland Vegetation Unit**
  - **Open Grassland; and**
  - **Degraded Natural Grassland.**
- **Wetlands/ Moist Grassland Vegetation Unit**
- **Modified Grassland Vegetation Unit**
  - **Agricultural Fields.**
  - **Old Agricultural Fields; and**
  - **Mining Area and Historical Infrastructure Areas.**

The location and extent of these vegetation units within the study area are illustrated in Figure 22 below.

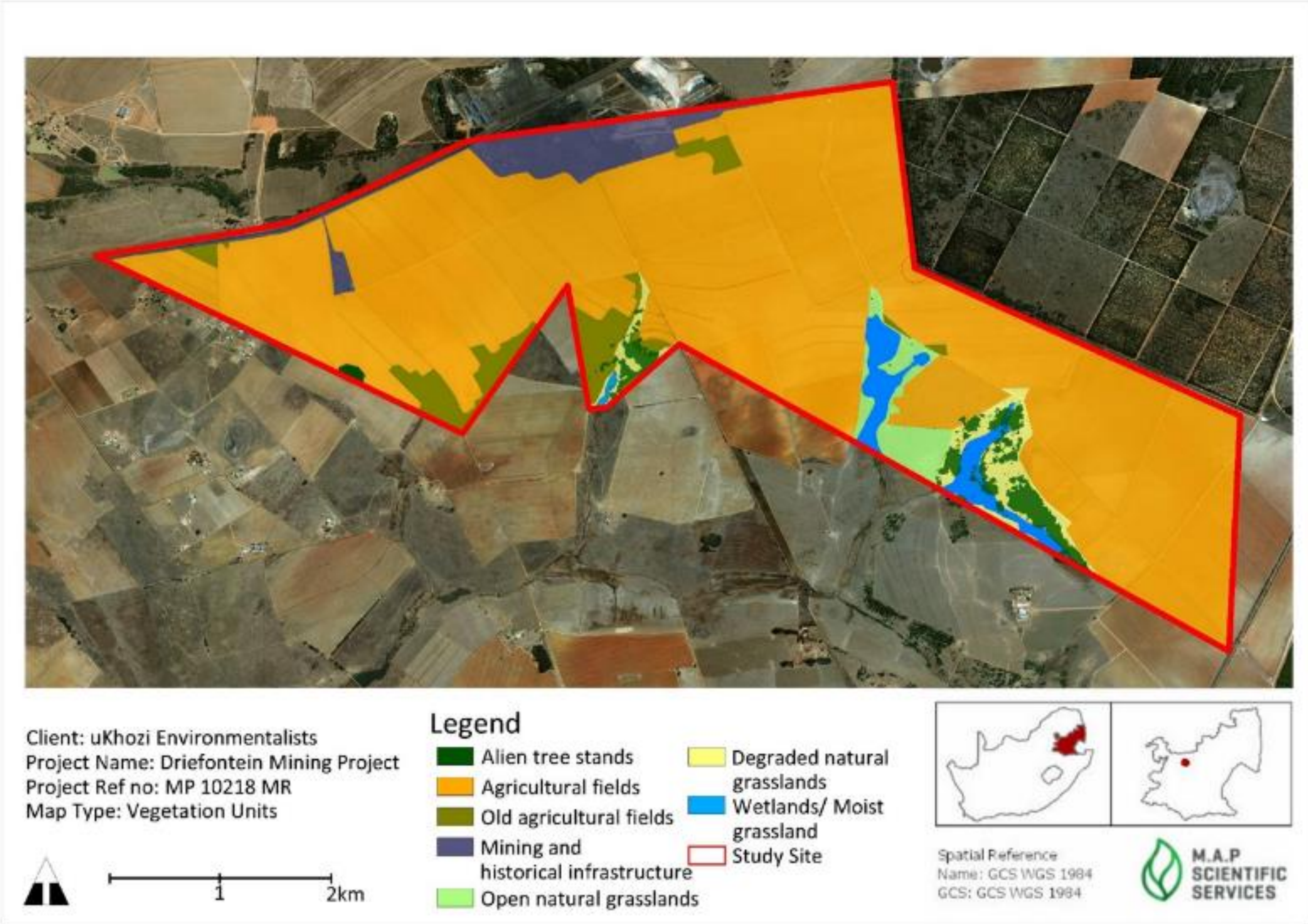


Figure 22: Vegetation units identified within the study area

10.5.2.1 Natural grassland vegetation unit

The natural grassland vegetation unit consists of open grassland and degraded natural grassland which is described in more detail below.

10.5.2.1.1 Open grassland

The Natural Grassland: Open Grassland vegetation unit is illustrated in Photo Plate 2 below.

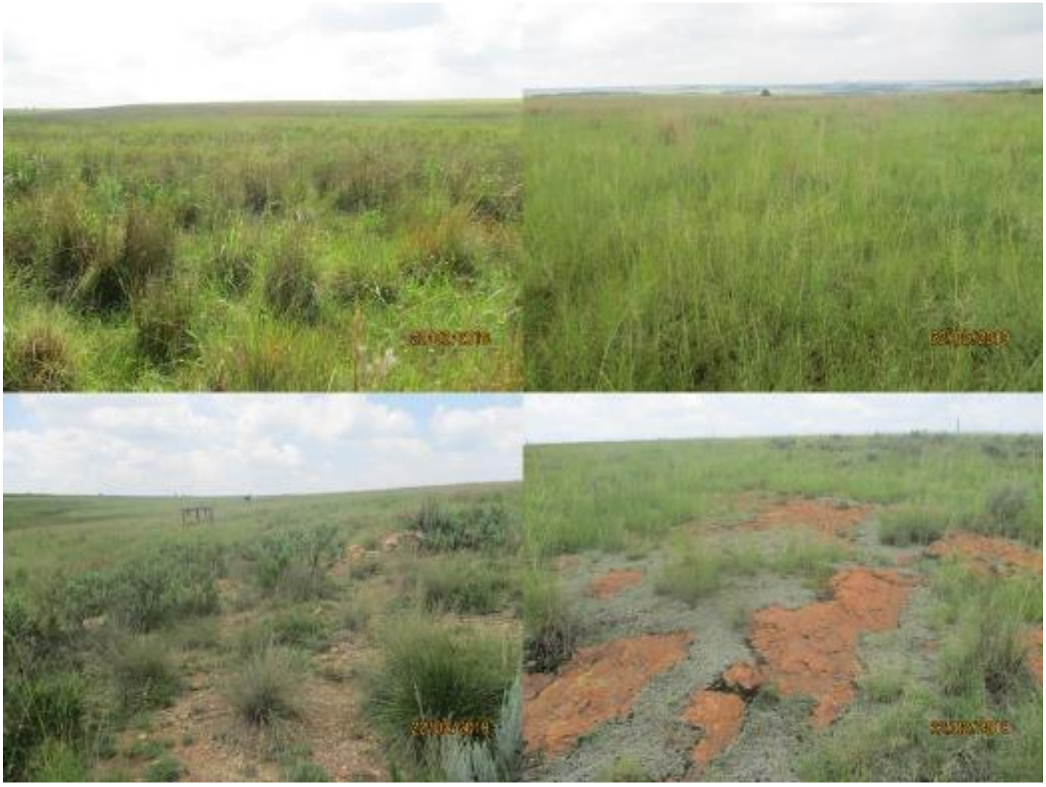


Photo Plate 2: Representative photographs of the Open Grassland vegetation unit, which coincides with a designated CBA area in terms of the MBSP (2014) (top) and rocky grassland areas within this vegetation unit (bottom)

The Open Grassland vegetation unit is represented in a portion of the study area along its southern boundary and is associated with the western watercourse/ wetland located on Portion 6 of Driefontein 398 JS. This area is indicated to be a CBA: Optimal Area in terms of the MBSP (2014). Rocky grassland areas also occur scattered within this habitat unit where it borders the watercourse. This Open Grassland vegetation unit comprises a well-developed grass layer, with a relatively high abundance and diversity of indigenous grassland forb species. Overall vegetation structure within these areas is intact, few listed alien and invasive species are present, and the veld is in a good ecological condition. The current main impact on this habitat unit is grazing by livestock, which has led to ruderal weed species such as *Gomphrena celosioides, Richardia brasiliensis* and *Hypochaeris radicata* being present throughout. *Stoebe plumosa*, an indigenous dwarf shrub that proliferates in overgrazed veld (*Bromilow, C. (2010) Problem*

Plants of South Africa. Third edition. Briza Publications, Pretoria) also occurs sporadically throughout this vegetation unit in small stands.

This vegetation unit is dominated by grass species typical of the Rand Highveld Grassland vegetation type, and the grass component is characterised by *Eragrostis chloromelas, E. curvula and E. plana*, with other representative grass species of the vegetation type including *E. gummiflua, Hyparrhenia hirta, Cynodon dactylon, Diheteropogon amplectens, Eragrostis chloromelas and Heteropogon contortus. Commonly encountered forb species include Felicia muricata, Helichrysum nudifolium var. nudifolium, H. rugulosum, Nidorella hottentotica and Selago densiflora*. Species such as *Pelargonium alchemilloides and Aristea sp*. occur less frequently. An Afromontane affinity, although less prominent than as described by Bredenkamp & Van Rooyen (1996) for the vegetation type, can be seen through the presence of *Erica drakenbergenis*, which is restricted to this vegetation unit within the study area. No indigenous trees or large shrubs were recorded during the field assessment.

The rocky areas, associated with steeper slopes, watercourses and fountains within the Open Grassland vegetation unit, provide niche habitat for shrubs and forbs such as *Lopholeana coriifolia, Dimorphotheca caulescens, Zornia linearis, Commelina subulata and grasses such as Microchloa caffra, Eragrostis racemosa, E. nindensis, Schizachyrium sanguineum, Sporobolus pectinatus, terrestrial sedges such as Cyperus semitrifidus and Bulbostylis burchellii, and ferns such as Selaginella dregei, Cheilanthus hirta and Pellaea calomelanos var. calomelanos*.

The Open Grassland vegetation unit provides suitable habitat for a number of floral Species of Conservation Concern (SCC) and species of medicinal value, although only two provincially protected species, namely *Crinum bulbispermum and Gladiolus papilio* were recorded in low abundance during the field assessment.

10.5.2.1.2 Degraded grassland

The Natural Grassland: Degraded Grassland vegetation unit is illustrated in Photo Plate 3 below.

Photo Plate 3: Representative photographs of the Natural Grassland Vegetation Unit: Impacted Grassland with Acacia mearnsii stands (top). Vegetation below A. mearnsii stands and degraded rocky grassland vegetation (bottom)

The Degraded Natural Grassland Vegetation Unit comprises natural grassland areas that have been noticeably impacted by grazing and the encroachment of alien tree species, most notably *Acacia mearnsii* (black wattle). When comparing the aerial imagery from 2004 – 2008 with current aerial imagery, it is evident that a marked increase in *A. mearnsii* cover, and density has taken place within these areas over the past decade (Figure 23).

Figure 23: Proliferation of A. mearnsii associated with the eastern watercourse on Portion 6 of the Farm Driefontein 398JS over the period 2004 – 2019 (Google Earth imagery)

Dominant forb species include indigenous species such as *Oldenlandia herbacea, Gomphocarpus fruticosus, Helichrysum rugulosum, Acrotome hispida, Selago*

densiflora, Felicia muricat*a**, as well as ruderal weeds such as ***Richardia brasiliensis, Conyza bonariensis and Alternanthera pungens, the presence of which is attributed to grazing. The grass layer is dominated by ***Eragrostis curvula***, a species that tends to increase under grazing. Historical and ongoing disturbances have contributed to an alteration of local species composition and a lower than expected plant species diversity present. Should disturbances cease and alien vegetation be efficiently controlled, the vegetation within these areas could recover over time. The unpalatable indigenous invasive species, ***Stoebe plumosa***, also occurs in dense stands throughout this vegetation unit (Photo Plate 4).

Photo Plate 4: Stoebe vulgaris encroachment within the Degraded Grassland vegetation unit

Rocky areas are present in the vicinity of the watercourses, which provide increased habitat potential and potential niche habitat for a different suite of floral species than in the surrounding area, however these areas have also been subjected to grazing and are densely populated with ***A. measrnsii***.

As a result of grazing and alien vegetation encroachment, the vegetation within this area is considered degraded, and control of alien species within this vegetation unit should receive priority. Although no floral SCC were observed within this vegetation unit, some habitat for such species is available, particularly within less impacted rocky grassland areas.

10.5.2.2 Wetland/Moist Grassland

The freshwater wetlands in the surrounding area form part of the Eastern Temperate Freshwater Wetlands (AZf3) vegetation unit according to Mucina and Rutherford (2006). The landscape can be described as flat or shallow depressions filled with (temporary) water bodies supporting zoned systems of aquatic and hygrophilous vegetation of temporarily flooded grasslands and ephemeral herb lands. Some 15% of the Eastern Temperate Freshwater Wetlands have been transformed to cultivated land, urban areas or plantations. In some places, intensive grazing and use of wetlands as drinking pools by cattle and sheep cause major damage to the wetland vegetation. A conservation target of 24% has been set for the Eastern Temperate Freshwater Wetlands (Mucina and Rutherford 2006). According to the 2011 National List of Threatened Terrestrial Ecosystems for South

Africa the Eastern Temperate Freshwater Wetlands vegetation unit is listed as a vulnerable threatened terrestrial ecosystem (RSA 2011).

The floral species encountered within the Wetland/ Moist Grassland vegetation unit is illustrated in Photo Plate 5 below.

Photo Plate 5: Representative photographs of the Wetland/ Moist Grassland vegetation unit

Two fountains originate on the southern boundary of the study area on Portion 6 of the Farm Driefontein 398JS, with a third fountain originating along the southern boundary of the study area on Portion 6 of the Farm Sterkstroom 400JS. The channeled/ unchanneled valley bottom and seepage wetlands and moist grassland areas associated with these watercourses, provide unique habitat within the study area.

The moist grassland vegetation associated with the wetlands encountered within the study area varies in terms of species diversity and level of disturbance, but in general species diversity is considered to be high with intact habitat, specifically within both of the watercourses located on the Farm Driefontein 389JS. Moist grasslands within Portion 6 of the Farm Sterkstroom 400JS, has been impacted to a larger degree as a result of the proximity of this area to historical agricultural activities.

No floral SCC were recorded in this vegetation unit, but the provincially protected species, *Kniphofia ensifolia* subsp. *ensifolia* and *Crinum bulbispermum* are present.

10.5.2.3 Modified areas

The floral species encountered within the Modified Vegetation Unit during the field assessment are included in Appendix C of the Terrestrial Biodiversity Assessment.

10.5.2.3.1 Agricultural fields

The Modified Areas: Agricultural Fields vegetation unit is illustrated in Photo Plate 6 below. The majority of the study area comprises the Agricultural Fields vegetation unit. These areas have been extensively modified through cultivation practices and are currently utilised as agricultural areas (predominantly maize, soybeans and planted grass pastures), with little or no natural vegetation remaining. Vegetation within existing access roads between agricultural fields comprise a variety of mostly pioneer grass species and grass species typical of disturbed areas such as *Cynodon dactylon, Melinis repens, Eragrostis curvula, Pogonarthria squarrosa, Paspalum urvillei, Hyparrhenia hirta and H. tamba with dominant forb species being Helichrysum rugulosum, Pseudognaphalium luteo-album and Cyperus esculentus. Alien forb species include Conyza bonariensis, Bidens pilosa, Bidens bipinnatus, Datura stramonium, Acacia mearnsii and Cirsium vulgare.*

Due to the high level of past and ongoing anthropogenic disturbance within this area, the probability of floral SCC occurring is very low. The proposed mining infrastructure is almost entirely located within this vegetation unit.

Photo Plate 6: Representative photographs of the Agricultural Fields vegetation unit, including access roads

10.5.2.3.2 **Old agricultural fields**

The Modified Areas: Old Agricultural Fields vegetation unit is illustrated in Photo Plate 7 below.

Photo Plate 7: Representative photographs of the Old Agricultural Fields vegetation unit

Limited sections within the study area comprise old agricultural fields that have previously been cultivated and are currently fallow. This vegetation unit is dominated by alien and invasive plant species such as *Verbena brasiliensis, V. bonariensis, Tagetes minuta and Bidens pilosa* as well as pioneer grass species such as *Chloris virgata, Aristida congesta subsp. congesta and Cynodon dactylon*. The old lands associated with the watercourse located on portion 6 of Sterkstroom 400JS,

is particularly degraded as a result of historical agricultural activities, as mentioned, with this area densely invaded by *Solanum mauritianum, Acacia mearnsii, Verbena bonariensis and Conyza sumatrensis*. The overall ecological condition of this vegetation unit is poor due to historical soil disturbance and vegetation clearance, and this area has a low potential for floral SCC to occur.

10.5.2.3.3 Existing mining and historical infrastructure

The Modified Areas: Existing Mining and Historical Infrastructure vegetation unit is illustrated in Photo Plate 8 below.

Photo Plate 8: Representative photographs of the Existing Mining and Historical Infrastructure vegetation unit

Existing mining areas associated with the Bankfontein Colliery are located in the northwest of the study area. A further area where modified vegetation is present is located within the western portion of the study area in the vicinity of demolished outbuildings, with associated access roads and a fruit orchard. As a result, vegetation within this area has been entirely modified with limited to no natural habitat remaining.

Vegetation in these areas is dominated by alien species such as *Acacia mearnsii, Morus alba* and *Pennisetum clandestinum*. This vegetation unit is unlikely to provide habitat for floral SCC.

10.5.3 Floral species of conservation concern

An assessment considering the occurrence of floral SCC including suitable habitat to support any such species was undertaken. No floral SCC are indicated by the SANBI BODATSA (2018) database to occur within the study area or its immediate surrounds which was confirmed through data received from the MTPA (pers. comm.) which indicated that no threatened floral species are known from the 2529DA QDS. The MTPA did however provide a further species list, which included floral SCC known to occur within 20km of the study area and these species were searched for during the field assessment, within respective suitable habitat. A list of these species, including their habitat requirements, threatened status and probability of occurring within the study area are listed in the table below.

Table 27: Floral SCC known to occur within 20km of the study area

Species	SANBI Threatened Status	Provincial Threat Status	Habitat (redlist.sanbi.org)	Probability of Occurrence
Anacampseros subnuda subsp. *lubbersii*	VU	VU	Grassland, on rhyolite boulders within Rand Highveld Grassland and Loskop Mountain Bushveld. A range-restricted species, known from seven location and declining due to ongoing habitat loss and degradation, as well as competition from alien invasive plants.	Possible – habitat for this species is within the Natural Grassland Vegetation Unit, particularly within rocky areas.
Boophone disticha	LC (Decreasing)	LC Protected: MCNA	Dry grassland and rocky areas.	Possible – habitat for this species is within the Natural Grassland Vegetation Unit, particularly the Open Grassland and associated rocky areas.
Callilepis leptophylla	LC (Decreasing)	Declining	Grassland or open woodland, often on rocky outcrops or rocky hill slopes.	Possible – habitat for this species is within the Natural Grassland Vegetation Unit, particularly the Open Grassland and associated rocky areas.
Crinum bulbispermum	**LC (Decreasing)**	**Declining Protected: MCNA**	**In Grassland and Savanna near rivers, streams, seasonal pans and in damp depressions.**	**Confirmed within the Open Grassland vegetation unit**
Eucomis autumnalis	LC (Decreasing)	Declining Protected: MCNA	Damp, open grassland and sheltered places from the coast to 2,450m.	Possible – habitat for this species is within the Natural Grassland Vegetation Unit, particularly the Open Grassland areas.
Hypoxis hemerocallidea	LC (Decreasing)	LC	Widespread in the eastern part of southern Africa from the Eastern Cape to Botswana and Mozambique.	Possible – habitat for this species is within the Natural Grassland Vegetation Unit.
Khadia carolinensis	VU	VU	Well-drained, sandy loam soils among rocky outcrops, or at the edges of sandstone sheets, Highveld Grassland, 1,700 m.	Unlikely due to lack of suitable habitat

Species	SANBI Threatened Status	Provincial Threat Status	Habitat (redlist.sanbi.org)	Probability of Occurrence
Kniphofia Ensifolia* subsp. *ensifolia	**LC**	**NT Protected: MCNA**	**On stream banks and low-lying, seasonally moist areas.**	**Confirmed within the Wetland/ Moist Grassland Vegetation Unit.**
Kniphofia typhoides	NT (Decreasing)	NT Protected: MCNA	Low-lying wetlands and seasonally wet areas in climax *Themeda triandra* grasslands on heavy black clay soils, tends to disappear from degraded grasslands.	Possible – habitat for this species is available within the Wetland/ Moist Grassland Vegetation Unit.
Nerine gracilis	VU	NT	Undulating grasslands in damp areas.	Unlikely due to lack of suitable habitat

Although no IUCN or SANBI RDL floral species were encountered within the study area, three provincially protected species were recorded as listed in Table 28 below.

Table 28: Floral SCC encountered within the study area

Species	Common name	IUCN/ SANBI RDL STATUS	Protected	Vegetation Unit
Gladiolus papilio	Butterfly gladiolus	LC	MNCA	Natural Grassland Vegetation Unit: Open Grassland
Crinum bulbispermum	Orange river lily	LC (Decreasing)	MNCA	Natural Grassland Vegetation Unit: Open Grassland
Kniphofia ensifolia subsp. *ensifolia*	Red hot poker	LC (NT in Mpumalanga Province)	MNCA	Wetland/ Moist Grassland Vegetation Unit.

No tree species protected under the National Forest Act (Act No. 84 of 1998), or species listed in terms of the NEMBA TOPS Regulations (2015) were encountered within the study area during the field assessment.

All floral SCC encountered were recorded from the Natural Grassland and Wetland/ Moist Grassland Vegetation Units and are provincially protected species in terms of the MNCA (Act No. 10 of 1998) not currently considered to be threatened on a national level. When considering the preliminary layout for the project, is should be possible to conserve the floral SCC listed above in situ. Should the mining layout change, or any floral SCC be recorded within the mining footprint area in future, it is recommended that these species be relocated to suitable habitat within the study area under the supervision of a qualified botanist.

10.5.4 Medicinal plant

Many floral species encountered within the study area have been recorded to have some medicinal use. Only the most prominent medicinal floral species encountered during the field assessment, as indicated by Van Wyk & Gericke (2003) and Van Wyk et al. (2005) are included in the table below. There are three habitat units identified in this region; wetlands, grasslands and transformed habitats, all of which have characteristics of historic

disturbance. The medicinal floral species listed below were encountered within the study area throughout all vegetation units. All medicinal species identified are indigenous, except for *Datura stramonium* which is a Category 1b alien and invasive species.

Table 29: Medicinal floral species identified during the field assessment across all vegetation units

Species	Common name	Plant parts used
Centalla asiatica	Pennywort	Dried aboveground parts, mainly leaves.
Crinum bulbispermum	Orange river lily	Bulbs and leaves.
Datura stramonium	Thornapple	Leaves, rarely green fruit.
Gomphocarpus fruticosa	Milkweed	Leaves, sometimes roots.
Helichrysum sp.	Everlastings	Leaves and twigs, sometimes roots.
Hypoxis hemerocallidea	Star flower	Tuberous rootstock.
Pellaea calomelanos	Hard fern	Leaves and rhizomes.

10.5.5 Alien invasive floral species

Alien and invasive floral species lead to degradation of the ecological integrity of an area, which in turn may lead to, amongst others, a decline in and potential local extinction in indigenous species diversity, an ecological imbalance and the decreased productivity of grazing land (*Bromilow, C. 2010. Problem Plants of Southern Africa. Third edition, first impression. Briza Publications, Pretoria*). Alien invasive floral species must be controlled in terms of the Alien and Invasive Species Regulations (2020).

During the field assessment, the alien and invasive floral species encountered were identified and are listed in Table 30 below. The Categories 1a, 1b, 2 and 3 Listed Invasive Species Categories as indicated by the NEMBA Alien and Invasive Species Lists (2020) are also shown, as well as the categories as per CARA (Act 43 of 1983).
Category 1a – Invasive species that require compulsory control.
Category 1b – Invasive species that require control by means of an invasive species management programme.
Category 2 – Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread.
Category 3 – Ornamentally used plants that may no longer be planted. Existing plants may remain, except within the flood line of watercourses and wetlands, as long as all reasonable steps are taken to prevent their spread.

Where the species is included as a declared invader weed or plant in Schedule 13 of the MNCA (Act No. 10 of 1998), as Alien Weeds and Plants, this is also indicated. From the table below, it is evident that a moderate to high diversity of listed alien species occurs within the study area, with a number of Category 1b invasive species present within the study area.

Table 30: Alien and invasive floral species identified during the field assessment across all vegetation units

Species	Common name	NEMBA Category	CARA Category	MNCA Schedule 13
Acacia mearnsii	Black wattle	2	2	Y
Ageratum conyzoides	Invading ageratum	1b	1	Y
Alternanthera pungens	Khakiweed	N/L	N/L	

Species	Common name	NEMBA Category	CARA Category	MNCA Schedule 13
Amaranthus hybridus subsp. *hybridus*	Green amaranth	N/L	N/L	
Argemone ochroleuca	White-flowered Mexican poppy	1b	1	
Bidens formosa	Cosmos	N/L	N/L	
Bidens pilosa	Blackjack	N/L	N/L	Y
Chenopodium album	Goosefoot	N/L	N/L	
Cirsium vulgare	Scotch thistle	1b	1	Y
Conyza bonariensis	Flax-leaf fleabane	N/L	N/L	
Conyza sumatrensis	Tall fleabane	N/L	N/L	
Cortaderia selloana	Pampas grass	1b	1	
Datura stramonium	Common thornapple	1b	1	Y
Eucalyptus camaldulenis	Red river gum	1b	2	Y
Gomphrena celosioides	Prostrate Globe-Amaranth	N/L	N/L	
Hibiscus trionum	Bladder weed	N/L	N/L	
Hypochaeris radicata	Hairy wild lettuce	N/L	N/L	
Morus alba	White mulberry	3	3	
Oenothera stricta	Evening primrose	N/L	N/L	
Oxalis corniculata	Creeping sorrel	N/L	N/L	
Paspalum dilatatum	Common paspalum	N/L	N/L	
Paspalum notatum	Lawn paspalum	N/L	N/L	
Paspalum urvillei	Tall paspalum	N/L	N/L	
Pennisetum clandestinum	Kikuyu	N/L	X2	
Persicaria lapathifolia	Spotted knotweed	N/L	N/L	
Physalis angulata	Wild gooseberry	N/L	N/L	
Phytolacca octandra	Forest inkberry	1b	X1	
Plantago major	Broadleaf ribwort	N/L	N/L	
Prunus persica	Peach tree	N/L	N/L	
Richardia brasiliensis	Mexican richardia	N/L	N/L	
Rumex crispus	Curly dock	N/L	X3	
Schkuhria pinnata	Small khakiweed	N/L	N/L	
Sesbania bispinosa	Spiny sesbania	N/L	N/L	
Solanum mauritianum	Bugweed	1b	1	Y
Solanum sisymbriifolium	Dense-thorned bitter apple	1b	1	
Tagetes minuta	Tall khakiweed	N/L	N/L	
Taraxacum officinale	Common dandelion	N/L	N/L	
Verbena bonariensis	Wild verbena	1b	N/L	
Verbena brasiliensis	Brazilian verbena	1b	N/L	
Verbena tenuisecta		N/L	N/L	
Xanthium strumarium	Large cocklebur	1b	1	Y

10.5.6 Floral habitat sensitivity

The results of the sensitivity analysis of each vegetation unit identified are outlined in the table below.

Table 31: Scores achieved in terms of the floral ecological sensitivity for each vegetation unit

Vegetation Unit	Floral SCC	Unique landscapes	Conservation status	Indigenous floral diversity	Habitat integrity	Total	Average
Natural Grassland Vegetation Unit: Open Grassland	4	4	5	4	4	21	High (4.2)
Natural Grassland Vegetation Unit: Degraded Grassland	3	3	4	3	3	16	Intermediate (3.2)
Wetlands/ Moist Grassland	4	5	5	4	4	22	Low (4.4)
Modified Grassland: Agricultural Fields, Old Agricultural Fields and Existing Mining and Historical Infrastructure	1	2	2	2	2	9	High (1.8)

10.6 Animal life (Fauna)

10.6.1 Habitat assessment

Five broad faunal habitat types were identified based on an unsupervised classification of a Sentinel 2 satellite image taken on 20 February 2019 (the same week as the field survey) (Figure 24). These five habitat types were: agricultural fields (maize and soya beans), grasslands, patches of trees (wattle (Acacia mearnsii)), bare ground (roads) and highly disturbed areas (mining activities) (Photo Plate 9). These habitat types formed part of the three broad vegetation units described in the floral assessment namely Natural Grassland, Wetlands/Moist Grassland and Modified Grassland Vegetation Units.

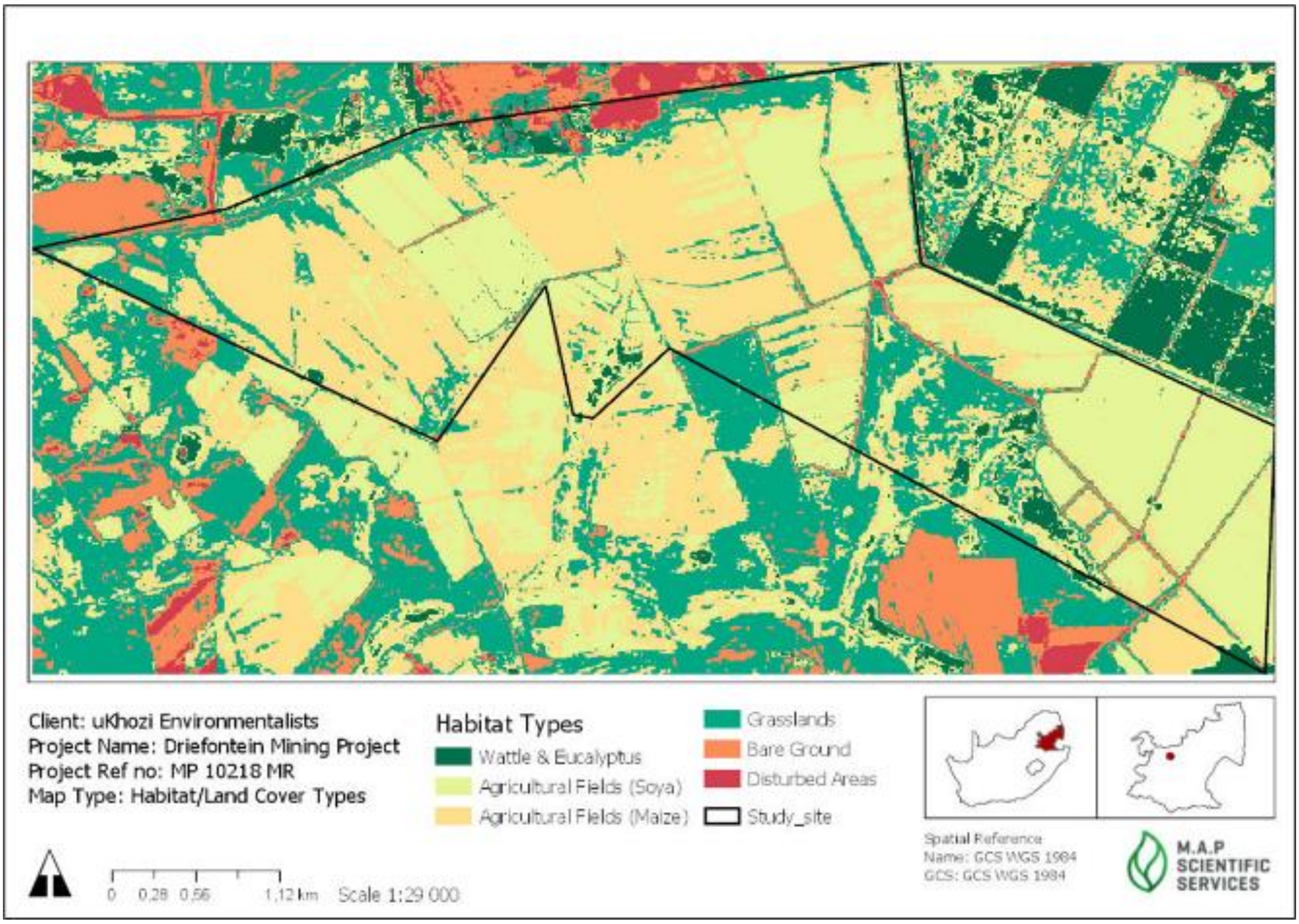


Figure 24: Faunal habitat types based on an unsupervised classification of a Sentinel 2 satellite image

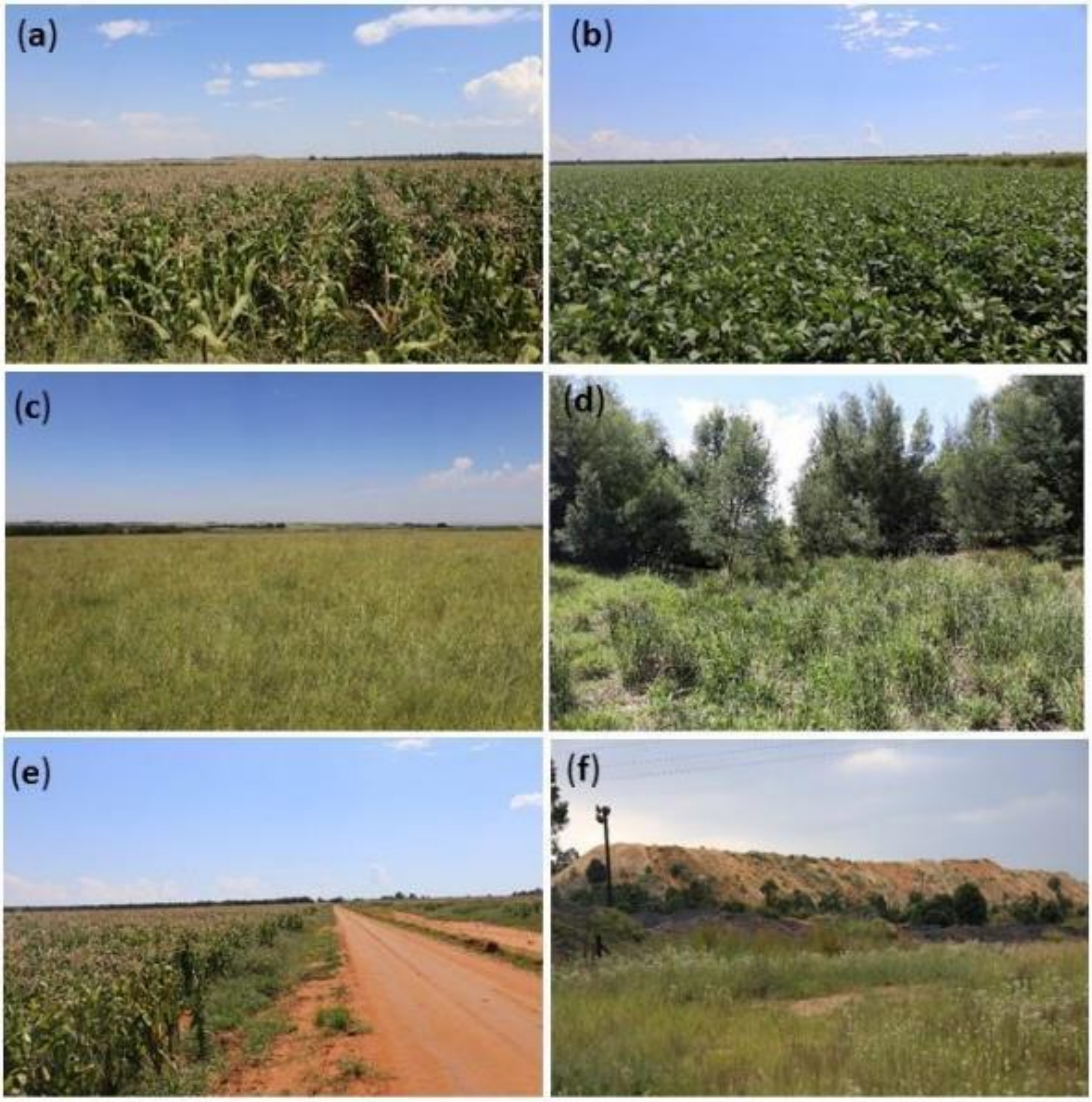


Photo Plate 9: The five broad faunal habitat types present on the study area identified by remote sensing. (a & b) agricultural fields (maize and soya bean), (c) open grasslands, (d) patches of wattle and/or Eucalyptus trees, (e) bare ground (e.g., roads) and (f) disturbed areas (e.g., mining activities)

The field survey confirmed the presence of these broad habitat types, but also indicated fine scale habitat heterogeneity within these habitat types. For example, three seasonal springs (fountains) and associated watercourses were present within the grasslands identified by remote sensing (Photo Plate 10). Moreover, within these grasslands there were rank, tall grassland patches that are relatively undisturbed (notably around the watercourses) as well as grassland areas that were regularly grazed by cattle. There were also some rocky areas embedded within these grasslands, not identified by remote sensing. The field visit confirmed that the most sensitive faunal habitats within the study area were the same areas identified as CBA: Optimal areas in the MBSP, 2014. These habitats can be described as seasonal springs associated with natural grasslands.

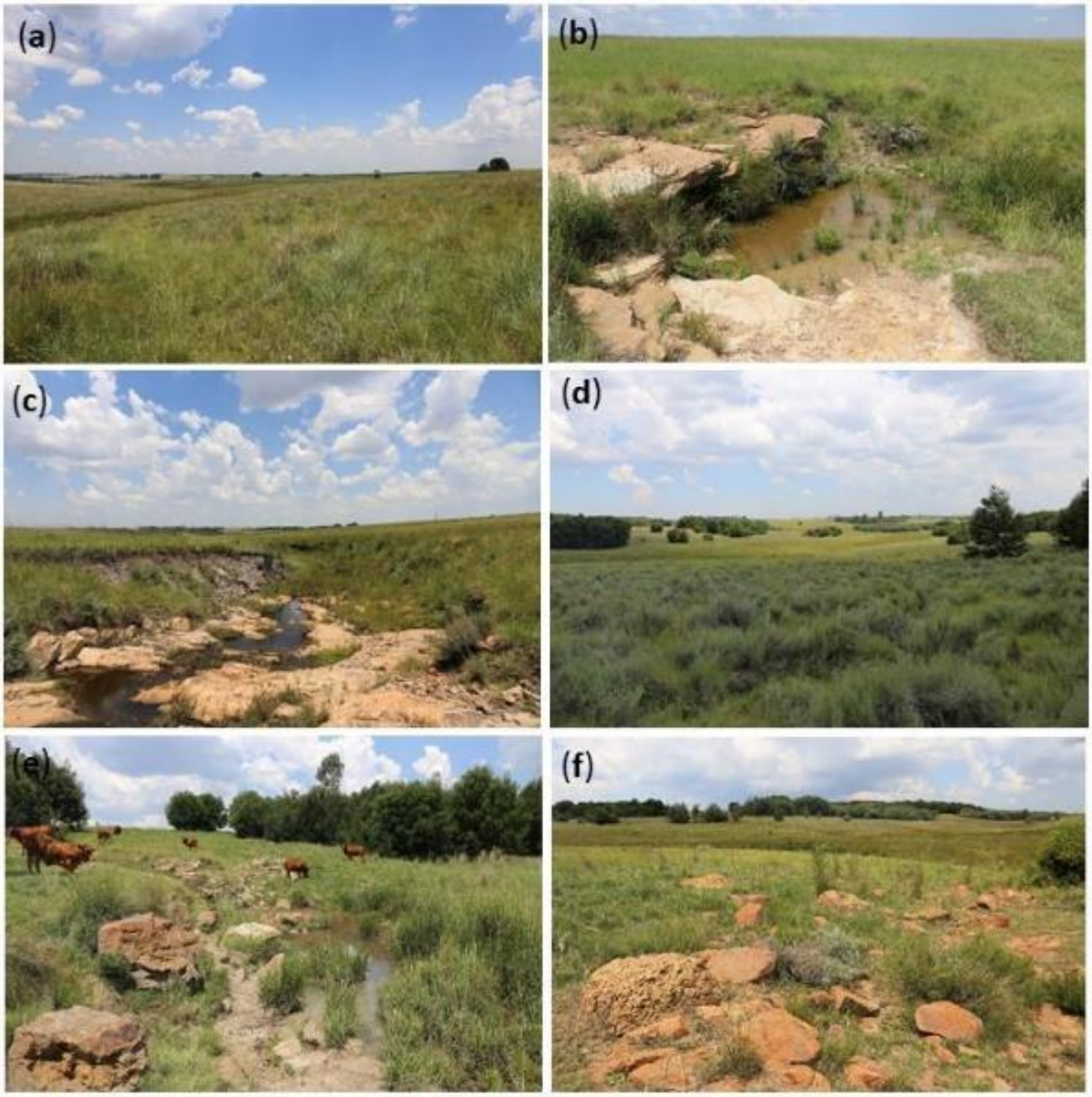


Photo Plate 10: Fine-scale habitat types present within the grasslands identified within the study area. (a) Open grassland areas, (b) source of seasonal spring, (c) watercourse associated with the seasonal spring, (d) tall, rank and relatively undisturbed grasses around the seasonal spring watercourses, (e) grazed grasslands, and (f) rocky patches interspersed with termitaria

10.6.2 Mammals

10.6.2.1 Community composition

The site falls within the distributional range of 20 terrestrial mammals, although only around seven are recorded in the area on a regular basis based on records from the Mammal Map database (www.mammalmap.adu.org.za). Species that can be confirmed present in the area based on the field include common duiker (*Sylvicapra grimmia*), steenbok (*Raphicerus campestris*), suricate (*Suricata suricatta*), black-backed jackal (*Canis mesomelas*), and porcupine (*Hystrix africaeaustralis*) (Photo Plate 11).

Photo Plate 11: Signs of mammal species encountered during the field survey. (a) Porcupine qills, (b) mongoose spp. and (c) black-backed jackal scats, and (d) black-backed jackal tracks

10.6.2.2 Mammal species of conservation concern

The DFFE Screening Report indicated that three mammal species of conservation concern may occur in the study area: rough-haired golden mole (*Chrysospalax villosus*), Maquassie musk shrew (*Crocidura maquassiensis*) and oribi (*Ourebia ourebi ourebi*). Refer to Table 32 below for the species status and probability of occurence.

Table 32: Probability of occurrence of mammal SCC indicated by the DFFE Screening Report

Species name	Ecology and on-site conclusion
Rough-haired golden mole (*Chrysospalax villosus*) 2016 Regional Red List Status: **VU** 2004 National Red List Status: **CR** 2016 Global Red List Status: **VU** TOPS listing (NEMBA): **None** CITES listing: **None** Endemic**: Yes**	The species has very specific habitat requirements and have only been recorded from 11 locations. It occurs in sandy soils in grasslands, meadows and edges of marshes and are impacted by livestock grazing during winter months, and the transformation of habitats (*Bronner GN, Asher R. 2016. A conservation assessment of Chrysospalax villosus. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa*). *Probability of occurrence:* **Low** (<25% probability of occuring on the site) – small fragments of suitable habitats were present on the study site, however these have been impacted by livestock grazing and agricultural activities.
Maquassie Musk Shrew (*Crocidura maquassiensis*) 2016 Regional Red List Status: **VU** 2004 National Red List Status: **VU** 2016 Global Red List Status: **LC** TOPS listing (NEMBA): **None** CITES listing: **None** Endemic**: No**	The Maquassie musk shrew is rare in South Africa, and little is known about the habitats and ecology of the species. Although it may tolerate a wide range of habitats, few records exist for Mpumalanga, all of which all were recorded pre-2000 (*Taylor PJ, Baxter R, Power RJ, Monadjem A, Child MF. 2016. A conservation assessment of Crocidura maquassiensis. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa*).

Species name	Ecology and on-site conclusion
	Probability of occurrence: **Low** (<25% probability of occuring on the site) - Given this lack of information on habitat requirements, few records in the province and general rarity, there is a low probability (<25%) that the species occur in the study area.
Oribi (*Ourebia ourebi ourebi*) 2016 Regional Red List Status: **EN** 2004 National Red List Status: **EN** 2016 Global Red List Status: **LC** TOPS listing (NEMBA 2007): **EN** CITES listing: **None** Endemic**: No**	Oribi prefer open grassland in good condition containing a mosaic of both short grass for feeding and long grass for feeding and shelter. They also use artificially managed or altered habitats such as hayfields, post burn areas and grasslands used by cattle (*Shrader AM, Little I, Coverdale B, Patel T. 2016. A conservation assessment of Ourebia ourebi. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa*). *Probability of occurrence:* **Unlikely** (<50% probability of occuring on the site) - although small patches of suitable habitats were present, it is unlikely to sustain a viable population in the study area.

No SCC were recorded during the site visit.

Three other mammal species that are listed as Near Threatened (NT) may occur in the area: serval (*Leptailurus serval*), brown hyena (*Parahyaena brunnea*) and South African hedgehog (*Atelerix frontalis*).

Serval is highly likely to occur on the study area, as this species is able to persist in agricultural areas if sufficient cover is available. Key vegetation types for the species such as wetlands and tall natural grasslands were also present on the study area, which support the notion that the species may occur here. Servals are sensitive to fragmentation mainly due to habitat specialisation and their preference for wetlands and its associated rodents (*Ramesh, T., Kalle, R. & Downs, C.T. (2015) Spatiotemporal variation in resource selection of servals: insights from a landscape under heavy land-use transformation. Journal of Mammalogy, 97: 1-14*).

South African hedgehog is likely to occur on the study area. Key grassland vegetation types for the species include the Soweto Highveld, Eastern Highveld, and Rand Highveld Grasslands, of which representative vegetation of the latter is present in the study area. On a local scale, the species prefer dense vegetation habitats and rocky outcrops that may provide food, cover and nesting materials (*Light J., Pillay, N., Avenant, N.L. & Child, M.F. (2016) A conservation assessment of Atelerix frontalis. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa*).

Brown hyena is unlikely to occur on the study area. Although the species is widespread across southern Africa, and occupy a range of ranching land, they typically avoid agricultural and heavily urbanised habitat. This species also requires some type of cover to lie up during the day, for which it favours rocky, mountainous areas with bush cover (*Yarnell, R.W., Richmond-Coggan L, Bussiere E, Williams K, Bisset C, Welch R, Wiesel I. (2016) A conservation assessment of Parahyaena brunnea. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa*).

10.6.3 Avifauna

10.6.3.1 Community composition

One hundred and forty-two avifaunal species have been recorded for pentad 2540_2935. Species most often recorded in the pentad, but also on the study area, were common waxbill (*Estrilda astrild*), Cape longclaw (*Macronyx capensis*), African stonechat (*Saxicola torquatus),* blackthroated canary (*Crithagra atrogularis*) and African pipit (*Anthus cinnamomeus*).

The field survey indicated that an avifaunal community typically associated with grasslands of the Mpumalanga Highveld inhabited the study area. Thirty-five (35) species were recorded during the survey, with the community dominated by grassland specialists such as the long-tailed widowbird (*Euplectes progne*), pin-tailed whydah (*Vidua macroura*), Levaillant's cisticola (*Cisticola tinniens*) and mask-weaver (*Ploceus velatus*). The red-billed quelea (*Quelea quelea*) was the bird species most often recorded. Three raptor species, the steppe buzzard (*Buteo buteo*), African harrier-hawk (*Polyboroides typus)* and marsh owl (*Asio capensis*) were also recorded on the study area during the survey.

10.6.3.2 Avifaunal species of conservation concern

No avifaunal SCC was recorded during the survey. However, four avifaunal SCC, namely African grass owl (*Tyto capensis*), grey crowned crane (*Balearica regulorum*), southern bald ibis (*Geronticus calvus*), and the yellow-billed stork (Mycteria ibis) have been recorded within pentad 2540_2935 during the timeframe of the SABAP2 project (2007 – present). Three Near Threatened (NT) species, the blue crane (*Anthropoides paradiseus*), greater flamingo (Phoenicopterus ruber) and lesser flamingo (Phoenicopterus minor) have also been recorded for the pentad. The NT category accommodate species for which there is concern (e.g., small, fragmented, decreasing populations) but for which data are insufficient, or threats and resultant population or range declines are not considered sufficiently severe to qualify the species as Vulnerable (VU).

In addition, the DFFE Screening Report indicated that the African marsh harrier (*Circus ranivorus*), southern bald ibis*, Sagittarius serpentarius* and (Eupodotis senegalensis) could occur in the study area.

The table below provides a short discussion on the ecology and probability of occurence in the study area for the four threatened Red List species, as well as the four species identified by the DFFE Screening Report (seven species in total as the

southern bald ibis is a Red List species and indicated by the DFFE Screening Report).

Table 33: Probability of occurrence of Red List bird species as well as SCC indicated by the DFFE Screening Report (*Information from Taylor et al. (2015)*)

Species name	Ecology and on-site conclusion
African Grass Owl (*Tyto capensis*) 2015 Regional status: **VU** 2000 Regional status: **VU** 2017 Global status: **LC** DFFE Screening Report: **No**	African grass owls are habitat specialists and roosts and breeds in tall, rank grass or sedges associated with damp substrates such as permanent and non-perennial wetlands and streams. It will breed, however, in any area of long grass and is not exclusively associated with wetlands. These owls hunt over drier and more open habitats near its wetland roost sites. *Probability of occurrence:* **Highly likely** (>75% probability of occuring on the site) – suitable habitat for African grass owls was present on the study area, particulary the rank grasslands closely associated with the seasonal springs.
Grey Crowned Crane (*Balearica regulorum*) 2015 Regional status: **EN** 2000 Regional status: **VU** 2017 Global status: **EN** DFFE Screening Report: **No**	Grey crowned cranes require mixed wetland-grassland habitats to forage, nest, and raise their young. They often forage in wetlands, nearby grasslands and croplands and breed within or on the edges of wetlands. Cultivated lands play an important role in the foraging strategy of the species – one study found that 56% of records of Grey Crowned Crane were in cultivated lands. *Probability of occurrence:* **Unlikely** (<50% probability of occuring on the site) – suitable breeding habitats were likely absent, the species are therefore unlikely to breed on the study area, but could utilise some of the grassland areas as **occasional foraging visitors**.
Yelllow-billed Stork (*Mycteria ibis)* 2015 Regional status: **VU** 2000 Regional status: **NT** 2017 Global status: **LC** DFFE Screening Report: **No**	Yellow-billed storks forage in a diversity of permanent and seasonal wetland habitats, with open shallow water that is free of vegetation. Food includes frogs, small fish, and other small aquatic prey. The species is usually gregarious and is often found with other waterbirds. *Probability of occurrence:* **Low** (<25% probability of occuring on the site) - suitable foraging and nesting habitats were absent, which suggests that there is a low probability the species will occur on the study area.
Southern Bald Ibis (*Geronticus calvus)* 2015 Regional status: **VU** 2000 Regional status: **VU** 2017 Global status: **VU** DFFE Screening Report: **Yes**	Southern bald ibis's mostly occur in high altitude grasslands. However, they are known to use artificial grasslands (e.g., golf courses, old maize fields, croplands) and open spaces in towns at a range of altitudes when foraging. For breeding, they require cliffs with suitable ledges, mostly above water. *Probability of occurrence:* **Unlikely** (<50% probability of occuring on the site) - suitable nesting and breeding habitats were absent, the species is therefore highly unlikely to be resident on the study area, but could utilise some of the grassland areas as **occasional foraging visitors**.
African Marsh Harrier (*Circus ranivorous)* 2015 Regional status: **EN** 2000 Regional status: **VU** 2015 Global status: **LC** DFFE Screening Report: **Yes**	This species is dependent on permanent wetlands for breeding, feeding and roosting. Nests are usually placed in reed beds over water. The species dependence on wetlands ensures that their distributional ranges are naturally patchy; however, with widespread wetland degradation, coupled with increased grazing pressure and unsuitable fire regimes, range has become severely fragmented. *Probability of occurrence:* **Unlikely** (<50% probability of occuring on the site) – suitable breeding habitats were likely absent, the species are therefore unlikely to breed on the study area, but could utilise some of the wetland/grassland areas as **occasional foraging visitors**.

Species name	Ecology and on-site conclusion
Secretarybird (*Sagittarius serpentarius)* 2015 Regional status: **VU** 2000 Regional status: **NT** 2015 Global status: **VU** DFFE Screening Report: **Yes**	The species prefer open grassland and shrub, with the ground cover shorter than 50cm and with sufficient scattered trees as roost/nest sites. It is widespread across South Africa but are threatened by habitat loss driven by agriculture and urban development. *Probability of occurrence:* **Unlikely** (<50% probability of occuring on the site) – suitable breeding habitats were likely absent, the species are therefore unlikely to breed on the study area, but could utilise some of the grassland areas as **occasional foraging visitors**.
White-bellied Bustard (*Eupodtis senegalensis)* 2015 Regional status: **VU** 2000 Regional status: **VU** 2015 Global status: **LC** DFFE Screening Report: **Yes**	The species requires relatively long grass (30 – 60 cm) and generally avoids overgrazed and recently burned areas. On farms they may make use of cultivated pastures as artificial grassland habitat. *Probability of occurrence:* **Unlikely** (<50% probability of occuring on the site) - The small fragments of remnant vegetation interspersed across the study area may represent suitable habitat for the species. However, despite the presence of potentially suitable habitat, it is **unlikely** that the species occur here given the overall transformed state of the study area and the lack of tall dense grasslands, which the species prefer.

Photo Plate 12: The natural grasslands habitat within the study area. These areas have been classified as being of high ecological sensitivity from a faunal perspective

10.6.4 Herpetofauna – Reptiles

10.6.4.1Community composition

Fifteen reptile species have been recorded for QDGS 2529DA (*Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland (2014) Edited by M.F. Bates, W.R. Branch, A.M. Bauer, M. Burger, J. Marais, G.J. Alexander & M.S. de Villiers. SANBI,*

***Pretoria*). These included six snakes (Family: Lamprophiidae and Colubridae), three lizards (Family: Cordylidae and Gerrhosauridae), two geckos (Family: Gekkonidae), two skink (Family: Scincidae) one agama (Southern rock agama (Agama atra) Family: Agamidae) and one seps species (Breyer's long-tailed seps (Tetradactylus breyeri) Family: Gerrhosauridae).**

During the survey, three reptile species were recorded. These were the spotted grass snake (Psammophylax rhombeatus), common variable skink (Trachylepis varia) and the yellow-throated plated lizard (Gerrhosaurus flavigularis). Spotted grass snake was recorded in the agricultural fields, while the common variable skink and yellow-throated lizard were recorded in the rocky patches with termitaria.

10.6.4.2 Reptile Species of Conservation Concern

Breyer's long-tailed seps (Tetradactylus breyeri) was the only reptile of SCC that has previously been recorded for the 2529 DA QDGS based on information from the MTPA. The table below provides a short discussion on the ecology and probability of occurrence for the species on the study area.

Table 34: Probability of Occurrence of threatened reptile species

Species name	Ecology and on-site conclusion
Breyer's long-tailed seps (*Tetradactylus breyeri*) 2015 Regional status: **EN** 2017 Global status: **LC**	The species is endemic to South Africa and are found in montane and Highveld grasslands of the Grassland Biome at altitudes of 1400-2000 m. They may take shelter on soil under stones or in moribund termitaria. *Probability of occurrence* **Unlikely** (>25% probability of occuring on the site) A small area (< 1ha) of suitable habitat was present on the study area. The area was intersperded with abandoned terminte mounts and rocks and was located adjacent the seasonal watercourses illustrated on the faunal habitat and habitat sensitivity maps.

Photo Plate 13: Abandoned termite mounds and scattered rocks that might provide suitable habitats for Breyer's long tailed seps

10.6.5 Herpetofauna – Amphibians

10.6.5.1 Community composition

Eight amphibian species have been recorded for QDGS 2529DA. These included three toads (Family: *Bufonidae*) and five frogs (Family*: Hyperoliidae and Pyxicephalidae*). The seasonal springs and associated watercourses represented suitable habitat for a number of amphibian species such as the common caco (*Cacosternum boettgeri*), Natal sand frog (*Tomopterna natalensis*) as well as guttural (*Sclerophrys gutturalis*) and red toads (*Schismaderma carens*). These species are widely distrubted across South Africa and occur in a variety of vegetation types (e.g., Savanna, Fynbos, Thicket and Grasslands). Within these biomes they favour open areas with short grassy vegetation and breed in almost any small, temporary water body, such as pools in inundated grasslands, seasonal streams, culverts and other rain-filled depressions (*Minter, L.R., Burger, M., Harrison, J.A., Braack, H.H., Bishop, P.J. & Kloepfer, D. (eds.) (2004) Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland. SI/MAB Series #9. Smitsonian Institution, Washington, DC*).

10.6.5.2 Amphibian species of conservation concern

No amphibian SCC has been recorded for the area, however, the data from the MTPA indicated that the Near-Threatened Giant Bullfrog (*Pyxicephalus adspersus*) has been recorded in the adjacent QDGSs 2529DA and 2529DC. This species is protected under the MNCA (Act No. 10 of 1998), Protected Schedule 2. The preferred habitat of this species is varied, but importantly it breeds in seasonal, shallow and grassy pans in flat open areas, and also utilises non-permanent vleis and shallow water on the margins of waterholes and dams. It is therefore likely that it could also occur in the grasslands associated with the watercourses in the study area.

10.6.6 Faunal habitat sensitivity

The sensitivity classification for the site in terms of faunal ecology is as follows:

- High: CBA areas as described and delineated in the MBSP, 2014. Faunal SCC such as African grass owls (Tyto capensis) may occur here, while other Red List and NT species may utilise these habitats for occasional foraging. The area also forms part of a larger CBA that stretches further southward from the study area.
- Intermediate: Natural grassland areas, some of which are classified as ONAs in the MBSP, 2014. These areas may be utilised as occasional foraging areas by threatened and NT faunal species.
- Low: Areas with degraded and/or secondary vegetation as well as areas where no natural vegetation occurs. This included agricultural fields, roads, and active and/or abandoned mine sites. Areas with degraded and/or secondary vegetation include dense Acacia mearnsii stands as well as natural vegetation that has been degraded due to heavy utilisation impacts and/or dense alien invasion (e.g., habitats along roads and the railway and old agricultural fields).

10.7 Surface Water

A watershed is formed along the northern boundary of Portion 5 of the farm Driefontein 398JS. Runoff from the study area flows overland in a southern direction. Two fountains originate on the southern boundary of the study area on Portion 6 of the farm Driefontein 398JS, with a third fountain originating along the southern boundary of the study area on Portion 6 of the farm Sterkstroom 400JS. The streams and associated wetlands formed by these fountains flow in a south-western direction and forms one larger stream that can be described as a tributary of the Klein Olifants River. This tributary discharges into the Klein Olifants River approximately 13km downstream of the study area.

10.7.1 Quaternary Catchments and Water Management Area

The application area is situated on the north-eastern boundary of quaternary catchment B12D in the Olifants water management area, with a small portion of the northern proposed opencast area located in quaternary catchment B12E, draining in a northern direction. The major rivers that are located within this WMA include the Elands-, Wilge-, Steelpoort-, Olifants and Letaba Rivers. Table 35 below presents the B12D quaternary catchment details.

Table 35: Quaternary catchment B12D details

Quaternary Catchment	BASIC INFORMATION							NATURALISED FLOW MARs		
								1920 - 1989	1920 - 2004	1920 - 2009
	Catchment area		S-pan evaporation			Rainfall		MAR (WR90)	MAR (WR2005)	MAR (WR2012)
	Gross	Net	evap	MAE WR2005	MAE WR90	Zone	MAP	Net	Net	Net
	(km^2)	(km^2)	zone	(mm)	(mm)	(Rainfall file in brackets)	(mm)	(mcm)	(mcm)	(mcm)
B12D	362	333.3	4A	1599	1600	B1C (ZB1CC)	703	13.80	19.88	21.70

10.7.2 Evaporation and Mean Annual Runoff

In the B12D and B12E quaternary catchments, the precipitation rate is lower than the evaporation rate with a Mean Annual Precipitation (MAP) to Potential Evapotranspiration (PET) of 0.33 (B12D) and 0.32 (B12E). Consequently, watercourses in this area are sensitive to changes in regional hydrology, particularly where their catchment becomes transformed and the water available to sustain them becomes redirected.

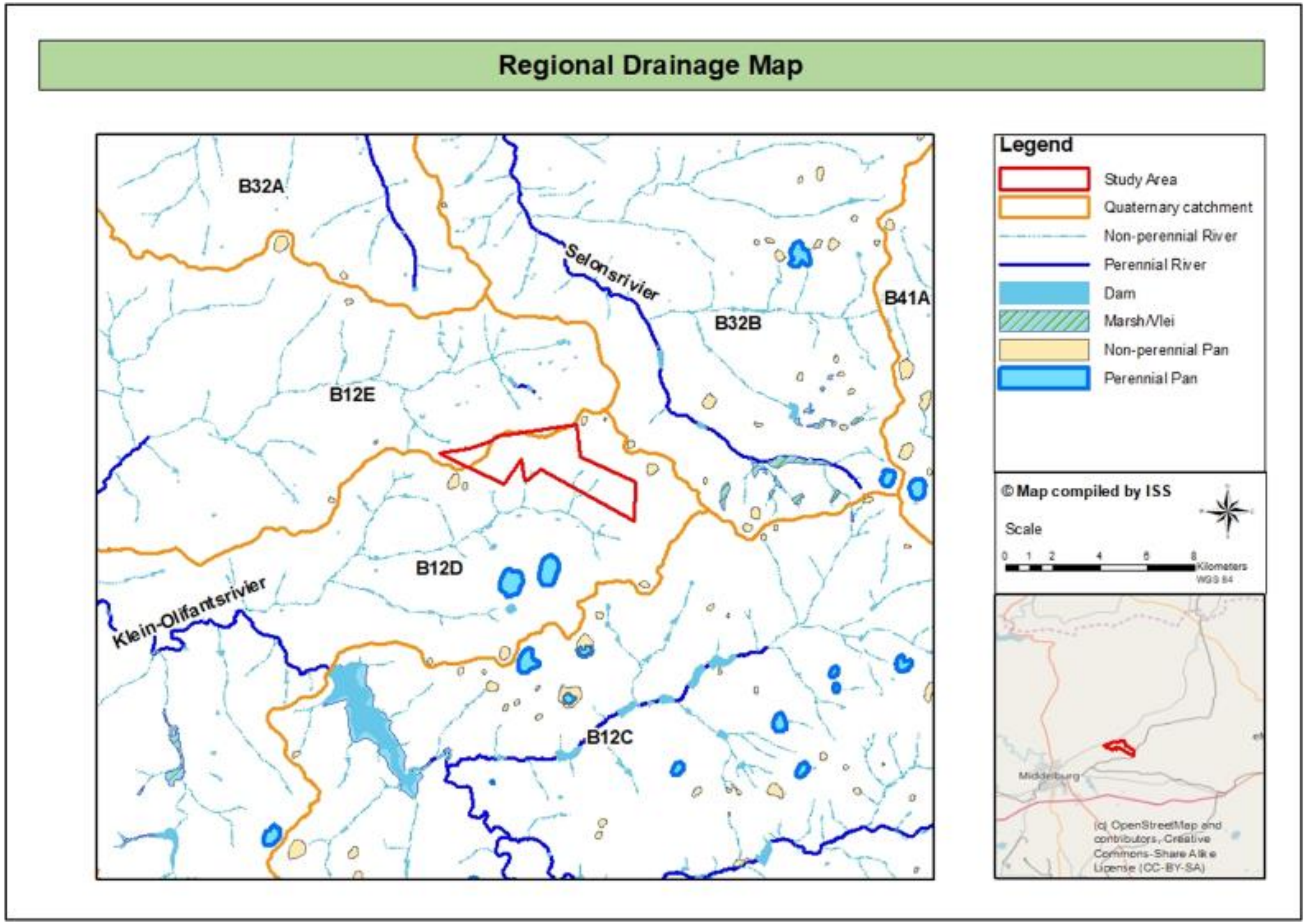


Figure 25: Regional drainage for the study area

10.7.3 Ecoregions and ecological importance

Ecoregions are regions that share similar ecological characteristics and according to Ferrar and Lötter (2007) this characterisation is "based on the understanding that ecosystems and their biota display regional patterns that mirror causal factors such as climate, soils, geology, physical land surface and vegetation." The study area transverses the Highveld (11) Ecoregion (according to the delineation provided by Kleynhans *et al.* 2005). The Highveld Ecoregion is an area of flat grasslands with undulating rocky areas and rich coal deposits covered by deep, red to yellow, sandy soils (Ballance *et al*. 2001). Water resources that overlie these deposits are threatened by numerous anthropogenic activities, including excavations associated with opencast coal mining, agriculture, and urbanisation.

According to the RHP, the in-stream and riparian habitats in the Highveld Ecoregion are in a fair to unacceptable state, and the biological communities also reflect fair to unacceptable health. Mining (mainly coal mining) and other industrial activities in the area have resulted in severe disturbance and are the main contributors to these in-stream and riparian habitat conditions. The general condition in *Ecoregion Highveld 11_2* is characterised as "*Poor*". These rivers have a low pH and high concentrations of dissolved salts. In some places, the riverbeds eroded down to the bedrock, leaving little suitable habitat for fish and aquatic invertebrates (Ballance *et al*. 2001).

10.7.4 Strategic Water Resource Areas

Strategic Water Source Areas (SWSAs) surface and ground water areas have been identified for South Africa. Strategic water areas are defined as follows: "Surface water SWSAs (SWSA-surface water): *Areas of land that supply a disproportionate (i.e., relatively large) quantity of mean annual surface water runoff in relation to their size*.

Groundwater SWSAs (SWSA-groundwater): *Are areas which combine areas with high groundwater availability as well as where this groundwater forms a nationally important resource*". (Le Maitre, 2018).

The majority of the study area is located within the Northern Highveld groundwater Strategic Water Source Area (SWSA) (Water Research Commission (WRC), 2018) (Figure 26).

Photo

Plate 14: Streams and associated with wetlands formed by fountains originating along the southern boundary of the study area

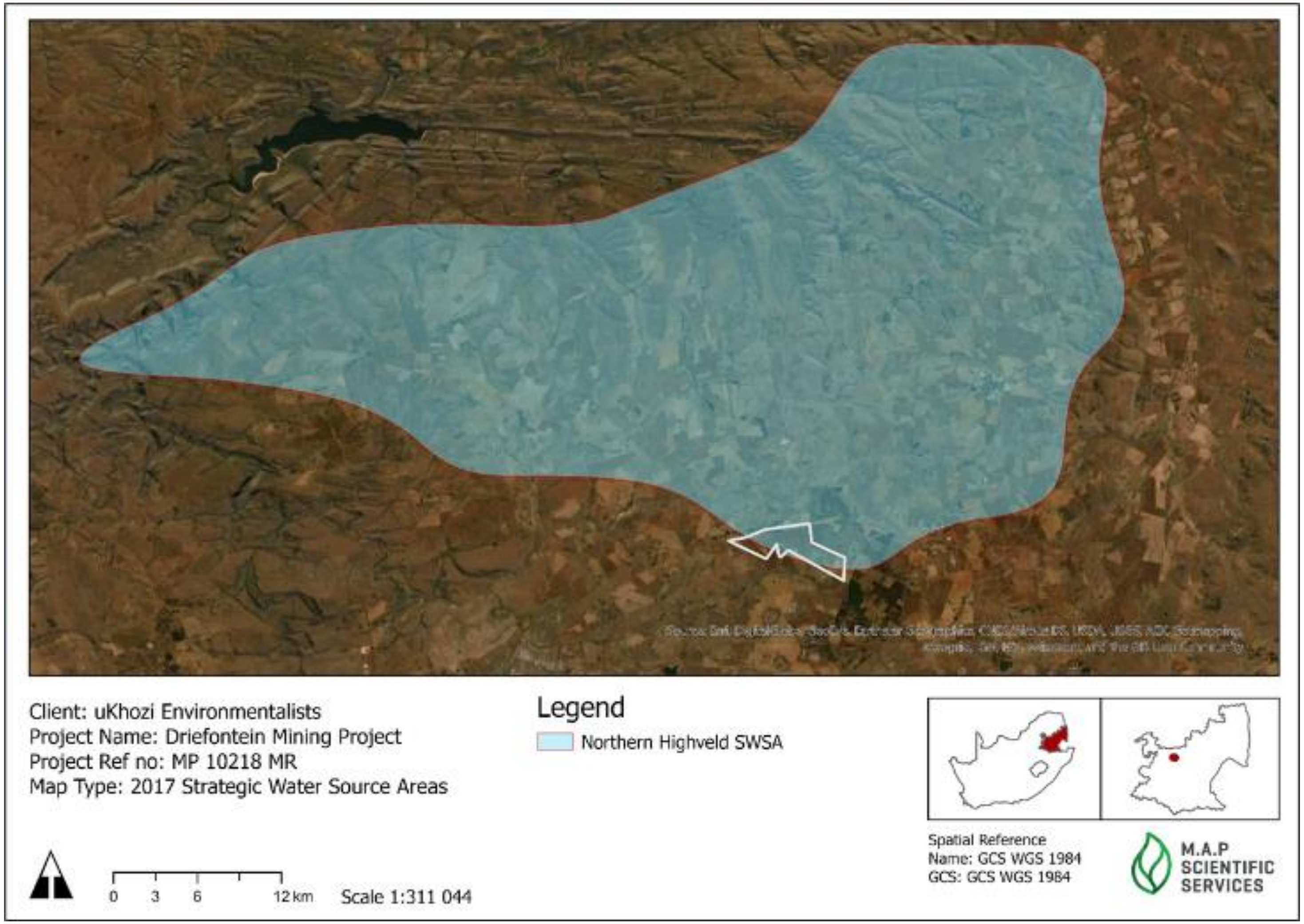


Figure 26: Strategic Water Source Areas (SWSA) associated with the study area (2017)

10.7.5 National Freshwater Ecosystem Priority Areas

The National Freshwater Ecosystem Priority Areas ("NFEPA") project is a multi-partner project between the CSIR, the Water Research Commission, the South African National Biodiversity Institute, the Department of Environmental Affairs, the South African Institute of Aquatic Biodiversity and South African National Parks. The project responds to the reported degradation of freshwater ecosystem condition and associated biodiversity, both globally and in South Africa.

River Condition ("RIVCON") is a classification used by the NFEPA programme. Rivers are divided into the following categories:

- *RIVCON A* = Unmodified and natural
- *RIVCON* B = Largely natural with few modification
- *RIVCON* AB = A or B above
- *RIVCON* C = Moderately modified
- *RIVCON* D = Largely modified
- *RIVCON* E = Seriously modified
- *RIVCON* F = Critically or extremely modified
- *RIVCON* EF = E or E above
- *RIVCON* Z = Tributary condition modeled as not intact, according to natural land cover

RIVCON A and *B* are considered intact rivers that can contribute towards river ecosystem targets. All the unnamed non-perennial tributaries associated with the study area flow eventually into the Klein Olifants River. According to NFEPA data, the Klein Olifants River is classified as RIVCON D indicating that the river system is largely modified and then further down the reach the Klein Olifants River is classified as RIVCON C indicating that the river system is moderately modified (Figure 27).

Within the B12D quaternary catchment the Present Ecological State (PES), Ecological Importance (EI) and Ecological Sensitivity (ES) per Sub Quaternary Reaches (SQR) for Secondary Catchments in South Africa were determined for the Klein Olifants River. SQR B12D-1095 is located upstream of the confluence between the non-perennial tributaries flowing from the study area and the Klein Olifants River. SQR B12D-1118 is located downstream of the confluence between the non-perennial tributaries flowing from the study area and the Klein Olifants River. The Klein Olifants River is found to have a PES of D, EI of Moderate and ES of High according to PES SQR B12D-1095. Further down the reach at SQR B12D-1118 the Klein Olifants River has a PES of D, EI of High and ES of High (Figure 28) (Department of Water and Sanitation, 2014).

10.7.6 National Biodiversity Assessment 2018

Critically Endangered, Endangered and Vulnerable ecosystems are collectively referred to as threatened ecosystems and may be listed as such in terms of the Biodiversity Act. In terms of rivers the Keeromspruit has a Present Ecological State (PES) of C-F indicating they are moderately to critically modified. The Keeromspruit has Ecosystem Threat Status (ETS) is Critically Endangered, and the Ecosystem Protection Level (EPL) is Not Protected. The PES of the Selons River ranges from C-F indicating a moderately to critically modified

system, whilst the EPL is Poorly Protected and the ETS is Endangered. The Klein-Olifiants River has a PES of D-F therefore it ranges from largely to critically modified and the EPL is Poorly Protected ant ETS is Critically Endangered. The PES ranges are displayed in Figure 29.

10.7.7 EIA screening tool

The aquatic biodiversity theme sensitivity of the application area indicates very high sensitivity areas are interspersed in a matrix classified as Low sensitivity (Figure 30).

10.7.8 Provincial biodiversity planning initiatives: MBSP

In 2014, the Mpumalanga Parks and Tourism Agency developed the Mpumalanga Biodiversity Sector Plan ("MBSP"). In essence the MBSP is a map guiding areas of conservation concern for the Mpumalanga Province. Two maps have been developed, namely one for terrestrial biodiversity, and the other for freshwater biodiversity. The MBSP maps the freshwater ecosystems of Mpumalanga into the following categories:

- **Critical Biodiversity Areas ("CBAs") – areas of high biodiversity value, needed to meet biodiversity targets which should be maintained in natural or near natural state.**
- **Ecological Support Areas – these areas support CBAs but are not essential for meeting conservation targets.**
- **Other Natural Areas – these areas have natural characteristics but have not been earmarked as priority areas for conservation but perform a range of biological as well as ecological functions.**
- **Heavily Modified Areas – Areas which have been impacted and have had a significant or complete loss of natural habitat and ecological function.**

According to the MBSP, the study area comprises three categories of the MBSP namely Other Natural Areas, Ecological Support Area's for non-FEPA wetlands, and Heavily Modified areas. Refer to Figure 31, *Lötter et al., 2014*.

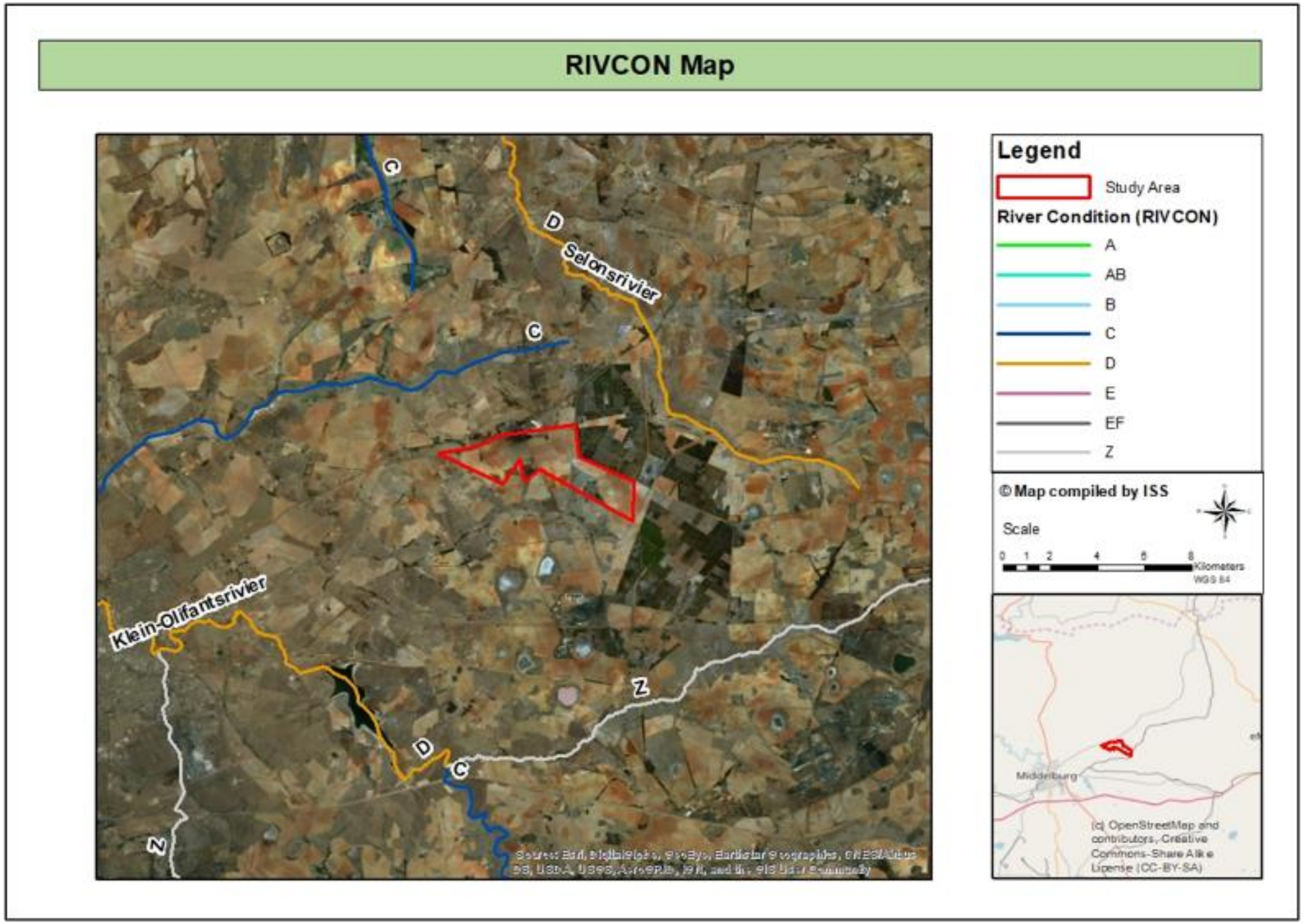


Figure 27: RIVCON (PES 1999) Map for the study area

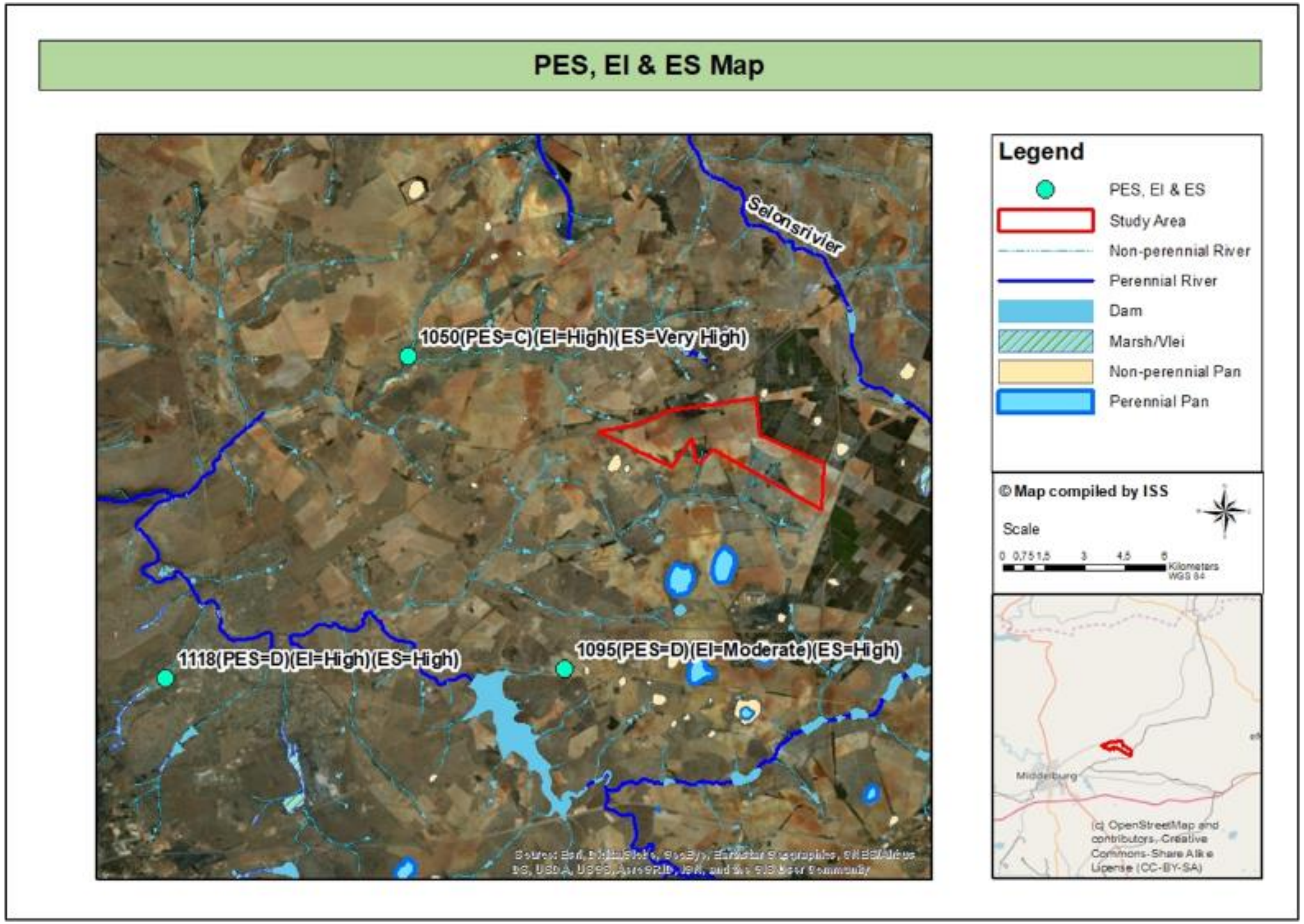


Figure 28: 2014 PES, EI and ES Map for the study area

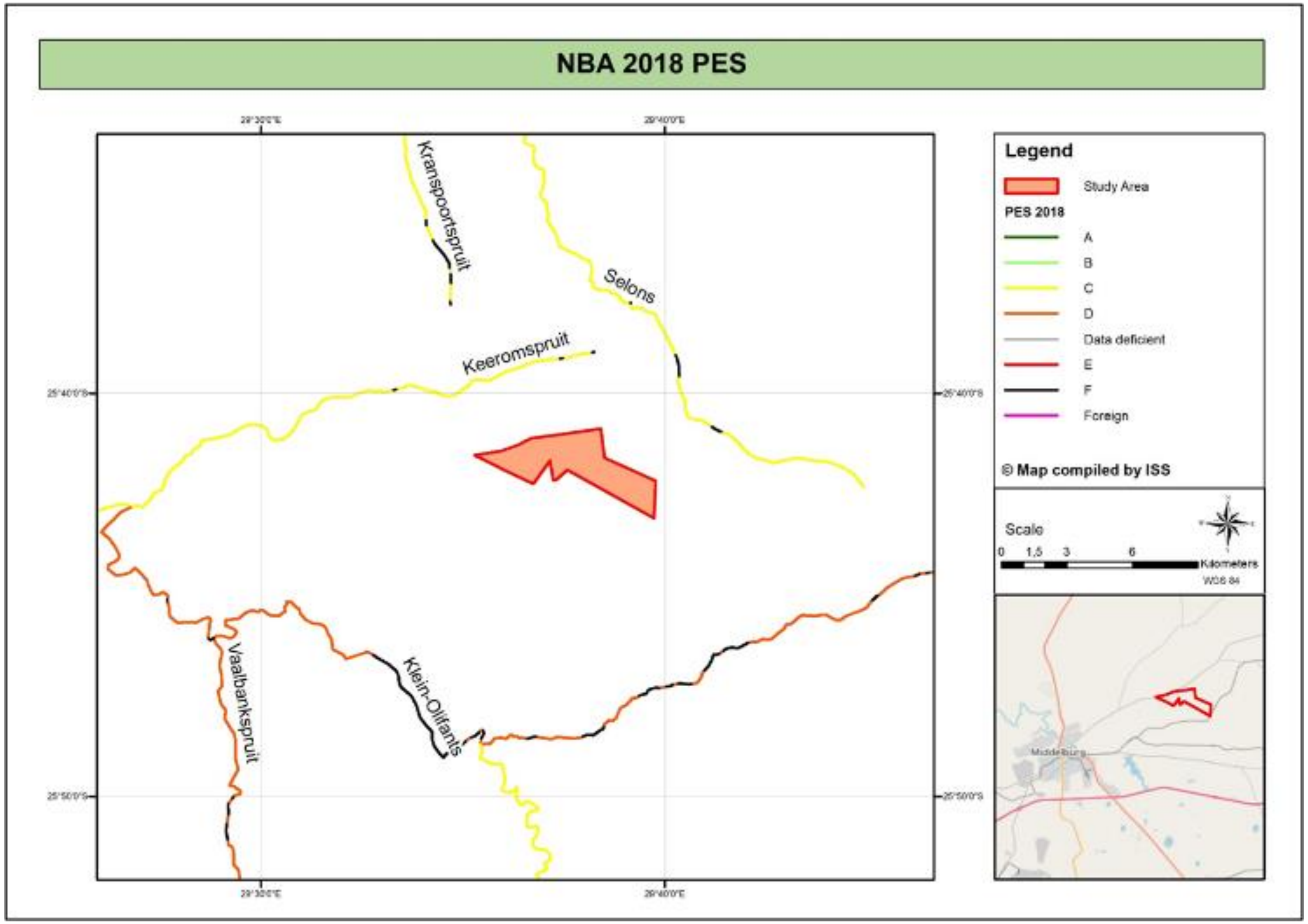


Figure 29: PES for the rivers in the region based on the National Biodiversity Assessment 2018

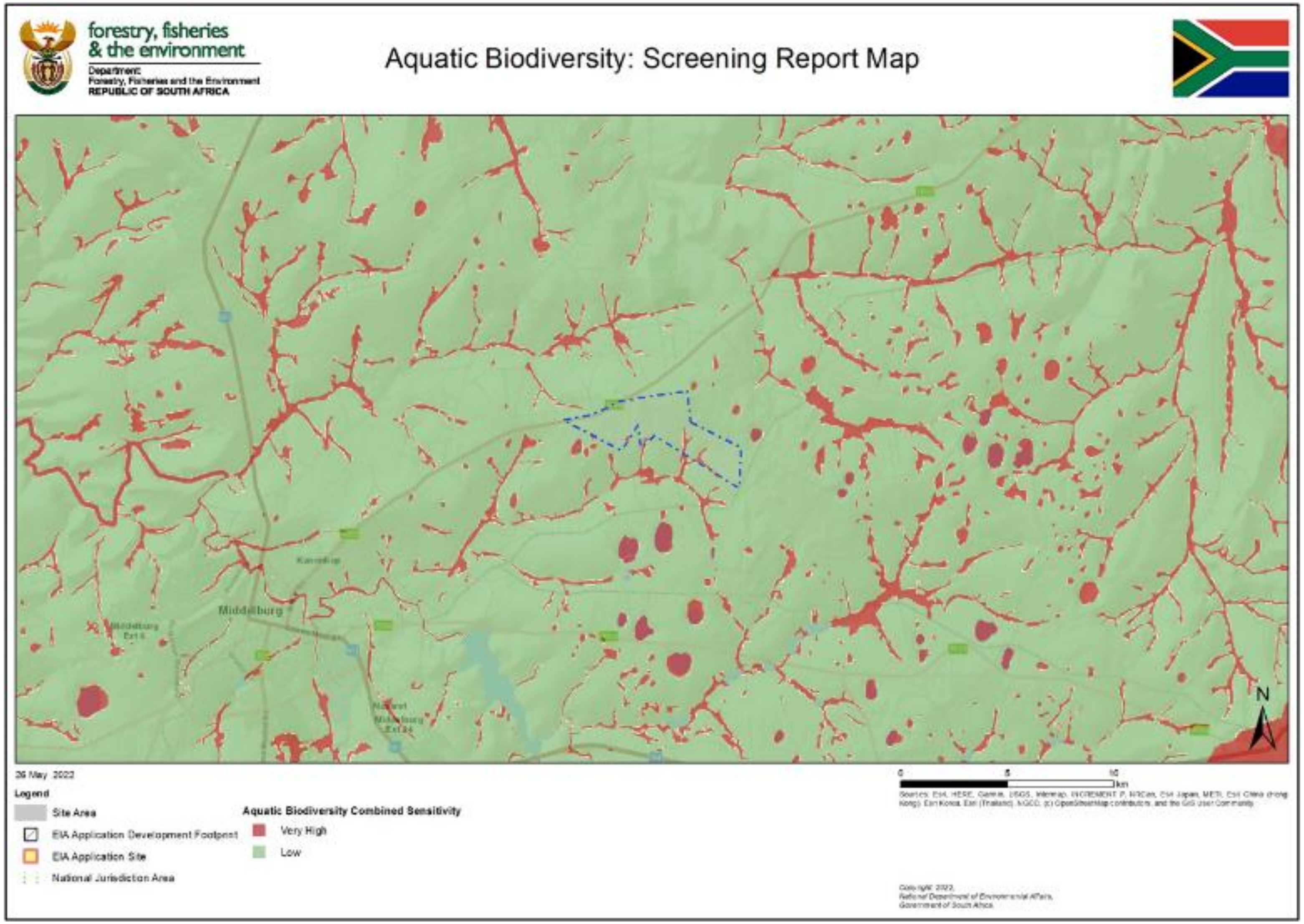


Figure 30: Aquatic biodiversity theme sensitivity

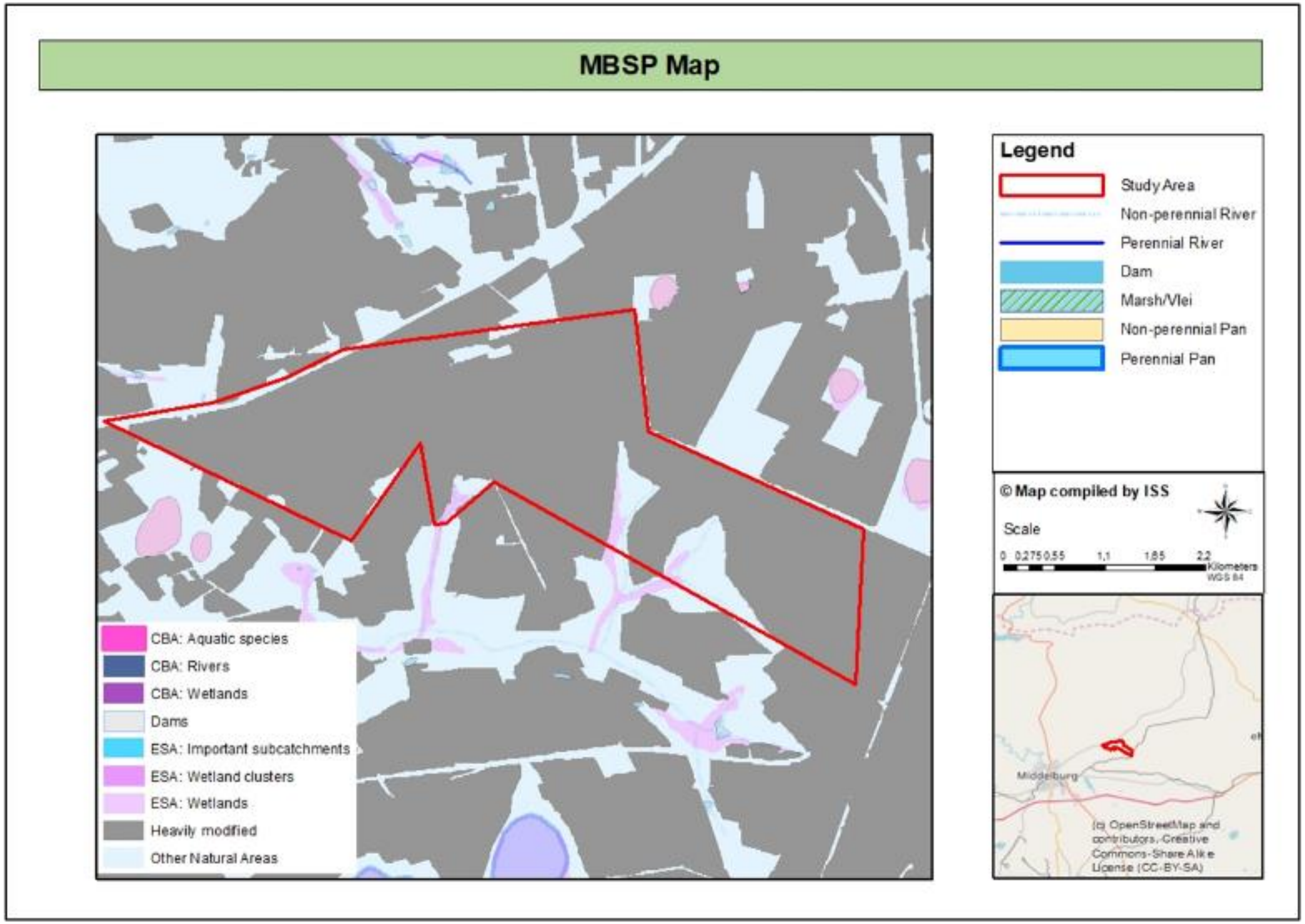


Figure 31: Mpumalanga Biodiversity Sector Plan Map for the study area (from the MBSP)

10.7.9 Baseline aquatic conditions

10.7.9.1 Selection of sampling points

With regard to the selection of sampling points for the baseline aquatic assessment, it is important to note that biomonitoring surveys can only be conducted in flowing water (streams and rivers), and not in wetlands, as the results will be inaccurate due to the fact that most biomonitoring assessment methods (including SASS5) were designed to assess river health, and are not applicable to wetland communities or habitats (Dickens and Graham 2002; Kleynhans 2007; Kleynhans et al. 2007).

Two sets of data are required in order to interpret the results of biomonitoring surveys, namely data from a “reference condition site”, where habitat conditions are expected to be relatively undisturbed, and data from an “affected condition site” (or “affected site”), where the influences resulting from a land-use is expected to have created stressors in the habitats of the aquatic biota. As the study area is situated in headwaters of the unnamed tributaries of the Klein Olifants River the amount of reference sites is limited. The only reference site was DBM4.

A total of six (6) sampling points have been selected for the baseline aquatic assessment. Table 36 over the page indicates the number, GPS coordinates, and a description of each of the sampling points. Due to the nature of the study area, the sites selected are all affected sites. The non-perennial tributaries of the Klein Olifants River all originate in the southern area of the study area.

The locations of these sampling points are illustrated in Figure 32 below.

Table 36: Description of sampling points for the baseline aquatic assessment

SURVEY SITE	LATITUDE	LONGITUDE	SITE DESCRIPTION
DBM1	-25.714383°	29.634858°	DOWNSTREAM OF STUDY AREA/AFFECTED SAMPLING POINT ▪ In an unnamed tributary of the Klein Olifants River, downstream of DBM4 and DBM5. ▪ Assess impacts of study area on the unnamed tributary flowing into the Klein Olifants River.
DBM2	-25.705849°	29.620569°	DOWNSTREAM OF STUDY AREA/AFFECTED SAMPLING POINT ▪ In an unnamed tributary of the Klein Olifants River, upstream of DBM3. ▪ Located just south of the study area, close to the headwaters of the non-perennial tributary. ▪ Assess impacts of study area on the unnamed tributary flowing into the Klein Olifants River.
DBM3	-25.714078°	29.616308°	DOWNSTREAM OF STUDY AREA/AFFECTED SAMPLING POINT ▪ In an unnamed tributary of the Klein Olifants River, downstream of DBM1, DBM2, DBM4, and DBM5. ▪ Measures impacts of study area on the unnamed tributary flowing into the Klein Olifants River.
DBM4	-25.717047°	29.640414°	DOWNSTREAM OF STUDY AREA/REFERENCE SAMPLING POINT ▪ In an unnamed tributary of the Klein Olifants River, upstream of DBM1. ▪ Acts as reference site for DBM5 and DBM1
DBM5	-25.705206°	29.639218°	LOCATED INSIDE THE STUDY AREA/AFFECTED SAMPLING POINT ▪ In an unnamed tributary of the Klein Olifants River, upstream of DBM1. ▪ Located inside the study area, close to the headwaters of the non-perennial tributary. ▪ Assess impacts of study area on the unnamed tributary flowing into the Klein Olifants River.
DBM7	-25.705390°	29.608530°	DOWNSTREAM OF STUDY AREA/AFFECTED SAMPLING POINT ▪ In an unnamed tributary of the Klein Olifants River, located in the headwaters of the non-perennial tributary to the west of the study area. ▪ Measures impacts of study area on the unnamed tributary flowing into the Klein Olifants River.

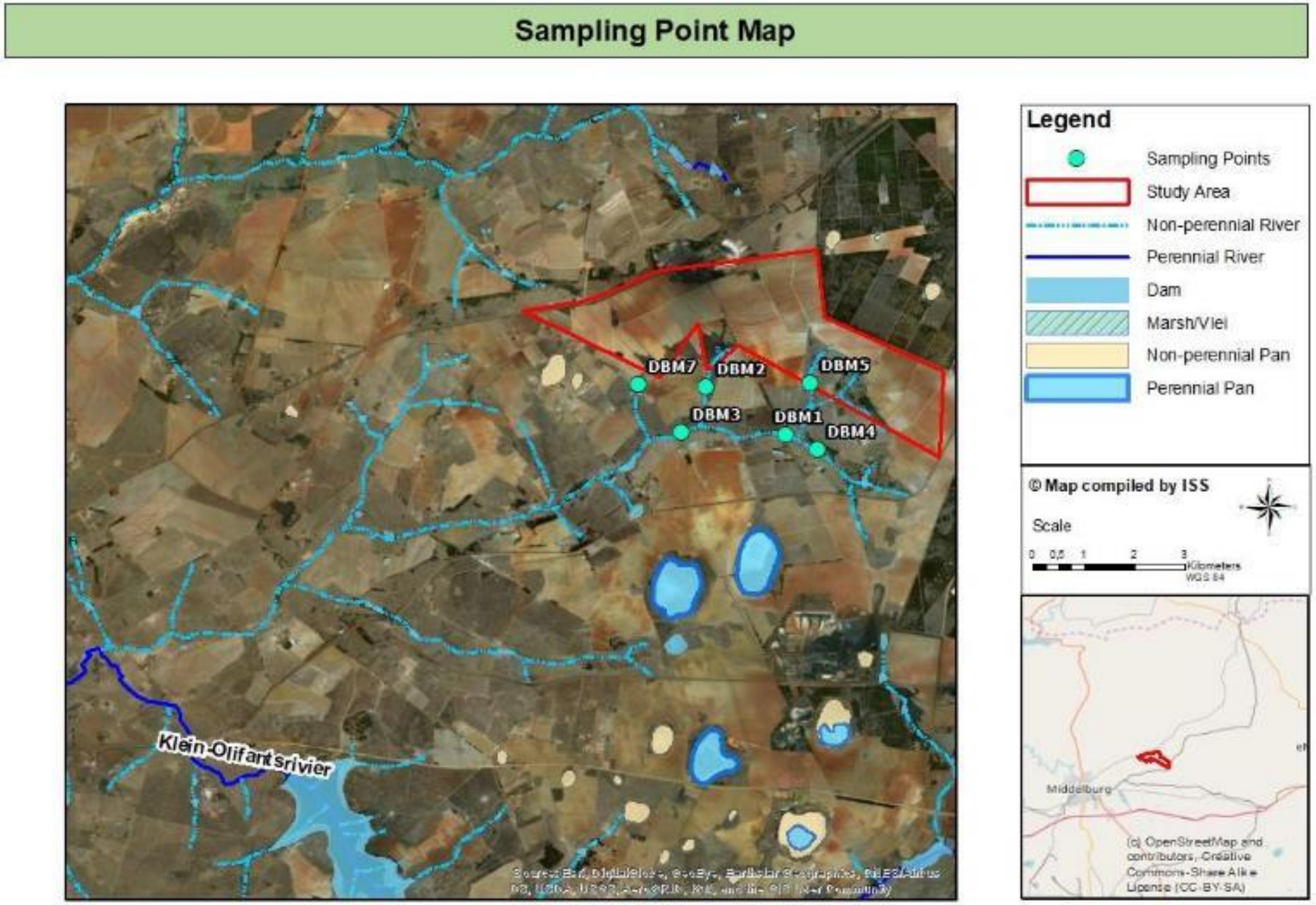


Figure 32: Sampling points for the Baseline Aquatic Assessment for the proposed Driefontein Mining Operation

10.7.9.2 Results of baseline aquatic assessment

The 2019 baseline aquatic assessment was conducted by Lorainmari den Boogert and Andre Strydom, all the sampling points listed in Table 36 were visited on the 1st of February 2019. No site visit was conducted in 2022.

The habitats at all sampling points were firstly evaluated by means of observations with regard to their surroundings, possible causes of stressors or disturbances on aquatic ecosystems, and the suitability of each site for future biomonitoring surveys.

The outcome of this evaluation indicated that biomonitoring sampling methods could not be applied at sampling points DBM4 and DBM7. Sampling point DBM4 had no flow at the time of the survey, and sampling point DBM7 was located in the headwaters of a non-perennial river and had limited water present at the time of the survey.

This implied that DBM1, DBM2, DBM3, and DBM5 could be further assessed by means of the biomonitoring sampling methods (a detailed description of how these methods is executed, and how results obtained from each of these methods are interpreted, is contained in Annexure A of the Baseline Aquatic Assessment attached as Appendix 6.3 to this report).

The results obtained for each of these sampling points during the baseline aquatic survey are summarised under the headings below (refer to Section 3 of the Baseline Aquatic Assessment for more detail).

10.7.9.2.1 DBM 1

DBM1 is located in an unnamed tributary of the Klein Olifants River, downstream of DBM4 and DBM5. Impacts at the sampling point include a cobble stone bridge crossing, an inundation of invasive plant species, grazing and trampling from cattle. Surrounding land use includes agricultural activities.

The in situ chemical parameters measured were within the Target Water Quality Range (TWQRs) for aquatic ecosystems with the exception of Electrical Conductivity (EC) and Dissolved Oxygen (DO). EC levels were at 10.5 mS/m whilst DO was measured to be 62.9% which is above the sub lethal range.

The biotic integrity of the unnamed, non-perennial tributary of the Klein Olifants River at downstream sampling point DBM1, located downstream of DBM4 and DBM5, was moderately modified. The South African Scoring System version 5 (SASS5) ecological category was C although the Integrated Habitat Assessment System (IHAS) score indicated a habitat suitable to support a diverse macro-invertebrate community. The Riparian Vegetation Response Assessment Index (VEGRAI) ecological category was D indicating that the vegetation is largely modified.

Based on the Fish Response Assessment Index (FRAI) results the fish community at site DBM1 was in a seriously modified state (FRAI Category E) at the time of the survey. Only 4 of the 10 expected fish species were recorded at this site, with *E. paludinosus* being the most abundant at the site. DBM1 also had the highest species diversity of all the sites sampled during this survey.

Photo Plate 15: DBM 1

10.7.9.2.2 DBM 2

DBM2 is located in an unnamed tributary of the Klein Olifants River, upstream of DBM3. Impacts at the sampling point include an erosion gully, dirt road and a road crossing, and invasive plant species. Surrounding land use include agricultural activities. There is a colliery directly north of the sampling point to the south of the R555.

The in situ chemical parameters measured were all within the TWQR's for aquatic ecosystems.

The biotic integrity of the unnamed, non-perennial of the Klein Olifants River at downstream sampling point DBM2, located upstream of DBM3, was largely natural with few modifications. The SASS5 EC was B although the IHAS score indicated a habitat that was insufficient to support a diverse macroinvertebrate community. The VEGRAI ecological category was D indicating that the vegetation is largely modified.

Based on the FRAI results the fish community at site DBM2 was in a critically modified state (FRAI Category F) at the time of the survey. DBM2 had the lowest species diversity with only *E. anoplus* sampled at the site. DBM2 was severely impacted by channel and bed modification and bank erosion, all which have a large impact on fish assemblages.

Photo Plate 16: DBM 2

10.7.9.2.3 DBM 3

DBM3 is located in an unnamed tributary of the Klein Olifants River, downstream of DBM1, DBM2, DBM4, and DBM5. Impacts at the sampling point include dirt roads, invasive plant species, grazing and trampling from cattle, and culverts. Surrounding land use include agricultural activities.

The *in situ* chemical parameters measured were within the TWQRs for aquatic ecosystems with the exception of Electrical Conductivity (EC) and Dissolved Oxygen (DO). EC levels were at 7.5 mS/m, whilst DO was measured to be 79.5% which is above the sub lethal range.

The biotic integrity of the unnamed, non-perennial tributary of the Klein Olifants River at downstream sampling point DBM3, located downstream of DBM1, DBM2, DBM4 and DBM5, was largely natural with few modifications. The SASS5 ecological category was B and the IHAS score indicated a habitat suitable to support a diverse macro-invertebrate community, the VEGRAI ecological category was C indicating that the vegetation is moderately modified.

Based on the FRAI results the fish community at site DBM3 was in a seriously modified state (FRAI Category E) at the time of the survey. Only 2 of the 10 expected fish species were recorded at this site. The alien species *M. salmoides* were only sampled at site DBM3. This site was impacted by the presence of a weir which resulted in a deeper water column and marginal vegetation favouring to the presence of this species. Two (2) other species were present at the site, *E. anoplus* and *E. paludinosus* of which the latter was the most abundant species sampled at DBM3. *Micropterus salmoides* is listed as an "invasive species regulated by area" in the Draft Alien and Invasive Species Regulations, 2009 (DWAF, 2009). The management of invasive fish and conservation of biodiversity is a high priority in the National Environmental Management Act (1998) and the Environmental Management: National Biodiversity Act (2004).

Photo Plate 17: DBM 3

10.7.9.2.4 DBM 5

DBM5 is located within the study area in an unnamed tributary of the Klein Olifants River, upstream of DBM1. Impacts at the sampling point include dirt roads, invasive plant species, agricultural activities, and erosion. Surrounding land use includes agricultural activities, dirt roads, and a shooting range.

The *in situ* chemical parameters measured were within the TWQRs for aquatic ecosystems with the exception of Dissolved Oxygen (DO). DO was measured to be 69.8% which is above the sub lethal range.

The biotic integrity of the unnamed, non-perennial tributary of the Klein Olifants River at downstream sampling point DBM5, located in the study area upstream of DBM1, was largely natural with few modifications. The SASS5 ecological category was B although the IHAS score indicated a habitat that was insufficient to support a diverse macro-invertebrate community. The VEGRAI ecological category was C indicating that the vegetation is moderately modified.

Based on the FRAI results the fish community at site DBM5 was in a seriously to critically modified state (FRAI Category E/F) at the time of the survey. Only 3 of the 10 expected fish species were recorded at this site during the February 2019 survey. Only three (3) indigenous species were sampled at site DBM5 which consisted of *E. anoplus, T. sparrmanii* and *P. philander*.

Photo Plate 18: DBM 5

10.7.9.3 SASS5 ecological category

For the purposes of the baseline aquatic survey at the proposed Driefontein Mine, it was possible to determine the SASS5 Ecological Category *(EC)* at DBM1, DBM2, DBM3, and DBM5. The SASS5 Score and ASPT for the 2019 baseline aquatic survey at the proposed Driefontein Mine in comparison to the biological bands for the Highveld Ecoregion (Lower zone) (Dallas 2007) are shown in Figure 33 below.

At downstream sampling point DBM1, located upstream of DBM3, the SASS5 EC was determined to be C. This indicates that the non-perennial tributary of the Klein Olifants River, at this sampling point, was moderately modified. At downstream sampling points DBM2, DBM3, and DBM5 the SASS5 EC was determined to be B, indicating that the non-perennial tributary of the Klein Olifants River, at these sampling points, is largely natural with few modifications.

Figure 33: SASS5 Score and ASPT Plot for sampling points at Driefontein Mine in comparison to the biological bands for the Highveld Ecoregion (Lower zone) (*Dallas 2007*)

10.7.10 Water use

Surface water is used primarily for irrigation and livestock watering purposes. Various irrigation dams are found around the study area.

10.7.11 Water Authority

The Department of Water and Sanitation (DWS) with the regional office based in Bronkhorstspruit is the responsible authority for this area.

10.8 Wetlands

Wetlands are defined in the National Water Act 36 of 1998 ("NWA") as "land which is transitional between terrestrial and aquatic systems, where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which in normal circumstances supports or would support vegetation typically adapted to life in saturated soils." In addition to water at or near the surface, other distinguishing indicators of wetlands include hydromorphic soils and vegetation adapted to or tolerant of saturated soils (DWA, 2005).

Riparian habitat often times performs important ecological and hydrological functions, some similar to those performed by wetlands (DWA, 2005). Riparian habitat is also the accepted indicator used to delineate the extent of a river's footprint (DWAF, 2005). It is defined by the NWA as follows: "Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse, which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas".

In 2019, Limosella Consulting was to undertake a wetland and/or riparian delineation and functional assessment. An update of the 2019 assessment was required and a subsequent site visit was undertaken in May 2022. The current assessment aimed to verify the extent and condition of wetlands presented in the 2019 report and further expands on the initial scope to address all the aspects set out in the Protocols for the Assessment and Reporting of Environmental Themes, GN320, (March 2020). The findings of the initial assessment and subsequent review is presented below.

10.8.1 National Freshwater Ecosystem Priority Areas

Surface water spatial layers such as the National Freshwater Ecosystem Priority Areas (NFEPA) wetland types for South Africa, the Mpumalanga Highveld Wetland database, and National Wetland Map 5 (NBA, 2018) (Figure 34) were consulted for the presence of wetlands, perennial, and non-perennial rivers within or in proximity to the study area. Based on these spatial layers, several wetland areas, mainly associated within the three streams mentioned above occur along the southern boundary of the study area, with the Mpumalanga Highveld Wetlands dataset indicating an additional seep wetland to the west of the channelled valley bottom wetland on Portion 6 of the farm Sterkstroom 400JS.

The study area transverses a non-FEPA and there are no Wetland FEPAs in close proximity to the study area, as indicated in Figure 35.

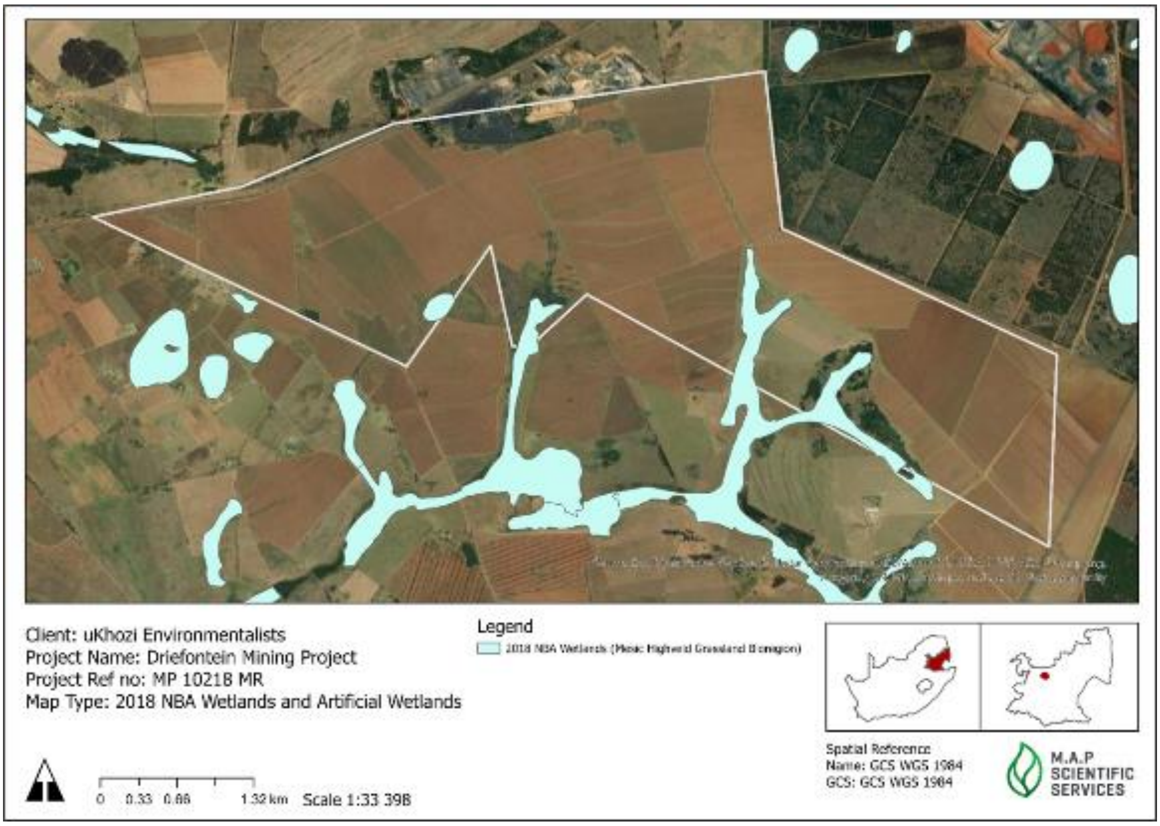


Figure 34: Wetlands as indicated by the National Wetland Map 5

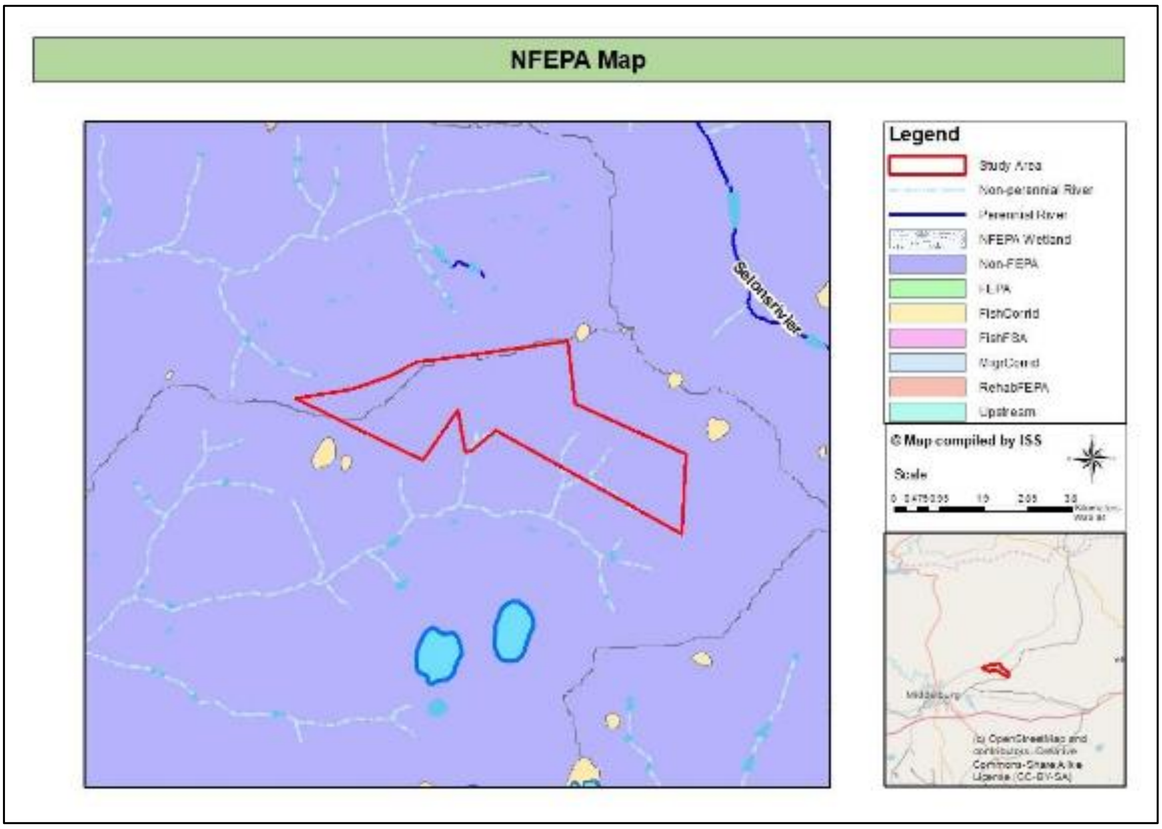


Figure 35: NFEPA Map for the study area

10.8.2 Wetland Classification and Delineation

The study area comprises approximately 1150 hectares and the wetlands occupy 69.57 hectares or 6 % of the study site (excluding recommended buffer zones). Four wetlands classified as follows were recorded on the study site in the 2019:

- Channelled Valley Bottom.
- Unchanneled Valley Bottom 1.
- Unchanneled Valley Bottom 2.
- Seepage

All the wetlands drain into the same unnamed tributary of the Klein-Olifants River.

Two other watercourses were identified within 500 m of the study site. Refer to Figure 36 for the 2019 wetland delineation map.

Since the Unchanneled Valley Bottom Wetland 2 and the historical seepage wetland form a functional unit, these two wetlands were merged in the revised wetland delineation map (May 2022). In the revised wetland delineation map (Figure 37 below), the four wetlands are classified as three functional types:

- Channelled valley bottom wetland (CVB),
- Unchanneled valley bottom wetlands (UVB); and
- Pan

Buffer zones reflected in the 2019 assessment remain unchanged. The recommended calculated buffer zone for all wetlands applicable to the proposed project (Based on the activity class 'Mining – Worst Case Scenario') is indicated on the figures below as follows:

- 40m Construction Phase.
- 67m Operational Phase.

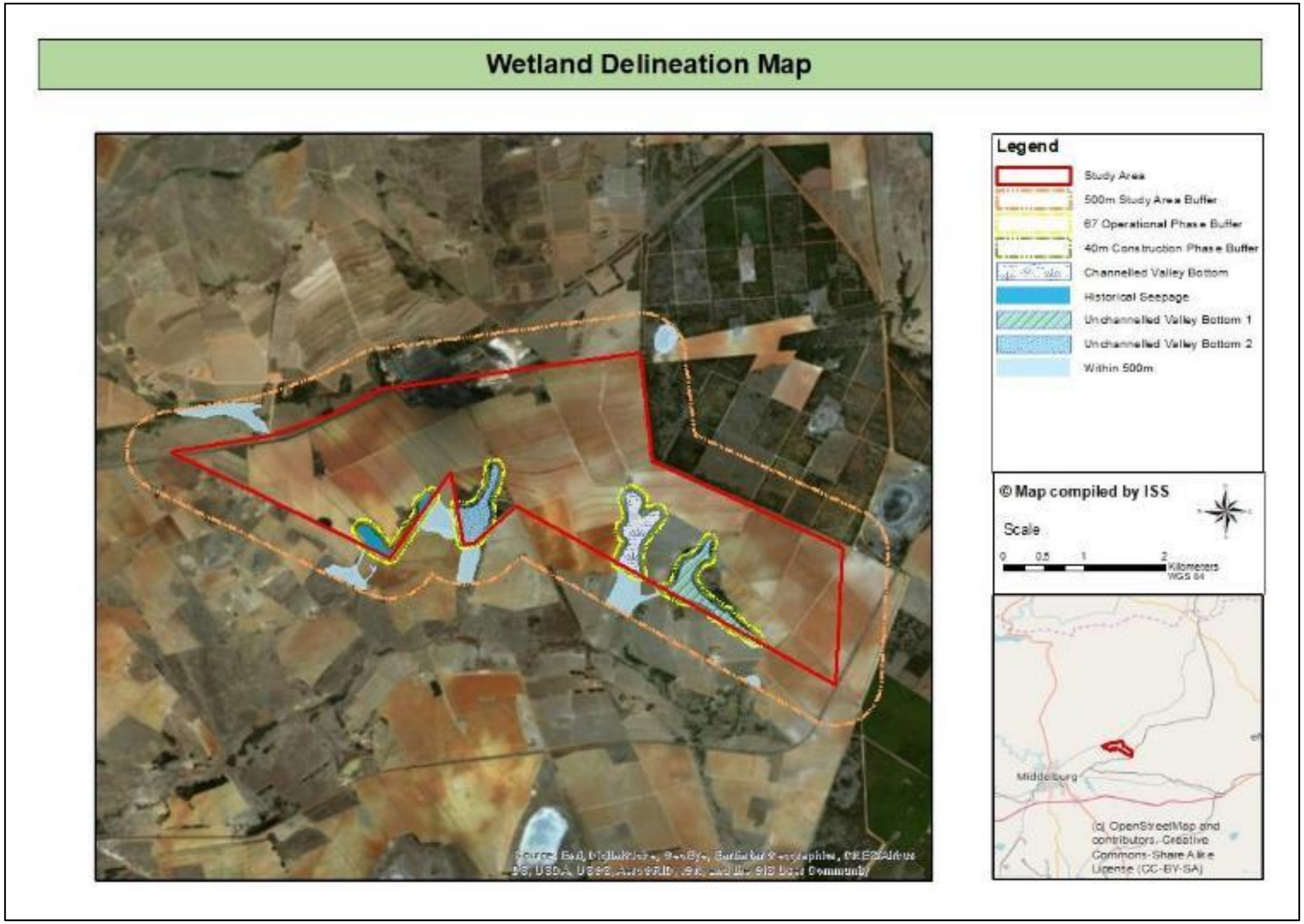


Figure 36: Wetland Delineation Map (2019)

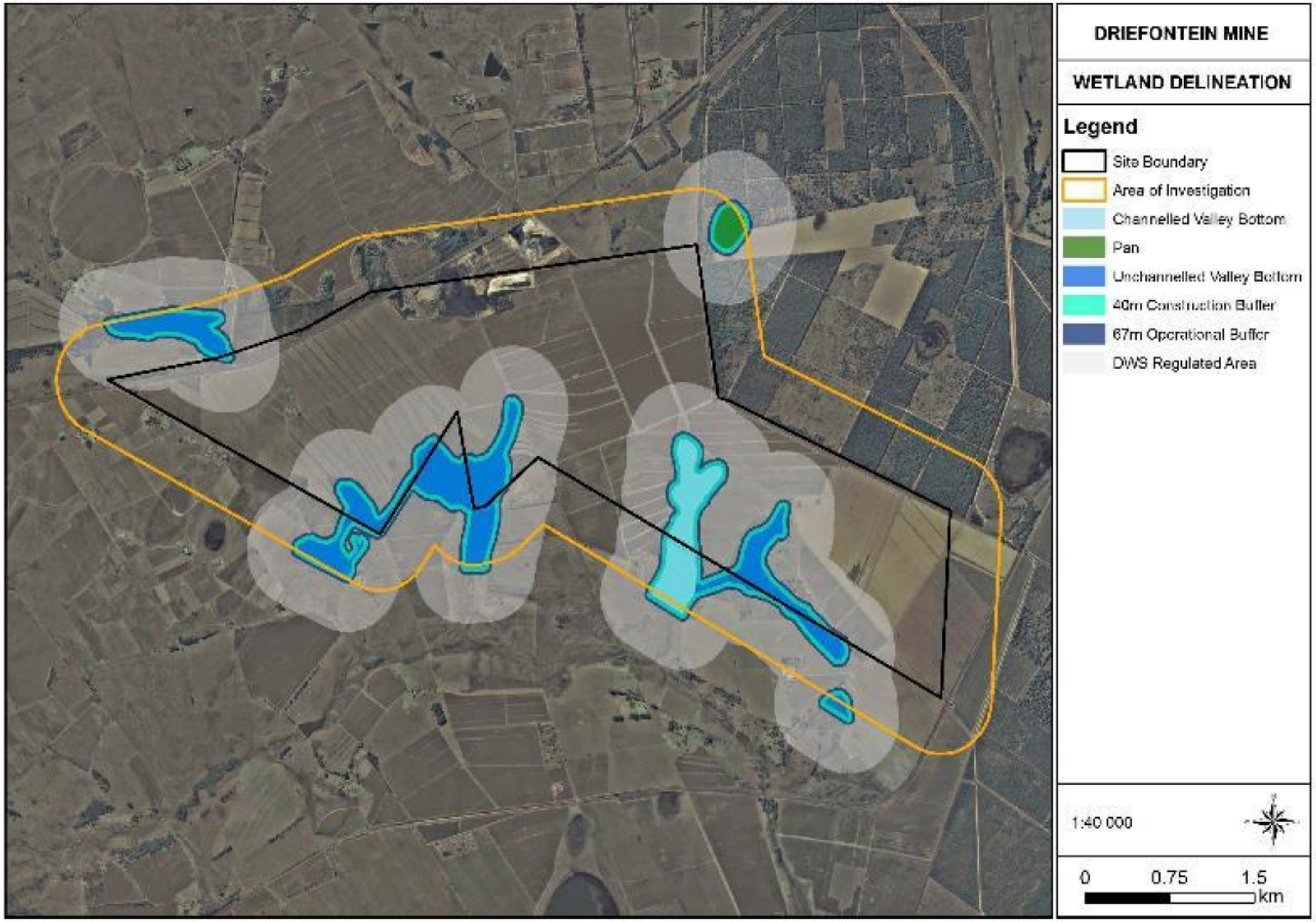


Figure 37: Revised wetland delineation map (May 2022)

10.8.3 Soil features of wetlands

The wetlands were characterised by seasonal and permanent wet zones. In the upper reaches of the soil profile, a sandstone layer was prevalent with water seeping from the rock layer. In the channeled valley bottom wetland saprolite was recorded in several sections of the wetland. The dominant soil form in the wetlands sampled were sandy soil, often with a bleached e horizon. Mottling and root oxidation were often recorded in the top horizons of the soil with the deeper horizons dominated by grey sandy soil with manganese concretions. An organic layer of approximately 5cm was recorded in some wetland areas. The dominant soil features of the wetlands on the study site are visually represented in the figures below (Figure 37). The soil characteristics are summarised in the table below (Table 37).

Table 37: Summary of the wetland soil conditions (Adapted from Job, 2010)

Site Conditions:	
Do normal circumstances exist on the site?	Yes
Is the site significantly disturbed (difficult site)?	No
Indicators of soil wetness within 50 cm of soil surface:	
Sulfidic odour (a slight sulfidic odour was noted in permanent zone)	No
Mineral and Texture	Sandy, unstructured
Gley	Yes
Mottles or concretions	Yes
Organic streaking or oxidised rhizopheres	Yes
High organic content in surface layer	Yes
Setting (In bold):	
crest (1) scarp (2) midslope (3) footslope (4) **valley bottom (5)**	
Additional indicators of wetland presence:	
Concave	No
Bedrock	Yes, some areas
Dense clay	No
Flat	No
Associated with a river	Yes – Klein Klip River

Figure 38: Soil characteristics of the valley bottom wetlands on the study site including water seeping from the sandy soil profile (top left)

10.8.4 Vegetation features of wetlands

The freshwater wetlands in the surrounding area form part of the Eastern Temperate Freshwater Wetlands (AZf3) vegetation unit according to Mucina and Rutherford (2006). The landscape can be described as flat or shallow depressions filled with (temporary) water bodies supporting zoned systems of aquatic and hygrophilous vegetation of temporarily flooded grasslands and ephemeral herb lands. Some 15% of the Eastern Temperate Freshwater Wetlands have been transformed to cultivated land, urban areas or plantations. In some places, intensive grazing and use of wetlands as drinking pools by cattle and sheep cause major damage to the wetland vegetation. A conservation target of 24% has been set for the Eastern Temperate Freshwater Wetlands (Mucina and Rutherford 2006). According to the 2011 National List of Threatened Terrestrial Ecosystems for South Africa the Eastern Temperate Freshwater Wetlands vegetation unit is listed as a vulnerable threatened terrestrial ecosystem (RSA 2011).

The channeled valley bottom wetland was dominated by short to medium wetland vegetation while the unchanneled valley bottom wetlands had more robust dense vegetation stands and invasive tree species. Species such as *Centella asiatica* were generally found near the edge of the wetland areas with cosmopolitan species such as *Phragmites australis* and *Typha capensis* found in the lower permanent reaches of the wetlands. The specie *Cyperus marginatus* was dominant in many of the permanent areas of the wetlands. The invasive woody species that has colonized the unchanneled valley bottom wetlands include Acacia mearnsii, Eucalyptus sp, and Pinus sp. New growth of Wattles (Acacia mearnsii) was observed in 2022 and in some instances clearing of Wattles had occurred adjacent to watercourses.

10.8.5 Wetland functional and integrity assessment

Conditions on site remain very similar to 2019. No improvement or significant deterioration of wetlands has occurred. As mentioned above, in review of the 2019 assessment, the seepage wetland and Unchanneled Valley Bottom wetland 2 has been combined since they essentially form part of a single functional unit and distinguishing between the two aspects is not useful to their management.

The wetlands scored low with regards to cultural benefits mostly due to the setting of the study site which is not accessible to the general public. The channelled valley bottom is however used for rifle target practise with many targets placed in the wetland. This is likely to have a very small overall impact on the wetland with the grazing of cattle having a larger impact. Some direct human benefits include wetland areas used for cultivation and grazing. The dense vegetation cover of the wetlands is likely to produce regulating and supporting benefits such as water quality enhancement and flood attenuation. The wetlands score high with regard to biodiversity support as they provide specialised habitat for numerous significant species as recorded during the study site. The valley bottom wetland is also likely to be sensitive to changes in water quality.

The area has a low human population density, and the surroundings are actively mined and/or used for forestry and are not accessible to the general public.

The main impacts associated with the wetland system is current and historical agriculture and grazing practices which continues to impact on them through input of nutrients and pesticides and altered soil characteristics (for example compaction and recharge properties) On aerial imagery the increase in the area colonised by the invasive wattle species is clearly visible. This is likely to increase without human intervention and thus have an impact on the wetland health and will deteriorate over the next 5 years. Other disturbances impacting on the PES scores include old and new dams, crop lands, pastures, eroded areas, old lands and gullies and trenches.

Figure 39: Images of impacts recorded within and surrounding the wetland area including shooting range and grazing, dense stands of invasive trees and erosion.

10.8.5.1 Wetlands PES and EIS Scores

The results are discussed below, and Table 39 provides a summary of the results recorded for each watercourse unit potentially affected including both unchanged 2019 values supplemented with 2020 calculations.

10.8.5.1.1 Present Ecological State (PES)

The channelled valley bottom scored a C - Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact, and the condition is likely to remain stable over the next 5 years. The seepage scored an E – Largely Modified. The change in ecosystem processes and loss of natural habitat and biota in this wetland is great but some remaining natural habitat features are still recognizable and the condition is likely to remain stable over the next 5 years. For the two unchanneled valley bottom wetlands a score of D - Largely modified was obtained. A large change in ecosystem processes and loss of natural habitat and biota has occurred and their condition is likely to deteriorate slightly over the next 5 years. This is due to the increasing number of invasive woody species that can be seen to be expanding on aerial imagery. The components of the PES scores are reflected in Table 38.

The pan is well vegetated and appears to have seepage input from adjacent slopes. No significant impacts were visible during the 2022 site visit. However, the location of dense stands of alien trees (*Acacia Mearnsii*) are likely to impact the hydrology of the pan by intercepting water. Furthermore, changes to surface water flow in the catchment of the pan resulting from the adjacent road, plantations and mining, are also likely to contribute to changed hydrology. Table 39 below presents the scores for the four modules considered in the WetHealth (Version 2) assessment. The combined PES score of 78% indicates an Ecological Category score of C. Wetlands in this category are Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact (Kotze *et al.*, 2020).

Table 38: Summary of hydrology, geomorphology and vegetation health assessment for the components of the wetland system assessed (Macfarlane et al, 2009)

Wetland Unit	Hydrology		Geomorphology		Vegetation		Overall Score	
	Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score
Channelled Valley Bottom	3.2	0	2.9	0	2.4	0	2.8	0
PES Category and Projected Trajectory	C	→	C	→	C	→	C	→
Unchannelled Valley Bottom 1	4.3	0	4.0	0	5.9	-2	4.7	-1
PES Category and Projected Trajectory	D	→	D	→	D	↓↓	D	↓
Unchannelled Valley Bottom 2	4.9	0	4.2	0	5.8	-2	4.9	-1
PES Category and Projected Trajectory	D	→	D	→	D	↓↓	D	↓
Seepage	7.0	0	6.2	0	6.0	0	6.5	-1
PES Category and Projected Trajectory	E	→	E	→	E	→	E	→

Table 39: WetHealth (Version 2) scores for the pan wetland

Final (adjusted) Scores				
PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	2.3	2.1	1.5	3.0
PES Score (%)	77%	79%	85%	70%
Ecological Category	C	C	B	C
Trajectory of change	→	→	→	→
Confidence (revised results)	Medium	Medium	Medium	Medium
Combined Impact Score	2.2			
Combined PES Score (%)	78%			
Combined Ecological Category	C			
Hectare Equivalents	7.0 Ha			

10.8.5.1.2 **Ecological Importance and Sensitivity (EIS)**

The EIS score comprises a combination two components, Ecological Sensitivity (ES) and Ecological Integrity (EI) listed in the DWS Resource Quality Objectives datasets (for example, DWS, 2014).

The channeled valley bottom and unchanneled valley bottom 1 forms part of the same wetland system and was thus assessed together. The EIS score of 2.7 falls into a category characterised by High ecological importance and sensitivity. Wetlands in this category are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers (DWAF, 1999).

The unchanneled valley bottom 2 and the seepage wetland form part of the same wetland system and was thus assessed together. The EIS score of 1.8 falls into a category characterised by Moderate ecological importance and sensitivity. Moderate wetlands are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water in major rivers.

The pan was assessed in May 2022. The EIS score of 1.5 falls into a category characterised by Moderately low ecological importance and sensitivity. Wetlands in this category are considered to be ecologically important and sensitive on a provincial or local scale. The Ecosystem Services provided by pan reflect its inward draining nature which is suited to trapping runoff that, on this site, contains sediments and pollutants. Since the site is somewhat isolated from residential settlements, it does not provide significant provisioning or cultural services.

10.8.5.1.3 **Summary of results for each wetland unit**

Table 40 provides a summary of the results recorded for each wetland unit potentially affected including both unchanged 2019 values supplemented with 2020 calculations.

Table 40: Summary of scores obtained for each wetland unit

Watercourse Type	Assessment Method
Channelled Valley Bottom wetland	**PES: C – Moderately Modified** with an overall impact score of 2.8. The condition of the wetland is expected to remain stable. **Ecosystem Services –** Important services include Maintenance of Biodiversity (High); Erosion Control (Moderately High); Nitrate Removal (Moderately High) and Carbon Storage (Moderately High). **EIS -** High **Recommended Ecological Management Category:** B. The development may not result in further deterioration of the Ecological Category

Unchanneled Valley Bottom wetland 1	**PES: D – Largely Modified** with an overall impact score of 4.7. The condition of the wetland is expected to deteriorate in the next 5 years. **Ecosystem Services –** Important services include Maintenance of Biodiversity (High); Erosion Control (Moderately High); Nitrate Removal (Moderately High) and Carbon Storage (Moderately High). **EIS -** High **Recommended Ecological Management Category:** C. The development may not result in further deterioration of the Ecological Category
Unchanneled Valley Bottom wetland 2 with seepage component	**PES: D – Largely Modified** with an overall impact score of 4.9. The condition of the wetland is expected to deteriorate in the next 5 years. **Ecosystem Services –** Important services include Toxicant; Nitrate and Phosphate removal and trapping (Moderately High). **EIS -** Moderate **Recommended Ecological Management Category:** C. The development may not result in further deterioration of the Ecological Category
Pan	**PES: C – Moderately Modified** with an overall impact score of 2.2. The condition of the wetland is expected to remain stable. **Ecosystem Services –** Important services include Toxicant; Nitrate and Sediment removal and trapping (Moderately High and Moderate). **EIS -** Low **Recommended Ecological Management Category:** C. The development may not result in further deterioration of the Ecological Category

10.9 Groundwater

10.9.1 Hydrogeology

According to the 1:500 000 General Hydrogeological Map (*Barnard, H.C., (2000). An explanation of the 1:500 000 General Hydrogeological Map. Johannesburg 2526. DWAF*) the Ecca Group and Selonsrivier Formation rocks typically act as secondary aquifers (intergranular and fractured rock aquifers). However, the multi-layered weathering system present on these rocks could prove to have up to two aquifer systems present in the form of a shallow, saprolitic aquifer with a weathered, intergranular soft rock base associated with the contact of fresh bedrock and the weathering zone: and a fractured bedrock aquifer. These aquifer systems are discussed below.

10.9.1.1 Unsaturated Zone - Shallow, saprolitic aquifer

The main source of recharge into the shallow aquifer is rainfall that infiltrates the aquifer through the unsaturated (vadose) zone. Vertical movement of water is faster than lateral movement in this system as water moves predominantly under the influence of gravity. This aquifer may contain coarse to medium grained sandy sediment when underlain by rhyolite or silt/clay sediment when underlain by shale. The hydraulic conductivity of this sandy unit can reach up to 20m/day with porosities ranging between values of 0.25 to 0.5. The hydraulic conductivity of the silt/clay unit ranges between 10^{-8} and 10^{-2}m.day^{-1} and porosity ranges between 0.35 and 0.5 for these sediments.

10.9.1.2 Saturated Zone - Fractured, bedrock aquifer

The porphyritic rhyolite and felsite associated with the Rooiberg Group represent acidic lava having a greater resistance to weathering than rock types which represent basic lava. The nature of these rocks and their weathering product is similar to that of granite, so that groundwater is usually encountered in the transition zone between weathered and more solid rock. Breccia and joint zones as well as lithological and dyke contact zones also contribute to a groundwater yield potential that is classed as poor on the basis that 86% of the available borehole yield records report a value of less than 2l/s. The groundwater rest level typically occurs between 10 and 30 m below surface. The average EC value was recorded as 34 mS/m with a mean pH value of 7.1. Elements that show a substantial coefficient of variation are sulphate and nitrate.

The rocks of the Ecca Group, although intruded by dolerite sills and dykes, the extent of these intrusions is much less than in the main Karoo basin. Groundwater occurrence is generally associated with fractures and joints developed locally along bedding planes, with contact zones between different sedimentary lithologies and with fault and associated shear zones. Extensively developed fractures and joints resulting from post-Karoo tectonic episodes also favour the occurrence of groundwater. The sedimentary rocks possess a low to very low primary permeability and low storage potential. The groundwater yield potential is classed as low on the basis 83% of boreholes on record produce less than 2l/s. The groundwater quality in this unit is normally classed as excellent, although significant coefficients of variation associated with the element’s sodium,

potassium, chloride sulphate and nitrite. The variation in nitrite concentration indicates that a measure of caution is required when considering this water for human consumption (*Barnard HC (2000). An explanation of the 1:500 000 general hydrogeological map, Johannesburg 2526. DWAF*).

According to Hodgson et al. (1998), three distinct superimposed groundwater systems are present within the occurring geology. They can be classified as the upper weathered Ecca aquifer, the fractured aquifers within the unweathered Ecca sediments and the aquifer below the Ecca sediments. These systems are discussed below.

10.9.1.2.1 Ecca Group Weathered Aquifer

The Ecca sediments are weathered to depths between 5 – 12 meters below surface and often form a perched aquifer. This aquifer is recharged by rainfall and estimated to be between 1-3 % of the annual rainfall. Rainfall that infiltrates into the weathered rock soon reaches an impermeable layer of shale underneath the weathered zone. The movement of groundwater on top of this shale is lateral and in the direction of the surface slope. The water discharges at surface in the forms of fountains and springs where the flow paths are obstructed by a barrier, such as a dolerite dyke, paleo-topographic highs in the bedrock, or where the surface topography cuts below the groundwater table at streams. It is suggested that less than 60% of the water recharged to the weathered zone eventually emanates in streams while the remaining water is evapo-transpirated or drained by some other means. This aquifer is generally low-yielding (100 – 2000 ℓ/h) because of its insignificant thickness. Wells or trenches dug into this aquifer are often sufficient to secure a constant water supply of excellent quality. The excellent water quality can be attributed to the many years of dynamic groundwater flow through the weathered sediments. Leachable salts have been dissolved and it is the only the slow decomposition of clay particles which presently releases salts into the water.

10.9.1.2.2 Fractured Ecca Group Aquifer

The pores within the Ecca sediments are too well cemented to allow any significant permeation of water. Groundwater movement is therefore along secondary structures, such as fractures, cracks and joints in the sediments. These structures are better developed in competent rocks such as sandstone, hence the better water yielding properties of the latter rock type. It should, however, be emphasised that not all secondary structures are water bearing. Many of these structures are constricted because of compressional forces that act within the earth's crust. The chance of intersecting a water-bearing fracture by drilling decreases rapidly with depth. At depths deeper than 30 m, water-bearing fractures with significant yield were observed to be spaced at 100 m or greater. Scientific siting of production boreholes is necessary to intersect these fractures. The mean yield of this aquifer is ~1250 ℓ/h. In terms of water quality, the fractured Ecca aquifer always contains higher salt loads than the upper weathered aquifer. Although the sulphate, magnesium and calcium concentrations in the Ecca fractured aquifer are higher

than that in the weathered zone, they are well within expected limits. The higher concentrations can be attributed to the longer exposure time of the water to the rock. The occasional elevated chloride and sodium levels can be attributed to boreholes in the vicinity of areas where salts naturally accumulate on surface, such as pans and some of the fountains.

10.9.1.3 Pre-Karoo Aquifer

Drilling in only a few instances has intersected the basement of the Karoo Supergroup which can be regarded as an insignificant aquifer due to:

- The great depth,
- Low yielding fractures,
- Inferior water quality with elevated concentrations of fluoride associated with the granitic rocks,
- Low recharge characteristics of this aquifer because of the overlying impermeable Dwyka tillite.

10.9.1.4 Hydraulic Conductivity

Both the porosity defined as the ratio of the volume of void space to the total volume of the rock or earth material and the hydraulic conductivity defined as the measure of the ease with which water will pass through the earth's material; of the Rooiberg Group as well as the Ecca Group fractured aquifers are known to be low. The commonly expected values of porosity and permeability for igneous rock types, similar to those present in the Rooiberg Group, are 0.05 (porosity) and 10^{-5} $m.d^{-1}$ (hydraulic conductivity) respectively (Kruseman and de Ridder, 1994). The values expected in the sedimentary rock types similar to the Ecca Group sediments are 0.1 (Porosity) and 10^{-3} to 10^{-7} $m.day^{-1}$ (hydraulic conductivity) respectively. Movement of groundwater in these aquifers was preferential in secondary structures such as joints, faults and fractures.

10.9.2 Hydrocensus

A hydrocensus was conducted within a 2 km radius of the proposed mining site as a site familiarisation exercise and collection of essential groundwater related data from the study area and surrounding environment. The hydrocensus was conducted in February 2019 and extended to around the mine boundary but only boreholes that could be visited is indicated. Farms where there was no access were not recorded. A summary of the groundwater information gathered during the hydrocensus is detailed in Table 41 with the hydrocensus points depicted in Figure 41. The detailed information can be seen in the Groundwater Impact Assessment Appendix A: Hydrocensus Information (attached as Appendix 6.4 to this report).

10.9.2.1 Boreholes

Six (6) boreholes, one (1) spring and one (1) dam were found during the hydrocensus of which:

- Two (2) are privately owned used for domestic drinking water.
- Two (2) boreholes and one (1) dam are privately owned for livestock watering.
- Two (2) boreholes and one (1) spring are privately owned and not in use.

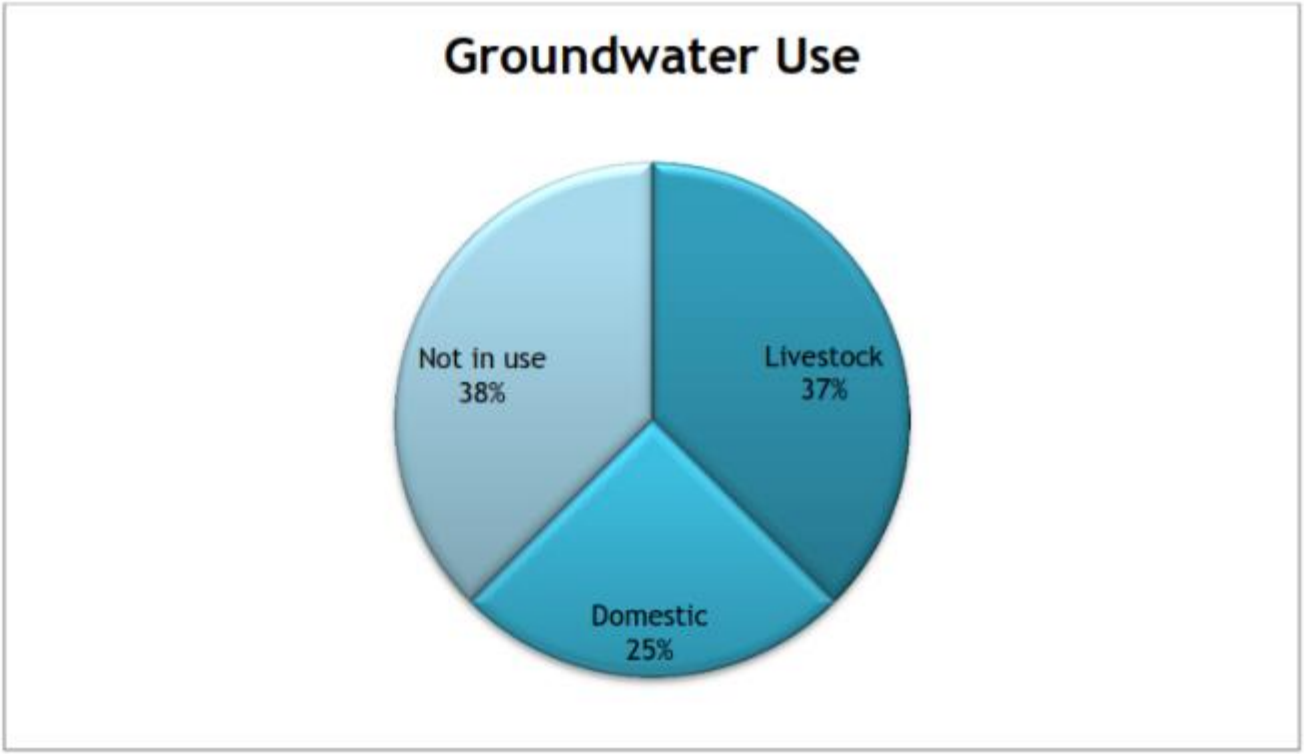


Figure 40: Groundwater and surface water distribution % use

Table 41: Hydrocensus summary

ID	Latitude	Longitude	Elevation	Casing height	Static water level (mbgl)	Static water level (mamsl)	Sampled (Y/N)			Comments
								Livestock	Domestic	
DRIE-BH1	-25.7149	29.64804	1638	0.800	8.6	1629.4	Yes		X	Number of people - approximately 20 people
DRIE-BH2	-25.71352	29.6532	1640	-	-	-	Yes	X		Low yielding borehole. Approximately 200 cattle
DRIE-BH3	-25.6916	29.62954	1661	-	-	-	Yes	X		Livestock watering. Approximately 200 cattle
DRIE-BH4	-25.6787	29.67243	1655	0.000	14.03	1640.97	Yes			Not in use. Water rusty
DRIE-BH5	-25.68072	29.67505	1662	0.000	12	1650	Yes			Not in use.
DRIE-BH6	-25.74619	29.65383	1647	0.000	11.98	1635.02	Yes		X	Admin offices of Canyon Coal. Approximately 80 people
DRIE Dam1	-25.71255	29.651272	1635	NA			Yes	Livestock watering		Livestock watering. Approximately 200 cattle
DRIE-SPRING 1	-25.702302	29.648215	1643				Yes			Low velocity flow

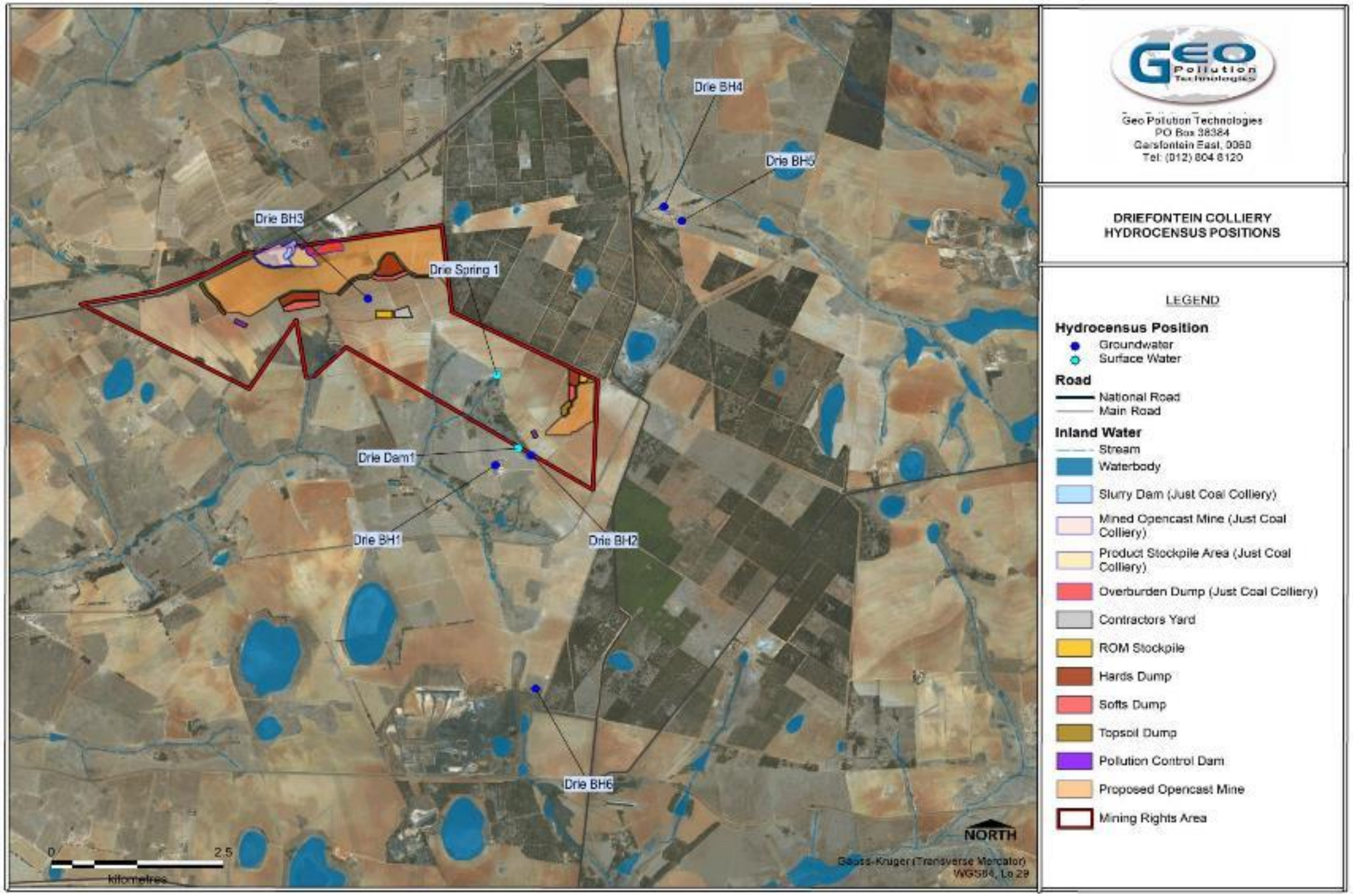


Figure 41: Hydrocensus points location

10.9.2.2 Groundwater levels

During the hydrocensus, four (4) boreholes were available for groundwater level measurement. The groundwater levels varied between a minimum of 8.6 m and a maximum of 14.03 m below ground level (Table 42). The relationship, using the boreholes from the hydrocensus, is shown in Figure 42 below.

This general relationship is useful to make a quick calculation of expected groundwater levels at selected elevations, or to calculate the depth of to the groundwater level (unsaturated zone):

Groundwater level = Elevation x gradient + intercept
Groundwater depth = Elevation – Calculated Groundwater Level

In general, a good relationship should exist between topography and static groundwater level. This relationship can be used to distinguish between boreholes with water levels at rest, and boreholes with anomalous groundwater levels due to disturbances such as pumping or local hydrogeological heterogeneities. However, due to the heterogeneity of the subsurface, these relationships should not be expected to hold everywhere under all circumstances, and deviations could thus be expected.

Table 42: Available groundwater level statistics

Groundwater level statistics	
Number of boreholes available	4
Number of boreholes with anomalous water levels	0
Min water level (mbgl)	8.6
Max water level (mbgl)	14.03
Mean water level (mbgl)	11.65

Utilising the hydrocensus boreholes water table elevations, a correlation between surface topography and water table elevation (Figure 43) were established. A correlation of 97% (R^2 =0.9705) between absolute surface and groundwater table elevations in meters above mean sea level (mamsl) represents a good correlation between water level elevation and topography. This means that there is a pressure gradient which mimics the topography. Therefore, groundwater within the weathered zone will generally make its way downslope towards the northeast-flowing stream and its tributary.

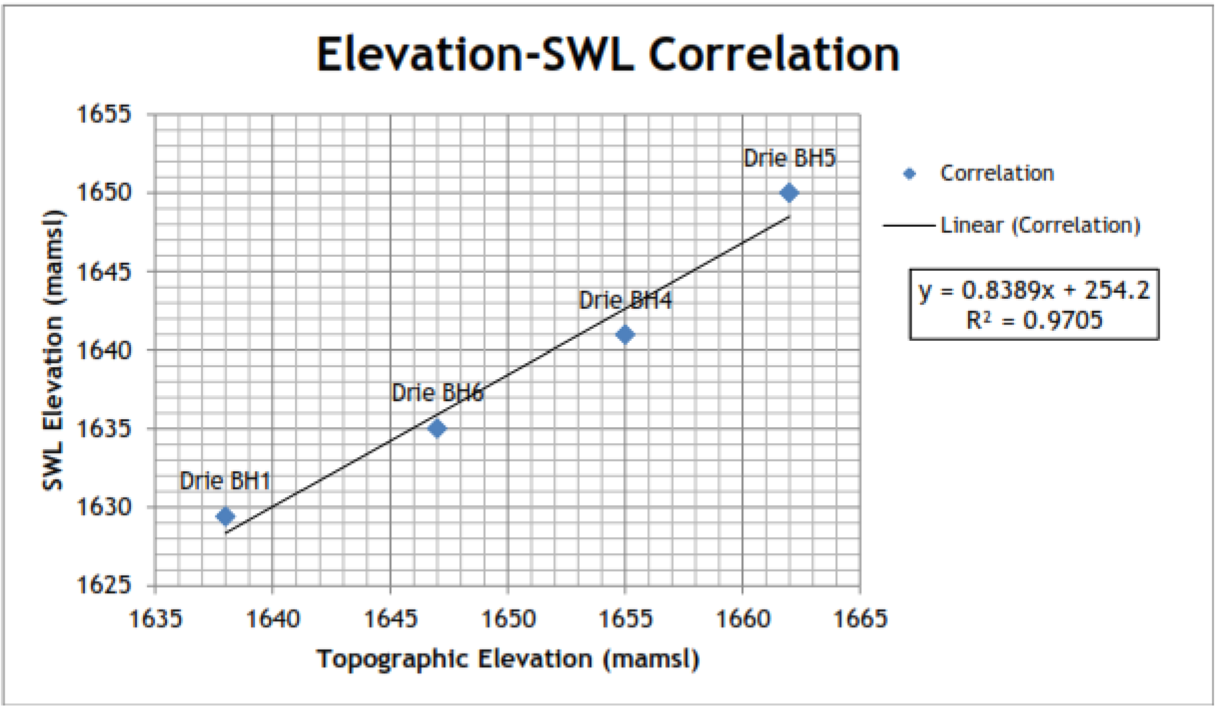


Figure 42: Correlation graph of topography vs available groundwater levels

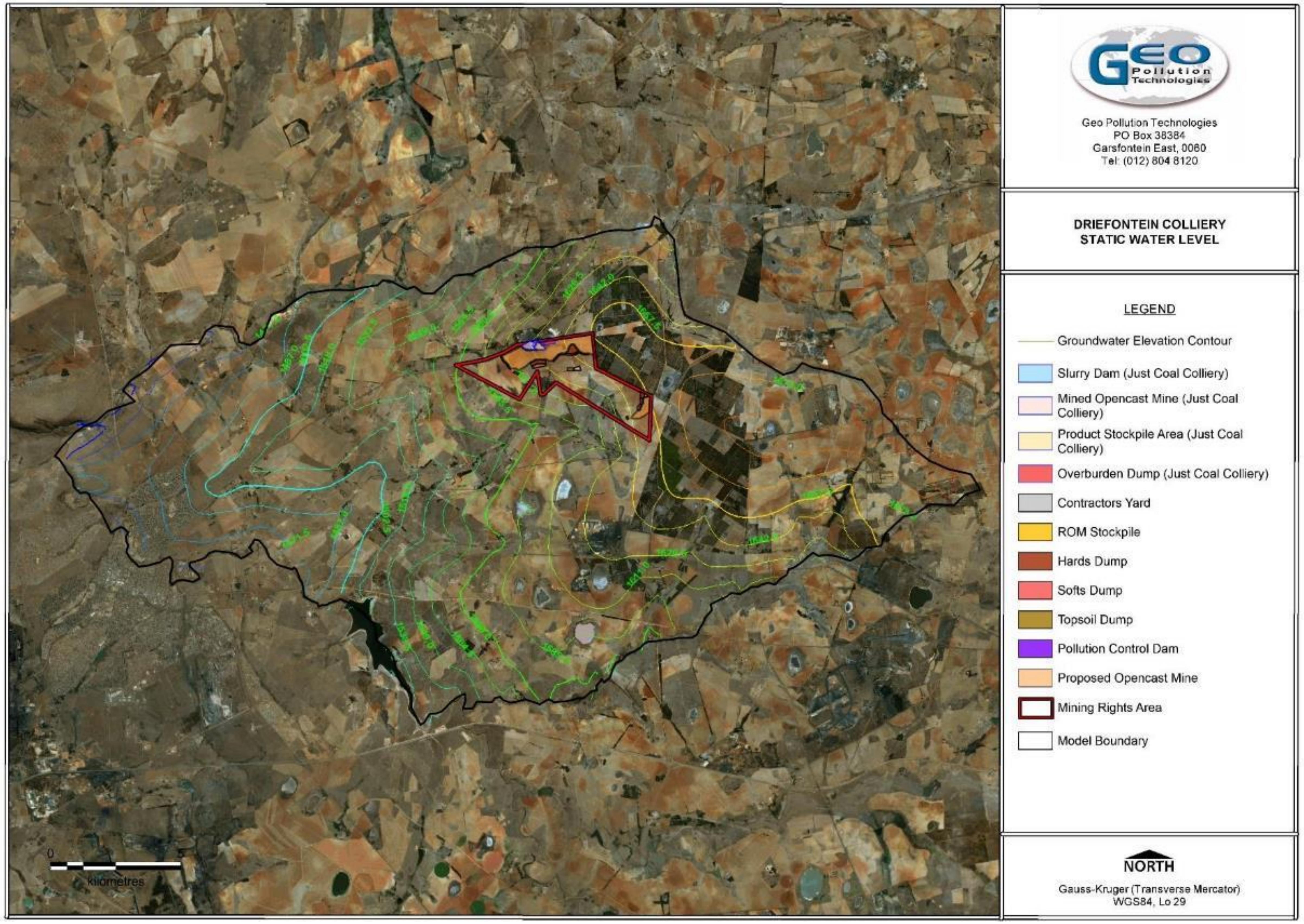


Figure 43: Contoured water levels of the water table aquifer (unconfined aquifer)

10.9.2.3 Geophysics

In order to delineate and target geological structures that may act as preferential groundwater flow paths, a ground geophysical survey was conducted as part of the Groundwater Impact Assessment by GPT (Pty) Ltd. The details of the ground geophysical traverses conducted are given in Table 43 and Figure 44. The groundwater flow vector map is presented in Figure 45.

Table 43: Details of actual ground geophysical traverses conducted

Line No	Start Coordinate (WGS84)	End Coordinate (WGS84)	Traverse Length (m)	Anomalies Identified at (m)
Traverse 1	-25.709734° 29.654884°	-25.701527° 29.658562°	980	390
Traverse 2	-25.713568° 29.658349°	-25.717397° 29.662004°	560	205
Traverse 3	-25.714913° 29.663943°	-25.706502° 29.668364°	1030	No
Traverse 4	-25.693759° 29.641387°	-25.699004° 29.627078°	1550	650

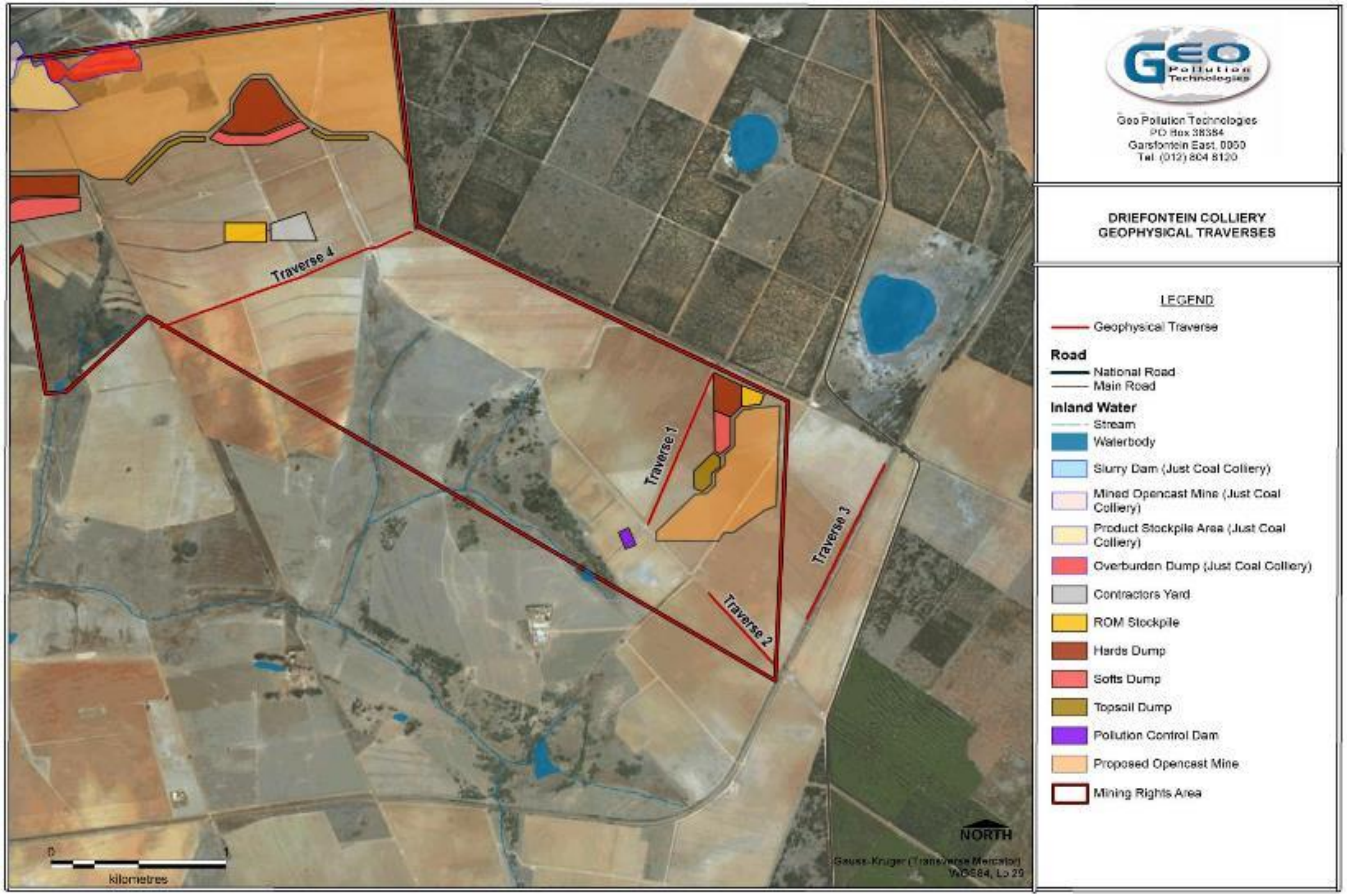


Figure 44: Location of the geophysical traverses

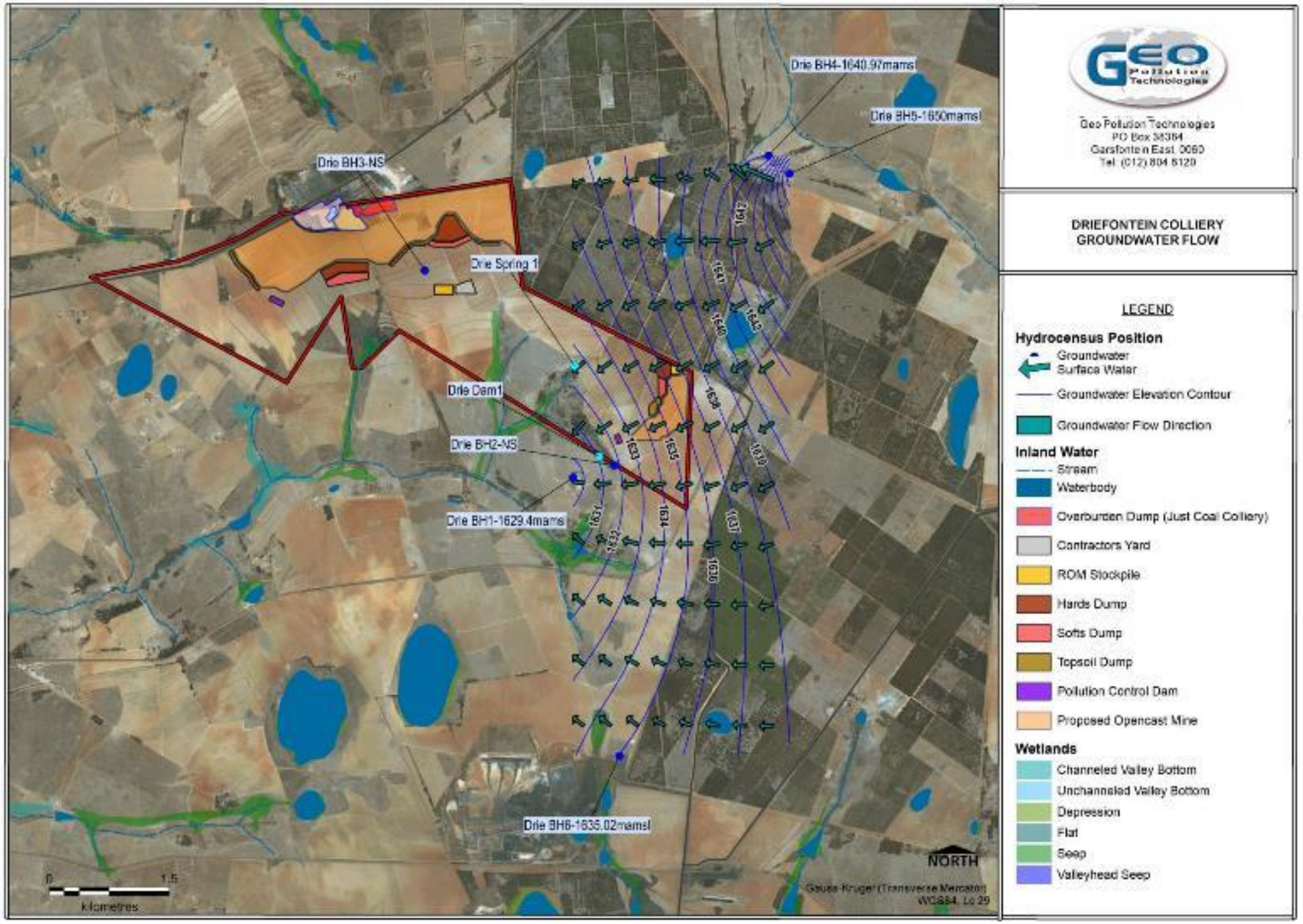


Figure 45: Groundwater flow vector map

10.9.3 Aquifer test results

The most commonly used method to estimate the transmissivity value for each borehole is to perform a hydraulic test with the subsequent analyses of the drawdown data with an analytical model. The results of the aquifer test data are attached under Appendix E of the Groundwater Impact Assessment while a summary of the aquifer test data is shown in Table 44.

Table 44: Aquifer test summary

Borehole name	Latitude	Longitude	Depth of borehole (m)	Aquifer thickness (m)	Water level (mbgl)	Maximum drawdown (m)	Transmissivity (m^2/day)	Conductivity as function of estimated aquifer thickness (m/d)
DFBH01	-25.706460°	29.656330°	31	22.8	8.2	5.34	4.9	0.2
DFBH02	-25.715000°	29.659650°	43	30.63	12.37	28.46	0.2	6.5×10^{-3}
DFBH03	-25.696010°	29.635400°	31	24.43	6.57	21.71	0.3	0.01

10.9.4 Groundwater quality

Water samples were collected from 5 boreholes and 1 surface water points around the site during the investigation. The analytical results were compared with the maximum recommended concentrations for domestic use as defined by the SANS 241-1: 2015 target water quality limits. The SANS 241-1: 2015 standard is applicable to all water services institutions and sets numerical limits for specific determinants to provide the minimum assurance necessary that the drinking water is deemed to present an acceptable health risk for lifetime consumption. Colours of individual cells refer to the drinking water classification of the specific groundwater sample. The results of the screening for groundwater are presented in Table 45 and Table 46 and discussed below.

10.9.4.1Groundwater quality vs SANS standards

From these results it was found that the water quality exceeded the SANS standard limits in the following:

- Combined Nitrate and Nitrite exceeds the SANS standard limit in DRIE-BH1 and DRIESPRING, indicating poor water quality. It also exceeds the SANS standard limit in the newly drilled boreholes DFBH01 and DFBH03.

- Fluoride concentrations are elevated in DRIE-BH1 and DRIE-BH5 possibly due to the underlying geology.

- Manganese concentrations are elevated in DFBH03 possibly due to the underlying geology.

The average sulphate concentration prior to mining in the hydrocensus boreholes was found to be 1.08 mg/l.

10.9.4.2 Spatial analysis of groundwater quality

The pie diagrams (Figure 46) show both the individual ions present in a water sample and the total ion concentrations in meq/ℓ or mg/ℓ. The scale for the radius of the circle represents the total ion concentrations, while the

subdivisions represent the individual ions. From the tables and figures the following can be deduced:

- **The boreholes upstream of the proposed mining area have higher proportions of HCO^{-}_{3} and Ca^{2+}**
- **The boreholes downstream of the proposed mining area have higher proportions of SO_4^{-2}, NO_3^{-} or $Cl^{-;}$ and Na^{+}, K^{+} and Ca^{2+}.**

Table 45: Water qualities compared to SANS 241-1:2015 guidelines for human consumption (hydrocensus points)

Parameter		Unit	SANS 241: 215 Recommended Limits	Risk	Results (Hydrocensus Boreholes)				
					DRIE-BH1	DRIE-BH2	DRIE-BH3	DRIE-BH5	DRIE-SPRING
Physical and Aesthetic Determinants									
Electrical conductivity at 25C	EC	mS/m	≤ 170	Aesthetic	19	5.72	6.52	17.8	3.74
Total Dissolved Solids	TDS	mg/liter	≤ 1200	Aesthetic	133	40	45.6	125	26.2
pH at 25C		pH units	≥ 5 to ≤9.7	Aesthetic	7.72	9.14	9	7.8	5.69
Chemical Determinants - Macro Determinants									
Nitrate as N	NO_3	mg/liter	≤ 11	Acute Health	0.227	0	0	0	1.35
Nitrite as N	NO_2	mg/liter	≤ 0.9	Acute Health	0	0	0	0	0.003
Combined Nitrate and Nitrite		mg/liter	≤ 1	Acute Health	1.00561	0	0	0	5.99034
Sulphate	SO_4	mg/liter	Acute Health ≤500; Aesthetic ≤250	Acute Health/Aesthetic	1.2	0.858	0.993	1.59	0.761
Fluoride	F	µg/liter	≤1500	Chronic Health	1800	58	135	3220	0
Chloride	Cl	mg/liter	≤ 300	Aesthetic	1.08	2.16	1.26	0.964	1.13
Sodium	Na	mg/liter	≤ 200	Aesthetic	18.5	4.09	3.29	20.7	2.25
Barium	Ba	µg/liter	≤ 700	Chronic Health	100	70	0	0	70
Total Iron	Fe	mg/liter	Acute Health ≤ 2; Aesthetic ≤0.3	Acute/Aesthetic	0	0.25	0.26	0	0
Total manganese	Mn	mg/liter	Acute Health ≤0.4; Aesthetic ≤0.1	Acute/Aesthetic	0	0	0.06	0	0
Concentration deemed to present an unacceptable health risk for lifetime consumption.									

Table 46: Water qualities compared to SANS 241-1:2015 guidelines for human consumption (newly drilled boreholes)

Parameter		Unit	SANS 241: 215 Recommended Limits	Risk	Results		
					DFBH01	DFBH02	DFBH03
Physical and Aesthetic Determinants							
Electrical conductivity at 25C	EC	mS/m	≤ 170	Aesthetic	4.43	27.8	0
Total Dissolved Solids	TDS	mg/liter	≤ 1200	Aesthetic	31	194	23.5
pH at 25C		pH units	≥ 5 to ≤9.7	Aesthetic	6.24	8.12	6.58
Chemical Determinants - Macro Determinants							
Nitrate as N	NO_3	mg/liter	≤ 11	Acute Health	1.25	0	0.585
Nitrite as N	NO_2	mg/liter	≤ 0.9	Acute Health	0.005	0.004	0.014
Combined Nitrate and Nitrite		mg/liter	≤ 1	Acute Health	5.5539	0.01312	2.63747
Sulphate	SO_4	mg/liter	Acute Health ≤500; Aesthetic ≤250	Acute Health/Aesthetic	0	4.88	0
Fluoride	F	µg/liter	≤1500	Chronic Health	0	1230	53
Chloride	Cl	mg/liter	≤ 300	Aesthetic	0.823	1.46	1.39
Sodium	Na	mg/liter	≤ 200	Aesthetic	4.03	41.9	1.8
Zinc	Zn	µg/liter	≤5	Aesthetic	6	0	2
Barium	Ba	µg/liter	≤ 700	Chronic Health	41	268	32
Boron	B	µg/liter	≤ 2400	Chronic Health	0	62	2
Copper	Cu	µg/liter	≤ 2000	Chronic Health	0	1	0
Total manganese	Mn	mg/liter	Acute Health ≤0.4; Aesthetic ≤0.1	Acute/Aesthetic	0	0	0.13
Nickel	Ni	µg/liter	≤ 70	Chronic Health	1	1	2
Aluminium	Al	µg/liter	≤ 300	Operational	3	38	29
Concentration deemed to present an unacceptable health risk for lifetime consumption.							

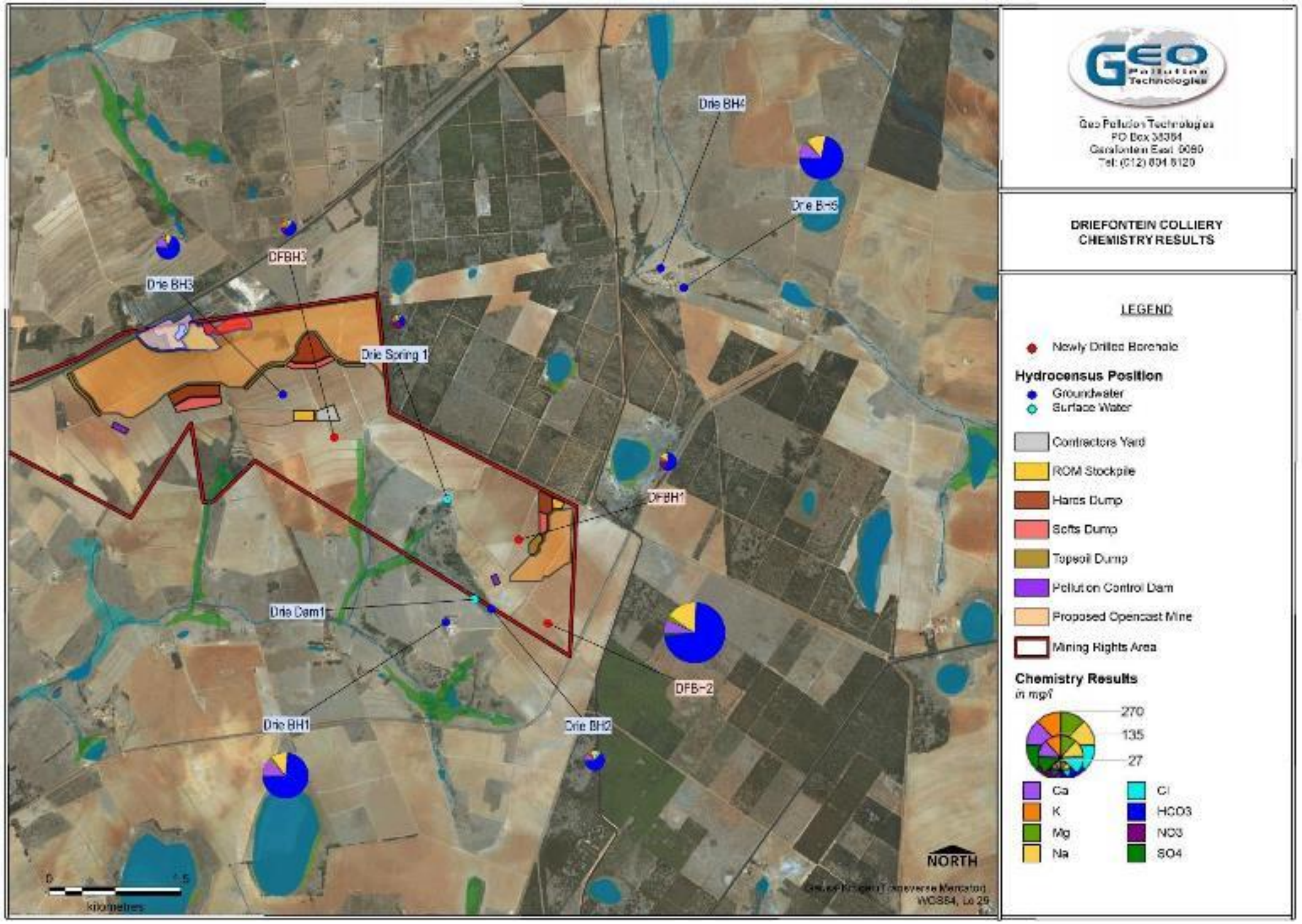


Figure 46: Pie diagrams for groundwater samples

10.9.5 Aquifer Characterisation

The term aquifer refers to a strata or group of interconnected strata comprising of saturated earth material capable of conducting groundwater and of yielding usable quantities of groundwater to boreholes and /or springs (Vegter, 1994). In the light of South Africa's limited water resources, it is important to discuss the aquifer sensitivity in terms of the boundaries of the aquifer, its vulnerability, classification and finally protection classification, as this will help to provide a framework in the groundwater management process.

10.9.5.1 Aquifer vulnerability

Aquifer vulnerability assessment indicates the tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer. Stated in another way, it is a measure of the degree of insulation that the natural and manmade factors provide to keep contamination away from groundwater.

- Vulnerability is high if natural factors provide little protection to shield groundwater from contaminating activities at the land surface.
- Vulnerability is low if natural factors provide relatively good protection and if there is little likelihood that contaminating activities will result in groundwater degradation.

The following factors have an effect on groundwater vulnerability:

- Depth to groundwater: Indicates the distance and time required for pollutants to move through the unsaturated zone to the aquifer.
- Recharge: The primary source of groundwater is precipitation, which aids the movement of a pollutant to the aquifer.
- Aquifer media: The rock matrices and fractures which serve as water bearing units.
- Soil media: The soil media (consisting of the upper portion of the vadose zone) affects the rate at which the pollutants migrate to groundwater.
- Topography: Indicates whether pollutants will run off or remain on the surface allowing for infiltration to groundwater to occur.
- Impact of the vadose zone: The part of the geological profile beneath the earth's surface and above the first principal water-bearing aquifer. The vadose zone can retard the progress of the contaminants.

The Groundwater Decision Tool (GDT) was used by GPT (Pty) Ltd to quantify the vulnerability of the aquifer underlying the site using the below assumptions.

- Depth to groundwater below the site was estimated from water levels measured during the hydrocensus inferred to be at mean of ~11.65 mbgl.
- Groundwater recharge of ~656.6 mm/a.
- Sandy clay loam soil vadose zone.

- Gradient of 1.5% were assumed and used in the estimation.

The aquifer vulnerability was determined using the criteria described above and assuming a worst-case scenario:

- Highly vulnerable (> 60), the natural factors provide little protection to shield groundwater from contaminating activities at the land surface.
- Medium Vulnerable = 30 to 60%, the natural factors provide some protection to shield groundwater from contaminating activities at the land surface, however based on the contaminant toxicity mitigation measures will be required to prevent any surface contamination from reaching the groundwater table.
- Low Vulnerability (< 30 %), natural factors provide relatively good protection and if there is little likelihood that contaminating activities will result in groundwater degradation.
- The GDT calculated a vulnerability value of 62%, which is medium.

10.9.5.2 Aquifer classification

The aquifer(s) underlying the subject area were classified in accordance with "A South African Aquifer System Management Classification, December 1995." The main aquifers underlying the area were classified in accordance with the Aquifer System Management Classification document (*Department of Water Affairs and Forestry & Water Research Commission (1995). A South African Aquifer System Management Classification. WRC Report No. KV77/95*). The aquifers were classified by using the following definitions:

- Sole Aquifer System: An aquifer which is used to supply 50% or more of domestic water for a given area, and for which there is no reasonably available alternative sources should the aquifer be impacted upon or depleted. Aquifer yields and natural water quality are immaterial.
- Major Aquifer System: Highly permeable formations, usually with a known or probable presence of significant fracturing. They may be highly productive and ability to support large abstractions for public supply and other purposes. Water quality is generally very good (Electrical Conductivity of less than 150 mS/m).
- Minor Aquifer System: These can be fractured or potentially fractured rocks which do not have a high primary permeability, or other formations of variable permeability. Aquifer extent may be limited and water quality variable. Although these aquifers seldom produce large quantities of water, they are important for local supplies and in supplying base flow for rivers.
- Non-Aquifer System: These are formations with negligible permeability that are regarded as not containing groundwater in exploitable quantities. Water quality may also be such that it renders the aquifer unusable. However, groundwater flow through such rocks, although imperceptible, does take place, and needs to be considered when assessing the risk associated with persistent pollutants.

Based on information collected during the hydrocensus it can be concluded that the aquifer system in the study area can be classified as a "Minor Aquifer System", based on the fact that the local population is not dependent on groundwater.

In order to achieve the Aquifer System Management and Second Variable Classifications, as well as the Groundwater Quality Management Index, a point scoring system as presented in Table 47 and Table 48 was used.

Table 47: Ratings – Aquifer System Management and Second Variable Classifications

Aquifer System Management Classification		
Class	Points	Study area
Sole Source Aquifer System:	6	
Major Aquifer System:	4	
Minor Aquifer System:	2	2
Non-Aquifer System:	0	
Special Aquifer System:	0 - 6	
Second Variable Classification (Weathering/Fracturing)		
Class	Points	Study area
High:	3	
Medium:	2	2
Low:	1	

Table 48: Ratings - Groundwater Quality Management (GQM) Classification System

Aquifer System Management Classification		
Class	Points	Study area
Sole Source Aquifer System:	6	
Major Aquifer System:	4	
Minor Aquifer System:	2	2
Non-Aquifer System:	0	
Special Aquifer System:	0 - 6	
Aquifer Vulnerability Classification		
Class	Points	Study area
High:	3	
Medium:	2	2
Low:	1	

As part of the aquifer classification, a Groundwater Quality Management (GQM) Index is used to define the level of groundwater protection required. The GQM Index is obtained by multiplying the rating of the aquifer system management and the aquifer vulnerability. The GQM index for the study area is presented in Table 49.

The vulnerability, or the tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer, in terms of the above, is classified as medium.

The level of groundwater protection based on the Groundwater Quality Management Classification:

GQM Index = Aquifer System Management X Aquifer Vulnerability

= 2 x 2 = 4

Table 49: GQM Index for the Study Area

GQM Index	Level of Protection	Study Area
<1	Limited	
1 - 3	Low Level	
3 - 6	Medium Level	4
6 - 10	High Level	
>10	Strictly Non-Degradation	

10.9.5.2.1 Aquifer protection classification

A Groundwater Quality Management Index of 4 was estimated for the study area from the ratings for the Aquifer System Management Classification. According to this estimate a medium level groundwater protection is required for the aquifer. Reasonable and sound groundwater protection measures based on the modelling will therefore be recommended to ensure that no cumulative pollution affects the aquifer, even in the long term. DWA's water quality management objectives are to protect human health and the environment. Therefore, the significance of this aquifer classification is that measures must be taken to limit the risk to the following environments.

- The protection of the underlying aquifer.
- The numerous pans and wetlands situated within and outside the mining rights area.

10.10 Air Quality

As mentioned above, the land use immediately surrounding the proposed Driefontein Coal Mine consists predominantly of cultivated land, grasslands, mining areas and plantations. The towns of Middelburg and Belfast are located approximately 20 km south-west and 35 km east of the proposed mine, respectively. The area is classified as rural in nature, with few urban built up or residential areas located within 20 km of the site. The application area falls within the Highveld Nationally Declared Air Quality Priority Area (HPA).

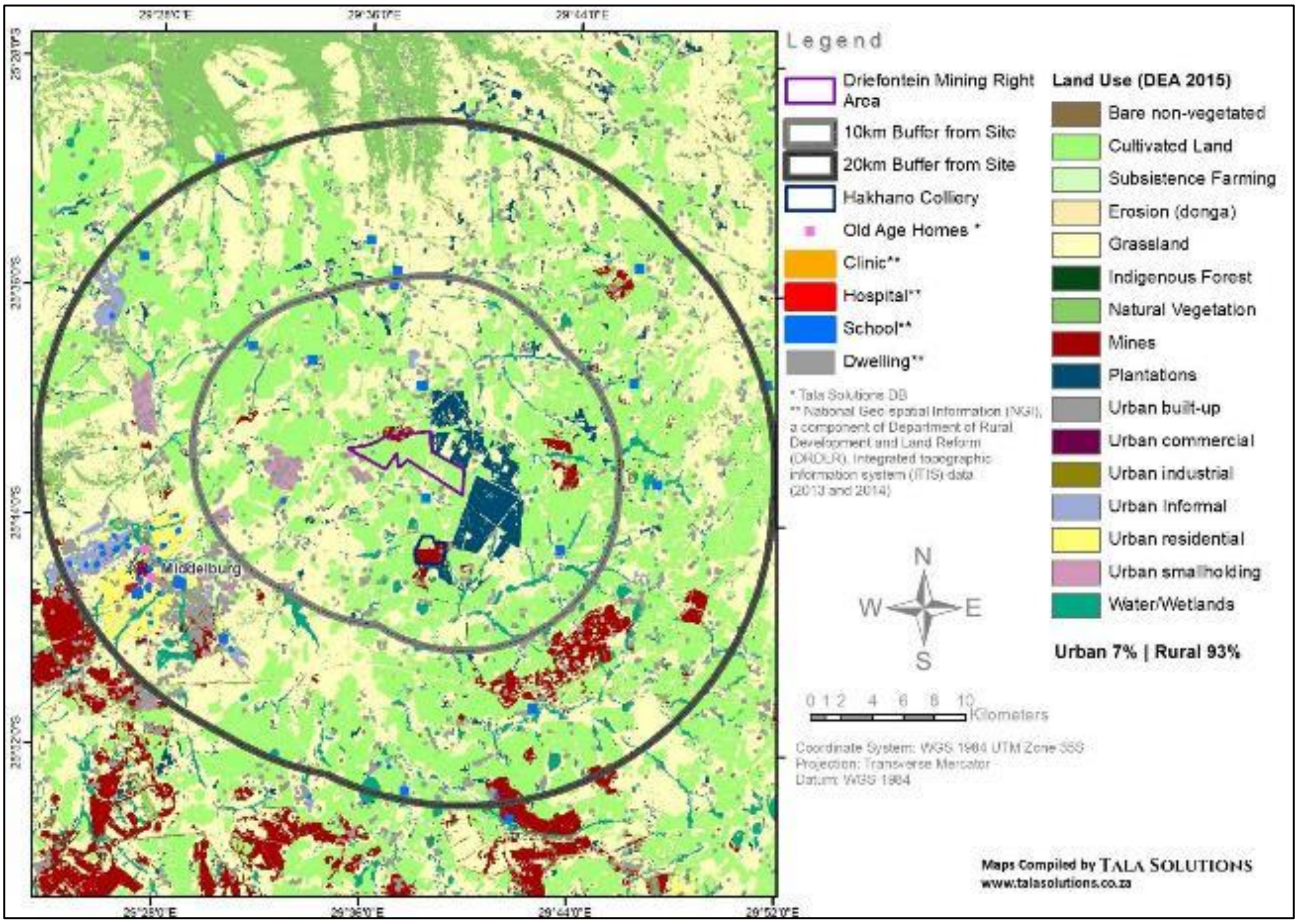


Figure 47: Land use surrounding the proposed Driefontein Coal Mine

10.10.1 Highveld Priority Area

The Highveld Priority Area (HPA) was declared a priority area by the Minister of Environmental Affairs and Tourism on the 23 November 2007 under the National Environmental Management Air Quality Act (Act No. 39 of 2004) (Government Gazette, No. 30518 of 23 November 2007). A Priority Area is usually associated with elevated ambient concentrations of criteria air pollutants such as PM_{10}, $PM_{2.5}$ SO2 and NO_x. Generally, a high number of emitters (industrial and non-industrial) are also concentrated in these areas. In the HPA, industrial emitters were identified as the most significant contributor of emissions accounting for 89% of PM_{10}, 90% of NO_x and 99% of SO_2. Industrial emitters within the HPA include (DEA, 2011):

- Power generation.

- Coal mining.
- Primary & secondary metallurgical operations.
- Brick manufactures.
- Petrochemical industry.
- Ekurhuleni industrial sources (excluding the above); and
- Mpumalanga industrial sources (excluding the above).

An assessment of ambient air quality monitoring data within the HPA, allowed for the following areas to be identified as areas of concern. These areas are associated with high frequency exceedances of the PM_{10} and SO_2 ambient standards. The air quality monitoring data for the HPA also shows seasonal trends. A higher frequency of exceedances of the standards are observed during the winter season where the dispersion potential of ground level pollutants (e.g., vehicle exhaust emissions) are largely reduced due to the strengthening of surface inversions (DEA, 2011).

- Witbank.
- Middelburg.
- Secunda.
- Ermelo.
- Standerton.
- Balfour; and
- Komati.

A comprehensive emissions inventory was compiled for the HPA. A combination of ambient air quality monitoring and dispersion modelling results identified nine areas within the HPA as hotspot areas, where ambient concentrations of PM_{10}, SO_2 and NO_2 frequently exceed and/or were predicted to exceed the ambient standards (Table 50). Residential areas associated with a high level of domestic fuel burning (wood and coal) were identified to experience high concentrations of particulates and CO.

The application area falls within the Steve Tshwete Local Municipality which has been identified as one of the nine (9) HPA Air Quality Hot Spot Areas.

Table 50: HPA Air Quality Hot Spot Areas (DEA, 2011;20)

Hot Spot	PM_{10}	SO_2	NO_2
Emalahleni	✓	✓	
Kriel		✓	
Steve Tshwete	✓	✓	✓
Ermelo	✓	✓	
Secunda	✓	✓	✓
Ekurhuleni	✓	✓	
Lekwa	✓	✓	
Balfour	✓		
Delmas		✓	

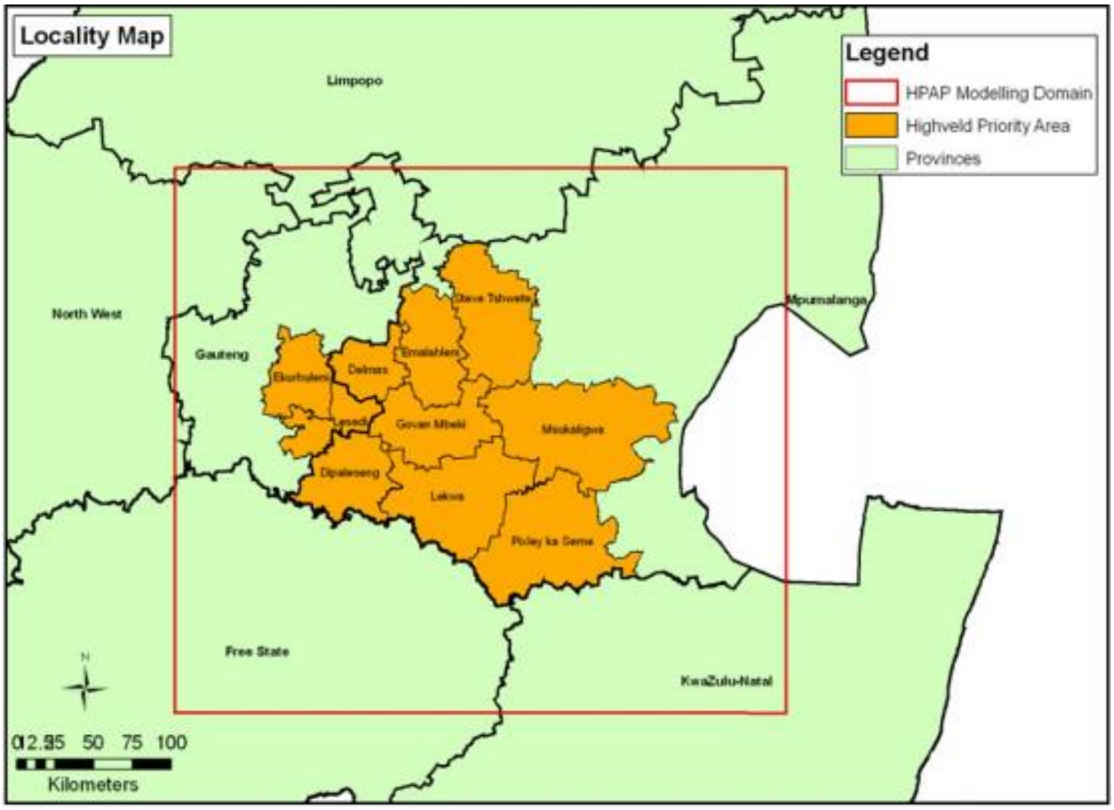


Figure 48: Highveld Priority Area (DEA, 2011)

10.10.2 Sensitive receptors

A sensitive receptor is defined as a person or place where involuntary exposure to air pollutants released by the site's activities could occur. Identified sensitive receptors which are located within a 20 km radius of the mine are presented in Table 51 and Figure 49 below. These points are located at the centre of residentials areas, or near schools, hospitals and old age homes, in order to determine the maximum concentrations that could be expected near sensitive receptors. Discrete points are not plotted for each individual sensitive receptor but are used to represent a group of sensitive receptors located near to each other (e.g., several schools).

Table 51: Discrete receptors within 20 km radius of the proposed Driefontein Mine

SURROUNDING RECEPTORS (<20KM)				
Discrete Receptor ID	Name Edu = educational/school/training facilities HC = healthcare/clinic/hospital facilities Old = old age home Residential = Dwellings/ farm houses	Co-ordinates X (m)	Co-ordinates Y (m)	Elevation (m)
DR1	Edu. Facilities	768452.2	7176578.69	1549.83
DR2	Edu. Facilities	761221.92	7169287.38	1487.81
DR3	Edu. Facilities	762919.33	7167285.96	1483.45
DR4	Edu. Facilities	762741.99	7166449.93	1501.29
DR5	Edu. Facilities	778509.41	7167408.12	1791.46
DR6	Residential	772970.25	7170385.71	1698.1
DR7	Residential	752957.97	7168976.44	1560.74
DR8	Residential	745363.73	7161496.4	1519.3
DR9	Residential	747511.29	7147979.62	1451.69
DR10	Edu. Facilities /Health Facility	746088.34	7146687.49	1495.78
DR11	Edu. Facilities /Residential	749009.39	7147194.2	1454.52
DR12	Edu. Facilities	751692	7143617.4	1531.48
DR13	Edu. Facilities	771573.08	7139146.39	1621.25
DR14	Residential	781856.49	7152509.67	1715.62
DR15	Edu. Facilities /Residential	778249.15	7160037.16	1735.9
DR16	Residential	763466.17	7161289.11	1626.93
DR17	Edu. Facilities /Residential	755519.84	7161961.45	1596.06
DR18	Residential	756726.56	7154290.21	1549.28
DR19	Residential	762930.84	7153001.12	1600.78
DR20	Residential	765774.88	7147127.44	1632.21
DR21	Edu. Facilities	753502.09	7162647.12	1570.74
DR22	Edu. Facilities /Residential	764482.03	7159941.72	1622.21
DR23	Residential	768021.35	7155562.24	1692.55
DR24	Residential	762853.76	7156919.18	1661.01
DR25	Residential	760773.6	7156674.45	1618.65
DR26	Residential	760569.63	7155272.95	1617.2
DR27	Residential	761954.68	7154123.65	1602.02
DR28	Residential	765781.97	7153082.52	1636.14
DR29	Residential	759147.99	7151592.03	1533.15
DR30	Residential	769057.4	7150385.98	1659.61
DR31	Edu. Facilities	764749.72	7152640.76	1619.97

Notes:
*DR = discrete receptor
*Approx. 1 hospitals/healthcare/clinic facilities within 20km of site (located in surrounding areas).
* Approx >10 school/training/educational facilities within 20km of site (located in surrounding areas).
*no old age home facility identified within 20km of the project site.

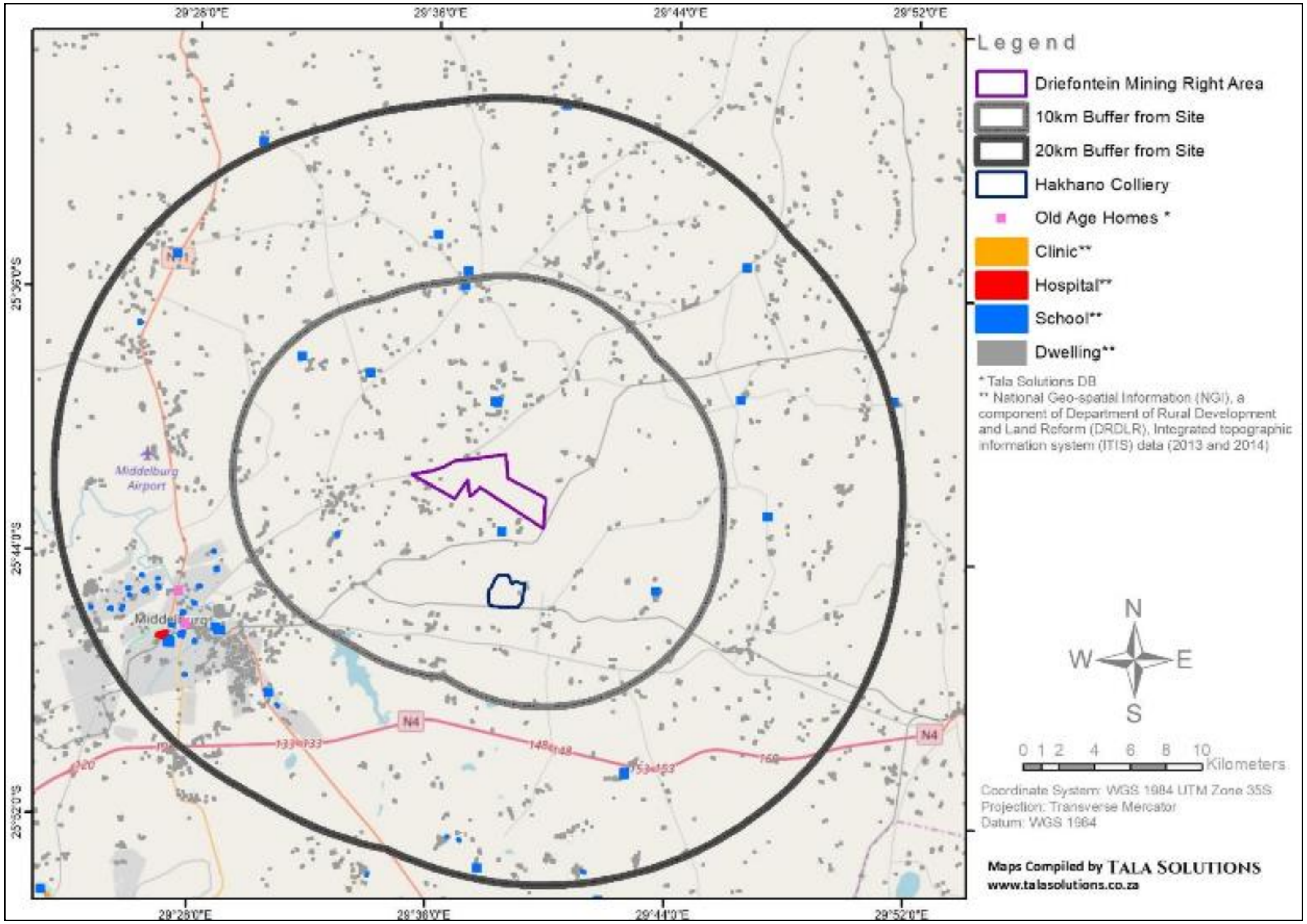


Figure 49: Sensitive receptors surrounding the proposed Driefontein Mine

10.10.3 Baseline air quality concentrations

The existing air quality situation is usually evaluated using available monitoring data from permanent ambient air quality monitoring stations and dust-fall networks operated near the project site. There was no data available (that could be determined) to present background concentrations for SO_2, CO, PM_{10} and $PM_{2.5}$ at the study site. Existing ambient monitoring stations (i.e., Mhluzi & Middelburg ambient air quality monitoring stations, owned and operated by the DEA, are located too far away (> 20km) from the study site and thus are not representative of air quality at the proposed Driefontein Mine. However, there was background data available for dust-fall rates. There is an existing dust-fall monitoring network currently in place at Hakhano Colliery (3km south of the proposed mine) and dust fall monitoring took place as part of the AQIA at the proposed Driefontein Mine. Dust-fall monitoring at the proposed mine commenced in April 2019 to determine the baseline conditions. Dust-fall rates in and around the proposed mine for the March 2018 – June 2019 period are given below in Section 10.10.3.1. It is anticipated that background $PM_{2.5}$ and PM_{10} concentrations in the area could be high due to existing mining activity taking place in the area.

10.10.3.1 Baseline Dust-Fall Rates

Dust-fall monitoring was conducted at eight (8) sites in and around the proposed Driefontein Mine, in contrast to four (4) sites at Hakhano Colliery. Dust-fall rates for the period March 2018 – June 2019 are presented in Figure 50 and Figure 52 and the locality of the dust buckets at the proposed Driefontein Mine are shown in Figure 51. Dust-fall rates at all twelve (12) sites range from 16 – 2 474 mg/m^2/day for the period. Higher dust-fall rates were recorded at Hakhano Colliery during the months June – August 2018 and December 2018. Out of 64 dust-fall rates recorded for the period there were ten (10) exceedances of the residential limit of 600 mg/m^2/day and five (5) exceedances of the non-residential limit of 1 200 mg/m^2/day (Table 52 and Table 53). Fourteen (14) exceedances were recorded at Hakhano Colliery, one (1) exceedance was recorded at the proposed Driefontein Mine. Furthermore, all exceedances of the non-residential area standard were at Hakhano Colliery.

Exceedances are recorded at all sites (North, East, South, and West) at Hakhano Colliery, as opposed to just one site (DCM-003) at the proposed Driefontein Mine. The prevailing wind directions are observed from the east, east-south-east and north-west quadrants (see Section 10.3.3 above), thus emissions from the proposed Driefontein Coal Mine will mostly likely be transported towards the westerly, west, north-westerly and south-easterly quadrants. One exceedance of the residential area standard of 600 mg/m/^{2}/day at site DCM-003 at the proposed Driefontein Mine could be attributed to the site's proximity to a coal stockpile area. However, the coal stockpile belongs to another mining company. The dust-fall rates at the proposed Driefontein Mine are indicative of background emissions sources as there are no mining activities at the proposed mine yet. Higher dust-fallout rates recorded at Hakhano Colliery could be attributed to processing activities (crushing, screening, material handling (loading/offloading) currently undertaken at the processing plant, vehicle dust entrainment on unpaved roads and wind erosion from material storage/stockpile areas at the mine.

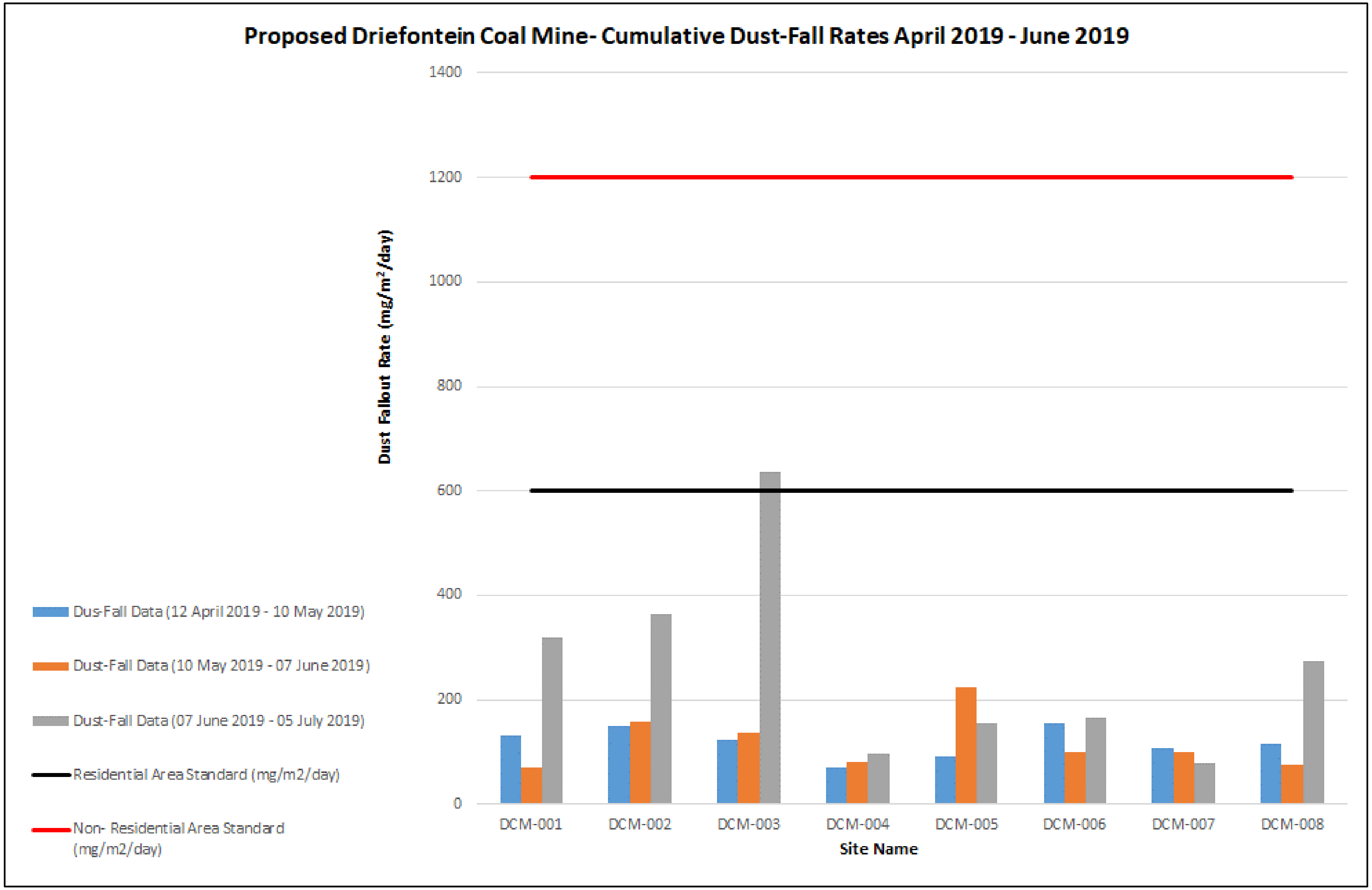


Figure 50: Dust-fall rates at the proposed Driefontein Mine for the period April 2019 – June 2019

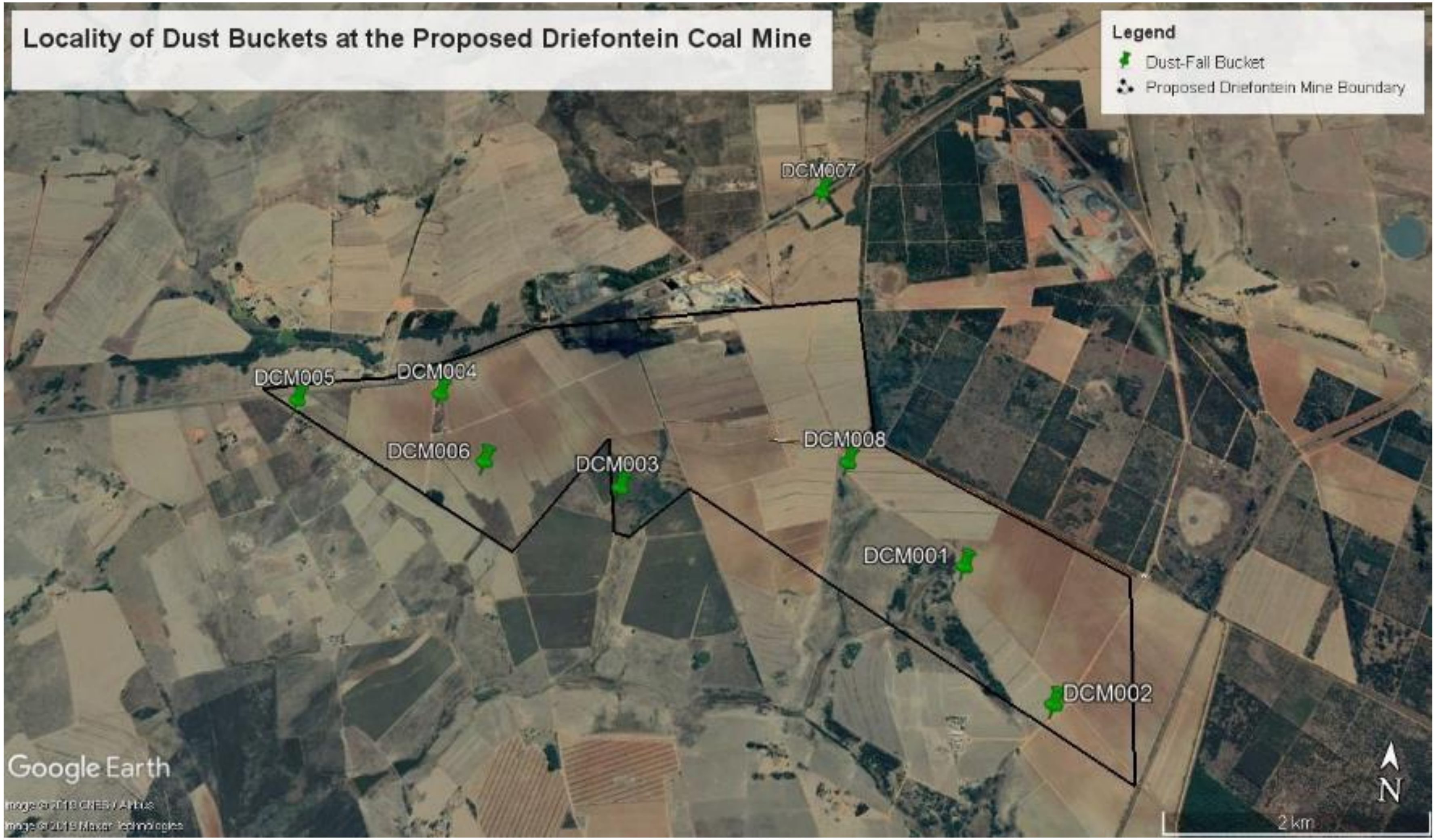


Figure 51: Locality of dust buckets (DCM-001 to DCM-008) at the proposed Driefontein Mine

Table 52: Summary of dust-fall rates at the proposed Driefontein Coal Mine for the period April 2019 – June 2019

Site ID	DCM-001	DCM-002	DCM-003	DCM-004	DCM-005	DCM-006	DCM-007	DCM-008
Site Name	Railway Crossing Entrance	Next to Railway Crossing	Behind Coal Stockpile R55	JJ Le Roux Farm	Sterkspan Boedery Road	R55 Road	Telkom Tower	Railway Entrance
Dus-Fall Data (12 April 2019 - 10 May 2019)	132.16	148.84	123.19	70.8	91.25	155.6	106.83	115.48
Dust-Fall Data (10 May 2019 - 07 June 2019)	71.59	157.8	137.35	80.24	222.78	100.06	99.75	75.36
Dust-Fall Data (07 June 2019 - 05 July 2019)	318	365.21	635.08	96.29	156.59	166.38	78.34	273.81
Residential Area Standard (mg/m2/day)	600	600	600	600	600	600	600	600
Non- Residential Area Standard (mg/m2/day)	1200	1200	1200	1200	1200	1200	1200	1200

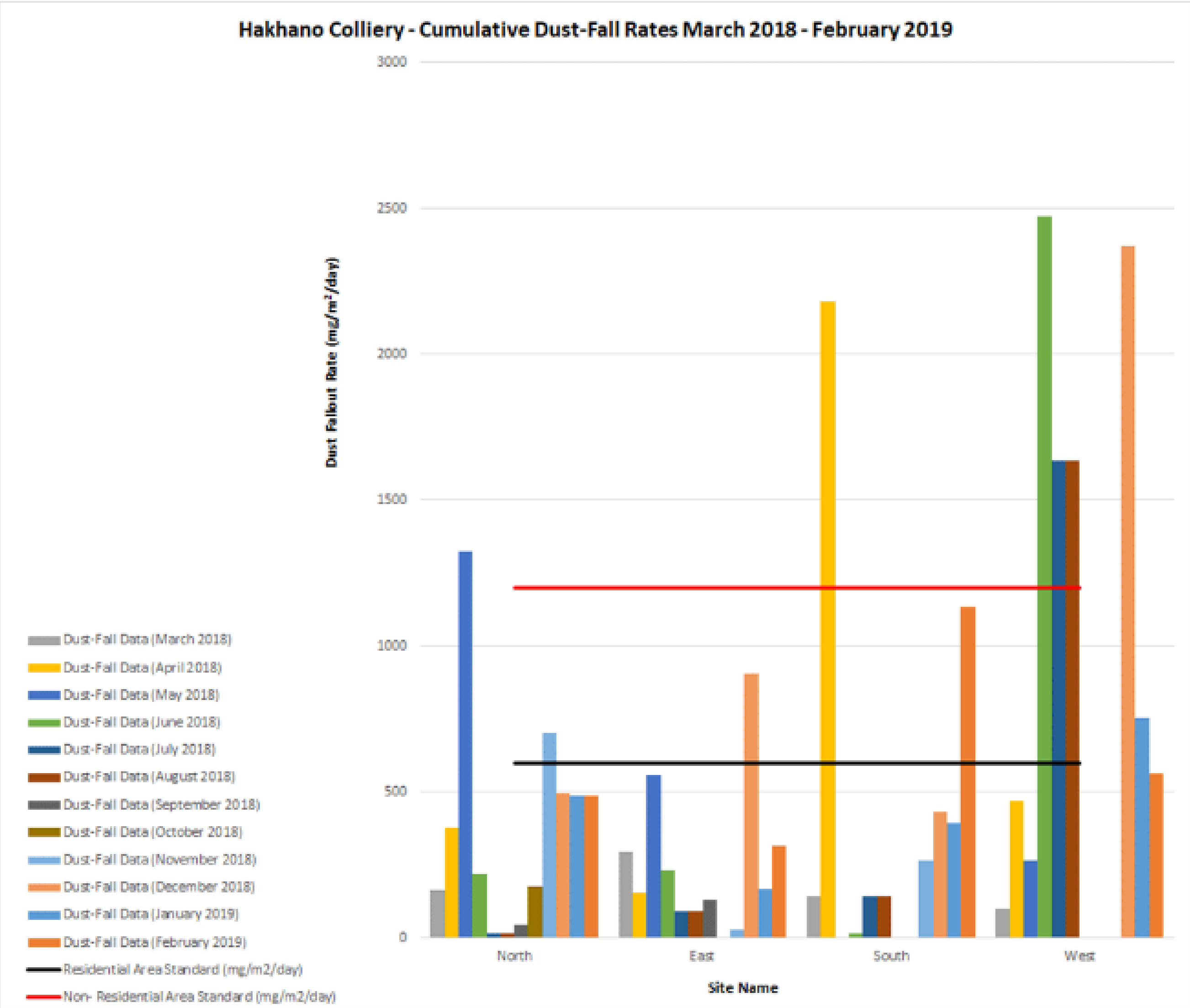


Figure 52: Dust-fall rates at Hakhano Colliery for the period March 2018 – February 2019

Table 53: Summary of dust-fall rates at Hakhano Colliery for the period March 2018 – February 2019

Site Name	North	East	South	West
Dust-Fall Data (March 2018)	165	294	142	102
Dust-Fall Data (April 2018)	376	155	2181	471
Dust-Fall Data (May 2018)	1327	558	contaminated	265
Dust-Fall Data (June 2018)	218	232	18	2474
Dust-Fall Data (July 2018)	63	61	contaminated	596
Dust-Fall Data (August 2018)	16	92	145	1637
Dust-Fall Data (September 2018)	46	130	stolen	stolen
Dust-Fall Data (October 2018)	179	stolen	contaminated	contaminated
Dust-Fall Data (November 2018)	704	30	268	stolen
Dust-Fall Data (December 2018)	496	905	432	2371
Dust-Fall Data (January 2019)	487	168	395	752
Dust-Fall Data (February 2019)	486	316	1137	564
Residential Area Standard (mg/m2/day)	600	600	600	600
Non- Residential Area Standard (mg/m2/day)	1200	1200	1200	1200

10.10.4 Surrounding sources of air pollution

Existing key sources of air pollution, within a 10km and 20km radius, surrounding the proposed Driefontein Mine include (Figure 53 and Figure 54):

- Forestry/Plantation activity (surrounding areas).
- Mining activity (north, east, south-east and south-west of the proposed mine).
- Vehicle dust entrainment on unpaved roads (surrounding areas); and
- Agricultural activity and potential biomass burning (surrounding areas).

Township/informal settlements, sewage works, and exposed areas were identified as additional sources of air pollution but to a small extent. Few sewage works, exposed areas and informal settlements are observed 15 – 20 km south-west of the proposed mine.

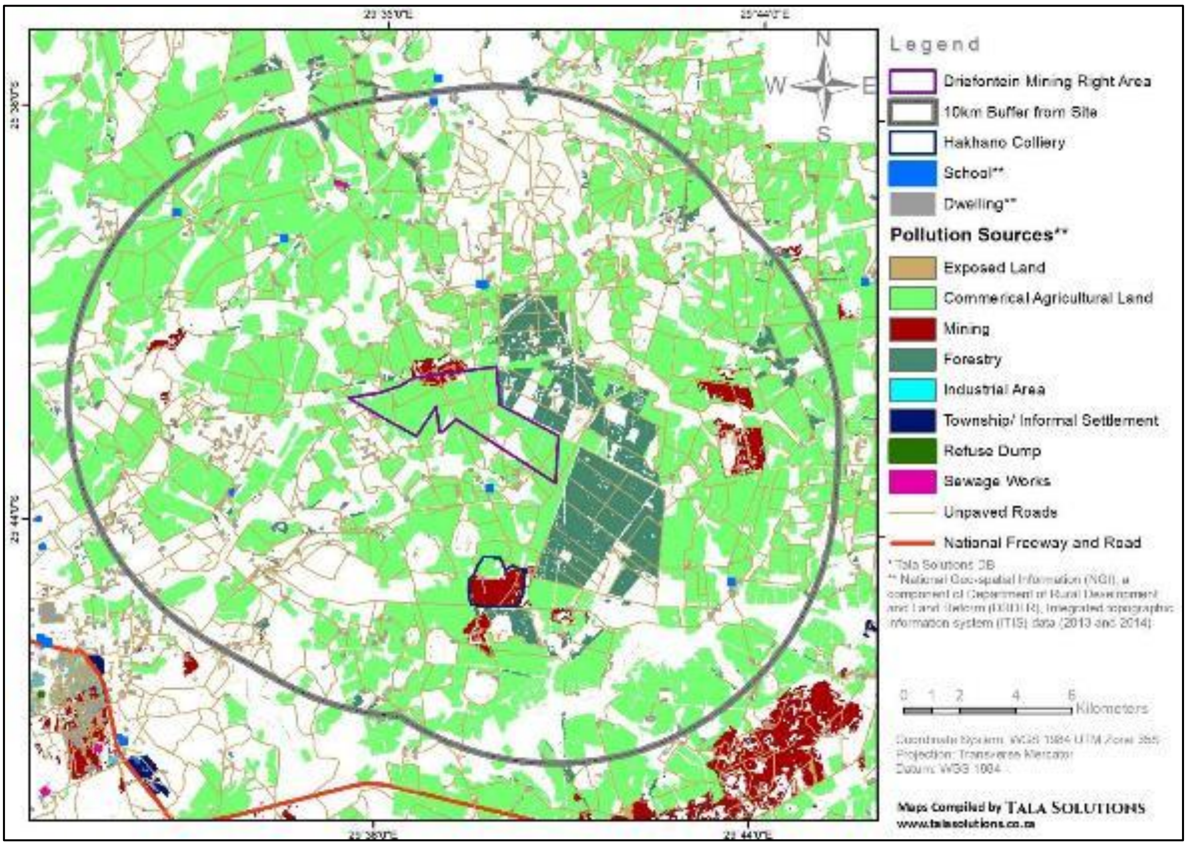


Figure 53: Identified emission sources within 10km of the proposed Driefontein Mine

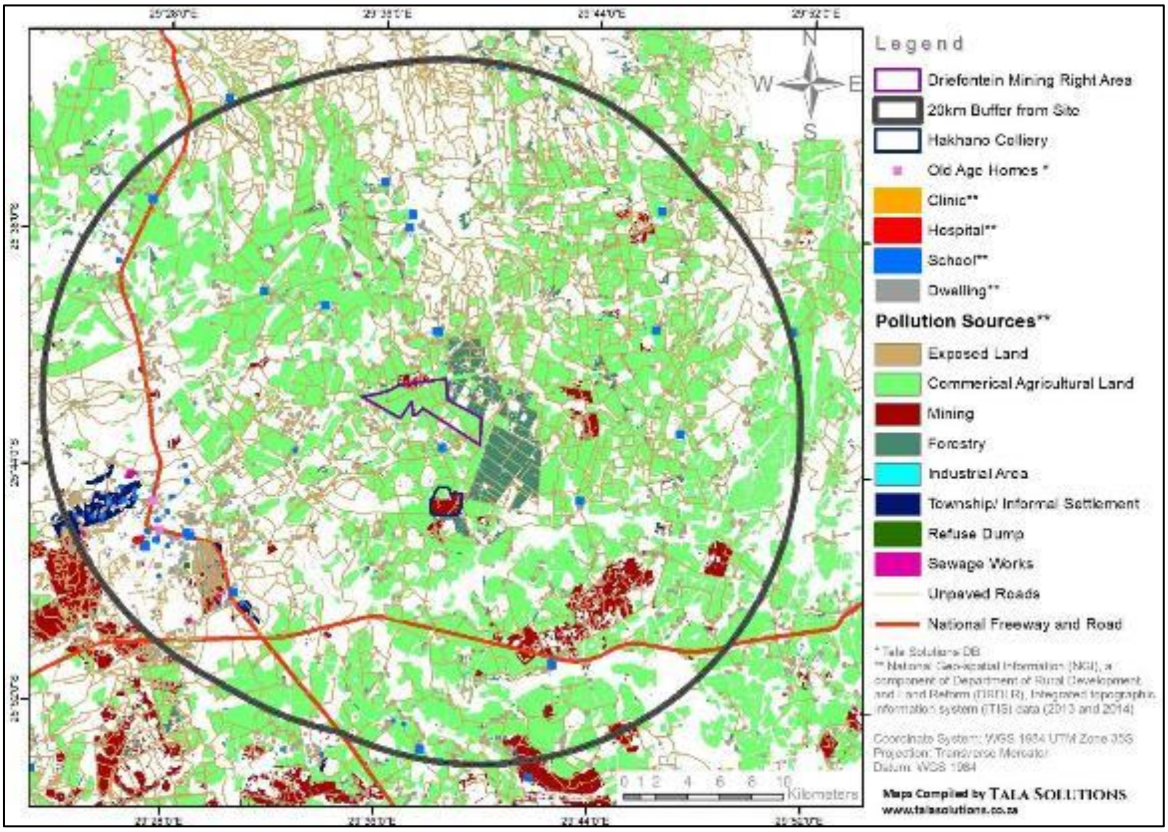


Figure 54: Identified emission sources within 20km of the proposed Driefontein Mine

10.10.4.1 Forestry/Plantations

Forestry activity occurs over small areas around the proposed mine, the exception being the section north-east to south-west of the proposed mine, just outside the mining right area, where forestry activity stretches over a larger area. The effects of plantations on ambient air quality are dependent on the type of plantations. Oil tree plantations, for example, are associated with production of high levels of VOCs, particularly isoprene. In general, plantations result in an increase in ambient NOx concentrations due to the frequent and heavier use of fertiliser (https://nerc.ukri.org/planetearth/stories/561). The use of mobile equipment and trucks during land preparation and removal of trees are also a source of emissions such as PM, SO_2 and NOx.

Plantations generally have sawmills. Air pollutants generated from sawmill operations are mainly associated with combustion processes such as wood recycling and disposal, as well as boilers. Additional sources of pollutants include wood drying in kilns, sawing, machining and sanding operations. Pollutants associated with boilers are dependent on the type of wood and fuel used to power the boilers and may include sulphur oxides (SOX), PM, NOX, CO, and VOCs. VOCs are also emitted from wood drying in kilns and during the application of solvents, coatings and lacquers to wood. Wood dust is an additional pollutant mainly associated with sawing, machining and sanding operations (Environmental, Health, and Safety Guidelines – Sawmilling and Manufactured Wood Products, International Finance Corporation).

10.10.4.2 Mining Activity

There are existing mining operations and stockpiles surrounding the proposed Driefontein Mine, particularly to the north, east, south-east and south-west. Hakhano Colliery (where processing of ROM coal ore from the proposed mine will be undertaken) is situated about 3km south of the proposed mine; while Just Coal Colliery and Mafube Colliery's Nooitgedacht Mine are situated directly north and 8 – 10 km south-east of the proposed mine, respectively. The following activities are key sources of emissions associated with mines:

- Material handling, storage and processing.
- Crushing and screening.
- Combustion processes (e.g., gas, diesel & oil combustion).
- Processing plant operations and associated combustion processes.
- Blasting and drilling.
- Excavation, bull dozing, grading.
- Removal of material (e.g., topsoil, overburden, ore).
- Wind erosion from exposed areas (e.g., opencast areas, stockpiles and storage piles).
- Conveying of material (material transfer).
- Vehicle dust entrainment due to truck hauling activities on unpaved roads; and
- Truck and mining equipment exhaust emissions.

Mining activity taking place near to the proposed Driefontein Mine is a key source of dust in the area.

10.10.4.3 Vehicle Dust Entrainment on Unpaved Roads

Vehicle-entrained dust emissions from the surrounding unpaved roads in the area potentially represent a key source of fugitive dust. When a vehicle or truck travels on an unpaved road, the force of the wheels on the road surface causes the pulverisation of surface material. Particles are lifted and dropped from the rolling wheels, and the road surface is exposed to strong air currents in turbulent shear with the surface. The turbulent wake behind the vehicle continues to act on the road surface after the vehicle has passed.

10.10.4.4 Agricultural Activity and Potential Biomass Burning

There are several commercial agricultural areas surrounding the project site. Emissions from agricultural activities are difficult to control due to the seasonality of emissions and the large surface area producing emissions. Expected emissions resulting from agricultural activities include particulates associated with wind erosion and burning of crop residue, chemicals associated with crop spraying and odiferous emissions resulting from manure, fertilizer and crop residue. Dust associated with agricultural practices may contain seeds, pollen and plant tissue, as well as agrochemicals, such as pesticides. The application of pesticides during temperature inversions increases the drift of the spray and the area of impact.

Dust entrainment from farming vehicles travelling on gravel roads may also cause increased particulates in an area. Dust from traffic on gravel roads increases with higher vehicle speeds, more vehicles and lower moisture conditions. The seasonal burning of the veld from July to September for field clearing in preparation for planting is also a source of smoke. The nature of the activity has a potential impact on air quality in the area.

10.11 Noise

Noise in the area is restricted to routine traffic to and from the surrounding farms and adjacent mining operations conducted by Hakhano Colliery and Bankfontein Colliery as well as other coal mines. The most important route in terms of calculable sound intensity levels is the R555 (likely class 3 route). The route can attain highway speeds. Further smaller routes are featured with their contributions minimal in terms of calculable acoustics. The R555 route is a defined by the Public Works, Roads and Transportation as high traffic (200 < 500 approximate ADDT), medium percentage heavy vehicles (20 < 50%). The road conditions (VCI Visual Condition Index) were classified as poor.

No significant railway or air transportation networks were identified (during site visits or by means of a desktop study). A small railway line does exist, however has been discontinued/derelict.

Agricultural activities such as the cultivation of lands and harvesting of crops along also contribute a low scale source of noise to the ambient level.

10.11.1 Potential Receptors

Seven (7) potential receptors were identified in the study area by the noise specialist. Receptor localities are presented in Figure 55 and the WGS coordinates provided in Table 54 below. Receptors were numbered from R1 to R7. Receptors within the study area compromised of the homestead of Mr. Jan Hendrik Roux (R1), a farm in the study area. Receptor R4 are two adjacent homesteads nearby the western footprint of the project.

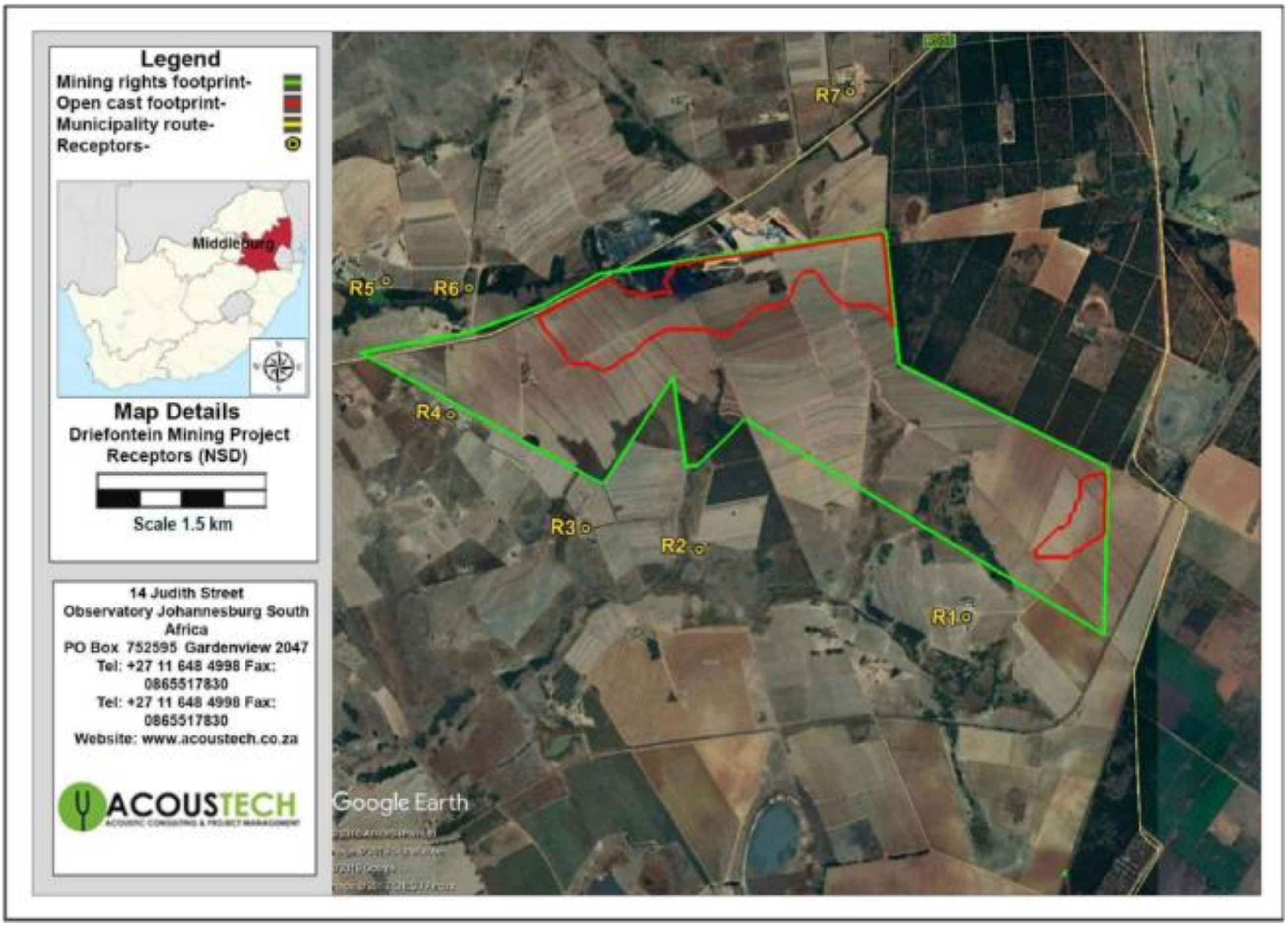


Figure 55: Noise receptor localities

Table 54: Noise receptor coordinates

Measurement Locality	Latitude	Longitude
NSD		
R1	765751.00 m E	7153097.00 m S
R2	763102.00 m E	7153819.00 m S
R3	761974.00 m E	7154052.00 m S
R4	760629.00 m E	7155203.00 m S
R5	759981.00 m E	7156554.00 m S
R6	760813.00 m E	7156466.00 m S
R7	764669.00 m E	7158366.00 m S

10.11.2 Baseline noise measurements

Acoustical measurements were conducted at three (3) localities. The measurement localities are presented in Figure 56 below. Where feasible a longer period measurement was attempted (approximate 24 hours). 10minute equivalent day (22:00 – 06:00) and/or night-time (06:00 – 22:00) measurements supplemented any area that was not feasible/required to measure for longer 24-hour periods.

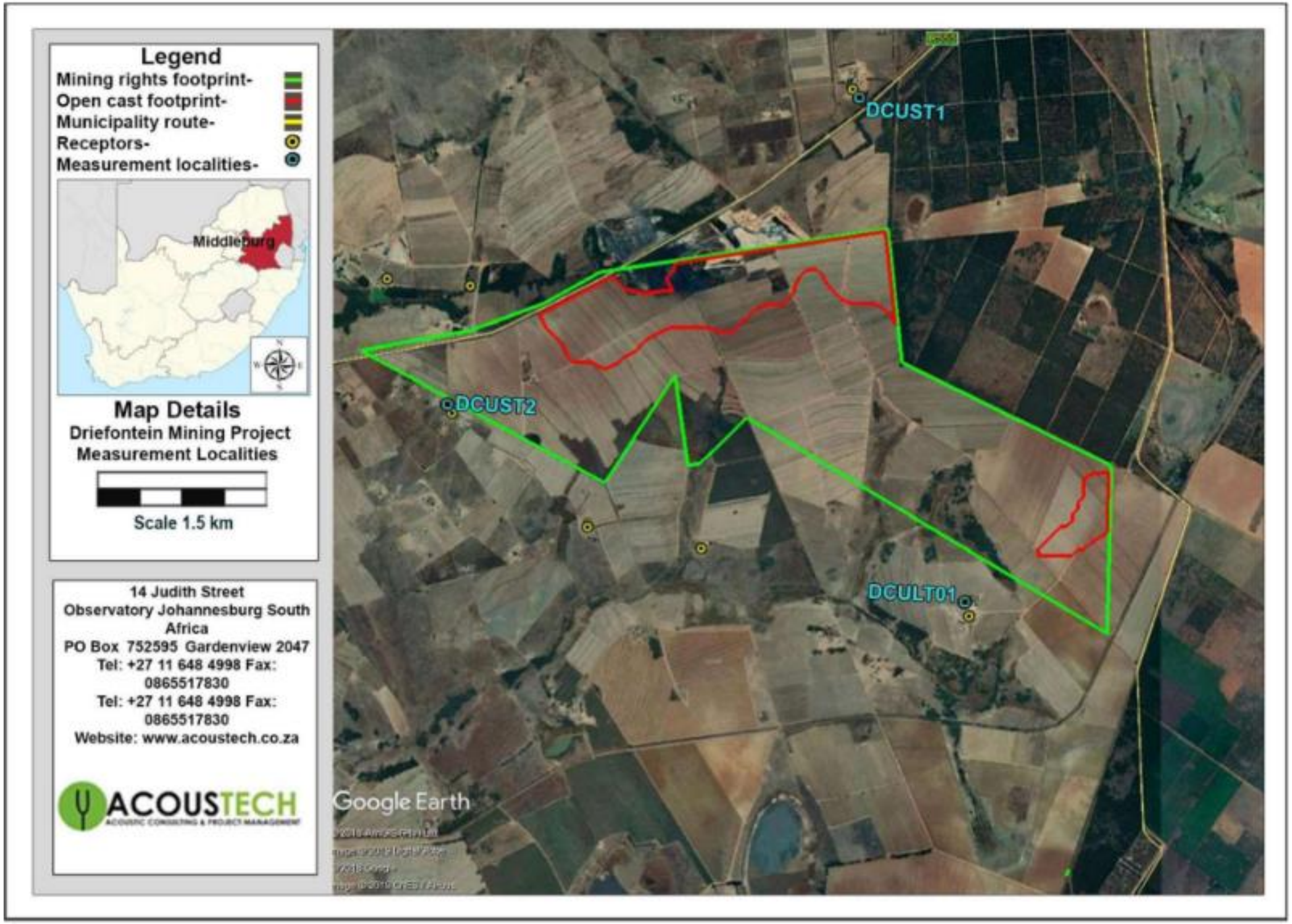


Figure 56: Measurement localities

The baseline results are presented below for:

- Longer-term Unattended Measurement – DCULT01 Roux Homestead; and
- Shorter-term Attended Measurements DCUST01 – DCUST02.

10.11.2.1 Longer-term Unattended Measurement – DCULT01 Roux Homestead

A locality away from dwelling noise (e.g., air-conditioning condenser units, workshops) was selected at the Roux Homestead. Foliage areas were also avoided (habitat for fauna noises). The selected farm did have a noisy/busy workshop (daytime use). Equivalent values (Impulse setting) are presented in Figure 57. Subsequent analysis of the data, desktop information and onsite investigations concluded the following:

- Calculated L_{Rdn} highlighted an area in comparison with an Urban (day) and Suburban (night) Rating levels. During the summertime the influence of faunal communication would be lower, and a worst-case Rural setting was selected (10 sec data in the absence of impulsive faunal sounds).
- Daytime measurements were influenced by dwelling and farming related noise sources (extraneous sounds/noise). Night-time data was lightly influenced by dwelling related sounds (e.g., dogs barking) and faunal communication (measurements conducted during summertime).

Point	Locality	Calculated Values (dBA)	Comparative Rating Level (SANS10103:2008)
DCULT01	Roux Homestead (R1)	L_{Rd} = 50 L_{Rn} = 41	Suburban (Night), see figure below, comments above. During winter times (lack of faunal communication) a Rural may be achievable.

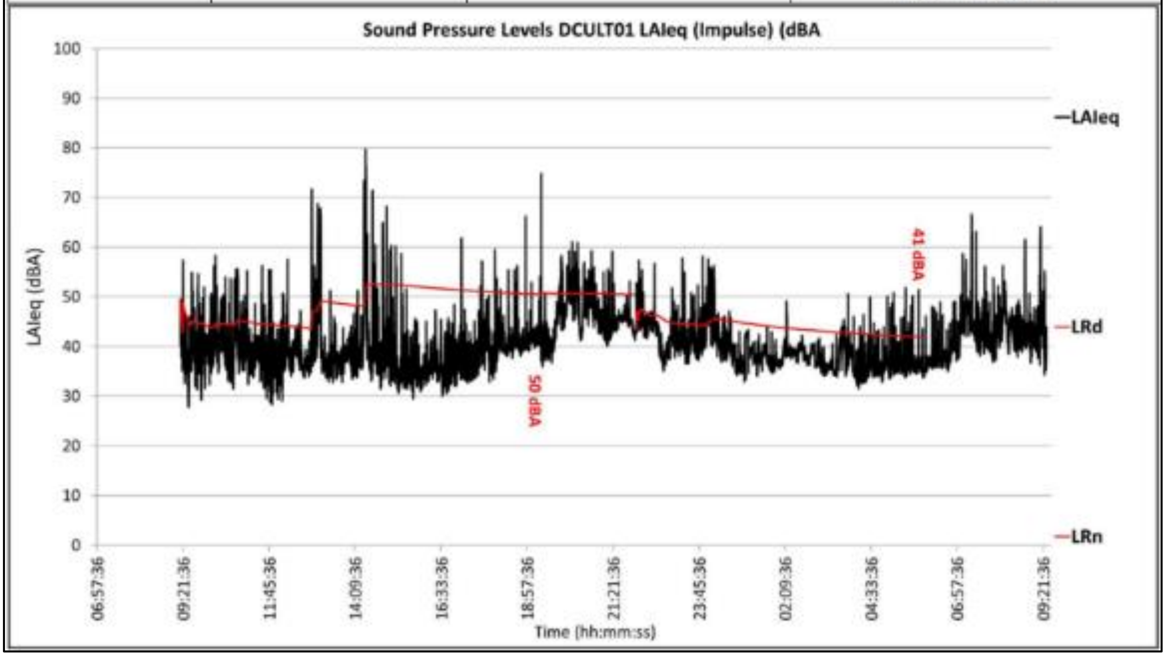


Figure 57: Rating level – Longer-term measurements DCULT01 Roux Homestead

10.11.2.2 Shorter-term Attended Measurements DCUST01 – DCUST02

Numerous attended daytime measurements were further conducted at receptors (calculated to 10-minute intervals presented). Investigations and measurements at these localities indicated the following:

- DCUST1 Muller Homestead (R8) – The receptor is over 1,5 km from the proposed surface mining area. The locality and receptor are based directly bordering the R555 local route. During measurements (10 minutes) numerous vehicles were noted along this route. Faunal communication was also audible.
- DCUST2 Homesteads (R4) – A locality bordering the receptor R4 was measured. Faunal communication and some R555 road noise were audible.
- Measurements near R6 and R5 was attempted, security at the front of the estate did not allow access. Receptor R4 (DCUST2) was within proximity of these receptors and was used for receptors Rating.

The resulting measurement and proposed Rating Level are presented in Table 55.

Table 55: Rating Levels – Single attended measurements $L_{Aleq,10min}$

Point	Locality	Measured Daytime Data (dBA)	SANS10103:2008 Daytime Rating Level Comparison L_{Rd}
DCUST1	Receptor R8	56	Urban 55 day
DCUST2	Receptor R4	43	Rural 45 day

10.11.3 Baseline Noise Levels Findings and Identified SANS10103:2008 Rating Levels

Based on the measurements in Section 10.11.2 above the following Rating Levels was applied for receptors:

- Rural Rating for receptors (R1 – R3). Analysed measurements, desktop studies and onsite investigations indicated that these receptors warrant a low rating (lack of busy transportation networks, industrial areas within proximity). It should be noted that longer-term measurements at R1 indicated that dwelling and faunal communication could influence measurements.
- Suburban Rating R4, R5, and R6 (within app. 500m of R555 route).
- An Urban rating level was selected for receptor R8 (within 150m of R555 route).
- Measurements, onsite investigations, online resources, and desktop studies indicated a moderately busy noise climate.

10.12 Visual aspects

10.12.1 Intrinsic value of the region

The value system of Mpumalanga Highlands was determined in the various collaborative, participative processes undertaken during the drafting of forward planning documentation, as such, the intrinsic value of the Highlands is found in the eco/agri tourism industry with strong linkages to the manufacturing industry. Even though the intrinsic value of the Mpumalanga Highlands is largely based on ecological characteristics, the values of the subject property and its immediate surroundings are largely based on the agricultural industry. The site is visible from the R555 district road and from the existing gravel road (D1433) connecting the R555 and R104. The R555 runs along the northern boundary of the application area and the D1433 gravel road runs along the eastern boundary. Within a 3km radius of the proposed mine the land use consists of agricultural, forestry, transportation, natural grassland and mining. The accumulation of mines within the region has contributed to a visually unappealing environment.

10.12.2 General landscape and use of the surrounding environment

The general landscape is typical of the Highveld Grasslands in that it is of a gently undulating topography, with dispersed perennial and non-perennial streams. The study area is characterised by a gently undulating topography and in the area of the site the slope is more or less in the order of 1.5%. The undulating topography acts as a partial screen from the south and completely conceals the project site from the north.

The larger region is characterised by commercial farming activities, plantations, smallholdings and existing mining activities with Middelburg serving as a larger urban centre. Infrastructure forming part of the existing Bankfontein Colliery is located within the northern part of the study area. East and north-east of the study site, land is predominantly under forestry plantations and has been since as early as 1945. The only trees remaining in the application area are located adjacent to the wetland areas and are predominantly invasive species. The study area is located within the Grassland Biome of South Africa, which is represented within the study area by the Rand Highveld Grassland vegetation type. This area is described as Eastern Highveld Grassland, Eastern Temperate Freshwater Wetlands and Rand Highveld Grasslands. The majority of the study area comprises the agricultural fields vegetation unit.

The broader study area is mainly a rural natural grazing and cultivated farmland area. The surrounding area has scattered clusters of farm homesteads especially towards the west. Theses isolated farm homesteads do not intrude highly on the landscape.

10.12.3 Sensitive receptors

The closest visual receptors are the farm homesteads located to the south and west of the project site. Other receptors include motorists travelling on the R555 district road, R104 district road and D1433 gravel road which lies to the north and east of the application area respectively. These roads are mainly used by residents and are not considered tourist related corridors. There are no nature reserves or scenic route trails within the surrounding area due to existing agricultural practises and industrial operations. Degraded areas are found to the north and east of the project site in the form of mining and forestry plantations.

10.12.4 Visual characterisation

10.12.4.1 Viewpoints

As indicated in Figure 58, twelve (12) Key Observations Points (KOPs) were identified from where inspections were conducted, and corresponding visual influence and characteristics have been defined. These KOPs correspond with movement routes, farm homesteads, rural dwellings, and general populated areas in the region (Refer to Table 56). These KOPs are described below to provide an overview of the visual characteristics of the study area.

Figure 58: KOPs in relation to the proposed mine

Table 56: KOP description

KOP	Location	Photo direction	Coordinates S			Coordinates E			Elevation	Type	Additional Notes	Distance from MRA
			Deg	*Min*	*Sec*	*Deg*	*Min*	*Sec*	*mamsl*			*meter*
1	Farm homestead of landowner (Mr Jan Roux) – short distance	North West & North East	25^0	42	50.68	29^0	38	58.56	1640	Residential area	The northern and South-Eastern overburden dumps will be visible from this KOP.	280m
2	D1433 gravel road (medium distance)	West	25^0	42	22.00	29^0	40	13.50	1687	Public gravel road	The northern and South-Eastern overburden dumps will be visible from this KOP.	760m
3	Informal settlement (long distance)	South	25^0	38	40.93	29^0	37	49.51	1639	Residential area	The northern overburden dumps might be visible from this KOP. Visual intrusion low because of distance from project site and existing dumps from Bankfontein Colliery.	4000m
4	R555 district road (short distance)	South	25^0	41	90.27	29^0	36	42.76	1657	Public road	The northern opencast pit and overburden dumps will be visible because it is situated adjacent the R555.	50m
5	Bankfontein Colliery administration offices (long distance)	No photo	25^0	40	01.12	29^0	36	17.54	1587	Agricultural	Access denied during site inspection.	2110m
6	R555 district road residential entrance points (medium to long distance)	East	25^0	41	38.35	29^0	35	10.68	1599	Public road	The northern overburden dumps will be visible because it lies at a higher topography compared to the KOP.	540m
7	Commercial operation (JLF Logistics) and houses (short distance)	East	25^0	41	50.87	29^0	35	52.52	1621	Residential area	The project site, especially the north-eastern overburden dumps, will be visible due to the relatively flat topography and lack of screening provided by the surrounding land	12m

KOP	Location	Photo direction	Coordinates S			Coordinates E			Elevation	Type	Additional Notes	Distance from MRA
			Deg	*Min*	*Sec*	*Deg*	*Min*	*Sec*	*mamsl*			*meter*
											uses.	
8	Farmhouses along public gravel road (medium distance)	North East	25^0	42	24.31	29^0	35	48.95	1619	Agricultural area	The project site, especially the north-eastern overburden dumps, will be visible due to the relatively flat topography and lack of screening provided by the surrounding land uses.	980m
9	Farm homestead (medium distance)	North East	25^0	42	34.40	29^0	36	12.08	1605	Residential area	The project site will be visible from this KOP, but the visual prominence will be less because of the topography and distance from the site.	950m
10	Farm homestead (long distance)	North	25^0	43	23.41	29^0	36	52.39	1591	Residential area	The project site will be visible from this KOP with the distance and topography providing partial screening.	2114m
11	R104 district road (long distance)	North	25^0	46	29.71	29^0	36	52.39	1612	Tourist related corridor (public road)	Project site will be barely visible from R104 because of the distance, existing screens such as the topography and cultivated lands.	7898m
12	Cluster of homes next to R555 district road (long distance)	East	25^0	42	01.04	29^0	33	25.36	1570	Residential area	Project site barely visible from this KOP because of the distance, existing screens such as the topography and vegetation.	3900m

10.12.4.1.1 KOP 1

KOP 1 is located at the permanent residence of Mr Jan Roux (highly sensitive receptor) situated directly south of the application area. Photo Plate 19 was taken in a north-west direction towards the proposed northern opencast pit and Photo Plate 2 was taken in a North-East direction towards the proposed South-Eastern opencast pit. The proposed northern (located 3500m north) and South-Eastern (located 900m north-east) overburden dumps will be visible from KOP 1. The topography won't absorb the project site. The visibility might be partially screened by crops during certain times in the year but overall, the area has a high visual sensitivity. The Bankfontein Colliery dumps and forestry plantations are existing visual intrusion in the background.

Photo Plate 19: KOP 1 (Photo direction: North-West)

Photo Plate 20: KOP 1 (Photo direction: North-East)

10.12.4.1.2 KOP 2

KOP 2 is located along the D1433 district road (medium sensitive receptor) situated east of the application area. The road is mainly used by residents and surrounding mining/siding operations. The South-Eastern overburden dumps located approx. 1100m to the west, and the northern overburden dumps, located approx. 4600m north-west, will be visible from this KOP. The topography will partially absorb the project site and the visibility might be partially screened by crops during certain times in the year but overall, the area has a high visual sensitivity. The existing visual intrusions are the Bankfontein Colliery dumps in the background and power lines in the foreground.

Photo Plate 21: KOP 2 (Photo direction: West)

10.12.4.1.3 KOP 3

KOP 3 is located at the informal settlement (highly sensitive receptor) situated 4700m north of the application area. The northern overburden dumps might be visible from this KOP, but the visual prominence will be less because of the distance from the project site. The topography will completely absorb the project site and the visibility might be totally screened by the existing Bankfontein Colliery and agricultural land uses in the foreground. KOP 3 has a low visual sensitivity due to the surrounding land uses.

Photo Plate 22: KOP 3 (Photo direction: South)

10.12.4.1.4 KOP 4

KOP 4 is located along the R555 district road (medium sensitive receptor) situated directly north of the application area. The road is mainly used by residents, surrounding mining operations and travelers between Stofberg and Middelburg. The northern open pit and overburden dumps located approximately 550m to the south will be visible from this KOP. Part of the project site will be screened by the existing Bankfontein Colliery and subsequently the overall area has a medium visual sensitivity. The topography will totally absorb the South-Eastern overburden dump.

Photo Plate 23: KOP 4 (Photo direction: South)

10.12.4.1.5 KOP 6

KOP 6 is located at a resident's entrance point from R555 (highly sensitive receptor) situated west of the application area. The road is used by the surrounding landowners. The northern overburden dumps, located approx. 2000m east, will be visible from this KOP. The topography will partially absorb the northern overburden dump. Part of the project site will be absorbed by the topography and screened by the existing Bankfontein Colliery therefor the area has a medium visual sensitivity. The existing visual intrusions are the Bankfontein Colliery, R555 district road and power lines in the foreground.

Photo Plate 24: KOP 6 (Photo direction: East)

10.12.4.1.6 KOP 7

KOP 7 is located at JLF Logistics entrance (highly sensitive receptor) situated along the western boundary of the application area. The northern overburden dumps, located approx. 1100m east, and South-Eastern overburden dumps, located approx. 6000m south-east, will be visible from this KOP. The topography will largely absorb the SE overburden dump. The area has a high visual sensitivity due to the relatively flat topography towards the project site and lack of vegetative cover. The visibility might be partially screened by crops depending on the type and time of the year. The existing visual intrusions are the Bankfontein Colliery overburden dumps in the background.

Photo Plate 25: KOP 7 (Photo direction: East)

10.12.4.1.7 KOP 8

KOP 8 is located at the entrance of an adjacent landowner's homestead (highly sensitive receptor) situated west of the application area. The northern overburden dumps, located approx. 1800m east, and South-Eastern overburden dumps, located approx. 6160m east, will be visible from this KOP. The topography will largely absorb the South-Eastern overburden dump, but the area has a high visual sensitivity due to the relatively flat topography towards the norther opencast pit and lack of vegetative cover. The visibility might be partially screened by crops depending on the type and time of the year. The existing visual intrusions are the Bankfontein Colliery overburden dumps in the background.

Photo Plate 26: KOP 8 (Photo direction: East)

10.12.4.1.8 KOP 9

KOP 9 is located at a farmer's homestead (highly sensitive receptor) situated south-west of the application area. The northern overburden dumps, located approx. 1800m north-east, and South-Eastern overburden dumps, located approx. 5400m east, will be visible from this KOP. The topography will largely absorb the South-Eastern overburden dump. The area has a high visual sensitivity due to the relatively flat topography towards the northern opencast pit and lack of vegetative cover. The visibility might be partially screened by crops depending on the type and time of the year. The existing visual intrusions are there are only the crop fields and some rural dwellings in the foreground and middle ground.

Photo Plate 27: KOP 9 (Photo direction: East)

10.12.4.1.9 KOP 10

KOP 10 is located at a farmer's homestead (highly sensitive receptor) situated south-west of the application area. The northern overburden dumps located 3200m north, and the South-Eastern overburden dumps, located 5200m east, will be visible from this KOP. The topography will partially absorb the northern overburden dumps therefor the area has a medium visual sensitivity. The existing visual intrusions are the Bankfontein Colliery overburden dumps in the background.

Photo Plate 28: KOP 10 (Photo direction: North)

10.12.4.1.10 KOP 11

KOP 11 is located along the R104 district road (medium sensitive receptor) situated to the south of the application area. The road is mainly used by residents, surrounding mining operations and travelers from the town Middelburg. The northern overburden dumps, located 9000m north, will be visible from this KOP. The topography will largely absorb the project site from this KOP. Most of the project site will be screened by the existing agricultural activities found in the foreground and subsequently the overall area has a low visual sensitivity. The existing visual intrusions include power lines in the foreground, dust from surrounding mines in the middle ground and the Bankfontein Colliery dumps in the background.

Photo Plate 29: KOP 11 (Photo direction: North)

10.12.4.1.11 KOP 12

KOP 12 is located along the R555 district road (medium sensitive receptor) situated west of the application area. The road is mainly used by residents, surrounding mining operations and travellers from the town Middelburg. The northern overburden dumps, located 5000m north, might be visible from this KOP. The topography will largely absorb the project site from this KOP and subsequently the overall area has a low visual sensitivity. The existing visual intrusions include power lines in the foreground and the existing Bankfontein Colliery and R555 in the middle ground.

Photo Plate 30: KOP 12 (Photo direction: East)

10.12.5 Visibility

According to Oberholzer, B. 2005. Guideline for involving visual & aesthetic specialists in EIA processes: Edition 1, visibility of the project refers to the geographical area from which the project will be visible, (The actual zone of visual influence of the project may be smaller because of screening by existing trees and buildings). Visibility in this context also relates to the number of receptors affected.

Most of the highly sensitive receptors, which include different farm homesteads, lie to the west, south-west and south within a 1000m from the project site. The viewshed map below indicates that the project site is visible from the south and west for approximately 7km away since the topography rises towards the north-east where the site is situated (refer to Figure 59). The project site is not visible from the north because the elevation of the area drops by approximately 60m towards the north (refer to Figure 60). The project site is visible from the east for a short distance along the D1433 gravel road but not from a medium to long distance due to the large forestry plantation located directly adjacent to the site.

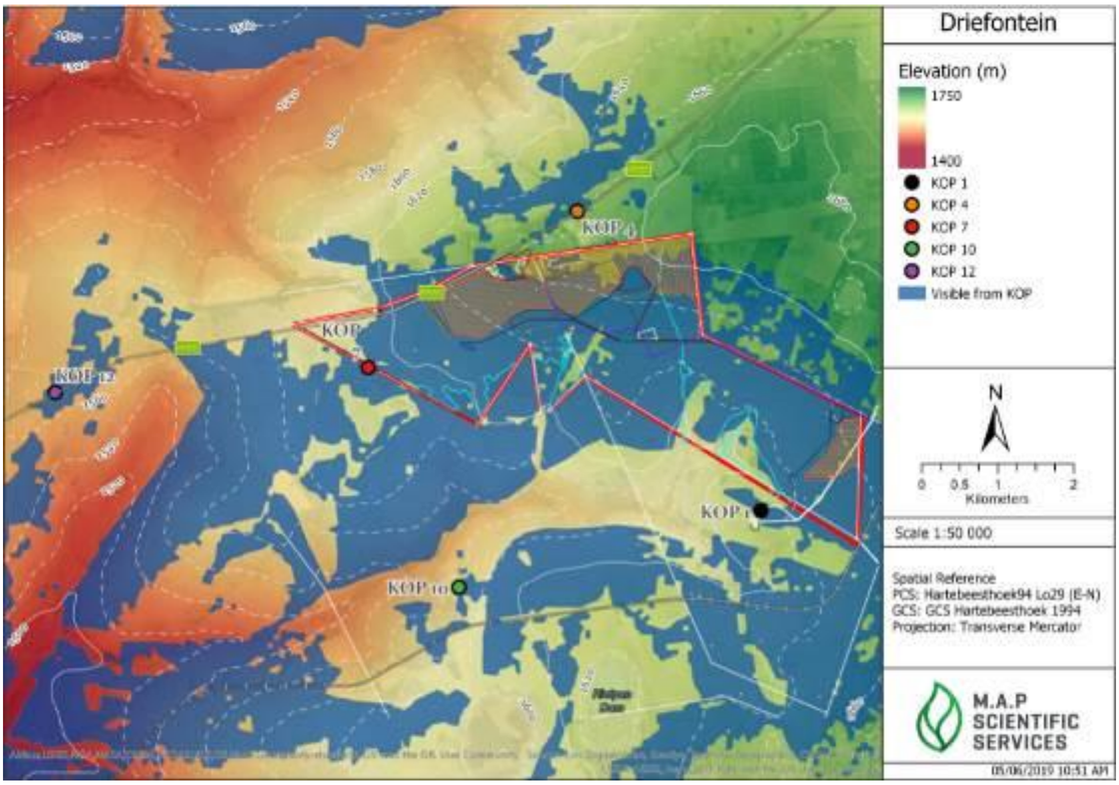


Figure 59: Viewshed Map indicating visibility from the south and west of the project site

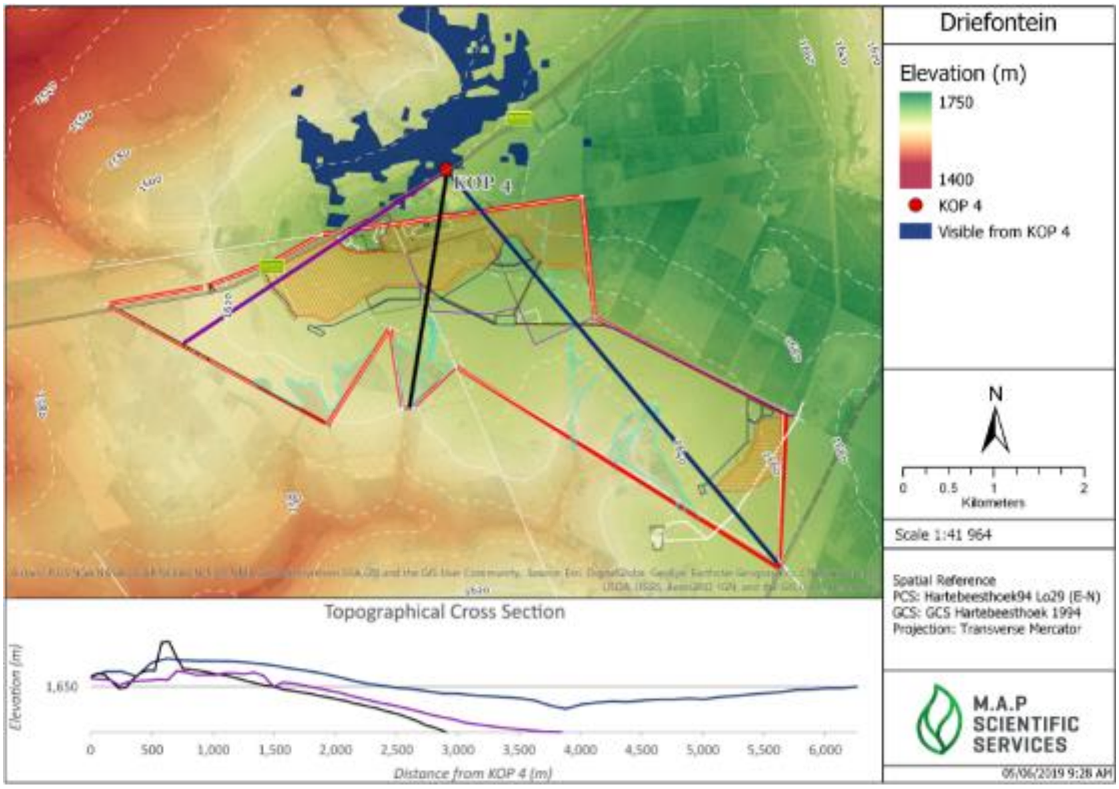


Figure 60: Viewshed Map indicating visibility from the north of the project site

10.12.6 Visual intrusion

According to Oberholzer, B. 2005. Guideline for involving visual & aesthetic specialists in EIA processes: Edition 1, visual intrusion is the level of compatibility or congruence of the project with the particular qualities of the area, or its 'sense of place'. This is related to the idea of context and maintaining the integrity of the landscape or townscape.

The immediate surrounds of the project area are characterised by agricultural activities especially cultivated crop lands and forestry. The proposed development is an opencast coal mine which is categorised as a category 5 development therefor it is expected to have a high visual intrusion. There are existing mining activities within the surrounding region such as the Bankfontein Colliery located on the northern boundary of the application area and the Hakhano Colliery located approximately 3.5km to the south which gives the regional area more of an industrial feel. However, since the project site is a greenfields area consisting of cultivated lands it has been assessed that the proposed mine will overall have a high visual intrusion.

10.12.7 Visual exposure

According to Oberholzer, B. 2005. Guideline for involving visual & aesthetic specialists in EIA processes: Edition 1, visual exposure is based on distance from the project to selected viewpoints. Exposure or visual impact tends to diminish exponentially with distance.

The ooverburden stockpiles will contribute significantly to the visual exposure due to their height and uncharacteristic nature compared to the surrounding area. The farm homesteads identified towards the west and south of the project site will be exposed. KOP 1, KOP 4 and KOP 7 are located within 500m of the project site therefor having a very high visual exposure. KOP 2, KOP 6, KOP 8 and KOP 9 are located within a 1000m of the project site therefore having a high visual exposure. KOP 3, KOP 10, KOP 11 and KOP 12 are located more than 2000m from the project site therefor having a low to very low visual exposure. Taking into consideration the above distances of the highly sensitive receptors as well as the visual prominence of mining infrastructure from different distances it has been assessed that the project will have an overall high exposure.

10.12.8 Visual sensitivity of receptors

According to Oberholzer, B. 2005. Guideline for involving visual & aesthetic specialists in EIA processes: Edition 1, visual sensitivity of receptors is the level of visual impact considered acceptable dependent on the type of receptors.

The closest visual receptors are the farm homesteads located to the south and west of the project site. Other receptors include motorists travelling on the R555 district road, R104 district road and D1433 gravel road which lies to the north and east of the application area respectively. These roads are mainly used by residents and are not considered tourist related corridors. There are no nature reserves or scenic route trails within the surrounding area due to existing agricultural practises and industrial operations. Degraded areas are found to the north and east of the project site in the form of mining and forestry plantations. However, since the closest visual receptors are homesteads which are permanently occupied the overall visual sensitivity of the receptors have been assessed as high.

10.12.9 Visual Absorption Capacity

According to Oberholzer, B. 2005. Guideline for involving visual & aesthetic specialists in EIA processes: Edition 1, Visual Absorption Capacity (VAC) can be defined as an 'estimation of the capacity of the landscape to absorb development without creating a significant change in visual character or producing a reduction in scenic quality'. VAC was determined by considering the nature and occurrence of vegetation cover, topographical characteristics, and human structures. A further major factor is the degree of visual contrast between the proposed new project and the existing elements in the landscape.

The topography of the region conceals the site almost completely from the north. There is only a small area to the north situated approximately 4km away from the application area which could be visible, and this is due to a rise in topography at that area, but the existing Bankfontein Colliery further acts as a screen to the project site from the north. The existing forestry plantations to the east completely absorbs the project site from more than 800m away. The topography and lack of vegetative cover to the south and west of the project site does not provide effective screening from KOP 1, KOP 6, KOP 7, KOP 8, KOP 9 and KOP 10. The agricultural activities surrounding the project area could potentially conceal parts of the project site during specific times during the year depending on what crops are planted but this could not be confirmed during the field inspection because of the time of year (June 2019). Based on the above, the project has been assessed to have an overall moderate visual absorption capacity because of the topography and existing mining operation to the north and the forestry plantations to the east which contributes to the screening of the project site from these directions.

10.12.10 Visual sensitivity of the area

According to Oberholzer, B. 2005. Guideline for involving visual & aesthetic specialists in EIA processes: Edition 1, visual sensitivity of the area is defined as the inherent visibility of the landscape, usually determined by a combination of topography, landform, vegetation cover and settlement pattern.

Topography – Due to active agricultural and mining activities occurring, the appeal of the landscape has been slightly compromised. The topographic value of the study area is therefore considered to have a moderate value.
Landform –A large portion of the proposed site's visual value has already been disturbed by current land uses. However, there are three visually prominent water drainage courses which originate in the southern region of the study area. ESAs are also associated with the watercourses; therefore, the aesthetic value of the landform is considered moderate.
Vegetation cover – Most of the application area has been transformed through the current mining and agricultural activities. Vegetation units located within the proposed site comprise of Natural Grasslands, Wetlands/ Moist Grassland and
Modified Grassland: therefore, the aesthetic value of the vegetation cover is considered moderate.

Settlement Pattern - The broader study area is mainly a rural natural grazing and cultivated farmland area. The surrounding area has scattered clusters of farm homesteads especially towards the west. These isolated farm homesteads do not intrude highly on the landscape and therefor the aesthetic value of the settlement pattern is considered moderate.

It can be concluded that the inherent visibility of the landscape, which is determined by the combination of topography, landform, vegetation cover and settlement pattern determines the overall visual sensitivity of the area. Based on the assessment of these individual characteristics the visual sensitivity of the area can be described as moderate, it is important to note that this is for the area and not only the specific project site.

10.13 Heritage Resources

In 2019, PGS Heritage (PGS) undertook the Heritage Impact Assessment for the proposed Driefontein Mine. An update of the 2019 assessment was required and a subsequent fieldwork was undertaken in May 2022. The fieldwork component of the study was aimed at identifying tangible remains of archaeological, historical and heritage significance. The fieldwork was undertaken by way of intensive walkthroughs of the proposed footprint area. The first phase of the fieldwork was conducted on 11 June 2019. The fieldwork team consisted of two archaeologists from PGS Heritage (John Anderson and Jennifer Kitto). The second phase of the fieldwork was conducted on 6 May 2022. The fieldwork team consisted of one archaeologist and one field assistant from PGS Heritage (Michelle Sachse and Xander Fourie).

The findings of the initial assessment and subsequent update is presented below.

10.13.1 Archival/historical maps

Historical topographic maps from 1968 to 2010 were available for utilisation in the background study. The maps were utilised to identify structures or graves that could possibly be older than 60 years and thus protected under Section 34 and 36 of the NHRA. Many of the structures identified are farmsteads or homesteads, demarcated as “huts”. One grave site was identified in the same location on all the maps. As discussed in the historical background of the area section of the HIA, there is a dense cultural history in Mpumalanga.

10.13.1.1 Topographical map 2529DA (First Edition) 1968

A portion of the First Edition of the 2529DA Topographical Sheet is depicted below. The map was based on aerial photography undertaken in 1964 and was surveyed in 1967 and drawn in 1968 by the Trigonometrical Survey Office. One grave site and several groups of African homesteads (“huts”) are depicted in the location of the study area (yellow circles). The grave site is likely to be 51 years or older.

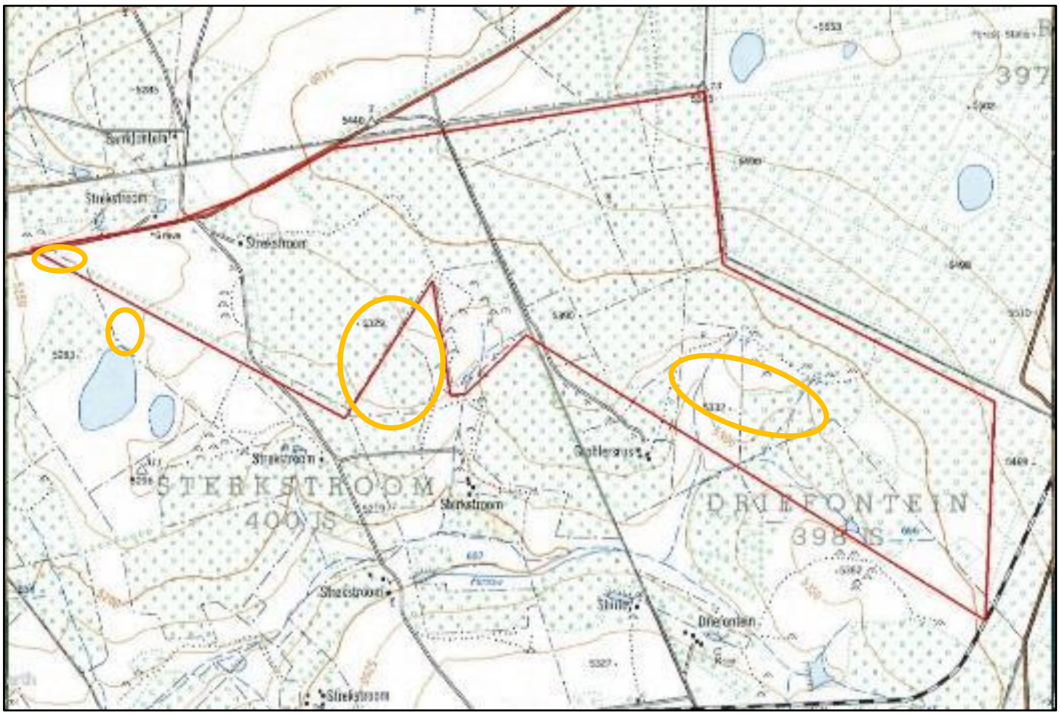


Figure 61: Enlarged portion of the Map 2529DA (Ed 1) 1968, showing the African homestead clusters and grave site (yellow circles).

10.13.1.2 Topographical Map 2529DA (Second Edition) 1984

A portion of the Second Edition of the 2529DA Topographical Sheet is depicted below. The map was published by the Chief Directorate: Surveys and Land information in 1987 and printed by the Government Printer. The same grave site and several groups of structures are depicted in the location of the study area (yellow circles). The structures will be less than 60 years old.

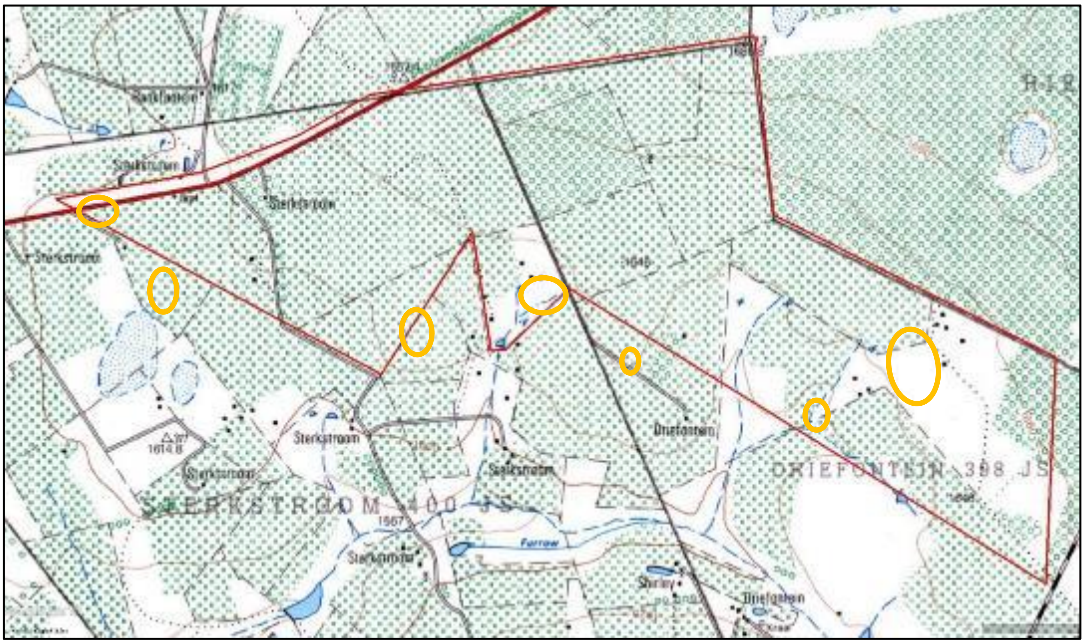


Figure 62: Enlarged portion of the Map 2529DA (Ed 2), 1984, showing the structure groups and grave site (yellow circles)

10.13.1.3 Topographical Map 2529DA (Third Edition) 2010

A portion of the Third Edition of the 2529DA Topographical Sheet is depicted below. The map was published and printed by the Chief Directorate: National Geo-spatial Information in 2014 by the Government Printer. Only the grave site depicted in the previous two editions and one structure are depicted on this map.

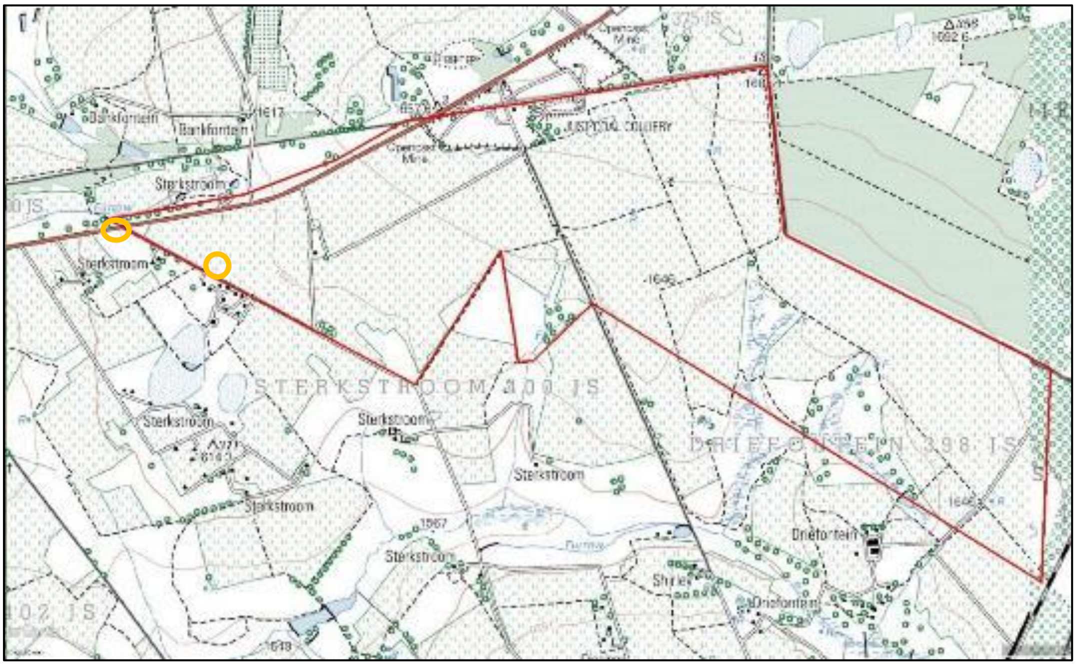


Figure 63: Enlarged portion of the Map 2529DA (Ed 2), 1984, showing the grave site and one structure (yellow circles).

10.13.2 Heritage sensitivity

The background assessment enabled the identification of possible heritage sensitive areas that included:

- Dwellings.
- Clusters of dwellings (homesteads and farmsteads).
- Burial grounds and graves.
- Structures/Buildings.

The findings have been combined to produce a heritage sensitivity map for the project (Figure 64). Objects depicted include burial grounds or possible graves, homesteads, and structures. Observation of the previous heritage reports has shown that graves are in abundance in the surrounding areas and especially near farmsteads. By superimposition and analysis, it was possible to rate these structure/areas according to age and thus their level of protection under the NHRA.

Table 57: Possible heritage sites in the study area

Name	Description	Legislative protection
Architectural Structures/ Dwellings	Possibly older than 60 years	NHRA Sect 3 and 34
Burial grounds	Graves	NHRA Sect 3 and 36 and MP Graves Act

Figure 64: Heritage sensitivity map showing locations of possible heritage features depicted on the topographical maps and satellite imagery: purple polygons = grave/s, orange polygons = homesteads ("huts"), blue polygons = structures

10.13.3 Fieldwork findings

Thirteen grave sites and burial grounds were present on the property during the first phase of the fieldwork in 2019. However, during the second phase of the fieldwork in 2022 it was evident that five of those thirteen previously identified graves sites has been destroyed. Also, during the second phase of the fieldwork a new grave site has been identified. Burial grounds and graves have high heritage significance and are given a Grade IIIA significance rating. A description of each site is provided below (taken from the HIA), and the location of these sites is depicted in Figure 65.

Table 58: Individual heritage sites description

Site number	Lat	Lon	Description	Heritage Significance	Heritage Rating
DFN001	25° 42.098'S	29° 39.069'E	According to the first phase of the fieldwork, the site consists of an informal burial ground. The graves are mostly stone packed with some having cement or granite dressings. A few have inscribed headstones with African names, but only one had a visible date of death (1978). The cemetery is in the middle of a cultivated ploughed maize field. A grave count revealed approximately 16-20 graves. During the second phase of the fieldwork the graves could not be located as the site is currently in the middle of a cultivated maize field. The graves have mostly likely been destroyed. **Site extent:** Approximately 50m x 50m. Burial grounds and graves are protected under Section 36 of the NHRA 25 of 1999. Thus, the site is provisionally rated as having a high heritage significance with a heritage rating of IIIA. All graves have high levels of emotional, religious and in some cases historical significance. It is also important to understand that the identified graves could have significant heritage value to the relevant families.	High Significance	IIIA

Site number	Lat	Lon	Description	Heritage Significance	Heritage Rating

View of the informal burial ground from the phase one fieldwork.

View of the one headstone with dates and a name from the phase one fieldwork.

<table>
<tr><th>Site number</th><th>Lat</th><th>Lon</th><th>Description</th><th>Heritage Significance</th><th>Heritage Rating</th></tr>
<tr><td colspan="6">
General view of the maize field, during the phase two fieldwork, located where site DFN001 was previously identified.</td></tr>
<tr><td>DFN002</td><td>25° 42.119'S</td><td>29° 38.972'E</td><td>According to the first phase of the fieldwork, the site consists of a group of three stones that could be an unconfirmed grave. The site is situated in the same ploughed mielie filed as Site DFN001 and has been avoided. It was identified as a grave by the farmer’s son. Site extent: approx. 200m^2

During the second phase of the fieldwork the graves could not be located as the site is currently in the middle of a cultivated maize field. The graves have mostly likely been destroyed.

Site extent: Approximately 20m x 20m.

Burial grounds and graves are protected under Section 36 of the NHRA 25 of 1999. Thus, the site is provisionally rated as having a high heritage significance with a heritage rating of IIIA. All graves have high levels of emotional, religious and in some cases historical significance. It is also important to understand that the identified graves could have significant heritage value to the relevant families.</td><td>High

Significance</td><td>IIIA</td></tr>
</table>

View of the stones identified as a possible/unconfirmed grave.

View of the grass patch containing the unconfirmed grave.

General view of the location of the site DFN002 during the second phase of the fieldwork.

DFN003	**25° 41.718'S**	**29° 36.274'E**	The site consists of an informal burial ground. The graves are mostly stone packed with a few inscribed with African names. Only one headstone had a visible date of death (1976). The graves are in a cultivated maize field, very close to the demolished ruins of a few structures. A grave count revealed approximately five graves. A few of the graves seem to have been cleaned recently which indicates that they are being visited by the family. During the second phase of the fieldwork the graves were identified as still visible and not disturbed, although the area is very overgrown. **Site extent:** Approximately 10m x 10m. Burial grounds and graves are protected under Section 36 of the NHRA 25 of 1999. Thus, the site is provisionally rated as having a high heritage significance with a heritage rating of IIIA. All graves have high levels of emotional, religious and in some cases historical significance. It is also important to understand that the identified graves could have significant heritage value to the relevant families.	High Significance	IIIA

 *View of the informal burial ground, during the phase one fieldwork, showing the cleaned graves.*	 *View of the one headstone with a name and date of death, pictured during phase one of the fieldwork.*
 *General view of the informal graveyard located at site DFN003, during phase two of the fieldwork.*	 *View of one of the headstones located in the informal graveyard at site DFN003, during phase two of the fieldwork.*

DFN004	25° 41.514'S	29° 35.816'E	According to the first phase of fieldwork, the site consists of an informal family burial ground. The visible graves have formal dressings of concrete or granite with inscribed headstones with Afrikaans names. At least one grave is stone packed. The names are mainly Van Heerden and Van Rensburg. The dates of death include 1891, 1905 and 1948. The graves are surrounded by a low pre-cast concrete wall. The burial ground is situated between a field and the northern boundary of the study area. A grave count revealed approximately 20 graves; however, the graves are obscured by extremely long grass. A colony of bees was also noted. During the second phase of the fieldwork the graves were identified as still visible and not disturbed, although the area is very overgrown. **Site extent:** Approximately 20m x 20m. Burial grounds and graves are protected under Section 36 of the NHRA 25 of 1999. Thus, the site is provisionally rated as having a high heritage significance with a heritage rating of IIIA. All graves have high levels of emotional, religious and in some cases historical significance. It is also important to understand that the identified graves could have significant heritage value to the relevant families.	High Significance	IIIA

 *View of the wall of the family burial ground, showing the extremely long and dense grass, identified during the phase one fieldwork.*	 *View of a few of the visible graves, identified during the phase one fieldwork.*
 *Headstone of Schalk Willem Van Heerden, died 1948, identified during the phase one fieldwork.*	 *Grave of SW Van Heerden, died 1905, identified during the phase one fieldwork.*

Headstone of Jacoba Susanna Maria Van Heerden, died 1956, identified during the phase one fieldwork.

Headstone of Jacobus Rudolf Jansen van Rensburg, died 1895, identified during the phase one fieldwork.

General view of the graveyard DFN004 during the phase two fieldwork.

General view of the graveyard at site DFN004 during phase two fieldwork, showing the overgrown nature of the site, the graves are hardly visible.

DFN005	25° 41.903'S	29° 37.452'E	According to the first phase of fieldwork, the site consists of an informal burial ground. The graves are mostly stone packed with a few headstones but no inscriptions. The graves are located on the edge of a ploughed maize field, near a patch of black wattle trees. A grave count revealed approximately seven graves. The graves are fenced. Three graves have been cleaned recently and one had grave goods on the dressing, which indicates that they are being visited by the family. During the second phase of the fieldwork the graves were identified as still visible and not disturbed, although the area is very overgrown. **Site extent:** Approximately 30m x 30m. Burial grounds and graves are protected under Section 36 of the NHRA 25 of 1999. Thus, the site is provisionally rated as having a high heritage significance with a heritage rating of IIIA. All graves have high levels of emotional, religious and in some cases historical significance. It is also important to understand that the identified graves could have significant heritage value to the relevant families.	High Significance	IIIA

 *View of the informal burial ground, showing the 3 cleaned graves, identified during the phase one fieldwork.*	 *View of the cleaned graves, showing the grave goods on one grave, identified during the phase one fieldwork.*
 *General view of the informal graveyard at site DFN005, during the phase two fieldwork.*	 *General view of the informal graveyard at site DFN005, during the phase two fieldwork.*

DFN006	25° 42.242'S	29° 38.671'E	According to the first phase of the fieldwork, the site consists of a heap of stones which is an unconfirmed grave. It was identified by the farmer's son as a grave. The stone heap is located at the edge of a patch of black wattle trees. A foot search of the ground in the trees did not reveal any other possible grave sites. During the second phase of the fieldwork the possible grave was identified as still visible, although the surrounding area has been disturbed by deforestation and ground clearing activities. **Site extent:** Approximately 5m x 5m. Burial grounds and graves are protected under Section 36 of the NHRA 25 of 1999. Thus, the site is provisionally rated as having a high heritage significance with a heritage rating of IIIA. All graves have high levels of emotional, religious and in some cases historical significance. It is also important to understand that the identified graves could have significant heritage value to the relevant families.	High Significance	IIIA

View of the stone heap which could be a grave, identified during the phase one fieldwork.

General view of the site DFN006, identified during the phase two fieldwork.

General view of the site DFN006, identified during the phase two fieldwork, showing the ground clearing activities in the surrounding area.

DFN007	25° 42.264'S	29° 38.915'E	According to the first phase of the fieldwork, the site consists of approximately five stone heaps and scattered stone concentrations. Some of these could be homestead foundations and at least one could be a grave. The site is situated in and around a stand of black wattle trees. It was identified as a grave site by the farmer's son. During the second phase of the fieldwork the possible grave was not identified as the area had been cleared and activities of deforestation had destroyed the site previously identified in 2019. **Site extent:** Approximately 15m x 15m. Burial grounds and graves are protected under Section 36 of the NHRA 25 of 1999. Thus, the site is provisionally rated as having a high heritage significance with a heritage rating of IIIA. All graves have high levels of emotional, religious and in some cases historical significance. It is also important to understand that the identified graves could have significant heritage value to the relevant families.	High Significance	IIIA

 *View of the site, showing the scattered stones, identified during the phase one fieldwork.*	 *View of one possible grave, identified during the phase one fieldwork.*
 *General view of the site DFN007, identified during the phase two fieldwork. The site has been destroyed.*	 *General view of the site DFN007, identified during the phase two fieldwork. The site has been destroyed.*

DFN008	25° 42.411'S	29° 38.926'E	According to the first phase of the fieldwork, the site consists of an informal burial ground. The graves are mostly stone packed with a few headstones, at least one had a date of 1962. The graves are located at the edge of a patch of black wattle trees. A grave count revealed approximately twenty graves. The burial ground is fenced. During the second phase of the fieldwork the possible grave was not identified as the area had been cleared and activities of deforestation had destroyed the site previously identified in 2019. **Site extent:** Approximately 20m x 20m. Burial grounds and graves are protected under Section 36 of the NHRA 25 of 1999. Thus, the site is provisionally rated as having a high heritage significance with a heritage rating of IIIA. All graves have high levels of emotional, religious and in some cases historical significance. It is also important to understand that the identified graves could have significant heritage value to the relevant families.	High Significance	IIIA

View of the informal burial ground, identified during the phase one fieldwork.

Another view of the burial ground, identified during the phase one fieldwork.

Headstone with name (Jonas Mashi[ane?]) but no visible date

Hea -62)

General view of the informal graveyard located at site DFN008, identified during the phase one fieldwork.

General view of the informal graveyard located at site DFN008, identified during the phase one fieldwork.

General view of the site DFN008, identified during the phase two fieldwork, showing the cleared and disturbed area next to the graves.

DFN009	25° 42.478'S	25° 42.478'S	According to the first phase fieldwork, the site contains a single packed stone heap which could be a homestead foundation or a grave. The site is situated in and around a stand of black wattle trees. It was identified as a grave site by the farmer's son. During the second phase of the fieldwork the possible grave was not identified as the area had been cleared and activities of deforestation had destroyed the site previously identified in 2019. **Site extent:** Approximately 2m x 3m. Burial grounds and graves are protected under Section 36 of the NHRA 25 of 1999. Thus, the site is provisionally rated as having a high heritage significance with a heritage rating of IIIA. All graves have high levels of emotional, religious and in some cases historical significance. It is also important to understand that the identified graves could have significant heritage value to the relevant families.	High Significance	IIIA

View of stone packed stones, possible single grave, identified during the phase one fieldwork.

Closer view of the possible grave, identified during the phase one fieldwork.

General view of the site located at DFN009, identified during the phase two fieldwork. The site has been destroyed.

DFN010	25° 42.628'S	29° 39.077'E	According to the first phase of the fieldwork, the site contains a single packed stone heap which could be a homestead foundation or a grave. The site is situated in and around a stand of black wattle trees. It was identified as a grave site by the farmer’s son. During the second phase of the fieldwork the possible grave was not identified as the area is very overgrown and the surrounding area had been cleared and activities of deforestation had destroyed the site previously identified in 2019. **Site extent:** Approximately 2m x 3m. Burial grounds and graves are protected under Section 36 of the NHRA 25 of 1999. Thus, the site is provisionally rated as having a high heritage significance with a heritage rating of IIIA. All graves have high levels of emotional, religious and in some cases historical significance. It is also important to understand that the identified graves could have significant heritage value to the relevant families.	High Significance	IIIA

View of stone packed stones, possible single grave, identified during the phase one fieldwork.

General view of the site DFN010, identified during the phase two fieldwork.

DFN011	25° 42.843'S	29° 39.256'E	According to the first phase of the fieldwork, the site consists of two informal graves situated adjacent to the road and within the fence of a field. The site is demarcated by a line of stones as well a fence. One grave is dressed with bricks and cement, and one has a granite dressing and headstone. The headstone was lying on its face, so no inscription was visible. It was identified as a grave site by the farmer’s son. During the second phase of the fieldwork the possible graves were identified. **Site extent:** Approximately 10m x 20m. Burial grounds and graves are protected under Section 36 of the NHRA 25 of 1999. Thus, the site is provisionally rated as having a high heritage significance with a heritage rating of IIIA. All graves have high levels of emotional, religious and in some cases historical significance. It is also important to understand that the identified graves could have significant heritage value to the relevant families.	High Significance	IIIA

View of stone packed stones, possible single grave, identified during the phase one fieldwork.

C *ntified during the phase one fieldwork.*

General view of the informal graveyard located at site DFN011, identified during the phase two fieldwork.

General view of the informal graveyard located at site DFN011, identified during the phase two fieldwork.

DFN012	25° 42.405'S	29° 38.535'E	According to the first phase of the fieldwork, the site consists of a single stone-packed grave. The site is situated a short distance from the road, inside a pastureland field, adjacent to a dead tree. During the second phase of the fieldwork the possible graves were identified. **Site extent:** Approximately 2m x 3m. Burial grounds and graves are protected under Section 36 of the NHRA 25 of 1999. Thus, the site is provisionally rated as having a high heritage significance with a heritage rating of IIIA. All graves have high levels of emotional, religious and in some cases historical significance. It is also important to understand that the identified graves could have significant heritage value to the relevant families.	High Significance	IIIA

View of the grave, identified during the phase one fieldwork.

General view of the site located at DFN012, identified during the phase two fieldwork.

General view of the site located at DFN012, identified during the phase two fieldwork.

DFN013	25° 41.900'S	29° 38.488'E	According to the first phase of the fieldwork, the site consists of one definite grave and one possible grave. The site is situated close to the south-west boundary of the study area. During the second phase of the fieldwork the possible graves were identified. The area is very overgrown. **Site extent:** Approximately 3m x 6m. Burial grounds and graves are protected under Section 36 of the NHRA 25 of 1999. Thus, the site is provisionally rated as having a high heritage significance with a heritage rating of IIIA. All graves have high levels of emotional, religious and in some cases historical significance. It is also important to understand that the identified graves could have significant heritage value to the relevant families.	High Significance	IIIA

View with definite grave in foreground and possible grave at the back, identified during the phase one fieldwork.

General view of the site located at DFN013, identified during the phase two fieldwork.

DFN014	-25.703790° S	29.645271° E	During the second phase of the fieldwork the graves were identified and recorded. This site was not part of the phase one fieldwork. Previously the area was covered in a dense cluster of trees and as such the graves were missed, the area has now been cleared by deforestation activities and as such the graves were identified. Only two graves are located at the site. **Site extent:** Approximately 5m x 5m. Burial grounds and graves are protected under Section 36 of the NHRA 25 of 1999. Thus, the site is provisionally rated as having a high heritage significance with a heritage rating of IIIA. All graves have high levels of emotional, religious and in some cases historical significance. It is also important to understand that the identified graves could have significant heritage value to the relevant families.	High Significance	IIIA

General view of the informal burial ground, identified during the phase two fieldwork. The surrounding area has been cleared by deforestation activities.

View of the two graves located at site DFN014, identified during the phase two fieldwork.

10.13.4 Palaeontology

10.13.4.1 Geological and palaeontological history

As mentioned above, the proposed development is primarily underlain by the Vryheid Formation (Ecca Group, Karoo Supergroup), which is known to contain a rich assemblage of Glossopteris flora (Photo Plate 31) which is the source vegetation for the Vryheid Formation. Gymnospermous glossopterids dominated the peat and non-peat accumulating of Permian wetlands after continental deglaciation took place (Falcon, 1986c, Greb et al., 2006).

Recent palaeobotanical studies in the Vryheid Formation include that of Adenforff (2005), Bordy and Prefect (2008) and Prefect *et al.* (2008, 2009, 2010) and Prevec, (2011). Bamford (2011) described numerous plant fossils from this formation (e.g., *Azaniodendron fertile*, *Cyclodendron leslii, Sphenophyllum hammanskraalensis, Annularia sp., Raniganjia sp., Asterotheca spp., Liknopetalon enigmata, Hirsutum* sp., *Scutum* sp., *Ottokaria* sp., *Estcourtia* sp., *Arberia* sp., *Lidgetonnia* sp., *Noeggerathiopsis* sp., *Podocarpidites* sp as well as more than 20 Glossopteris species.

In the past palynological studies have focused on the coal bearing successions of the Vryheid Formation and include articles by Aitken (1993, 1994, 1998), and Millsteed (1994, 1999), while recent studies were conducted by Götz and Ruckwied (2014).

Bamford (2011) is of the opinion that only a small amount of data has been published on these potentially fossiliferous deposits and that most likely good material is present around coal mines and in other areas the exposures are poor and of little interest. When plant fossils do occur, they are usually abundant. According to Bamford it is not feasible to preserve all the sites but in the interests of science these sites ought to be well documented, researched and the collected fossils must be housed in an accredited institution.

To date no fossil vertebrates have been collected from the Vryheid formation. The occurrence of fossil insects is rare, while palynomorphs are diverse. Non-marine bivalves and fish scales have also been reported from this formation. Trace fossils are abundantly found but the diversity is low. The mesosaurid reptile, *Mesosaurus* (Photo Plate 32) has been found in the southern parts of the basin but may also be present in other areas of the Vryheid formation. Regardless of the rare and irregular occurrence of fossils in this biozone a single fossil may be of scientific importance as many fossil taxa are known from a single fossil.

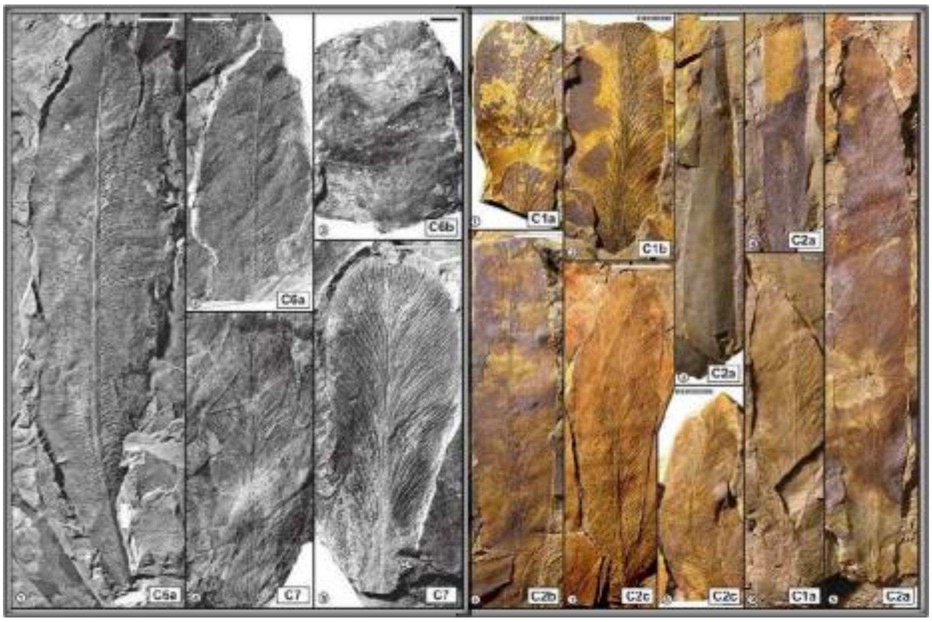


Photo Plate 31: Examples of Glossopteris leaves (*Prevec et al 2009*)

Photo Plate 32: Mesosaurus sp. National Museum specimen NMQR3536

10.13.4.2 Palaeontological Sensitivity

According to the PalaeoMap on the South African Heritage Resources Information System (SAHRIS) database, the Palaeontological Sensitivity of the Vryheid Formation (Ecca Group, Karoo Supergroup) is Very High (Almond and Pether 2008, SAHRIS website). A Phase 1 Paleontological Impact assessment was thus conducted to confirm if fossils are present in the proposed development footprint.

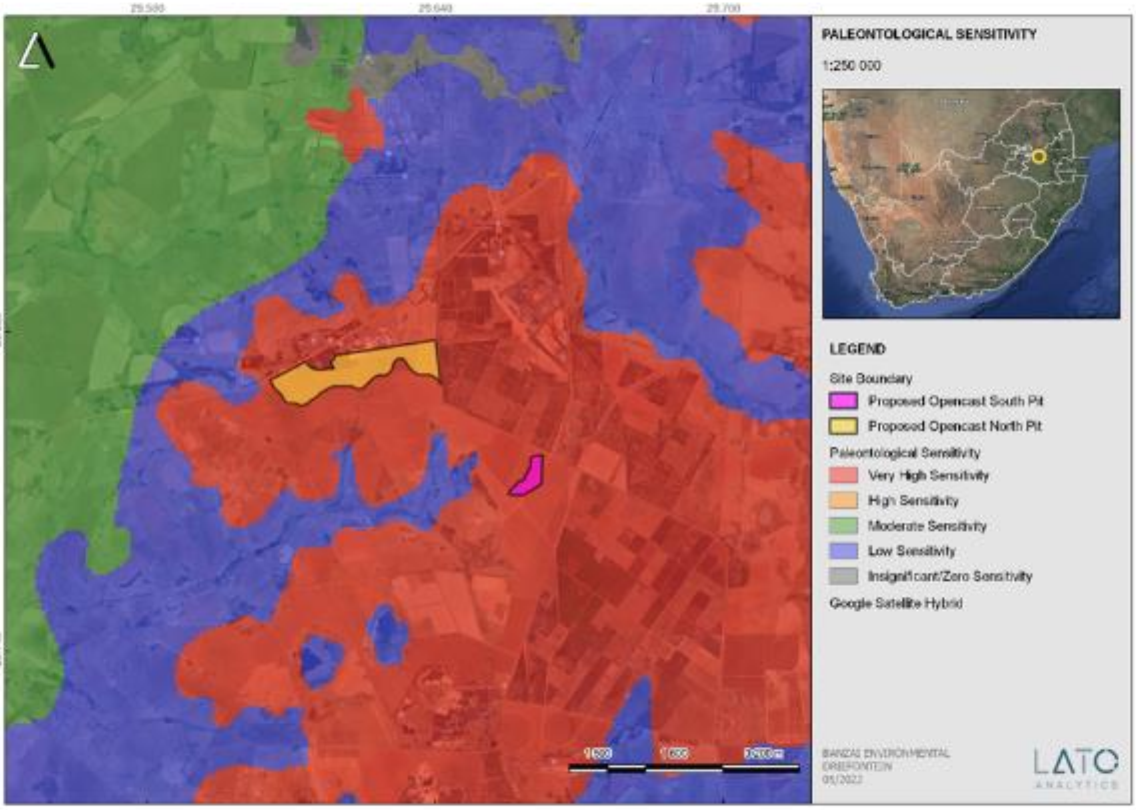


Figure 65: Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences) indicating the proposed development in variegated colours

A one-day site specific field survey of the proposed Driefontein Mine footprint was conducted on foot and by motor vehicle on 14th May 2022. The following photographs were taken on site (Photo Plates 33-35) No visible evidence of fossiliferous outcrops was identified, although there is a high possibility that fossils do exist in the application area.

Photo Plate 33: Proposed Northern development is underlain by agricultural land with no outcrops (View from northern border)

Photo Plate 34: Proposed Northern development utilised as agricultural land with no outcrops (View from northern eastern border)

Photo Plate 35: Proposed South-Eastern development utilised as agricultural land with no outcrops (View from northern western border)

10.14 Socio Economic

The project is in the Nkangala District Municipality ("NDM") and Ward 9 of the Steve Tshwete Local Municipality (STLM) of the Mpumalanga Province. The NDM includes the following municipalities:

- Emalahleni Local Municipality.
- Steve Tshwete Local Municipality.
- Victor Khanye Local Municipality.
- Emakhazeni Local Municipality.
- Thembisile Hani Local Municipality.
- Dr JS Moroka Local Municipality.

Figure 66: Nkangala District Municipality

Nkangala is the economic hub of Mpumalanga and is rich in minerals and natural resources. One of the strengths of the district is the Maputo Corridor, which brings increased potential for economic growth and tourism development. The proximity to Gauteng opens opportunities to a larger market, which is of benefit to the district's agricultural and manufacturing sectors. The further potential inherent in exporting goods provides opportunities that need to be investigated. The main economic sectors include mining, manufacturing, energy and agriculture.

STLM covers a geographical area of approximately 3 976 km2. The towns and settlements within the local municipality include Middelburg, Hendrina, Pullens Hope, Rietkuil and Komati. The Municipality is well located as it is traversed by the Maputo Development Corridor, the Middelburg / Steelpoort mining resource link, as well as the Middelburg / Bethal / Ermelo / Richards Bay Corridor.

This section will focus on the demographic and economic status quo of the broader local municipal area. A target of 30% of the employment base will be drawn from the Local Municipal Area (*Draft Project SLP Driefontein Mine*) and specific reference is made to Ward 9, where the project is located. STLM and specifically Ward 9 (“mine community”) should be one of the primary beneficiary recipients for LED project investments through the SLP objectives.

10.14.1 Population statistics

Demographics of the STLM are reflected below:

Table 59: Population statistics

Demographics	STLM (Census 2011)	STLM (CS 2016)	Ward 9 (Census 2011)
Population	229 831	278 749	6 629
Households	64 971	86 713	-
Average household size	3,3	3,2	-
Age structure			
- Population under 15 years	25%	23,9%	28%
- 15 to 64 years	70,7%	72,4%	66%
- Over 65 years	4,3%	3,7%	6%
Males per 100 females	108,1	110,1	-
Population growth per annum	4,76%	4,39%	-
Female headed households	29,4%	30,3%	-
Dependency ration per 100 (15 – 64 years)	41,5	38,1	-

STLM is under pressure due to population growth and, according to Census 2011 and Community Survey (“CS”) of 2016, the population increased with an average of 4,5% per annum between 2001 and 2016. This trend could be attributed to the number of industries that were opened within the first 10 years post 2001 that attracted workers into Middelburg (STLM IDP). This is a substantial population growth which inevitably puts severe additional strain on the available municipal services and job creation. Furthermore, STLM exhibits the second highest urbanisation rate in the NDM at 72,1%, which is also coupled with the depopulation of rural areas (STLM IDP). Ward 9 is large, but sparsely populated with few small settlements. The population of Ward 9 (6 629) makes up 2,4% of the total STLM population.

10.14.2 Age and gender

The age and gender structure of the population is a key determinant of population change and dynamics. The shape of the age distribution is an indication of both current and future needs regarding educational provision for younger children; health care for the whole population and vulnerable groups, such as the elderly and children; employment opportunities for those in the economic age groups; and provision of social security services, such as pension and assistance to those in need. The age and sex structure of smaller geographic areas are even more important to understand, given the sensitivity of small areas to patterns of population dynamics (such as migration and fertility). An increase in the young and economically active population of a municipality would thus mean the potential increase in income earnings, however, the growth would place pressure on educational resources and job opportunities, as there is the possibility for smaller and slower growing economies to provide work to the increasing population.

10.14.2.1 Gender

The male dominated population in STLM is due to an economy that attracts migrants as a result of lucrative employment opportunities in manufacturing, industrial and mining opportunities. There are 52% males vs. 48% females. Ward 9 displays a similar trend, with 53% males and 47% females.

Table 60: Gender statistics (2011)

Population statistics	Steve Tshwete LM	Ward 9
Male : Female ratio	52 : 48	53 : 47
Female headed households	29.4 %	-

People from across the country and other African countries are attracted to the municipality. According to the Census 2011 migration data, STLM attract people, particularly from Limpopo (8%), Gauteng (7%), Kwa-Zulu Natal (4%) and regionally (4%) (STLM IDP).

10.14.2.2 Age

As a result of migration to the area (jobseekers), a significant portion of the population growth is between 20 and 34 years of age. The most populous age group in 2011 were between ages 20 to 29 years of age. However, there has been a gradual decrease in the population over the age of 29 years and this trend is a major concern to the STLM. The IDP states that this could be due to the causes of death identified by the 2011 census with influenza and pneumonia, accidental injury and tuberculosis being the top three (STLM IDP) and places strain on Municipal health resources.

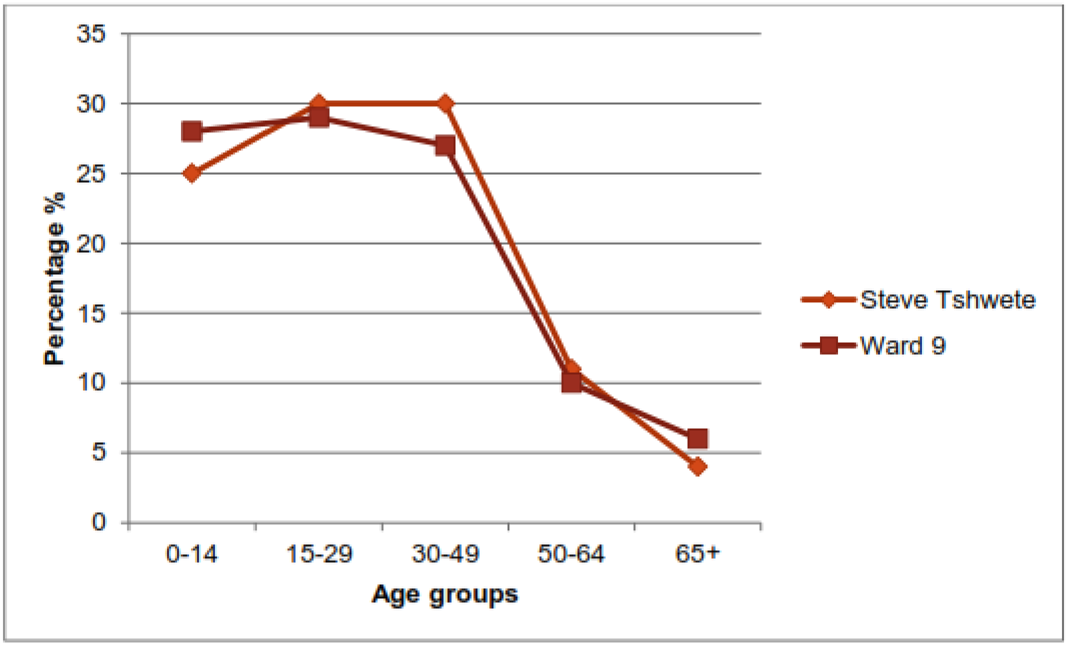


Figure 67: Age groups (2011)

The percentage of children below 14 years and pensioners older than 65 years of age are higher in Ward 9 than in the broader Steve Tshwete LM. It is clear that the limited employment opportunities in Ward 9 discourage the economic active population to settle here.

10.14.3 Race and language

The majority of people in STLM are Black, followed by the White population. The most popular languages spoken are Afrikaans and English followed by IsiNdebele, IsiXhosa, IsiZulu and various other African languages. A similar trend is evident in Ward 9, where 90% of the population is Black and 9% White (Census 2011). The conclusion can be drawn that employment at the mines and industry has over the years resulted in an influx of people from other provinces, and the subsequent pluralistic cultures and groups.

10.14.4 Education

Persons with no schooling are defined as people who have never received any form of formal education. This implies illiteracy in most cases and would limit the person to perform manual labour. The importance of education is emphasized, as it plays an important role in labour market outcomes. In the last quarter of 2016 (Q4:2016), the unemployment rate among graduates in SA was 7% and those with education levels less than matric contributed 59% of the unemployed (www.politicsweb.co.za). Education levels are thus directly linked with the population's level of employability.

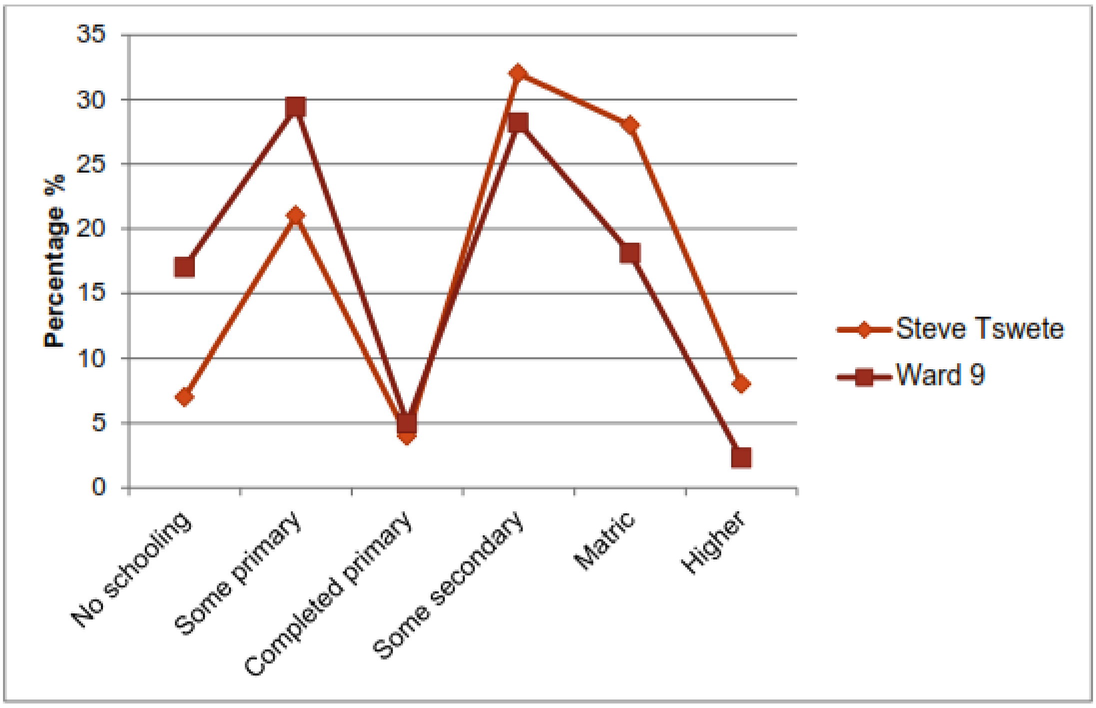


Figure 68: Education levels (2011)

The majority of the population in the municipality have some form of education with only 7,46% of the population having no schooling. This compares well with the national statistics (8,7%) and is above the Provincial average (14%) (www.world-data-atlas.com). Education levels in Ward 9 are much lower than the STLM averages: in Ward 9, 17% of the population is regarded as illiterate. According to Census 2011, the percentage of people with matric and higher education in STLM for the period between 2001 and 2011 increased by more than 5%. Eight percent (8%) of the STLM population has a post-matric qualification, versus only 2,3% in Ward 9; and only 28% of STLM residents had obtained their matric, whereas in Ward 9 only 18% completed secondary school. This is a disconcerting factor since legislation stipulates those specific levels of education and skills are required for different levels of employment on mines. The low education and skills levels thus exclude a large portion of the local population from employment opportunities at Driefontein Colliery. There are slight discrepancies amongst the various sources consulted with regards to education statistics in the STLM, especially the number of people that did not receive any education and which are functionally illiterate. For purposes of this report Census 2011 data was used. The socio-economic analysis is specifically aimed at spatial related matters, i.e., employment, income and economic profile.

In the last ten years the municipality has made huge investments in infrastructure and housing development as a result of that, poverty and inequality has been decreasing steadily. However, the current rate of unemployment and poverty are key factors contributing to high inequality levels.

10.14.5 Unemployment and youth employment

Employment status refers to whether a person is employed, unemployed or not economically active. The official unemployment rate therefore gives the number of unemployed persons as a percentage of the labour force. The labour force, in turn, is the part of the 15 - 64-year population that is ready to work and excludes persons not economically active (scholars, housewives, pensioners, disabled) and discouraged work-seekers.

Table 61: Unemployment rates

	Unemployment %	Youth unemployment % (15-34)
South Africa (2016)	27	37,1
Mpumalanga (2016)	26	38,8
Steve Tshwete LM (2011)	19,7	27,1

The overall official unemployment rate for South Africa during the first quarter of 2018 was 26.7%. The lower unemployment rate in STLM, when compared with national and provincial statistics, could most likely be attributed to the power stations and mines. From the table above it is clear that South African youth (15 to 34 years) are vulnerable in the labour market. The unemployment rate among young people was 38,2% in 2018, implying that more than one in every three young people in the labour force did not have a job in the first quarter of 2018. Some of these young people have become discouraged with the labour market and they are also not building on their skills base through education and training (http://www.statssa.gov.za). It is necessary to bridge the study-work divide in order to equip youth with the necessary skills. As a result of migration to the STLM (jobseekers), a significant portion of the population growth is between 20 and 34 years of age and approximately 50% (53 630) of the labour force is youth. In 2011, 27,1% of the youth group was unemployed (Census 2011). Based on the 2011 Census, the

unemployment rate for the STLM from year 1996 to 2001 almost doubled. However, from 2001 to 2011 there was a decrease in the unemployment rate from 35.4% to 19.7%. At 19,2%, Ward 9 displays similar unemployment trends as the broader municipal area.

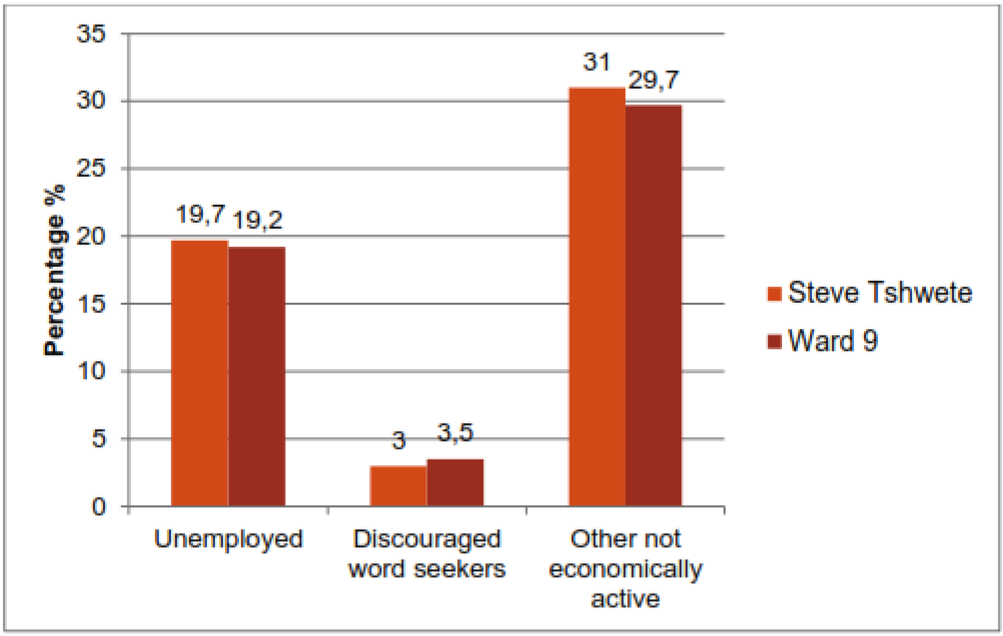


Figure 69: Unemployment (2011)

10.14.6Incomes

Migration to the area (population increases), large-scale retrenchments over the last number of years and declining national and international economies have attributed to unemployment in the Municipality. Also, mining methods that are changing from the traditional labour-intensive underground mining to capital intensive, low-labour opencast mining, is resulting in increased unemployment amongst the semi- and unskilled workers. Yet, as illustrated above, STLM has witnessed a drop-in unemployment from 2001 to 2011 (STLM IDP).

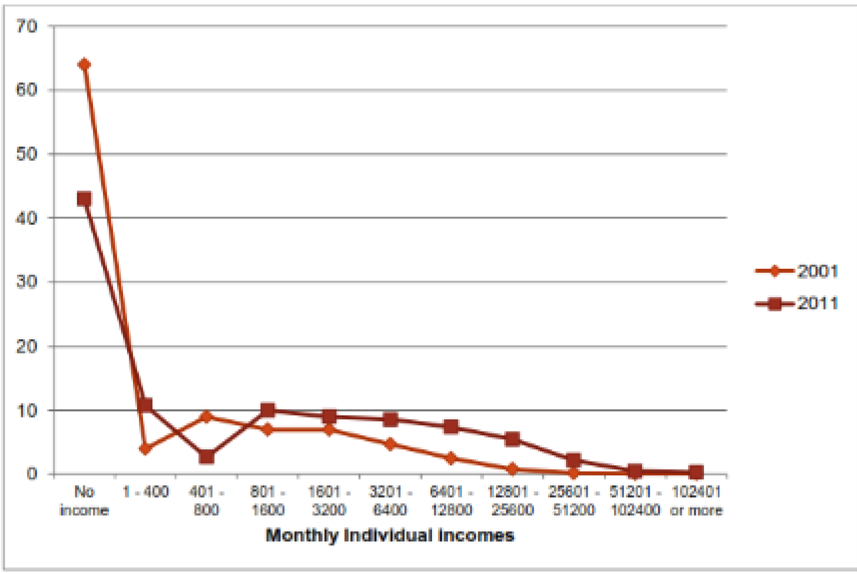


Figure 70: Individual incomes STLM

10.14.7 Economic profile

STLM's economy contributes about 14,7% towards the Mpumalanga economy with an estimated growth of about 4% from 2011 until 2016 (STLM IDP). The Municipality's economy and contribution towards the provincial Growth Domestic Product ("GDP") also continues to grow significantly. Together with eMalahleni, STLM is the largest contributor to the Nkangala district economy. The Municipality has experienced tremendous growth in the past years and has become highly urbanised with areas of decentralised industries and mining regions. The economic dominance of eMalahleni (Witbank) and Middelburg within NDM has the potential of influencing population migration from nearby localities thereby putting a strain on the provision of job opportunities and basic services.

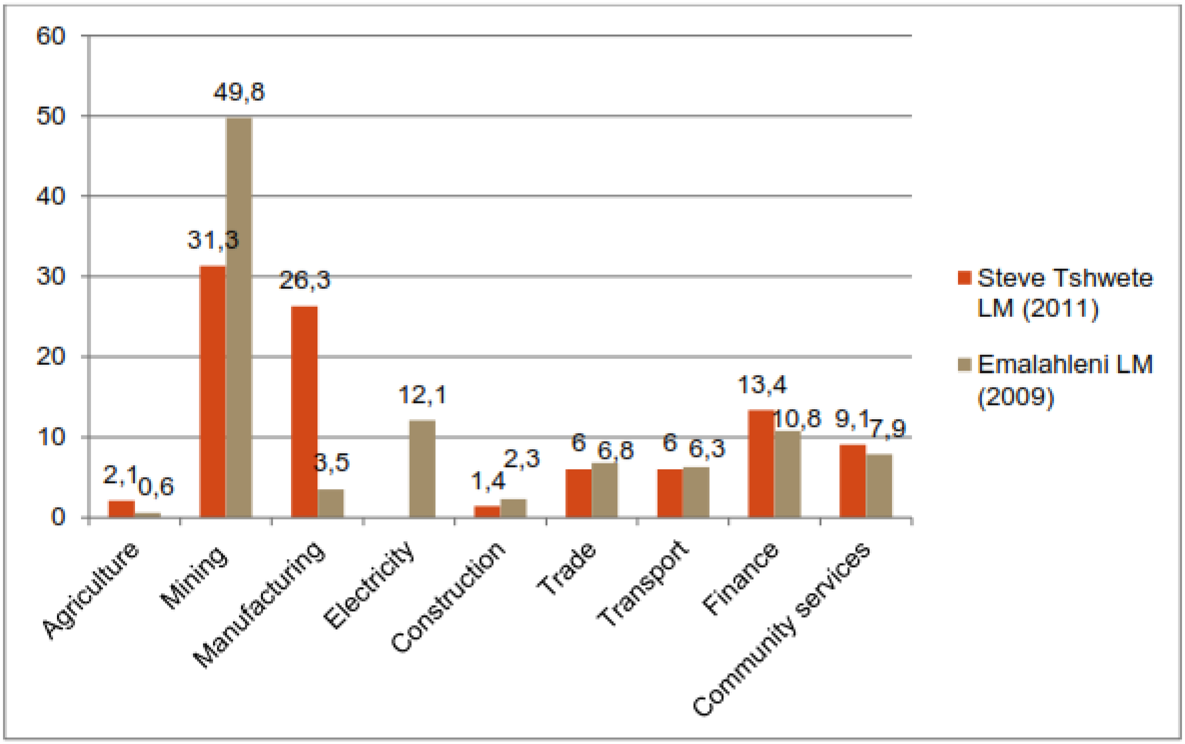


Figure 71: Economic indicators

Manufacturing, mining and finance are the main drivers of the STLM economy and, despite other key economic sectors being on the decline, mining continuous to grow (STLM IDP). Some of the most notable industries in the local economy are Columbus Steel and Eskom Power stations and these sectors (mining and manufacturing) generate large scale employment, especially valuable in the rural areas. Agriculture's contribution to the economy is relatively low compared to other sectors.

10.14.8 Economic sectors & activities

10.14.8.1 Retail and wholesale trading

Middelburg forms the main commercial centre of STLM where most people conduct their shopping/retail/wholesale activities (STLM IDP). Most of the other towns and settlements in and around the Municipality contain some smaller concentration of economic activities by way of shopping centres/spaza shops intended to serve people locally.

10.14.8.2 Industrial/Manufacturing

As far as industrial activity is concerned, the major industrial areas in the STLM area are mostly situated within or around Middelburg town. Columbus Steel is the world's fifth largest stainless-steel producer that anchors the stainless-steel cluster (Mpumalanga Business Chamber, 2008).

10.14.8.3 Mining

Mining is a very significant economic sector but has in some instances also become a major form of development constraint due to shallow undermining. There is a conflict between the mining operations and settlement development, especially in terms of the hazards associated with past mining operations, such as underground fires in old mines, seepage from mines and communities mining coal from remaining coal pillars and old coal dumps. Coal mining has also out-performed agriculture in terms of land-use; thereby causing a major challenge on agricultural development. There are seven mines located in Ward 9.

10.14.8.4 Electricity

The majority of Eskom's power stations are located in the Mpumalanga province. Power stations in STLM include Duvha, Hendrina, Komati and Arnot. The power stations are resource based and are one of the contributors to the development of dispersed settlements.

10.14.8.5 Agriculture

The areas between the mining activity, the power stations and the residential areas are mostly utilised for agricultural purposes. Agricultural activities mostly comprise crop farming (especially maize) and cattle farming. Agricultural land around the STLM area is increasingly under threat, due to the need for urban expansion, mining development and electricity generation. The constraints posed by undermined land further decreases the attractiveness of agricultural land for development. Kanhym Estates, Alzu and Koornfontein Farming are some of the strong active participants in the local economy, with supporting businesses such as millers and a strong regional co-operative (Mpumalanga Business Chamber, 2008).

10.14.8.6 Tourism

Tourism is a growing sector in STLM with well-established resorts, tourist attractions and world-class accommodation as well as wildlife and adventure excursions. Examples are Fort Merensky, Loskop Nature Reserve, Botshabelo Mission Station, Ndebele open-air museum and the Middelburg Country Club. No tourism attraction of significance is located near the project site.

10.14.9 Poverty and inequality

In the last ten years the Municipality has made huge investments in infrastructure and housing development and as a result of that, poverty and inequality has decreased steadily. However, the decline in poverty levels may also be because of the social security interventions by government such as grants. Regardless of this, high inequality levels still prevail as a result of unemployment and poverty.

Table 62: Poverty (2011)

	STLM
Poverty rate	25,9%
Number of people in poverty	59 929
Poverty gap (R million)	R110

10.14.10 Health and HIV/AIDS

Statistics show that the number of people with HIV has begun to increase since 2010. HIV/AIDS has a devastating effect on the social and economic development of STLM's population. The rate of infection is rapidly increasing, and more and more people are getting ill and dying from AIDS. According to the 2013 Antenatal Care Survey, HIV prevalence has however declined from 52 to 43%. This positive change can be attributed to the active Aids Council, vigorous campaigns and community awareness. According to the 2011 Census, Influenza and pneumonia, accidental injury and Tuberculosis are the top major causes of death within STLM (STLM IDP).

10.14.11 Housing, infrastructure and services

The high population growth rate in STLM strains municipal resources. Population statistics, the annual population growth is estimated at 4,39% with approximately 86 713 households in 2016 (CS 2016). This means an increase of 21 742 households since 2011.

10.14.12 Spatial development characteristics

The STLM area is characterised by relatively continuous spatial patterns compared with other Municipalities in the Nkangala district. This area is also less affected by the effects of mining power supply. Lack of land and increasing costs for the middle to low-income housing developments cause high urbanisation rates which affect the depopulation of the rural areas. As indicated earlier, STLM showed the second highest urbanisation rate in NDM at 72.1%. Towns such as Mhluzi and Nazareth are the main centres of growth for the middle to low income and are likely to attract funding for development. It is envisaged that high income residential developments will move closer together filling the unidentified gap known as the green area of Midleni corridor in Middelburg. Other major developments since 2004 include the Middelburg eastern bypass and the R555 Main axis (STLM IDP).

In the rural areas a number of dispersed settlements have been established which are associated with the mines and power stations. The long-term maintenance costs make the sustainability of these settlements questionable, especially after the lifetime of the coal mines and power stations has expired. Eskom has developed Rietkuil, Pullenshope and Komati and mining villages namely Blinkpan / Koornfontein, Goedehoop, Naledi and Lesedi were developed to accommodate mine employees. Kanhym, as farming company, developed Thokoza and Eikeboom villages. Social services and amenities are usually better developed in these settlements (STLM IDP). Informal small and larger settlements occur throughout the Municipality. Many of the informal settlements are located on private owned land and are thus not recognised by Council as legal formal settlements. Little, if any, services are being provided.

10.14.12.1 Types of dwellings

The STLM IDP states that the formalization of all informal settlements should be a priority to the Municipality as the STLM loses income due to people in informal settlements not paying for services. Even though the number of informal dwellings declined from 1996 to 2001, it again showed an upward trend from 2001 to 2011. The increase in informal dwellings in this period is linked with the high population growth rate between 2001 and 2011 (STLM IDP). The number of formal dwellings in the STLM decreased from 83 to 81,9% between 2011 and 2016 (CS 2016). The STLM faces several key challenges with regards to housing provision, which includes:

- Housing backlogs which resulted in long waiting lists and extended delivery lead times.
- Limited municipal resources (funding and capacity).
- Lack of affordable housing which encourages employees to remain in unsustainable areas; and
- Bulk infrastructure costs which have delayed the delivery of services stands in sustainable areas and which have added to the cost of housing and selling prices.

10.14.12.2 Household services

The dispersed nature of settlements in the Municipality makes the cost-effective delivery of engineering services very difficult. The sustainability of some of these settlements is questionable, seeing that the lifelines of the settlements, such as the mines or power stations, sometimes close down. According to the STLM IDP the municipality has made progress in providing services to its communities, but the 2016 CS figures indicate that service provision has declined.

Table 63: Engineering services on household level (%)

	Flush toilet or chemical toilets	Weekly refuse removal	Piped water inside dwelling	Electricity for lighting
Census 2011	81,9	84,7	62,6	90,8
CS 2016	79,4	77,4	55,6	90,6

10.14.12.3 Emergency services

Firefighting, rescue and special services are rendered to the inhabitants of Middelburg as well as in the magisterial district through well-established emergency services. The main station is in Middelburg and a fire station at Hendrina was established to render a better fire and rescue service to the local community (www.stevetshwetelm.gov.za). There are three (3) police stations located in Middelburg town and Mhluzi.

10.14.12.4 Health services

Middelburg General Hospital is in the urban centre and there are approximately fourteen clinics in the STLM area. Eight of these clinics are in Middelburg town (STLM IDP). The relatively close distance from the Project Area to the health services in Middelburg is an advantage for the mine and employees.

10.14.12.5 Education facilities

Information obtained from the IDP indicate that in total there are 25 primary schools and 19 secondary schools and one technical college in STLM. Secondary schools are limited to the urban areas of Middelburg and Hendrina.

10.14.13 Local economic development

10.14.13.1 Purpose and challenges

The aim of Local Economic Development ("LED") implemented by local government is to achieve economic growth, alleviate poverty, and inclusively improve the quality of life of all community members to redress socio-economic imbalances and stimulate economic growth and development. The outcome should be creation of employment opportunities and the alleviation of poverty, whilst attracting external investment. It is not an isolated function, and the output should be the result of co-operation between government and private partnerships. Projects, budgets and strategies for job creation, SMME development and skills development and training that are incorporated in the Project SLP should thus be in line and linked with IDP and LED initiatives of the STLM. Challenges for LED in STLM have been identified as:

- The scarcity of land for agricultural activities that poses a serious threat to the future of emerging farmers and food security.
- Climate change impacting negatively on food security; and
- The competing land use amongst sectors that cause a strain on local economic development.
- This is particularly relevant between the mining sector and agriculture which poses a huge food security challenge.

10.14.13.2 LED Strategies and objectives for STLM

STLM's LED strategy mainly focuses on the building of more diverse economies for increased job creation. The following are identified constraints, LED strategies and outputs for STLM in terms of their main economic sectors (STLM LED Strategy).

Table 64: LED strategy and objectives

Sector	Constraints / Impacts	Strategies	Output
Mining	• Competing with agriculture for land • High input costs • Fluctuating market demands and dropping commodity prices • Retrenchments and loss of job opportunities • Lost business opportunities	• Create secondary industries to sustain local economy beyond mining • Rehabilitate and re-use land for other purposes	• Local economy strengthened beyond the mining sector
Agriculture	• Lack of support for emerging farmers • Slow land redistribution processes • Underperforming agricultural sector	• Increase access to support services for emerging farmers • Improve land restitution process	• Improved access to land for agricultural purposes • Improved access to support services especially for emerging farmers • A strengthened agricultural sector
Manufacturing	• Export of raw material • Lack of beneficiation • Imports of finished goods	• Establish beneficiation hub for steel and metals	• Processing of raw materials and manufacturing of local goods
SMMEs	• Underdeveloped emerging entrepreneurs and limited service providers • Lack of technical and business skills • Stringent supply chain policies • Insufficient access to markets • Lost procurement opportunities	• Incubation programme for SMMEs • Supplier development program • Training and capacity building	• Increased skilled local workforce and SMME/entrepreneu rs • Improved business local business opportunities

10.14.13.3 LED projects

"Broad-based" LED projects supported by government and that have been implemented in STLM include the Community Works Programme ("CWP") and Expanded Public Works Programme("EPWP").

Table 65: LED projects

LED Project	Description	Impact
Community Works Programme ("CWP")	• Introduced in STLM in 2012: Programme participants do community work • Provides job safety net for unemployed people • Creates opportunities for unemployed youth • Gives beneficiaries much needed cash to bridge their search for full-time or part-time employment • Operates in the following areas and participants were trained in: environment; education; agriculture; social and health and construction	The following areas in Ward 9 were targeted: • Somaphepha Village, Kwamaketane Farm, Kwamakalane, Emahlathini Farm, Beestepan Farm, and Butata Farm
Expanded Public Works Programme ("EPWP")	• Nationwide programme which aims to draw the unemployed into productive work, accompanied by training, so that they can increase their capacity to earn an income • Examples: Upgrading of parks; Litter picking/Street cleaning; Installation of various infrastructure projects; etc.	• For the 2014/15 financial year, about 833 jobs were created within the EPWP through environmental and infrastructure projects. • Out of the 833 jobs about 128 were Full Time Equivalent.

A number of smaller, ward specific projects have been identified to alleviate issues on a micro scale. Canyon Resources received an interim LED project for city surveillance from the STLM. The project entails installation of CCTV devices and procurement of response cars for the response officers. Approval of the project will be finalised upon intensive research and issuance of the Mining Right (Draft Project SLP).

10.14.13.4 SMME development

For purposes of this report, it is worth emphasising the importance of SMMEs in the South African economy's context. National Government has identified SMME's as a vehicle to drive employment throughout the country as it is acknowledged that SMME's have high employment creation potential. The support for SMME's can be classified into two primary focus areas: firstly, the support provided to the existing SMME's; and secondly the support provided to the emerging entrepreneur in the start-up or initial phases of the business life cycle (Mpumalanga Business Chamber, July 2008). STLM recognizes the importance of formal and informal business in townships, and conducted a
summit in February 2016 where they presented programs on how business within townships can be revived. The programs included the following initiatives (www.stevetshwetelm.gov.za):

- Industrial benefits (LED programs and projects).

- Township economy projects, Supplier Development Programs for SMMEs by private companies and establishment of an Industrial Park to house SMMEs (Node D); and
- Government funding, District support initiatives and the Municipality's long-term plan to develop local businesses and link them with corporate businesses to enhance procurement opportunities.

The STLM have an existing database of SMMEs and local small businesses. Training and equipment would however still be required to enable these entities to function effectively in a business environment (Mr. Nkosi, LED Manager: STLM. 3 May 2019).

10.15 Traffic

A traffic survey was conducted by Koleko Solutions (Pty) Ltd at the selected intersections surrounding the proposed mine area to determine the existing traffic volumes. The light vehicles, heavy vehicles (typically 2-4 axles) and very heavy vehicles (typically 5 and more axles) were all counted during the scoping process. The weekday AM and PM peak hours were determined based on the highest traffic volumes registered during the morning and afternoon periods respectively. The results are summarised below.

10.15.1 Traffic conditions

The surrounding road network consist of the R104, R555 and D1433. The traffic volumes on R104 are generally low, in the order of 120 vehicles per hour per direction, while the volumes on R555 are approximately 100 vehicles per hour per direction. The D1433 that links the R555 to the R104 are mainly be used by trucks – the road typically carries volumes less than 10 vehicles per hour per direction.

Refer to Figure 72 below indicating the regional road network.

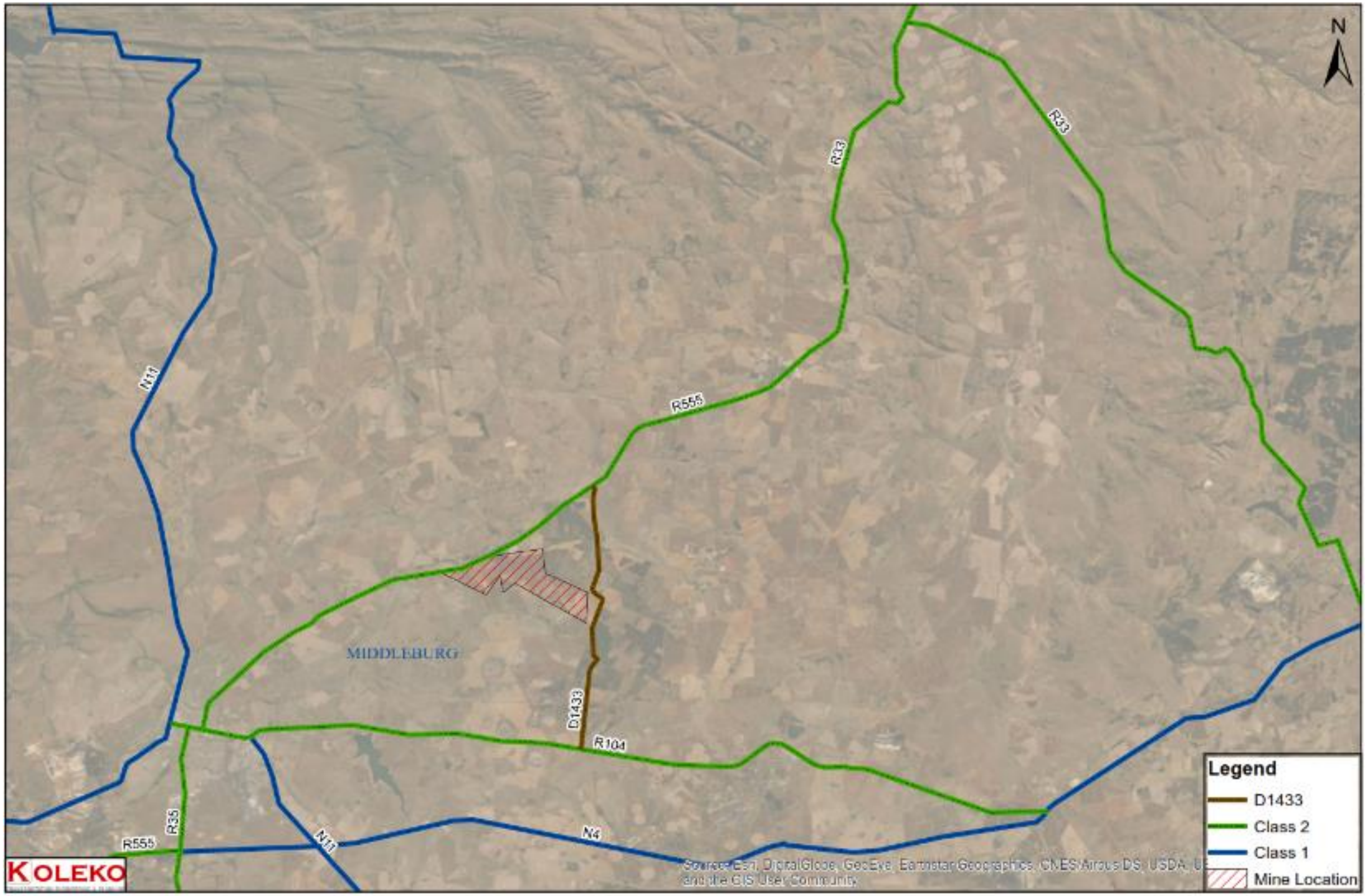


Figure 72: Regional road network

10.15.2 Non-Motorized Transport and Public Transport

In terms of public transport infrastructure provision, no formal taxi bays were observed at the external road network on the R104 or R555 close to the application area. Also, no taxi facilities were observed along the D1433. Notable is that the survey also indicated that there were no taxis along the D1433, off which most employees will access the site.

10.15.3 Description of existing external road network

The existing surrounding roads that might be impacted by the traffic generated by the proposed development are described in Table 66 below.

10.15.4 Road condition and road safety

The R555 and the R104 situated north and south of the proposed development respectively, are in a fairly good condition – with a paved surface and visible road signs and lane markings. The D1433 situated to the east of the proposed development is unpaved and narrow. From the traffic survey, an insignificant number of trucks used the road (only one heavy vehicle) during both the AM and PM peak hours. When the mine operations commence, the number of trucks may increase, and the road may need to be widened to allow for a 3.5 m lane per direction.

Table 66: Existing external road network

Road Name	Description	Photo
R555	The R555 is a regional road with one lane per direction. The road has mainly a mobility function and some accessibility function. In the vicinity of the proposed mine area, this road carries traffic volumes, in order of 200 and 300 vehicles (both directions) during the weekday AM and PM peak hours, respectively. This road is expected to be used by most of the vehicles transporting the mine's materials as well the workers of the mine. The photo shows the surface condition along the R555.	
R104	The R104 is a paved regional road with one lane per direction. The road is oriented in an east-west direction and situated to the south of the proposed development. It also intersects with the D1433. In the vicinity of the proposed mine area, this road carries traffic volumes, in order of 150 and 200 vehicles (both directions) during the weekday AM and PM peak hours, respectively. The photo plate shows the surface condition along the R104.	

Road Name	Description	Photo
D1433	The D1433 is a gravel District Road. The road is oriented in a north-south direction to the east of the proposed development and connects the R555 to the R104. The access road from the mine area to the processing colliery is along this road. Currently, the road carries very low volumes in the order of 15 and 10 vehicles (both directions) during the weekday AM and PM peak hours respectively. The photo plate shows the surface condition of the D1433.	

10.16 Specific environmental features occurring on site which may require protection, remediation, management or avoidance

The following specific environmental features have been identified that my require protection, remediation, management, or avoidance:

- **Natural Grassland and moist grassland areas.**
- **Identified Wetlands, Channelled valley bottom wetland (CVB), Unchanneled valley bottom wetlands (UVB), and Pan.**
- **Fauna and flora SCC.**
- **The burial grounds and graves sites identified inside the application area.**
- **Fossils.**

10.17 Current land uses

As described under Section 10.4 above, the land on which the mining application is made is under intensive dryland cultivation with all the required mechanisation equipment and farm buildings. It is part of larger land holdings that is owned or rented by Mr. Jan Roux and on which crops, and livestock are produced. The farm buildings are located on adjoining land (a section of Portion 6 of Farm 398 that is not part of the application).

10.17.1 Information used in financial analysis

The following land use assumptions were used in the financial analysis:

10.17.1.1 Crop production potential

According to the Department of Agriculture's comprehensive atlas, yield of the major crops under dryland conditions are as follows:

- Maize: 4 – 5 t/ha.
- Soya: 1,5 - 2 t/ha.

The farmer (Mr Jan Roux) estimates the average yield under high management ability as follows:

- Maize: 8,0 – 9,0 t/ha.
- Soya: 2,5 – 2,8 t/ha.

A yield of 8,5 t/ha for maize and 2,5 t/ha for soya was used for the financial analyses.

The reason for the high average yield attained by the farmer in relationship with that indicated by NDA is as follows:

- The farmer embarked on the program to improve the soil's tilth and fertility by incorporating large quantities of cattle manure in the fertilisation practices. According to Mr. Jan Roux he applies as much as 20 tonnes per hectare. This practice has dramatically increased his crop yield to a much higher level.
- He deep ripped the soil to break up compacted layers caused by chemicals and cultivation practices. This coincided with applications of large quantities of lime to neutralise soluble aluminium that occurred in the subsoil due to a low pH.

Approximately 907 ha are arable and planted to cash crops.

10.17.1.2 Crops under irrigation

No land is under irrigation and there is no water available for irrigation.

10.17.1.3 Livestock production

The farmer utilises stover and hay to feed a cattle herd with 250 breeding cows.

10.17.2 Financial Analysis

10.17.2.1 Gross margins

10.17.2.1.1 Crops

Gross margins were calculated for the major crops for the area. The input costs were based on research done by the Protein Research Foundation for 2018/19, with inputs from Grain SA, and Bureau for Food and Agricultural Policy (BFAP, 2017) (see details in the addenda of the Agricultural Potential Assessment attached as Appendix 6.1). The mechanisation costs were calculated from: Guide to Machinery Costs, Compiled by Directorate ADSS, KZN Agriculture and Environmental Affairs.

Table 67: Gross margin of crops

Per unit	Income (R/ha)	Variable costs (R/ha)	Gross margin (R/ha)
Maize	19 040	9 235	9 805
Soya	13 002	7 343	8 856
AVERAGE [2]	**17 832**	**8 856**	**8 976**

[2] 80% is planted with maize and 20% with soya

10.17.2.1.2 Livestock

The gross margin was adapted from the projections of COMPUTUS Management Bureau, CC, Bethlehem.

Table 68: Gross margin of weaner production (Weight of 250 kg @R32/kg, 90 @ calving %)

Item	Values (Rand/LSU)
SALES	**7 875.00**
DIRECT EXPENSES	**2 796.10**
Summer lick	305.50
Winter lick	912.60
Veterinary	150.00
Bull cost	150.00
Marketing	58.00
Transport	20.00
Labour	650.00
Farm Fodder	350
Repairs and maintenance	200.00
Margin	**5 078.90**

10.17.2.2 Assumptions

The following assumptions are made:

- High management skills apply.
- Equipment is available on the farm and no additional equipment is required. Depreciation is calculated over the lifespan of the asset.
- Farm infrastructure (stores, water, electricity is on the adjoining property). Since the assets are employed as part of the farming unit it should also contribute to the maintenance. Depreciation over the lifetime of the asset.
- Replacement of equipment is calculated in the mechanisation cost.

- The analysis uses general norms; it is mainly done at a level to indicate financial viability (or lack thereof) of the farm as a farming unit.
- The financial calculations are made based on cost of 2019 with only the size of land which was changed.

10.17.2.3 Farming income

As mentioned above, while the mining area only consists of 471 ha the agricultural activities could possibly not proceed due to the fragmentation of agricultural land within the 7-year LoM and the uncertainly regarding future land-use within the MRA. Considering the uncertainty about the potential effect of the mining operations on the sterilization of the agricultural land and following the precautionary principle, the Agricultural Potential Assessment assessed two scenarios with regards to the farming income:

(1) A worst-case scenario that implies that all agricultural activities taking place on the MRA (907 ha) will cease to exist.

(2) A best-case scenario that implies that agricultural activities will continue alongside mining and only the area directly affected by mining (471ha) will be impacted.

10.17.2.3.1 Worst case scenario

Accepting the assumptions above, the potential income for farming was calculated for the situation where land cost is not excluded. The following conclusions can be made:

- The application property is a productive farming unit.
- The gross farm income is estimated at R18,1 million per year.
- A net farm income of R7,4 million is estimated after depreciation and overhead costs.

The detail calculations are provided in the Addenda of the Agricultural Potential Assessment attached as Appendix 6. Table 69 indicates the net income for the farmer after overheads:

Table 69: Farm nett income after overheads (excluding land costs) – Worst case

Income Statement	Year 1
Income	**18 142 374**
Direct Production Cost	
1. Material cost:	8 383 708
2. Direct labour cost	369 894
3. Water & Electricity cost	158 000
Total Direct Production Cost	**8 911 602**
Overhead Cost	
1. Maintenance	166 000
2. Depreciation	966 800
3. Administration Cost	150 600
4. Management Salaries	516 000
Total Overhead Cost	**1 799 400**
Gross Profit before Interest &Tax	**7 431 372**

Based on the above financial analysis, the following conclusion can be made:

- The application property is a productive farming unit.
- The gross farm income is estimated at R18,1 million per year.
- A net farm income of R7,4 million is estimated after depreciation and overhead costs.

10.17.2.3.2 Best case scenario

Accepting the assumptions above, the potential income for farming was calculated for the situation where land cost is not excluded. The following conclusions can be made:

- The application property is a productive farming unit.
- The gross farm income is estimated at R9,575 million per year on the area directly affected my mining activities (471ha).
- A net farm income of R3.05 million is estimated after depreciation and overhead costs on the area directly affected my mining activities (471ha).

The detail calculations are provided in the Addenda of the Agricultural Potential Assessment. Table 70 indicates the net income for the farmer after overheads:

Table 70: Farm nett income after overheads (excluding land costs) – best case

Income Statement	Year 1
Income	**9 574 772**
Direct Production Cost	
1. Material cost:	4 394 317
2. Direct labour cost	170 165
3. Water & Electricity cost	158 000
Total Direct Production Cost	**4 722 482**
Overhead Cost	
1. Maintenance	166 000
2. Depreciation	966 800
3. Administration Cost	150 600
4. Management Salaries	516 000
Total Overhead Cost	**1 799 400**
Gross Profit before Interest &Tax	**3 052 890**

10.18 Specific environmental features and infrastructure on the site

Refer to Section 10.16 above for a description of specific environmental features within the application area. The majority of farms surrounding the project area are equipped with quality infrastructure such as farm dwellings and sheds, with livestock handling facilities and irrigation systems however the only infrastructure located inside the application area are boreholes, heritage sites and industrial installations (infrastructure from Bankfontein Colliery). Infrastructure identified, by the blasting specialist, within a 3500m radius of the application area include houses, general structures, power lines, pipelines, reservoirs, mining infrastructure, roads (R555, D1433 and gravel roads), shops, schools, gathering places, and heritage sites. Refer to a full list and location of these structures in Section 14 of the Blast & Vibration Impact Assessment attached as Appendix 6.11 to this report.

10.19 Environmental and current land use map

The current land cover, as indicated by the Mpumalanga Land Cover database (2010), within the study area is characterised by cultivated commercial fields, old lands, mining activities, with grassland and wetland areas occurring along the southern border. Refer to Figure 73 below.

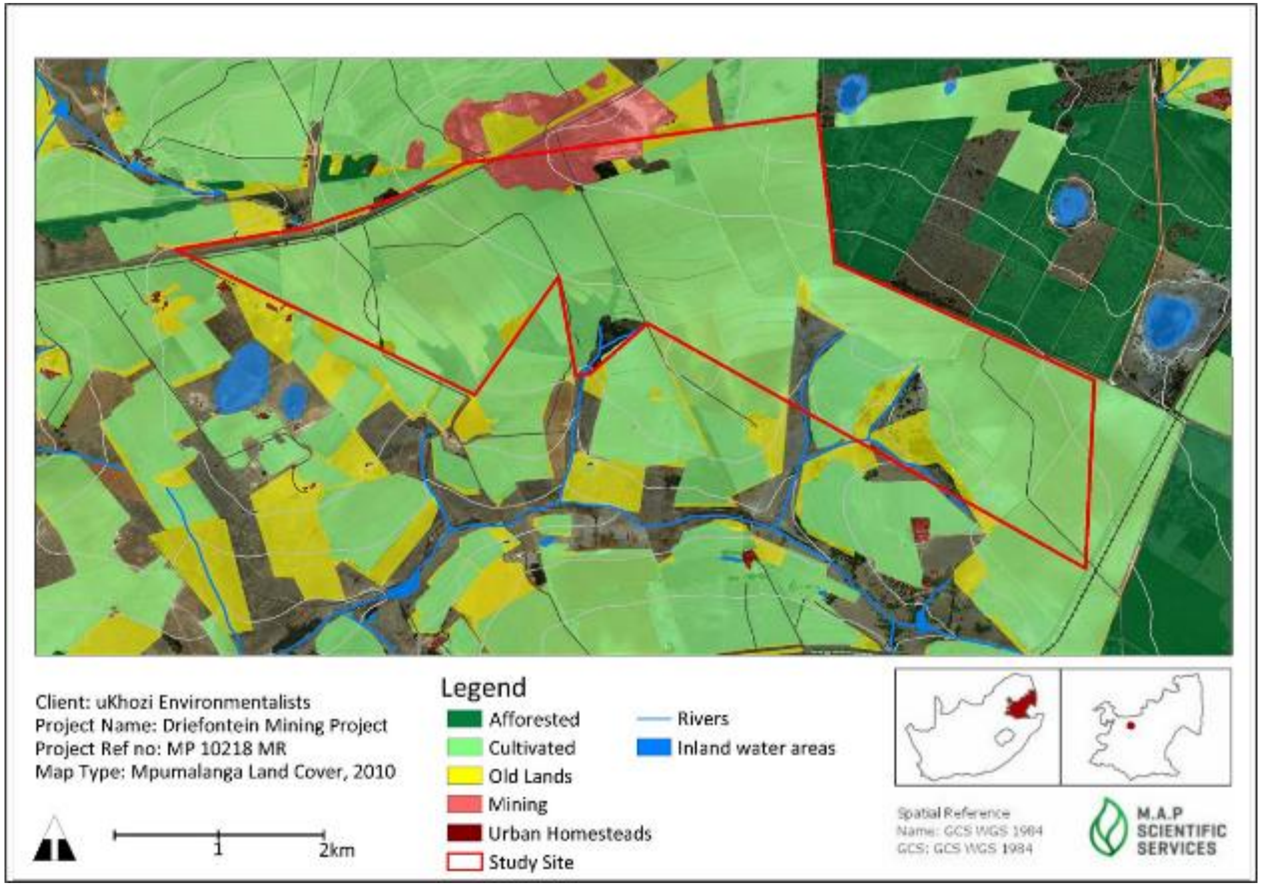


Figure 73: Land Cover as indicated by the Mpumalanga Land Cover database (2010)

11 Impacts and Risks identified during Scoping Phase

Scoping is widely regarded as a critical step in the Environmental Impact Assessment (EIA) process. Through scoping, significant issues which require further investigation are identified. Issues that are identified as having a potentially significant impact are carried forward into the Environmental Impact Assessment phase and subsequently the Environmental Management Phase. Table 71 summarises the potential impacts identified during the Scoping Phase for all project phases. These impacts and additional impacts identified as part of the EIA Phase have been further refined and assessed. The results are discussed and quantified in Section 13 according to the quantitative impact assessment methodology described in Section 12.

Table 71: Summary of the potential impacts identified during the Scoping Phase

Environmental Aspect	Impacts	Duration	Probability	Level of Significance (Pre-mitigation)	Reversible	Degree to which impact can cause irreplaceable loss of resource	Can be avoided, managed / /mitigated (Yes/No)
Construction Phase							
Geology	Disturbance of geological profile caused by the establishment of the initial box cut and ramps.	Permanent	Almost certain	High	Not reversible	High	No
Topography	Alteration of the natural topography caused by site establishment and soil stripping.	Long term	Almost certain	Medium	Partially reversible	Low	No
Soils	Alteration to the biophysical, chemical and physical characteristics of the soils caused by soil stripping.	Long term	Almost certain	High	Reversible over time	High	Yes
	Loss of soil resource (soils covered or removed) due to sterilisation, erosion (wind and/or water) and compaction.	Permanent	High	Medium	Partially reversible	High	Yes
	Soil contamination from hydrocarbon spillages from construction vehicles and machinery.	Short term	Medium	Low	Completely reversible	Very low	Yes
Land capability and use	Loss in agricultural potential caused by site establishment and soil stripping.	Permanent	Almost certain	High	Not reversible	High	No
	Change of land use from agriculture to mining.	Long term	Almost certain	High	Reversible over time	High	No
Vegetation	Loss and degradation of vegetation resulting in the disturbance of ecological functioning.	Long term	Almost certain	Medium	Partially reversible	Low	Yes
	Disturbance in vegetative growth caused by dust outfall on vegetation outside the development footprint area.	Short term	High	Low	Completely reversible	Low	Yes
	Destruction of natural habitat forcing animals to relocate.	Long term	High	Medium	Not reversible	Medium	Yes
Animal life	Harm to animals as a result of increased human activity in the area.	Short term	Medium	Low	Not reversible	Very low	Yes
	Disturbance of animal species especially sensitive bird species nesting in and around the remaining natural areas.	Short term	High	Medium	Partially reversible	Low	Yes
Wetlands	Loss and disturbance of watercourse habitat and fringe	Short term	High	Medium	Partially	High	Yes

Environmental Aspect	Impacts	Duration	Probability	Level of Significance (Pre-mitigation)	Reversible	Degree to which impact can cause irreplaceable loss of resource	Can be avoided, managed / /mitigated (Yes/No)
	vegetation.				reversible		
	Changing the amount of sediment entering wetlands and associated change in turbidity (increasing or decreasing the amount)	Short term	High	Medium	Partially reversible	High	Yes
Surface water	Alteration of drainage patterns and the amount of water entering the surface water resources down gradient of the site.	Long term	Almost certain	High	Reversible	Medium	Yes
	Sedimentation of downstream surface water resources caused by erosion and sediment runoff from cleared areas.	Short term	High	Medium	Not reversible	Medium	Yes
	Decrease in natural surface water runoff to surrounding watercourses caused by storm water management.	Short term	Almost certain	Medium	Not reversible	Medium	Yes
	Deterioration in surface water quality due to hydrocarbon, sewage or other waste spillages ending up in surrounding watercourses.	Short term	High	Medium	Not reversible	Low	Yes
Groundwater	Removal of vegetation and topsoil will decrease the recharge of aquifers.	Short term	High	Low	Not reversible	Very low	Yes
	Contamination of the underlying aquifer through hydrocarbon spillages.	Short term	Medium	Low	Not reversible	Low	Yes
Air quality	Reduction in the ambient air quality through the creation of fugitive dust from construction vehicles, drilling and blasting.	Short term	Almost certain	Medium	Reversible	N/A	Yes
Noise	Increase in ambient noise levels caused by infrastructure establishment.	Short term	Almost certain	Medium	Reversible	N/A	Yes
Visual	Change in the visual characteristics of the immediate area and its surrounds.	Long term	Almost certain	High	Not reversible	N/A	Yes
Socio Economic	The existing status quo of the local economy will be affected by the introduction of relatively higher paying (assumed) but short-term employment opportunities.	Short term	Almost certain	Medium	N/A	N/A	Yes
Health, safety	Increased potential for accidents within the construction site.	Short term	Medium	Low	Not	N/A	Yes

Environmental Aspect	Impacts	Duration	Probability	Level of Significance (Pre-mitigation)	Reversible	Degree to which impact can cause irreplaceable loss of resource	Can be avoided, managed / /mitigated (Yes/No)
and security					reversible		
Heritage resources	Degradation of heritage and paleontological resources.	Permanent	High	High	Not reversible	Very high	Yes
Operational phase							
Geology	Permanent alterations to the geological profile through the total removal of target ore body.	Permanent	Almost certain	High	Not reversible	Very high	No
Topography	The topography of the area will be affected by the various stockpiles which will be moved, grown and reduced continually during the life of the operations.	Long term	Almost certain	Medium	Reversible over time	N/A	No
Soils, Land Use and Capability	Alteration to the biophysical, chemical and physical characteristics of the soils caused by soil stripping.	Permanent	Almost certain	Very High	Not reversible	Very High	No
	Loss of soil resource caused by sterilisation, erosion and compaction over the mine footprint area.	Long term	High	High	Partially reversible	High	Yes
	Contamination of soils located at the ROM stockpile areas, PCDs, sewage facilities and workshop.	Long term	Almost certain	High	Partially reversible	Very high	No
	Loss of soil resource due to cracking caused by poorly consolidated concurrent rehabilitation at surface.	Permanent	High	High	Not reversible	Very high	Yes
	Disruption of ecosystems and potential loss of agricultural land, land capability being reduced to mining.	Long term	Almost certain	High	Reversible over time	Very high	Yes
	Land use will remain altered and high potential agricultural land will be lost.	Permanent	Almost certain	Very High	Not reversible	Very High	No
Vegetation	Total destruction of the remaining natural vegetation inside the mining area.	Permanent	High	Medium	Not reversible	Medium	Yes
	Potential invasion of alien plants on disturbed areas.	Long term	High	Medium	Completely reversible	Low	Yes
	Dust outfall and blown coal dust will affect the adjacent undisturbed vegetation directly by settlement on the leaves	Long term	High	High	Reversible	Medium	Yes

Environmental Aspect	Impacts	Duration	Probability	Level of Significance (Pre-mitigation)	Reversible	Degree to which impact can cause irreplaceable loss of resource	Can be avoided, managed / /mitigated (Yes/No)
	and indirectly through contamination of soil and surface water.						
Animal life	Displacement of indigenous animal and bird species caused by increased human activity in the area.	Long term	High	Medium	Partially reversible	Very low	Yes
	Fatalities in terrestrial mammals.	Long term	Medium	Low	Not reversible	N/A	Yes
Wetlands	Reduction in base flow reporting to wetlands.	Long term	High	High	Partially reversible	High	Yes
	Changing the quantity and fluctuation properties of the wetlands by restricting water flow or increasing flood flows	Long term	High	High	Partially reversible	High	Yes
Surface water	Alteration of drainage patterns and the amount of water entering the surface water resources down gradient of the site.	Long term	High	High	Not reversible	Medium	Yes
	Potential contamination of surface water with coal.	Long term	High	High	Not reversible	High	Yes
	Surface water contamination through operational wastes generated.	Long term	Medium	Medium	Not reversible	Medium	Yes
	Surface water contamination due to sedimentation from overburden deposition.	Long term	High	High	Not reversible	Medium	Yes
Groundwater	Drawdown of water table due to the dewatering of the aquifers.	Permanent	Almost certain	Very High	Reversible over time	Very High	No
	Leaching/Seeping of contaminants from the PCDs, slurry dams, ROM and overburden stockpile areas polluting the aquifer.	Long term	High	High	Not reversible	High	Yes
	Aquifer contamination caused by polluted water migrating away from the mining area (leachate plume).	Permanent	High	High	Not reversible	Very High	Yes
Air quality	Reduction in ambient air quality through fugitive dust caused by operational activities.	Long term	Almost certain	High	Partially reversible	N/A	Yes
	Reduction in the ambient air quality through greenhouse gas emissions.	Permanent	High	High	Not reversible	High	No

Environmental Aspect	Impacts	Duration	Probability	Level of Significance (Pre-mitigation)	Reversible	Degree to which impact can cause irreplaceable loss of resource	Can be avoided, managed / /mitigated (Yes/No)
Noise	Increase in ambient noise level at the site and surrounding area.	Long term	Almost certain	High	Completely reversible	N/A	Yes
Visual	Disturbance to the sense of place caused by dust and mining activities.	Long term	Almost certain	High	Partially reversible	N/A	Yes
	Visual intrusion of artificial lighting from lighting masts, security lights and vehicles at night.	Long term	High	Medium	Completely reversible	N/A	Yes
Socio Economic	Additional employment opportunities through the implementation of the SLP.	Permanent	High	High	N/A	N/A	Yes
	Economical injection to the local area through the implementation of the SLP.	Long term	High	Medium	N/A	N/A	Yes
	The local and regional road transport network will suffer additional pressure from the haulage trucks.	Long term	Almost certain	High	Not reversible	N/A	Yes
	Disruptions in daily living and movement patterns for surrounding communities, landowners, tenants and road users	Long term	High	Medium	Partially reversible	N/A	Yes
	Loss of agricultural jobs	Long term	High	High	Not reversible	N/A	No
	Damage to surrounding infrastructure caused by ground vibrations and fly rock.	Long term	High	High	Not reversible	N/A	Yes
Health, safety and security	Increase in criminal activities.	Long term	Medium	Low	Partially reversible	N/A	Yes
	Health and safety risks for workers	Long term	Medium	Medium	Not reversible	N/A	Yes
	Increase potential for traffic accidents	Long term	Medium	Medium	Not reversible	N/A	Yes
	Potential fires fuelled by combustible hydrocarbons	Long term	Medium	Medium	Not reversible	N/A	Yes
Heritage	Degradation of heritage and paleontological resources.	Permanent	High	High	Not	Very high	Yes

Environmental Aspect	Impacts	Duration	Probability	Level of Significance (Pre-mitigation)	Reversible	Degree to which impact can cause irreplaceable loss of resource	Can be avoided, managed / /mitigated (Yes/No)
resources					reversible		
Decommissioning and post closure							
Topography	Altering the established topography by reshaping it to emulate pre-mining environment.	Short term	High	Medium +	N/A	N/A	Yes
	Ponding on areas due to bulking failure and lack of compaction.	Short term	Medium	Low (27)	Reversible	Very low	Yes
Soils, Land Capability and Use	Loss of soil resource through erosion and cracking of surface from areas of unconsolidated rehabilitation.	Permanent	High	Very High	Not reversible	Very High	Yes
	Loss of soil resource due to compaction and contamination during the removal of infrastructure.	Short term	Medium	Medium	Not reversible	High	Yes
	Amelioration of soils and recovery of topsoil to "baseline" conditions that are conducive for commercial scale production of adapted crops.	Permanent	Medium	Medium +	N/A	N/A	Yes
	Slow positive impact on areas requiring rehabilitation and transforming mining to a state of post-mining, engineered agricultural and wilderness areas.	Permanent	Medium	Medium +	N/A	N/A	Yes
	Land use will change from mining back to agriculture and wilderness areas.	Permanent	Medium	Medium +	N/A	N/A	Yes
Vegetation	Re-vegetation of previous natural areas and topdressing in an aim to establish pastures for livestock grazing.	Permanent	Medium	Low +	N/A	N/A	Yes
	Alien Infestation resulting from the introduction of species not naturally occurring (nurse grass species) in the area.	Short term	High	Medium	Reversible	Low	Yes
Animal life	Positive impact of livestock breeding and naturally assisting the transformation back to natural state.	Permanent	Medium	Low +	N/A	N/A	Yes
	Slow positive impact as animal species return to the re-habilitated areas, although they will be disturbed by	Permanent	Medium	Low +	N/A	N/A	Yes

Environmental Aspect	Impacts	Duration	Probability	Level of Significance (Pre-mitigation)	Reversible	Degree to which impact can cause irreplaceable loss of resource	Can be avoided, managed / /mitigated (Yes/No)
	decommissioning and rehabilitation activities.						
Surface water	Sedimentation of downstream surface water resources caused by erosion and sediment runoff from unvegetated rehabilitated areas.	Permanent	High	Medium	Not reversible	Medium	Yes
	Free drainage and natural surface water patterns stabilisation.	Permanent	Medium	Low +	N/A	N/A	Yes
	Surface water contamination associated with removal of coal wastes and associated infrastructure.	Short term	Medium	Low	Not reversible	High	Yes
	Decanting resulting in the contamination of surface water resources down gradient of the mining area.	Permanent	High	High	Reversible	High	Yes
Groundwater	Aquifer contamination caused by polluted water migrating away from the mining area (leachate plume).	Permanent	High	High	Not reversible	Very High	Yes
	Recovery of groundwater levels after the cessation of dewatering.	Permanent	High	High +	N/A	N/A	Yes
Air quality	Increase dust levels for a short period during decommissioning activities.	Short term	Permanent	Medium	Completely reversible	N/A	Yes
Noise	Increase noise levels for a short period during decommissioning activities.	Short term	Permanent	Medium	Completely reversible	N/A	Yes
Visual	The removal of infrastructure will leave a temporary bare “scar” on the landscape.	Short term	High	Low	Reversible over time	N/A	Yes
Socio economic	On decommissioning of the mine various labours will be left without employment.	Permanent	Permanent	High	N/A	N/A	Yes
	Short term employment opportunities.	Short term	High	Low +	N/A	N/A	Yes

12 Methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks

In order to ensure uniformity, a standard impact assessment methodology will be utilised so that a wide range of impacts can be compared with each other.

The methodology used determines the significance of the impacts by evaluating the consequence (extent, duration, and severity) and likelihood (probability) of each impact. The definitions of the terms used within the methodology are provided below, followed by the stepped approach.

Definitions
Aspect – a particular part or feature of something. Impact – is defined as any change to the environment, whether positive or negative, resulting from a facility/project/development's products, development, and activities. Cause/Activity – the precipitating factor resulting in a perceived impact. Mitigation Measures – identified actions and requirements designed to be instituted to reduce the undesirable effects of a perceived impact. Significance Level – the degree of importance of the impact on the social and/or biophysical environment; a proxy for the degree to which the impact is reversible and may cause irreplaceable loss of a resource. The approach used to determine significance makes use of value judgements to determine the degree of change on the social and/or biophysical environment, after which the consequence and likelihood of the impact are ranked to provide a significance level. Extent – the spatial scope of the perceived impact. (How large an area will be impacted). Duration – the temporal scope of the perceived impact, or the period of time during which the social and/or biophysical environment is changed by the impact. (How long the impact will last). Severity – the degree to which the natural, cultural, and/or social functions and processes of an environment may be affected or altered by a perceived impact. (How extreme/harsh the impact will be. The degree of disturbance). Probability – the possibility or likelihood of the impact occurring or manifesting.

12.1 Approach

The stepped approach used is provided below:

Step 1: The different aspects of the proposed project are identified along with the associated environmental and social impacts which may occur during each phase of the project.

Step 2: Assess the consequence of the impact by providing a numerical score for each of the following factors using the ranking scales in Table 72: Variables with each category score:

- Extent
- Duration

- Severity

The consequence is determined using the sum of the extent, duration, and severity variables. The extent and duration criteria have five parameters, with a scaling of 1 to 5. Severity also has five parameters, but with a weighted scaling. The assessment of the severity of the impact is a relative evaluation within the context of all the activities and other impacts within the framework of the project. The severity rating is weighted as 2 since this is the critical issue in terms of the overall risk and impact assessment (thus the scaling of 2 to 10, with intervals of 2). The severity is thus measured as the degree to which the project affects or changes the environment. The maximum value of significance points (SP) is 20.

Step 3: Assess the likelihood of the impact by providing a numerical score for each of the following factors using the ranking scales in Table 72: Variables with each category score:

- Probability of the impact.

The likelihood of the impact occurring is determined using the probability frequency variables with a scaling of 1 to 5.

Step 4: Once these factors are ranked for each impact, the significance points are calculated by using the formula below.

SP (Significant Points) = Consequence (Extent + Duration + Severity) x Likelihood (Probability)

Step 5: Mitigation measures for each impact are determined as part of the impact assessment, and the above approached is repeated to determine the significance of each impact post-mitigation.

12.2 Significance Level

The maximum value is 100 significant points. The significance level could therefore be rated as either Very High (VH), High (H), Medium (M), Low (L), or Very Low (VL) on the following basis:

Very Low	Negligible impact which does not require further mitigation.	SP ≤20
Low	Acceptable impact for which mitigation is desirable but not essential. The impact by itself is insufficient even in combination with other low impacts to prevent the implementation of the project. These impacts will result in either positive or negative medium to short term effects on the social and/or natural environment.	SP 21-40
Medium	An important impact which requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in either a positive or negative medium to long-term effect on the social and/or natural environment.	SP 41-60
High	A serious impact, if not mitigated, may prevent the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term change to the (natural &/or social) environment and result in severe negative or beneficial effects.	SP 61 – 80
Very High	A very serious impact which, if negative, may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are unmitigable and usually result in very severe negative or very beneficial effects.	SP ≤81

Table 72: Variables with each category score

		Extent (Magnitude) of the Impact	SP
CONSEQUENCE	Site specific	Limited to a specific part of the mine boundary.	1
	Project area	Limited to within the mine boundary.	2
	Local	Within a 5km radius of the mine boundary.	3
	Regional	Beyond a 5km radius of the mine boundary.	4
	National	Widespread, far beyond the project area.	5
		Duration of the Impact	
	Immediate	One day to one month.	1
	Short term	Two months to six months.	2
	Medium term	Six months to one year.	3
	Long term	Two years to seven years. Ceases with operational life (7 years for this specific project).	4
	Post Closure/Permanent	Impact occurs beyond lifespan of the project.	5
		Severity of the Impact	
	Minor	Non-harmful. Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are not affected.	2
	Low	Potentially harmful. Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are negligibly altered.	4
	Medium	Slightly harmful. Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are slightly altered.	6
	High	Significantly Harmful. Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are notably altered.	8

	Very High	Extremely harmful. Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are severely altered.	10
Likelihood	Probability of impact		
	None	0% chance of the impact occurring.	0
	Improbable	The possibility of the impact materializing is very low. 1% to 9% chance of occurrence.	1
	Low Probability	Impact not expected to occur, but conceivable. 10% to 30% chance of occurrence; and Circumstances rarely encountered.	2
	Medium Probability	Impact may occur sometimes. 31 – 60% chance of occurrence. Circumstances occasionally encountered.	3
	High probability	Impact will probably occur. 61 – 90% chance of occurrence. Circumstances frequently encountered;	4
	Almost Certain	91 -100% chance of occurrence.	5

12.3 Assessment of potential impacts and risks

The findings of the specialist studies, which guided the selection of the final site layout, are presented in Section 10 (baseline) and Section 13 (potential impacts) of this EIAR. The complete specialist reports are attached as Appendix 6. The specialists' findings were used to assess the project's potential impacts and risks during its complete life cycle. Refer to Section 13.3 for a quantitative assessment of the potential impacts.

12.4 Positive and negative impacts that the proposed activity alternatives will have on the environment and the community that may be affected

No activity alternatives are considered except for the No Go Option.

The positive impacts of the No Go Option will be that the potential negative environmental impacts, associated with the development of the mine (as described in Section 13 below), will not occur and the existing agricultural activities associated with the directly affected farms will continue unaltered.

The negative impacts of the No Go Option will be that the minable coal resource will not be utilised and the positive socio-economic impacts (as described in Section 13 below) associated with the development of the mine will not occur.

12.5 Possible mitigation measures that could be applied and the level of residual risk

Refer to Section 13.3 for the mitigation measures identified to reduce and/or minimize potential impacts and risks where they are unavoidable.

12.6 Site selection matrix

N/A. As mentioned earlier no alternative sites were considered as part of this application. Refer to Section 12.7 below for a motivation.

12.7 Motivation where no alternative sites were considered

No alternative sites are considered as part of this application because the application area has already been determined through extensive prospecting operations and mining can only take place in the area on which the Mining Right is granted. Sumsare Consulting was commissioned by Canyon to complete the drilling of and data compilation for the proposed Driefontein Project (the Resource Report was submitted as Annexure C of the MWP). Based on the drill hole data, the resource could be delineated with confidence and the qualities and quantities were accurately determined which warranted the development of a viable mining project. Canyon has invested large amounts of resources and time in the effort to determine if a viable coal resource exist over the prospecting right area and based on the results of the exploration exercise the mining right application area was identified.

12.8 Statement motivating the preferred site

Refer to Section 12.7 above for a motivation why this site was chosen. As explained above no other sites are considered as part of this application. The final site layout shown in Figure 114 represents the best overall option as determined through the impact assessment (Section 13).

13 Full Description of the Process Undertaken to Identify, Assess and Rank the Impacts and Risks the Activity will impose on the Preferred Site through the Life of the Activity

This section describes the potential positive and negative environmental impacts identified for the proposed Driefontein Mine. It contains the findings of the specialist studies, which were used to assess the project's potential impacts and risks during its complete life cycle, from the construction phase, through the operational phase, to the decommissioning, rehabilitation, and closure phase. The objective was to determine the significance level of each of the potential environmental impacts and to identify mitigation measures to prevent, reduce or contain the impacts during all the phases of the proposed mine. The impacts were assessed, according to the methodology described in Section 12 above, and the findings are discussed in detail in Section 13.2 below followed by the quantitative assessment in Section 13.3. The following key principles contained in the National Environmental Management Act (Act 107 of 1998) (NEMA), were considered during the impact assessment:

- Sustainability – development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs.
- Mitigation hierarchy – avoidance of environmental impact, or where this is not possible, minimising the impact and remediating the impact; and
- The duty of care of developers towards the environment as embodied in the NEMA (section 28) and the NWA (section 20).

The assessment methods proved adequate to determine the nature and significance levels of all impacts that the proposed development may have on the natural, social, and economic environments. Based on the findings of the EIA, which included a thorough public participation process from the scoping phase through to the EIA phase, a comprehensive Environmental Management Programme (EMPr) has been developed to prevent, reduce or contain the impacts during all the phases of the proposed mine – see Part B of this report.

13.1 Project phases and activities

The potential environmental impacts of the proposed project have been assessed for the:

- Construction phase.
- Operational phase; and
- Decommissioning/rehabilitation, and post closure phase.

Potential cumulative impacts were also identified and discussed, where applicable.

13.2 Environmental Impact Assessment

The potential environmental impacts are discussed in detail under the different environmental aspects for each of the project phases. The different impacts associated with the alternatives considered are also discussed where applicable.

13.2.1 Geology

13.2.1.1 Construction phase

The opening of the initial box cut will result in the disturbance of the geological profile. During the construction phase the disturbance will be limited to a relatively small area where the initial box cut will be established. By the nature of mining projects, the geology is exploited for the target minerals therefore the impact of the proposed project on the target ore body and the overburden and rock above this ore body is necessary for the project and unavoidable.

13.2.1.2 Operational phase

As indicated on the preliminary layout plan the MRA will be divided into two (2) open pits. The disturbance of the geological profile over these areas is definite and non-reversible as the mineral resource will be removed from the geology. The mitigation and management measures recommended by the blast and vibration specialist must be implemented to limit the extent of the impact to the MRA.

13.2.1.3 Decommissioning/rehabilitation and post closure phase

No further impact envisaged.

13.2.2 Topography

13.2.2.1 Construction phase

The topography will be altered during site establishment and soil stripping. The stockpiling of soils with the excavation of the dirty water channels along with the construction of the diversion berms, will also contribute to the topographical changes. The disturbance will be limited to part of the project area during the construction phase, it is reversible in the long term (>7 years) as the post mining topography will be landscaped to emulate the pre-mining topography, but the impact will definitely occur.

13.2.2.2 Operational Phase

Opencast mining and earthworks inside the MRA will ultimately result in the alteration/modification of the surface topography. In addition, the topography of the area will be affected by the planned activities in terms of the various overburden and ROM stockpiles which will be moved, grown, and reduced continually during the life of the operations. This negative impact is unavoidable but can be mitigated during the operational phase and reversed after mining. The positive impact will occur during rehabilitation when the overburden material is used to backfill the open pits.

13.2.2.3 Decommissioning, rehabilitation, and post closure phase

13.2.2.3.1 Restoration of the pre-mining topography

The aim is to restore the natural topography by dismantling and removing all infrastructure as well as ripping and landscaping the compacted areas. The topography must be shaped in such a way as to allow the natural drainage lines to return as close as practically possible to its pre-mining state. The impact will be positive if this occurs as surface water drainage is restored and topography returned to functioning state.

13.2.2.3.2 Subsidence of the rehabilitated area

Bulking of the reinstated materials or possible subsidence are realistic conditions of rehabilitation that will result in the ponding of surface water if the compaction of the materials and final landscaping are not well managed and implemented. Ponding will result in inundation of low-lying areas by surface water (clean and possibly dirty) which will potentially sterilise, contaminate, or salinize the soils, and render the land unusable for any natural functions. The impact will be highly significant and will in turn affect the future land use and capability of the area negatively. If this impact occurs the area must be graded again in order to achieve the post mining objectives before applying for closure.

13.2.3 Soils, land use and capability

Index (Pty) Ltd was appointed to conduct the Agricultural Potential Assessment for the proposed Driefontein Mine. The largest part of the MRAA is cultivated and is classed as high potential arable land. High potential land is defined as follows: Land best suited to, and capable of consistently producing acceptable levels of goods and services for a wide range of agricultural enterprises in a sustainable manner, taking into consideration expenditure of energy and economic resources. It includes:

- Land Capability Classes i, ii and iii.
- Unique agricultural land.
- Irrigated land; and
- Land suitable for irrigation (deep well-drained soils - assuming irrigation water is available).

The land affected in this case is the Class i, ii and iv arable land. The arable land is 921 hectares of which 907ha is cultivated. Based on the preliminary mine layout plan, 470,71 ha will be lost to the mining activities (412ha will be directly impacted by mining and the remaining 58ha situated between the main haul road and northern opencast pit will be disturbed). The balance of 450 ha of arable and cultivated land falls within the mining rights area but will not be disturbed. The areas affected by mining related to land use capability is presented Table 73 below.

Table 73: Areas affected by mining related to land use capability

Potential class	Total area	Mining area [1]
Arable classes	**920,72**	**470,71**
Class i	858,18	419,95
Class ii	20,80	19,26
Class iii	6,28	
Class iv	35,46	31,50
Non arable classes	**254,83**	**53,21**
Class vi	131,27	1,27
Class viii	123,56	51,95
Total	**1 175,55**	**523,92**

The potential impacts are discussed below with regards to the soil, land use and capability as a result of the surface infrastructure that will be constructed and operated during the different phases of the operation.

13.2.3.1Construction phase

13.2.3.1.1 Soil erosion

Soil erosion is an irreversible loss of soil resource, which decreases the land capability of an area. This will potentially occur when establishing the box cut, as well as from surface activities such as roads and stockpiling, as these activities will cause soils to be bare, with no vegetation protection, as well as concentrating run off. Both wind and water erosion are a risk and once the soil surface is exposed, the intensity of single rainstorm may result in soil particles being transported away. Exposed soil surfaces will remain at risk of soil erosion during the operational and decommissioning phases.

13.2.3.1.2 Soil compaction

Soil compaction increases the strength plant roots need to exert to grow through soils, as well as decreases the water and nutrient storage capacity of the soil. All areas where vehicles and equipment will traverse during the construction phase to deliver materials, prepare the terrain, and construct the infrastructure will be at risk of soil compaction. Several areas such as the haul roads, dump areas, and ROM stockpile areas will be deliberately compacted during the construction phase to stabilise the surface following engineering specifications. The effect could only be mitigated by deep ripping these areas once they are no longer in use.

13.2.3.1.3 Soil pollution

Oil, fuel spills and leaks from construction vehicles and equipment as well as waste generation on site, can result in soil pollution which diminishes the potential for vegetation growing in the soil and could lead to further pollution of water resources. The mixing of concrete on site can also be a source of soil pollution.

13.2.3.1.4 Loss of soil quality

The stripping and stockpiling of topsoil prior to construction of infrastructure, will disturb the in-situ profiles drastically. Even though care might be taken to strip topsoil effectively from the underlying material, degradation could occur when soil horizons mix and/or erosion of stockpiles occur. Soil porosity and water-holding capacity will be affected and the lengthy storage of topsoil (while the pit remains open) will destroy the soil microbiology and the nutrient cycles it maintains. The impact on the soil quality during the construction phase will be negative and is unavoidable. If the proposed development proceeds without appropriate mitigation measures, then valuable soil (or its characteristics) will be lost, and it is unlikely that the study site soil will be restored to its pre-development agricultural state during the decommission phase of the project due to the nature of the proposed project (i.e., opencast coal mine). Therefor the topsoil must be managed from the construction phase to decommissioning phase to ensure that it retains its characteristics. A loss of topsoil (through sterilisation, erosion, or contamination) would generally result in a decrease in the rehabilitation and future land use potential of any land that is disturbed by the construction of the proposed infrastructure and mining activities.

13.2.3.2 Operational phase

13.2.3.2.1 Soil erosion

The impact will persist from construction into the operational phase as the exposed soil surfaces will remain at risk of soil erosion. Opening of the opencast pits and any additional surface infrastructure development in support of the proposed mine, will result in additional areas exposed to soil erosion through wind and water movement.

13.2.3.2.2 Soil compaction

The impact will persist from construction into the operational phase as trucks and vehicles traversing the haul roads between the different infrastructure components, will increase the existing compaction during operations. Soil compaction could also occur during concurrent rehabilitation when filling in the pits trucks drive across the newly laid down soil.

13.2.3.2.3 Soil pollution

The impact will persist from construction into the operational phase as hydrocarbon spills from operational vehicles and equipment as well as waste generation on site, can result in soil pollution. Dust suppression of haul roads will increase the pollutant load of soil at and around the haul roads and any spills from the PCDs and rainwater seepage and runoff from the ROM coal stockpile, can cause soil pollution during the operational phase. The proposed mine will add sources of soil contaminants, which will increase the cumulative impacts associated with soil pollution in the area.

13.2.3.2.4 Loss of soil quality

The impact on soil quality will persist into the operational phase with stripping and stockpiling of topsoil continuing to disturb the in-situ soil profiles as mining progresses and additional surface infrastructure is developed. Coal dust settling on stockpiles during the operational phase could result in further degradation of soil quality. Soil stockpiles will need to be maintained and protected during the operational phase to ensure that the quality of the soil material is maintained. Although there is an impact resulting from the stockpiling of the study site soil for the duration of the operation phase, this is a mitigation measure as it guards against higher significance impacts such as the alteration of the study site soil characteristics through contamination and/or compaction. It is expected that the quality of the soil will not be adversely affected if correct mitigation measures are implemented with respect to managing the soil stockpiles during the operational phase. The topsoil must be managed from construction through to decommissioning to enable the mine to rehabilitate the area as close as possible to the pre mining state. The positive impact of stripping the soils will occur during concurrent rehabilitation when the topsoil containing a gene bank of seeds of indigenous species can be spread over the rehabilitated area.

13.2.3.2.5 Loss of high potential cultivated land and crop production

The largest part of the proposed mining area is cultivated land of which 471 ha will be lost to mining activities (opencast mining and infrastructure). The agricultural potential assessment (Index, 2022) assumed that the agricultural income loss will be over the directly affected area within the 7-year LoM.

Based on this assumption, the total agricultural loss for the 7 years LoM over the area directly affected by mining is estimated to be R3.05 million annual income from crop production. The destruction of high potential cultivated land is definite and can't be avoided but the extent must be limited to the area being mined. It is recommended that a soil management plan is developed which sets out a clear set of actions and responsibilities for the control of impacts affecting the soil, land use and land capability within the operations' development footprint.

If required, the Applicant must appoint an independent Valuer to determine the market value of the land and to ensure fair compensation for land acquired for mining purposes or compensate the farmer for annual loss of income during the life of mine.

13.2.3.2.6 Loss of grazing land and animal production

The farm currently operates with 250 breeding cows (LSU) that can potentially generate R1,18 million per year. The proposed mining activities could potentially transform 177 ha from rangeland to mining land resulting in the loss of animal production. The extent of the disturbed area must be minimised and additional site alteration through chemical and physical degradation must be avoided at all costs by implementing the recommended mitigation measures.

13.2.3.2.7 Loss of agricultural employment opportunities

It is estimated that approximately one labourer is required per 100 hectares of cultivated land. Therefore, the change in land use from agriculture to mining could potentially lead to the loss of 9 permanent employment opportunities. Based on this estimate, potentially 9 labourers could lose their jobs. Should this occur, the mine must either employ these individuals or provide training and support to assist farm employees to find suitable employment opportunities elsewhere.

13.2.3.3 Decommissioning/rehabilitation and post closure phase

13.2.3.3.1 Soil erosion

The impact will persist from the construction and operational phase into the decommissioning, rehabilitation, and closure phase as the exposed soil surfaces will remain at risk of soil erosion.

13.2.3.3.2 Soil compaction

During the decommissioning phase, the movement of vehicles and equipment will again result in soil compaction.

13.2.3.3.3 Soil pollution

Oil, fuel spills and leaks from vehicles and equipment as well as waste generation on site during the rehabilitation of the site and the materials that are decommissioned can result in soil pollution during decommissioning.

13.2.3.3.4 Loss of soil quality

Topsoil will be used to cover areas where vegetation needs to re-establish during the rehabilitation phase. The soil that might develop there will have different physical and chemical properties which could result in the loss of the pre-mining soil quality. Even with the implementation of the rehabilitation plan the loss of available soil resources could still manifest as surface erosion and/or gully formation across the envisioned rehabilitated arable landscape.

Furthermore, depressions on back-filled spoils and opencast areas generally develop due to underlying differential settlement, resulting in seasonally or permanently saturated areas on the rehabilitated landscape (adopted from Coaltech, 2019). This reduces the arable potential of the land as agricultural machinery required for high productivity cropping cannot operate on undulating, waterlogged topographies. The waterlogged conditions may also inhibit vegetation growth suitable for grazing and pasture-related land uses. This risk could result from:

- Changes to the physical properties of the materials (soil, overburden, etc.) that have been 'reassembled' as part of the rehabilitated landform profile.
- Changes to the soil chemistry (specifically changes to sodium potential) of replaced soils.

The growth and the associated yield of the established vegetation cover will affect the manner and intensity of which the rehabilitated landscape can be used. The loss of established vegetation and or cultivated lands could result from excessive/unmitigated animal grazing and/or movement across the rehabilitated landscape, diffusion and/or capillary rise of salts from underlying spoils into placed cover soil. Possible modelling or specialist investigations to help quantify this long-term risk could include:

- Soil erosion modelling linked to a soil (cover) balance.
- Vegetation surveys.
- Post-rehabilitation land capability assessments linked to the relinquishment criteria.
- Assessment of landform topography design criteria and conformance to this plan to assess probability of secondary subsidence.

13.2.3.3.5 Return to arable land and crop production

Adherence to the proposed mitigation measures in terms of soil stripping and management as well as the closure plan, could allow dryland agriculture to commence after mining. It is assumed that agricultural production will resume in the areas not directly affected by mining after year 7 (436ha) while the 471 ha within the mining area will be rehabilitated to grazing land potential from year 9 to year 20 after which it should return to current agricultural yields, implying zero agricultural losses after year 20.

13.2.4 Terrestrial biodiversity (Flora and Fauna)

M.A.P Scientific Services (MAPSS) was appointed to undertake a terrestrial (floral and faunal) biodiversity assessment for the proposed Driefontein Mine.

It is important to note that all mining footprint areas are located within existing disturbed areas, and impacts on surrounding natural habitats, will mainly be limited to potential edge effects and indirect impacts provided that the proposed mining footprint area is adhered to. Refer to Figure 74 below showing the proposed mine layout plan overlaid on the combined floral and faunal ecological sensitivity map developed for the proposed mine followed by a discussion of the potential impacts during the different phases.

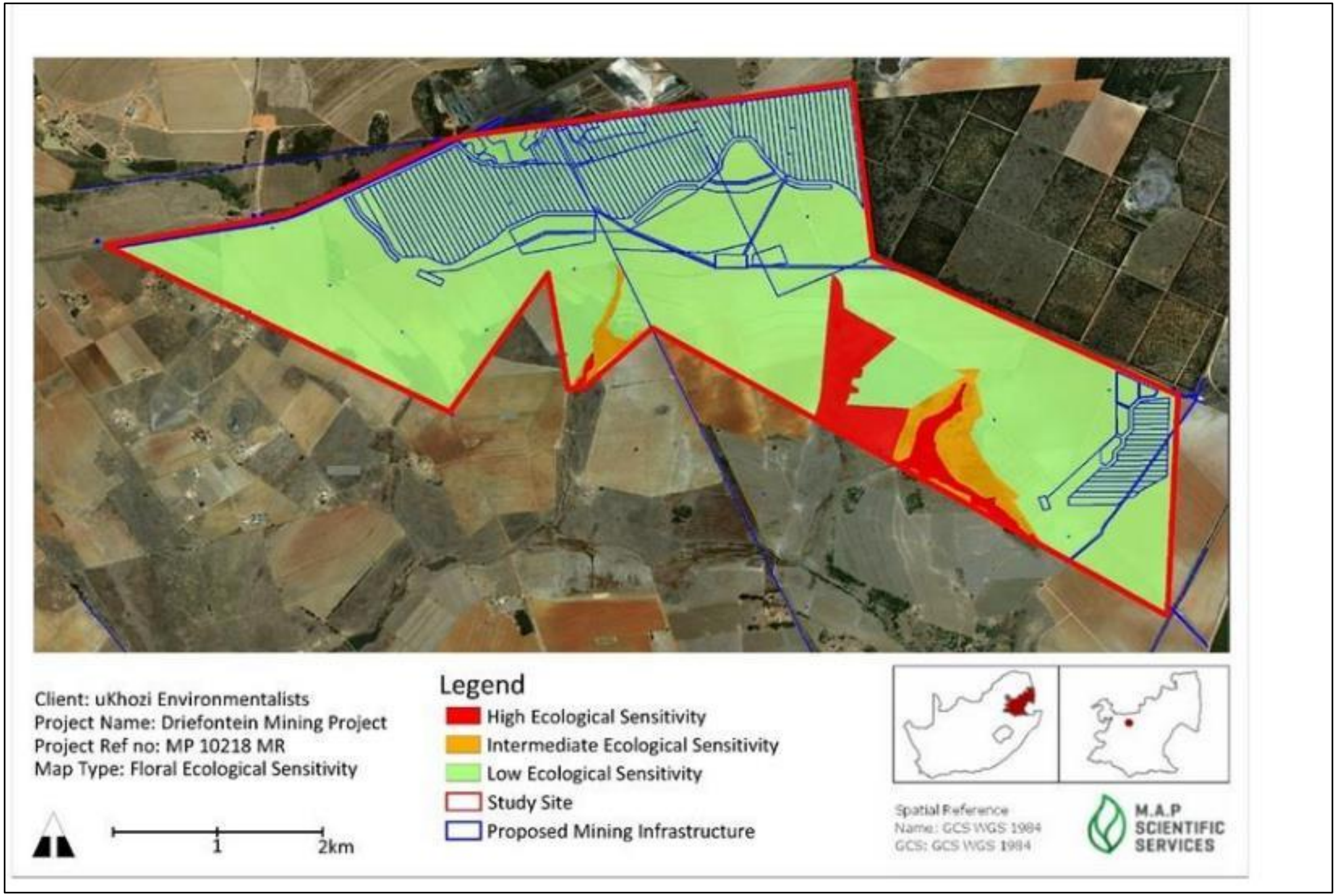


Figure 74: Floral and faunal ecological sensitivity map for the study area

13.2.4.1 Construction phase

The construction activities will involve site clearance in areas designated for infrastructure, opening of the box cut and overburden stockpiling. Vegetation (mainly agricultural fields) within these areas will be lost from site and it is likely that alien and invasive floral species, some which are already present within the study area, will proliferate as a result of disturbance, with the risk of these spreading into adjacent, high sensitivity natural grasslands. The vegetation and forestry plantations within surrounding areas and adjacent properties could also be impacted by dust fallout generated by the construction and transportation activities or indirect impacts such as increased erosion.

From a faunal perspective, construction activities associated with the mining operation could lead to direct loss of habitat should natural faunal habitats bordering the mining footprint area be impacted during construction. Loss of habitat also means loss of food and nesting resources, cover and movement corridors, which lead to the disappearance of the affected species from the area. Habitat loss also inevitably leads to fragmentation, the division of habitat into smaller and more isolated fragments separated by a matrix of human-transformed land cover. The loss of area, increase in isolation, and greater exposure to human land-uses along fragmented edges could initiate long-term changes to the structure and function of the remaining grassland habitat fragments. However, much of the remaining natural habitats in the study area have already been fragmented by agricultural activities and is unlikely to function as a faunal linkages or migration corridors. Although fragmented, these habitat patches could serve as stepping stones for dispersing faunal species and should be protected where possible in line with the mitigation measures proposed in Section 13.3 below.

13.2.4.2 Operational phase

The operational activities, which include opencast mining will result in the loss of agricultural land inside the mining footprint area and if mining boundaries are appropriately managed and adhered to, will not lead to the direct loss of natural habitat within the study area.

Alien and invasive plant species are however likely to further establish on the disturbed areas and mine boundaries and dust outfall and blown coal dust during the operational phase of the project, particularly due to transport and handling of coal, could affect the growth of adjacent undisturbed vegetation within the south of the study area, as well as that of forestry plantations. By impacting vegetation, dust may have an indirect effect on the availability of food and nesting items for faunal species. Moreover, potential faunal SCC may however continue to move between grassland fragments, irrespective of operational activities. When this happens, vehicle operations during the operational phase of the mine could impact on these species by causing road deaths. This will be a negative impact that has local consequences.

In addition, the risk of veld fires may increase during the operational phase of the mining project. Highveld grasslands do experience regular fires, which is important for maintaining vegetation structure and composition – however, a drastic increase in fire frequency can have a detrimental effect on vegetation as well as the faunal communities associated with it. The natural grassland vegetation and watercourses/ wetlands within this area play an important role in the local ecology and floral habitat provision within the region, which is characterised by maize cultivation and existing mining activities.

Concurrent rehabilitation is proposed as part of the operational phase of the project, whereby overburden will be used to progressively backfill opencast voids, followed by shaping of soils and the re-establishment of vegetation. If natural revegetation is not successful, commercial (artificial pasture) species will be used to revegetate disturbed areas for use as pasture. Alien and invasive floral species may remain present should revegetation not be successful and should an alien and invasive floral species control plan not be implemented for the duration of the project.

Together with large-scale agricultural activities and the extensive mining and beneficiation activities occurring in Middelburg and surrounding areas, the proposed mining operations may contribute towards regional cumulative impacts as a result of loss of natural vegetation and floral species, should the proposed operations extend beyond the designated project footprint areas. Such cumulative impacts may include the potential ongoing loss of the Rand Highveld Grassland vegetation type (EN) and further impacts on the Rand Highveld Grassland Ecosystem (VU). The spread of alien plant species within this vegetation type is likely, with specific mention of ongoing proliferation of *Acacia mearnsii* populations and further alien species introduced through disturbance from the proposed mining operations, which may replace indigenous vegetation and contribute to an overall loss of biodiversity. Provided that the proposed mining activities do not encroach into surrounding natural habitat and that mitigation measures as proposed are adhered to, the proposed project will however not contribute significantly to loss of CBA areas and loss of floral SCC.

Cumulative impacts associated with habitat loss may also indirectly affect faunal species. For instance, some faunal SCC have large home ranges and forage widely for food and nesting resources. The transformation of the study area may alter such movements and behaviours and further contribute to the isolation of grassland faunal communities. Effective rehabilitation of the mining operation and open cast areas during the closure and decommissioning phase is essential in order to minimise cumulative impacts resulting from the mining activities.

13.2.4.3 Decommissioning/rehabilitation and post closure phase

The decommissioning/rehabilitation, and closure phase involves the removal of all infrastructure and rehabilitation of the disturbed area. The impact of this development phase in relation to the operational phase is mostly positive, as concurrent, and final rehabilitation will contribute towards regeneration of natural habitat once mining has been concluded. Alien and invasive floral species may remain present should revegetation not be successful and should an alien species management programme not be implemented for the duration of the project, which could impact on the suitability of the rehabilitated areas and backfilled opencast pits for the planned final land use.

Latent or residual impacts on the receiving floral ecological environment are possible, particularly should the proposed operations extend beyond the designated project footprint areas or should rehabilitation be ineffective. Residual risks mainly relate to proliferation and spread of alien invasive floral species, unrehabilitated edge effects such as erosion within areas surrounding the proposed mine which may permanently alter floral species composition, and ineffective rehabilitation and revegetation of open cast areas in particular, which may lead to permanent alteration of the landscape. For faunal species, latent or residual impacts relate to the increased isolation and edge effects associated with habitat fragmentation.

13.2.5 Surface water

Iggdrasil Scientific Services (ISS) was appointed to undertake a baseline aquatic assessment for the proposed Driefontein Mine.

The location of the proposed infrastructure for the Driefontein Mine is concentrated primarily in the northern region of the study area. This area is located relatively far from the drainage lines of the non-perennial streams. According to the MBSP the majority of the proposed area is located within a Heavily Modified region.

The potential impacts during the different phases of the proposed mine are discussed below.

13.2.5.1 Construction phase

13.2.5.1.1 Alteration of water quality

During the construction phase a number of wastes will be produced including sewerage, domestic waste, wash-water, used oils and grease, diesel or lubricant spills, etc. Wastes generally contain pollutants and present a potential risk to the water and surrounding environment if not managed effectively. Oil and diesel spillages may occur during the construction phase which can contaminate surface water. Other potential contaminants (e.g., from chemical toilets, domestic waste, fuel depots, storage facilities, vehicle wash bays, workshop facilities, etc.) can reduce surface water quality or result in discharge that exceeds the maximum concentrations permitted by the National Water Act and can be toxic to aquatic life.

The watercourses found in the southern part of the application areas flow in a south-western direction away from the mining area towards a tributary of the Klein Olifants River. Therefor any contaminants generated during construction that is picked up by storm water runoff could flow into these watercourses and contaminate the downstream tributary of the Klein Olifants River. These contaminants can be contained within the mining area through the effective implementation of a storm water management plan.

13.2.5.1.2 Altering the amount of sediment entering water resource and associated change in turbidity

Clearing of surface vegetation will expose the soils, which in rainy events would wash down into the downstream watercourses, causing sedimentation.

Runoff after rain can give rise to erosion and sedimentation. The disturbed areas of land or active stockpile dumps piled up near the mine are usually susceptible to erosion and silting is thus likely. Increased sediment movement off the construction sites will add to the cumulative impact of increased sediment loads in the watercourses down gradient of the site.

In addition, indigenous vegetation communities are unlikely to colonise eroded soils successfully and seeds from proximate alien invasive trees can spread easily into these eroded soils.

13.2.5.1.3 Altering the flow regime of a watercourse

Impacts on hydrological functioning at a landscape level and across the site can arise from changes to flow regimes (e.g., suppression of floods, loss of flood attenuation capacity, unseasonal flooding, or destruction of floodplain processes). Construction activities such as the stripping and stockpiling of topsoil, development of infrastructure and surface water redirection will reduce the surface water inputs into the downstream tributaries of the Klein Olifants River.

There are several impacts related to the change in the hydrological regime. These impacts include reduced surface runoff and changes in groundwater recharge. Surface runoff is reduced as rainfall collects in collapsed areas after heavy summer rains. On the other hand, the increased speed of runoff due to impermeable structures and drains could cause extensive erosion and scouring of the aquatic ecosystems if not designed adequately. Furthermore, construction of access roads to the mining area may also contribute to changes in the hydrological regime volumes of surface water feeding into the watercourses.

13.2.5.1.4 Loss of aquatic biota

Aquatic biota within the aquatic ecosystems in the Klein Olifants River has already been adversely affected by anthropogenic activities most notably upstream and surrounding agricultural activities, invasive aliens, trampling by livestock, etc., as well as road crossings and impoundments, which causes sedimentation and bank erosion. The proposed mining activities are likely to further adversely affect the communities should adequate mitigation measures along with monitoring not be conducted. Impacts of sedimentation, impaired water quality, introduction of toxicants and increased turbidity could lead to the loss of sensitive aquatic community members.

13.2.5.2 Operational phase

13.2.5.2.1 Alteration of water quality

Toxicity levels will increase if no or a poorly constructed stormwater management plan around the pits, ROM stockpiles and overburden dumps are applied. Increased toxicity levels will affect all the trophic levels within the aquatic ecosystem.

Changes to the water quality could result in changes to the ecosystem structure and function as well as a potential loss of biodiversity. Water quality deterioration often leads to modification of the species composition where sensitive species are lost and organisms tolerant to environmental changes dominate the community structure.

Drainage from the site may result in surface water issues, as any polluted surface water on the site has the potential to flow into the Tributary of the Klein Olifants River. The system has agricultural dependents further downstream which could be negatively impacted by decreasing water quality.

The potential sources of surface water pollution during the operational phase are described in the table below.

Table 74: Potential sources of surface water pollution (Operational phase)

Pollution source	Description
Contamination of surface water by oil and diesel spillages as well as other wastes and potential contaminants	Machinery and equipment will be used for the operation of the mining activities which may leak, or spillages may occur during on-site refuelling. If the petrochemical storage facilities within the mining area are not adequately designed and managed, potential leakages and spillages could negatively impact the water quality in the watercourse or wetland areas via petrochemical contaminants.
	Ablution facilities will be operated within the mining area in the form of septic tanks. Overflow from these tanks can impact on the stormwater runoff from the mining area.
	Domestic waste materials (food containers, plastics, papers, etc.) that will be used by the labour and employees during the operational phase could potentially contaminate the wetland areas, which could pose a risk to the water quality characteristics of these areas. The risk of this impact occurring is very low if the movement around aquatic ecosystems in the projected mining area are kept to a minimum and facilities for the disposal of litter provided.

Pollution source	Description
Pollution of surface water due to seepage, runoff, and spills from the mining activities	During the operational phase of the mine, rainfall is likely to filter through into waste heaps, dumps and coal stockpiles and may dissolve some pollutants that may pose a risk to the surrounding watercourses. Possible releases from the pit, PCDs, and ROM coal stockpile area is expected to have reduced pH levels, increased EC and TDS and other impacts associated with coal mining. This water may end up in river systems due to failure of pipes transporting water, overflow from pollution control dams, accidental discharges, etc. This can have significant impacts as the concentrations of pollutants can be high and can cause acute effects in the aquatic ecosystem. Additionally, storm water from the mining site can transport pollutants to the aquatic ecosystem. This impact may also be cumulative in nature, but mining activities can be adapted to reduce the probability of the impact occurring by ensuring adequately sized, properly designed and lined stormwater management facilities are put in place.
Drainage from mining site incl AMD and mine water	Mine excavation usually has a water influx, either due to rainfall or interception of ground water flows which must be pumped out. It can be contaminated by particulate matter, oil and grease, unburnt explosives and other chemicals. If the coal seams contain high amounts of pyrites the mine water may be acidic and thus pollute the groundwater and the nearby aquatic ecosystem after being discharged. This phenomenon is commonly known as AMD, and it can have a detrimental effect on associated aquatic ecosystems. These effects can be categorised as chemical, physical, biological and ecological, although the overall impact on the community structure is the elimination of species, simplifying the food chain and so significantly reducing ecological stability. AMD poses a threat to the aquatic environments within the study site during and after operations.

13.2.5.2.2 Altering the amount of sediment entering water resource and associated change in turbidity

Opencast mining will result in earthworks and soil disturbance as well as the removal of natural vegetation. The mining area will be stripped of all vegetation and will increase the risk of siltation downstream of the operations. Stormwater runoff containing high silt could impact on the water quality in the watercourses which in turn could impact on the ecological state and functionality of these areas.

Access roads to the mining area may contribute to sedimentation, erosion, and siltation. Long term toxicant input in sediment may often lead to the occurrence of contaminant levels far higher than that in the surrounding water. The problem of particular concern in the study site is that the rivers and streams in the area already contain high sediment loads due to the current land uses. Any further increase in sedimentation and erosion can cause a further loss in habitat diversity and quality that will further contribute to impacts on biological communities.

On the other hand, implementing the recommended mitigation measures and restricting storm water runoff with a high silt load from entering the watercourses will result in a reduction in water volumes which in turn will reduce the current sediment deportation occurring on site. A net reduction in sediment feeding the Klein Olifants River can be seen as a positive impact.

13.2.5.2.3 Altering the flow regime of a watercourse

It is assumed that water flow to mine pits and receiving water bodies will be diverted away to prevent pollution, therefore, surface water inputs into the tributaries of the Klein Olifants River will decrease.

The alteration of flow regimes is often claimed to be the most serious threat to ecological sustainability of rivers and their associated floodplain wetlands (Bunn and Arthington 2002). Flow modifications within a river may have several effects on the aquatic biota found within these systems. Firstly, flow is a major determinant of physical habitat, which in turn is a major determinant of biotic community structure. Secondly, aquatic species have evolved life history strategies primarily in direct response to the natural flow regimes; thirdly, the invasion and success of exotic species in rivers is facilitated by the alteration of flow regimes (Poff and Ward 1990, Bunn and Arthington 2002). This could be reversed post mining with rehabilitation efforts, due to bare soils increasing runoff into the watercourses and increasing flows.

13.2.5.2.4 Loss of aquatic biota

Aquatic biota within the aquatic ecosystems in the Klein Olifants River has already been adversely affected by anthropogenic activities most notably upstream and surrounding agricultural activities, invasive aliens, trampling by livestock, etc., as well as road crossings and impoundments, which causes sedimentation and bank erosion. The proposed mining activities are likely to further adversely affect the communities should adequate mitigation measures along with monitoring not be conducted. If alteration of flow regimes and water quality is not addressed alongside habitat loss, sedimentation and possible toxic contaminants from the mining operation, it is expected that there will be a significant decrease in species richness of aquatic fauna and benthic macroinvertebrates.

13.2.5.3 Decommissioning/rehabilitation and post closure phase

13.2.5.3.1 Alteration of water quality

Chemicals, diesel, oil and other hazardous substances will be used throughout the life of the mine and will sometimes be stored on site. If spills occur during the decommissioning phase, they could negatively impact on the downstream river system if the contaminants are washed downslope. Similarly, waste and sewerage will also have a negative impact if they enter the downslope watercourses through accidental releases from site.

After the colliery is closed, contaminated water management becomes passive. Ground water inflows and recharge through rehabilitated spoils is likely to create pit decant. Decant emanating from the lowest perimeter point on the pit perimeter will be discharged into the environment. This decant will be driven by rainfall recharge through the rehabilitated spoils. The decant water quality could potentially contaminate the downstream watercourses. Decant flows will likely be seasonal and volumes will be dependent on the quality of rehabilitation done. The potential for decant and location of these points was assessed during the Groundwater Impact Assessment (Refer to Section 13.2.7.3.1 below).

13.2.5.3.2 Altering the amount of sediment entering water resource and associated change in turbidity

During the decommissioning phase, most impacts will be associated with the removal of surface infrastructure, haul roads, final pit closure and removal of all water management infrastructure which will leave the underlying soils bare, and susceptible to wind and runoff water erosion. Large storm flows in the two tributaries will wash the excess sediment into downstream river system

13.2.5.3.3 Altering the flow regime of a watercourse

The impacts will be similar but on a smaller scale than the busier construction phase (refer to Section 13.2.5.2.3 above). Once mining has ceased, the opencast pits will be backfilled and rehabilitated.

Surface settlement on rehabilitated soils and opencast areas could increase the recharge rate of water through the backfilled open pit spoils, in particular if a free draining landscape is not achieved. Subsequently, the water ingress results in the reduction in local catchment yield as surface water that should have been routed towards local water resources is now constricted by surface ponding and spoil ingress also possibly leading to Acid Mine Drainage (AMD). Predictive groundwater and pollution plume modelling and or associated specialist investigations to help quantify this long-term risk includes post-rehabilitation land capability assessments (specifically on cover integrity), assessment of landform topography design criteria and monitoring data analysis of actual water quantities manifesting at decant locations, as compared to modelled volumes (adopted: Coaltech, 2019)

13.2.5.3.4 Loss of aquatic biota

AMD is a threat to the aquatic environments within the study site. These effects can be categorised as chemical, physical, biological, and ecological, although the overall impact on the community structure is the elimination of species, simplifying the food chain and so significantly reducing ecological stability.

The predicted increase in sulphate levels post closure are expected to have a negative impact of the aquatic biota (Refer to Section 13.2.7.3.2 below for the predicted pollution plume).

13.2.6 Wetlands

The construction and operation of the mining activities have various potential negative impacts on the wetlands associated with the site. Considering the full scale of the mitigation hierarchy as per the mining and biodiversity guidelines avoidance is the first step to consider (DEA et al. 2013). The proposed mine layout avoids the identified wetlands and their buffer zones although some areas overlap with the DWS 500m regulated area. Refer to Figure 75 showing the proposed mine layout overlaid onto the wetland delineation map. The potential impacts during the different phases of the proposed mine are discussed below.

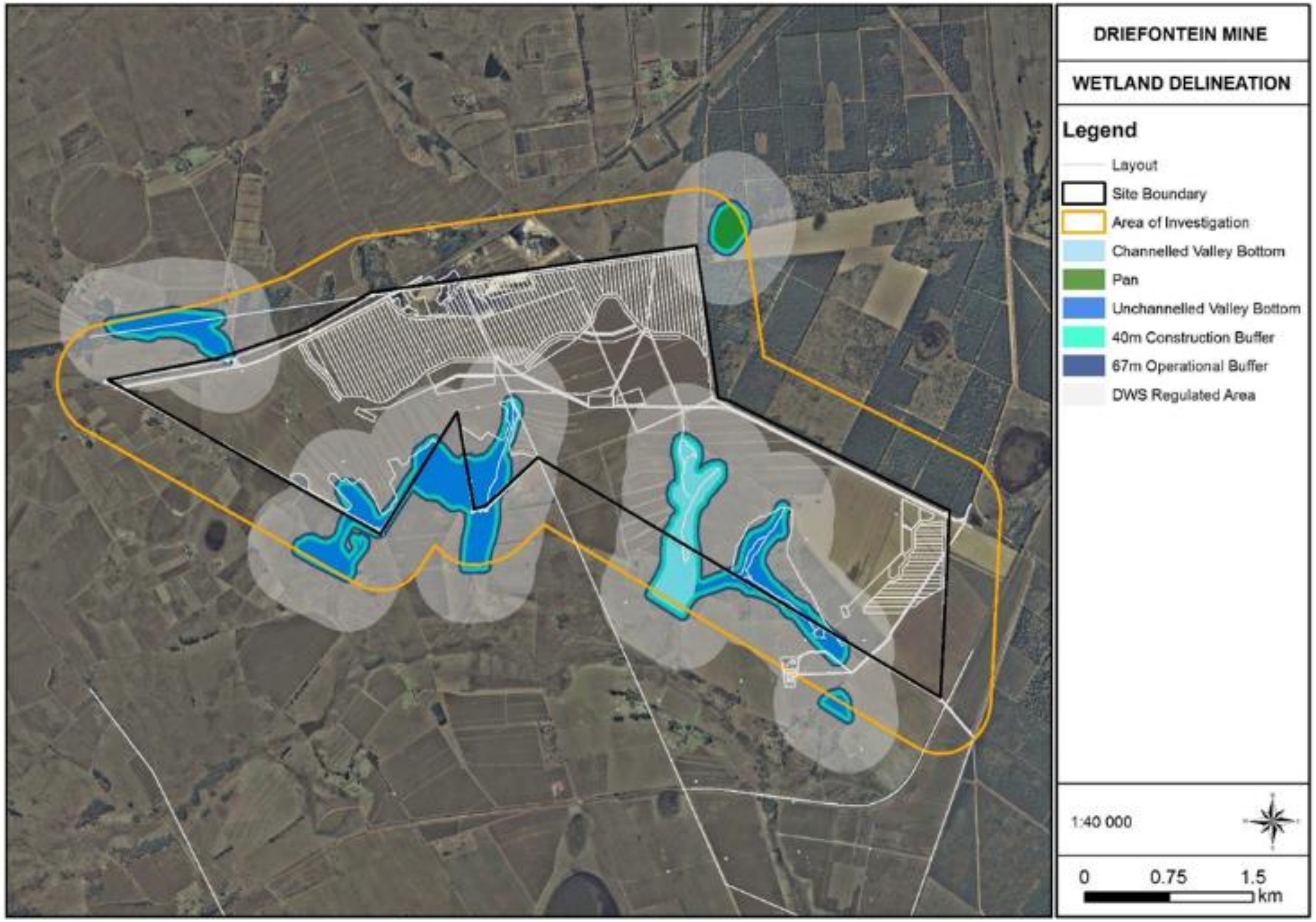


Figure 75: Proposed mine layout relative to wetlands and associated buffers

13.2.6.1 Construction phase

13.2.6.1.1 Change in hydrological function

Impacts on hydrological functioning at a landscape level and across the site can arise from changes to flow regimes (e.g., suppression of floods, loss of flood attenuation capacity, unseasonal flooding, or destruction of floodplain processes). Construction activities such as the removal of vegetation, stripping and stockpiling of topsoil, development of infrastructure and surface water redirection will reduce the surface water inputs into the downstream wetlands.

There are several impacts related to the change in the hydrological regime. These impacts include reduced surface runoff and changes in groundwater recharge. Surface runoff is reduced as rainfall collects in collapsed areas after heavy summer rains. On the other hand, the increased speed of runoff due to impermeable structures and drains could cause extensive erosion and scouring of the aquatic ecosystems if not designed adequately. Furthermore, construction of access roads to the mining area may also contribute to changes in the hydrological regime volumes of surface water feeding into the wetlands.

The change in hydrological function can contribute to changes to water volumes available to support specialised wetland habitats within the local catchments and beyond.

13.2.6.1.2 Sedimentation and siltation

Changes in sediment entering and exiting the system. Changing the amount of sediment entering water resource and associated change in turbidity (increasing or decreasing the amount). Construction activities will result in earthworks and soil disturbance as well as the removal of natural vegetation. This could result in the loss of topsoil, sedimentation of the watercourses and increase the turbidity of the water. Possible sources of the impacts include:

- Earthwork activities during construction
- Clearing of surface vegetation will expose the soils, which in rainy events would wash through the watercourse, causing sedimentation.
- Disturbance of soil surface.
- Disturbance of slopes through creation of roads and tracks adjacent to the watercourses.

Should changes be made to the bed or banks of the watercourses unstable channel conditions may result causing erosion, meandering, increased potential for flooding and movement of bed material, which will result in property damage adjacent to and downstream of the site.

13.2.6.1.3 Introduction and spread of alien vegetation

The moving of soil and vegetation resulting in opportunistic invasions after disturbance and the introduction of seed in building materials and on vehicles.

Invasions of alien plants can impact on hydrology, by reducing the quantity of water entering a watercourse, and outcompete natural vegetation, decreasing the natural biodiversity. Once in a system alien invasive plants can spread through the catchment. If allowed to seed before control measures are implemented alien plans can easily colonise and impact on downstream users.

13.2.6.1.4 Changes in water quality

During the construction phase a number of wastes will be produced including sewerage, domestic waste, wash-water, used oils and grease, diesel or lubricant spills, etc. Wastes generally contain pollutants and present a potential risk to the water and surrounding environment if not managed effectively. Oil and diesel spillages may occur during the construction phase which can contaminate surface water. Other potential contaminants (e.g., from chemical toilets, domestic waste, fuel depots, storage facilities, vehicle wash bays, workshop facilities, etc.) can reduce surface water quality or result in discharge that exceeds the maximum concentrations permitted by the National Water Act and can be toxic to aquatic life. These contaminants can be contained within the mining area through the effective implementation of a storm water management plan.

The proposed construction activities will occur outside the wetland and buffer zone areas however due to the close proximity of the proposed activities to the wetlands it still falls within the Medium risk category.

13.2.6.2 Operational phase

13.2.6.2.1 Change in hydrological regime

It is assumed that water flow to mine pits and receiving water bodies will be diverted away to prevent pollution, therefore, surface water inputs into the unchanneled and channelled valley bottom wetlands will decrease. Reduction of water into the wetlands could decrease the functionality. The change in hydrological function can contribute to changes to water volumes available to support specialised wetland habitats within the local catchments and beyond.

13.2.6.2.2 Sedimentation and siltation

Opencast mining will result in earthworks and soil disturbance as well as the removal of natural vegetation. The mining area will be stripped of all vegetation and will increase the risk of siltation downstream of the operations. Stormwater runoff containing high silt could impact on the water quality in the wetland areas which in turn could impact on the ecological state and functionality of these areas.

Access roads to the mining area may contribute to sedimentation, erosion, and siltation. Long term toxicant input in sediment may often lead to the occurrence of contaminant levels far higher than that in the surrounding water.

Should changes be made to the bed or banks of the watercourses unstable channel conditions may result causing erosion, meandering, increased potential for flooding and movement of bed material, which will result in property damage adjacent to and downstream of the site.

13.2.6.2.3 Introduction and spread of alien vegetation

The impact will persist into the operational phase with the moving of soil and vegetation and the introduction of seed on vehicles resulting in opportunistic invasions. Invasions of alien plants can impact on hydrology, by reducing the quantity of water entering a watercourse, and outcompete natural vegetation, decreasing the natural biodiversity. Once in a system alien invasive plants can spread through the catchment. If allowed to seed before control measures are implemented alien plants can easily colonise and impact on downstream users.

13.2.6.2.4 Loss and disturbance of watercourse habitat and fringe vegetation

Disturbance of soil/water processes upslope from the wetlands may cut off interflow that feeds downslope wetlands. According to the Geohydrological Assessment (GPT, 2019), the impact of the proposed mine on streams in the area can be estimated qualitatively from the model in so far as the groundwater component (base flow) of the stream is concerned. Such an assessment will not include possible surface runoff influences caused by mining, but merely addresses the base flow component due to gaining (or losing) of groundwater by the stream.

It can be deduced from the calculated figures that the cumulative groundwater drawdown at the streams/wetlands close to the mine will have an impact (Table 75). In particular the wetlands and spring located to the south and south-west of the mines and the pan located to the east of the South-Eastern opencast. If these wetlands and pan are indeed connected to groundwater, there is a likelihood that flow to the wetlands could be affected by the mining activities. The volume of groundwater flowing to the wetlands was calculated as can be seen in the table below.

A 0% impact cannot be achieved as the planned opencast will be in the catchment of these wetlands. A reduction in flow of 6-18 % can be expected for the wetlands at the study area as the result of the planned opencast mine.

Table 75: Reduction in flow contribution to wetlands

Wetland	Wetland Catchment Area Before Mining (ha)	Unsaturated Flow Contribution before Mining (25% of MAR) (m^3/day)	Unsaturated Flow Contribution before Mining (15% of MAR) (m^3/day)	Wetland Catchment Area During Mining (ha)	Unsaturated Flow Contribution during Mining (25% of MAR) (m^3/day)	Unsaturated Flow Contribution during Mining (15% of MAR) (m^3/day)	Percentage reduction in flow contribution
Northern	723	1190	710	592	970	580	18
Southern	447	730	440	418	685	410	6

13.2.6.2.5 Changes in water quality

The mining activities have the potential to negatively impact on the water quality of the wetlands in a number of ways which include:

- Deterioration of water quality through coal-related substances entering the system. These substances will include both suspended solids such as coal dust and dissolved solids including sulphates and metal ions which can lower the pH of the water and can reach toxic levels.
- AMD as well as an increase in siltation caused by stockpiles, exposed coal, and exposure of overburden from opencast to rain could lead to the significant decrease of water quality in the surrounding wetlands.
- Hydrocarbon pollution due to spillages from diesel storage tank, vehicles and heavy machinery or accidental spillages of chemicals.

13.2.6.3 Decommissioning/rehabilitation and post closure phase

The landscaping of the disturbed area will allow surface water drainage to be restored which in turn will increase the catchment size area. The decommissioning activities will attempt to restore the topography in such a way that the storm water can again follow the natural drainage lines towards the downstream wetlands.

The impacts will be similar but on a smaller scale than the busier construction phase.

13.2.7 Groundwater

Geo Pollution Technologies - Gauteng (Pty) Ltd (GPT) was appointed to conduct the hydrogeological impact study for the proposed Driefontein Mine.

Conceptual model development is an integral step of groundwater flow and transport modelling. A conceptual model is a simplified representation of the conditions at and in the vicinity of the mining site and provides the framework during the development of the risk assessment and numerical flow and transport model.

In order to understand the aquifer, groundwater monitoring boreholes were drilled into the Driefontein Aquifer. The existing conceptual site model is shown in (Figure 76). The cross-section shows the lithological units and their relative depth and thickness. Groundwater occurrence is associated with weathering and a high degree of fracturing in quartzite and shale layers. Fractures are sub-horizontal with the quartzite layers. The quartzite possibly acts as barriers to flow and create compartments which will prevent groundwater from moving through areas of occurrence. The conceptual model also includes a proposed scenario, in order to understand what the effect of mining would be on the surrounding environment.

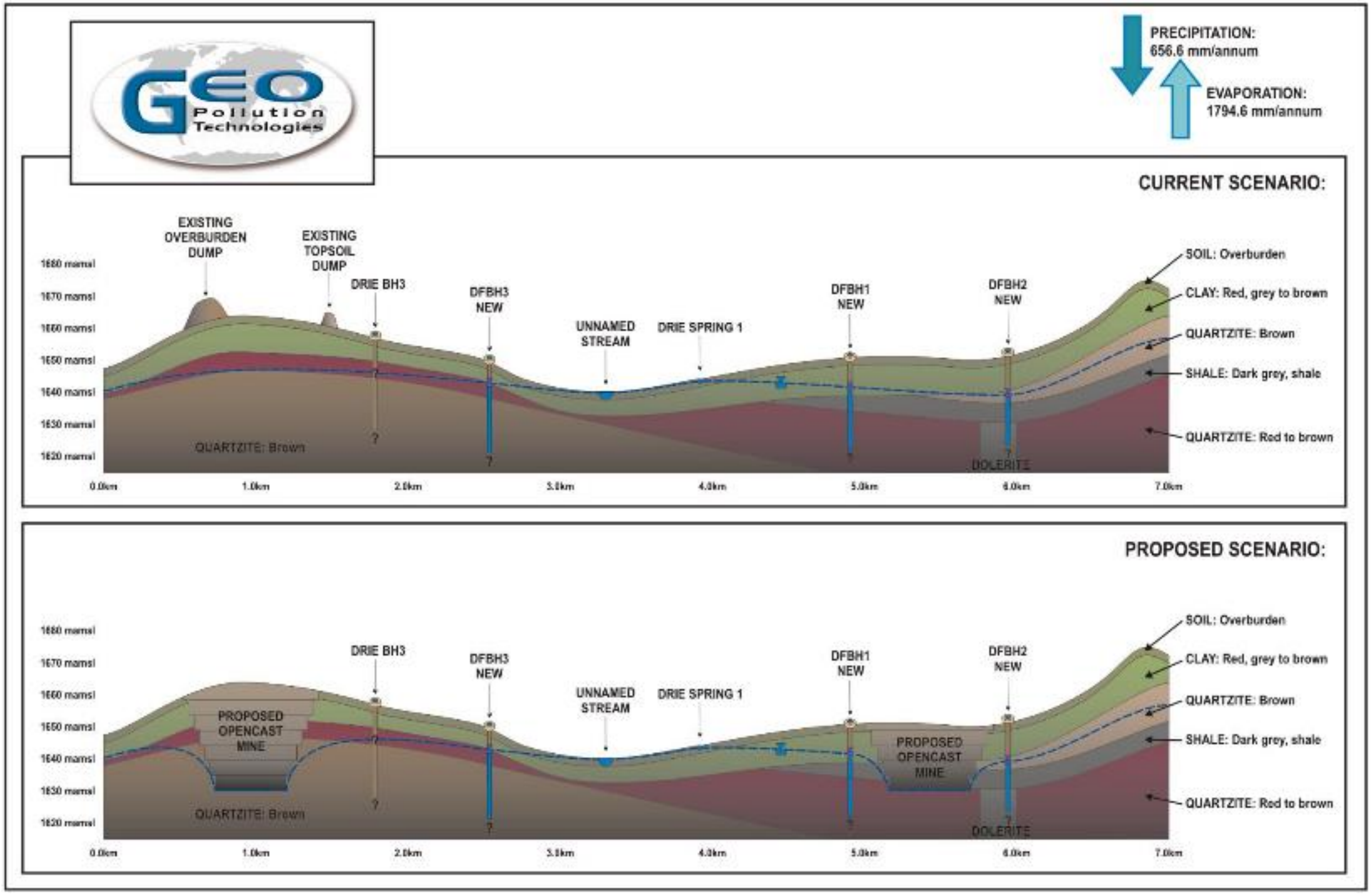


Figure 76: Conceptual site model

A numerical groundwater flow and transport model was constructed and simulated to aid in decision making processes and environmental management. The purpose of the numerical model is to develop a tool than can be used to assess the impact of the proposed mine i.e., dewatering volumes associated with the mine during the operational phase taking into account existing operations. Together with this, simulate the impacts associated with potential pollution sources.

Water level and quality data obtained during the hydrocensus was used to calibrate the steady state numerical groundwater flow model. The results obtained during the steady state scenarios were used as initial conditions to simulate dewatering and contaminant transport impacts. Refer to Section 7 of the Groundwater Impact Assessment (attached as Appendix 6.4 to this document) for a detailed explanation of how the model was constructed.

The model represents the following scenarios:

- Pre-Mining – This model represents the pre-mining scenario and is used for calibration purposes. The model is representative of steady-state natural conditions prior to the application of stresses to the aquifer and provides a baseline from which all following calculations are performed.
- During Mining – This model represents the groundwater situation during operation of the proposed mine. For the purposes of this model a worst-case scenario was assumed, namely that all the opencasts will be dewatered during the mining period. The modelling included the following transport and dewatering scenarios:
    - <u>Transport</u>
    - Proposed Northern Opencast
    - Proposed South-Eastern Opencast
    - Current Stockpiles
    - Pollution Control Dams

    - <u>Dewatering</u>
    - Proposed Northern Opencast
    - Proposed South-Eastern Opencast

  The numerical groundwater flow model indicates the associated flow directions and velocities and simulated inflow rates towards the mining activities.

- Post mining - This models the post-mining scenario, assuming that the most likely recharge over the rehabilitated opencasts will be 0.0004 m/d. This amounts to a recharge of about 20% of rainfall, which is probably a realistic if not worst-case scenario (*Grobbelaar, R et al: Long-Term Impact of Intermine Flow from Collieries in the Mpumalanga Coalfields, Sept 2004. Institute for Groundwater Studies, University of the Free State, Bloemfontein RSA*). The modelling included the following transport and
  dewatering scenarios:
    - <u>Transport</u>

- Proposed Northern Opencast
- Proposed South-Eastern Opencast
- Current Stockpiles
- Pollution Control Dams

➢ Discharge

- Proposed Northern Opencast
- Proposed South-Eastern Opencast
- Current Stockpiles
- Pollution Control Dams

It is the aim of this section to describe the likely hydrogeological impact that the mine might have on the receiving environment during the different phases. The cumulative pollution impacts of all current and historic mining in addition to the proposed mine could not be calculated as any data on surrounding mines is not available. However, it is highly recommended that a regional study be undertaken to quantify impacts on at least a quaternary scale, or a data sharing agreement should be reached with neighbouring mines.

13.2.7.1 Construction phase

The construction phase will consist mainly of establishment of infrastructure on site, the mobilisation of earth moving equipment and the opening of the boxcut. This phase is not expected to influence the groundwater levels. In terms of groundwater quality hhydrocarbon spillages from construction vehicles could infiltrate the groundwater system and contaminate the underlying groundwater resources. With the exception of lesser oil and diesel spills, there are no activities expected that could impact on regional groundwater quality. This phase should thus cause very little additional impacts in the groundwater quality. It is expected that the current status quo will be maintained.

13.2.7.2 Operational phase

The operational phase is interpreted as the active mining of the proposed mine. It is inevitable that these effects will impact on the groundwater regime. The potential impacts that will be considered are the groundwater quantity and quality.

13.2.7.2.1 Lowering of groundwater levels

During the operational phase, it is expected that the main impact on the groundwater environment will be de-watering of the surrounding aquifer. Water entering the mining areas will have to be pumped out to enable mining activities. This will cause a lowering in the groundwater table in- and adjacent to the mine. The dewatering of the aquifer has been calculated for the proposed mine using the calibrated numerical model as described above. A worst-case scenario was modelled, assuming that all opencasts would be dewatered. This will obviously not be the case, and the actual drawdown could thus be less. However, as the recovery of groundwater is expected to be very slow, it could well be that the first opencast is still in an early stage of recovery. Thus, the worst-case scenario could also be close to the actual scenario. The predicted impacts of mining on the groundwater quantity can be summarised as follows:

- The northern opencast pit is expected to receive inflows of 370 m^3/d. The drawdown from this area is expected to influence water levels in DFBH3 and DRIE-BH3. Expected water level decline at these receptors is expected to range between 13 and 18m.
- The South-eastern opencast pit is expected to receive inflows of 480 m^3/d. The drawdown from this area is expected to influence water levels in DF-BH1, DF-BH2, DRIE-BH1 and DRIEBH2. Expected water level decline at these receptors is expected to range between 3 and 22m.

The calculated drawdown is summarised in Table 76 and depicted in Figure 77 below, as contours of drawdown for the mine being dewatered simultaneously. However, these figures are overestimations and probably reflect worst-case scenarios. The actual inflow will depend on the area being mined at any one moment in time. However, at the last boxcut, the inflow from the backfilled portion of the mine could be substantial and the above inflows can be approached. It is important to view these numbers for the water make of the mine in relation to natural evaporation, as listed in the table. Illustrative volumes are included in the table as if the evaporation will take place over the whole opencast, for comparative purposes. As the whole opencast will not be open at any one time, this is obviously an overestimate. Nevertheless, it is illustrative that evaporation can contribute considerably to the removal of groundwater seepage into the opencast. Furthermore, it should be realised that evaporation is a seasonal effect. Direct recharge from rainfall will in turn add to these volumes. The amount of direct recharge will depend on the season as well as the mining layout and storm water management.

13.2.7.2.2 Aquifer contamination caused by polluted water migrating away from the mining area (leachate plume)

The flow in the aquifer will be directed towards the mine during operations and very little groundwater pollution is thus expected. Additionally, current contaminated groundwater could also flow into the mine, diverting the current contaminant plume. However, an increase in sulphate concentration in the tributary of the Keeromspruit is expected as can be seen in Table 76 and Figure 78 below.

Table 76: Summary of potential impacts during operation – spread of pollution

Mining area	Area (ha)	Potential impacted receptor	Estimated increase in concentrations during operation (mg/ℓ)
Northern Pit	208.2	Tributary of the Keeromspruit north of pit	200 -400

13.2.7.2.3 Leaching/seeping of contaminants into the sub surface

The associated mining activities also have the potential to impact on the groundwater quality in the following ways:

- Dirty water contained in the pollution control dams could contaminate the underlying aquifer through seepage in the event of failure.
- Seepage could also occur on the operational areas (coal stockpiles and overburden).

However, since all the waste storage facilities such as the PCDs, coal stockpiles and overburden dumps will be lined, little to no seepage is expected at these areas.

Table 77: Summary of potential impacts during operation – dewatering

Mining Area	Area (ha)	Mining Seam	Maximum Drawdown (m)	Cone of depression from edge of pit (m)	Estimated Inflow for the Total Area (m^3/day)	Evaporation (m^3/day)	Potential Impacted Receptor	Expected Water Level Decline (m)
Northern Pit	208.2	S2L, S2L, S1L	35	1477	370	10 202	DF-BH3	13.50
							Drie-BH3	17.10
South Eastern Pit	28.6	S2L, S2L, S1L	44	974	475	1403.8	DF-BH1	21.48
							DF-BH2	3.45
							Drie-BH1	9.77
							Drie-BH2	13.10

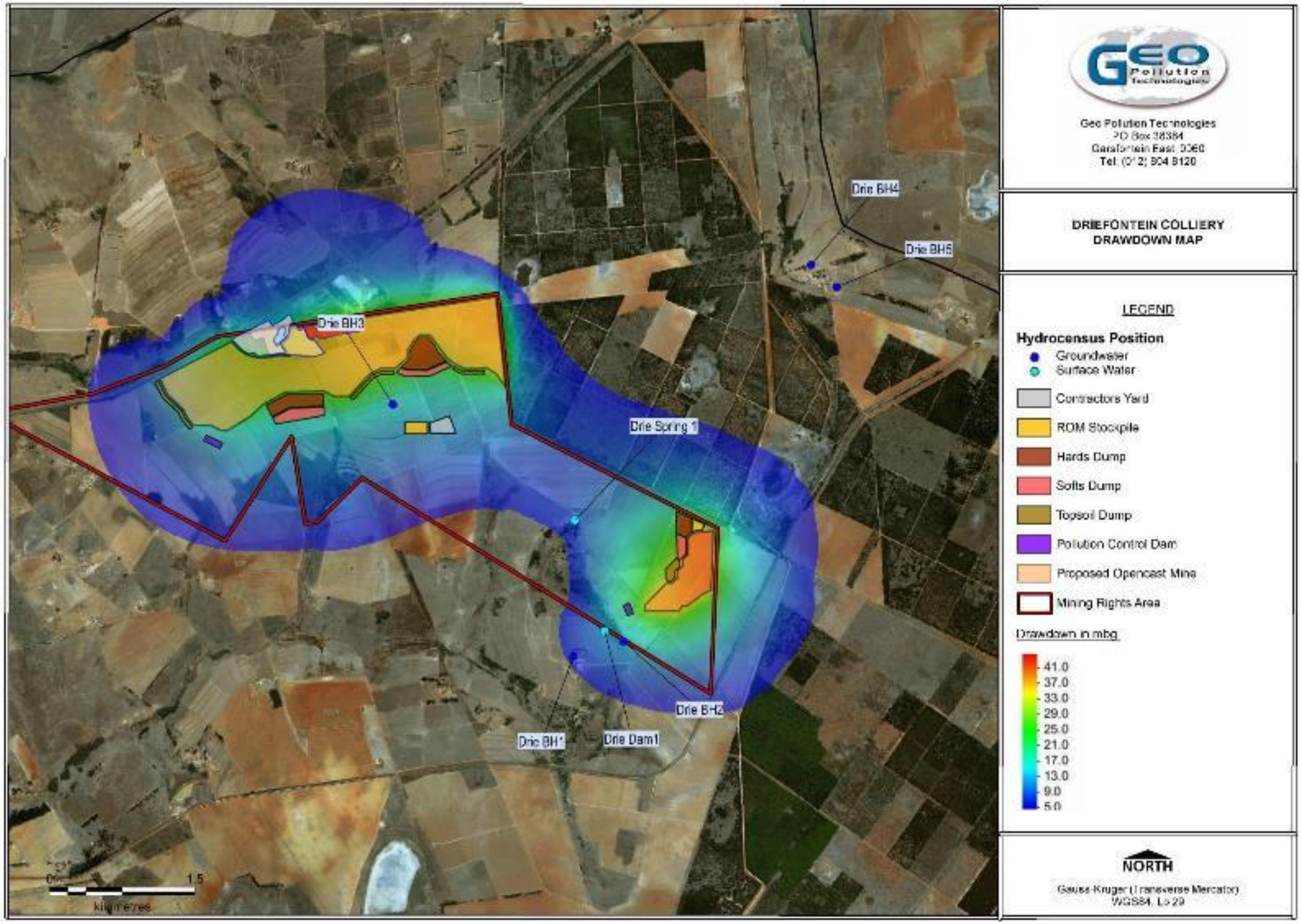


Figure 77: Cone of depression during mining

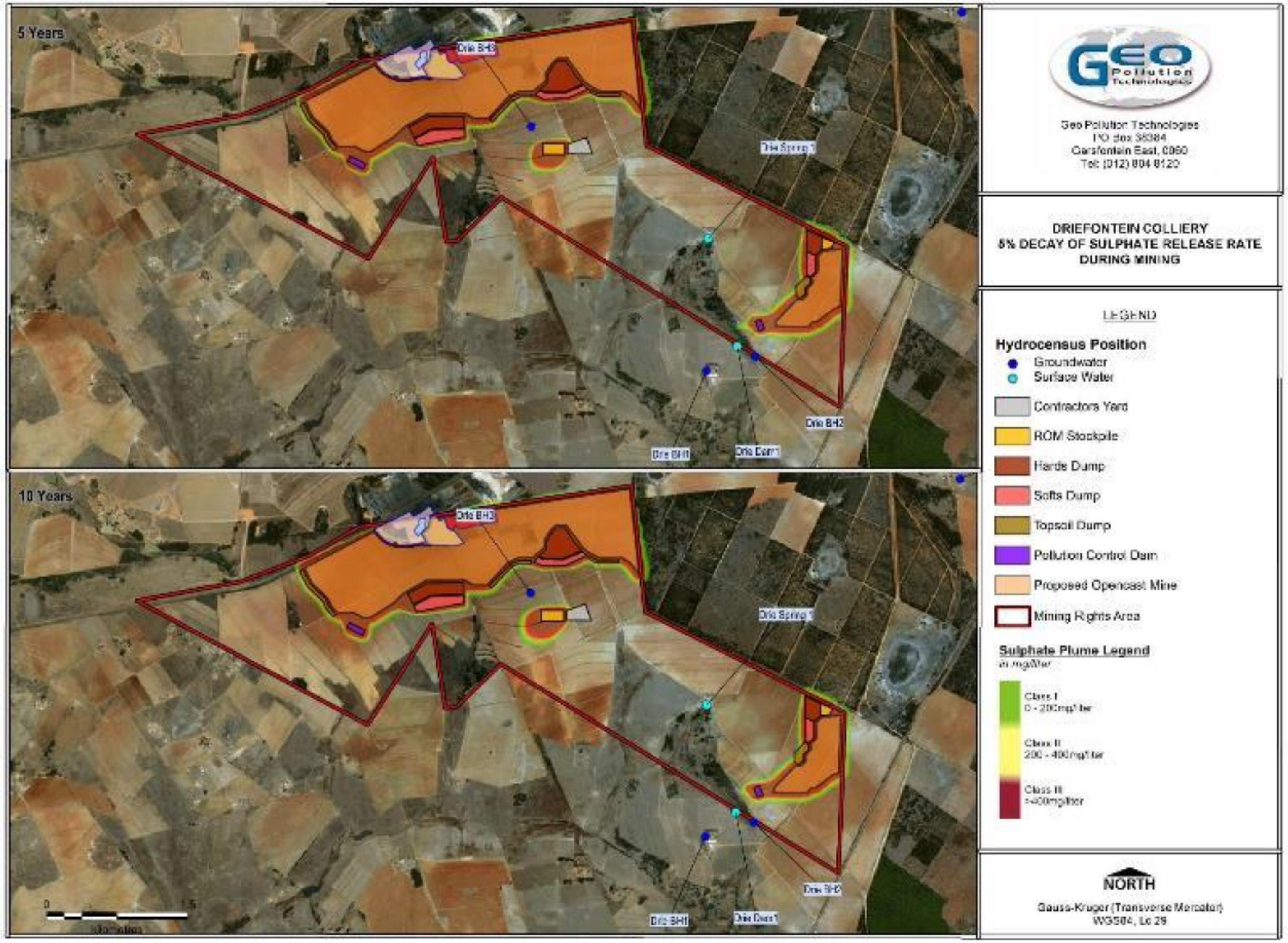


Figure 78: Predicted spread of pollution during mining with 5% decay

13.2.7.3 Decommissioning/rehabilitation and post closure phase

During this phase it is assumed that dewatering of the proposed mine will be ceased, and it will be allowed to flood. The groundwater regime will return to a state of equilibrium once mining has stopped and the removal of water from the mining void has been discontinued. The rise in groundwater level is predicted to be relatively slow and the water levels are expected to recover only in about 30 to 40 years. The slow recovery is ascribed to the low hydraulic conductivity of the surrounding bedrock.

The potential impacts are discussed below, and a summary of the potential impacts is shown in Table 78.

13.2.7.3.1 Groundwater rebound and potential decant

Following closure of the mine, the groundwater level will rise to an equilibrium that will differ from the pre-mining level due to the disturbance of the bedrock. This estimated rebound time in years for each individual opencast after cessation of pumping is shown in Table 78. After rebound has reached equilibrium or water in the pit equal to surrounding host rock, decant has the potential to occur due to excessive rainfall and surface water run-off water entering the pit. The percentage of the rainfall/run-off that is recharged into the rehabilitated opencast and potential decant depends on:

- The slope of the rehabilitated pit and its direct surroundings.
- The thickness and composition of the topsoil. i.e., clay content and compaction.
- The vegetation of the rehabilitation and its direct surroundings.
- The amount rainfall and intensity of the rainfall events.
- The size of the ramps and the final voids.

The northern and South-Eastern pits are expected to rebound within 40 years. Decant is not predicted at the northern pit but decant from the South-Eastern pit is expected to take place to the south-west of the pit at a rate of 1-2 l/sec. The predicted decant areas are shown in Figure 79. Please note that predicted decant areas may vary from exact real word decant areas due to sub-surface heterogeneity, however the general areas of predicted decant should hold true.

Active treatment of the decant may be viable, however all passive methods should be investigated first during the operational phase of the mine. The decant management strategy will be investigated further as part of the WULA.

13.2.7.3.2 Aquifer contamination caused by polluted water migrating away from the mining area (pollution plume)

Once the normal groundwater flow conditions have been re-instated, polluted water could potentially migrate away from the mining areas. As some discards and exposed reactive mineral surfaces will remain in the mine, this outflow could be contaminated as a result of mine drainage.

As sulphate is normally a significant solute in drainage from mines, sulphate concentration from the mine has been modelled as a conservative (non-reacting) indicator of mine drainage pollution. A starting concentration of 2000 mg/liter has been assumed as a worst-case scenario. However, geological material is a transient contaminant source and decreases in the concentration of released contaminants are expected over time. A 5% decrease in contaminant concentrations in the mine was incorporated into the transport modelling (*MACK, B. & SKOUSEN, J. 2008. Acidity Decay Curves of 40 Above Drainage Mines in West Virginia. 2008 National Ground Water Association Remediation of Abandoned Mines Conference. Denver*) as well as a 0% decay rate as a worst-case scenario.

The migration of contaminated water from the mining area has been modelled as described, and the results are presented in Figure 80 and Figure 81 in terms of the extent of the pollution plume 5, 10, 25 and 50 years after the operations have ceased. Heterogeneities in the aquifer are unknown and the effect of this cannot be predicted. Furthermore, no chemical interaction of the leachate with the minerals in the surrounding bedrock has been assumed. As there must be some interaction and retardation of the plume, this calculation will represent a worst-case scenario. A summary of the potential impacts post closure is listed below and shown in Table 78:

- Contamination from the Northern opencast is expected to affect the tributary of the Keeromspruit north of pit with expected concentration increases of 200 – 400 mg/L with regards to sulphate.
- Contamination from the South-eastern pit is expected to affect DFBH1 and DRIE-BH1 with expected concentration increases of 200 - 400 mg/L with regards to sulphate.

This residual risk could manifest due to the following events:

- Unpredicted/unplanned deterioration or variance of groundwater qualities as potential groundwater plumes migrate outside of the rehabilitated pit boundaries.
- Lack of control of natural groundwater recharge rates, or variances from predicted rates, affecting the ability to maintain predefined land capabilities.
- Unmitigated/unplanned use of groundwater by either upstream or downstream water users that affects the mine’s planned/predicted water use/s (qualities and quantities).

Predictive ground water and or pollution plume modelling and/or specialist investigations to help quantify this long-term risk includes geohydrological modelling, over time (continually calibrated with monitoring data) - to define and monitor the probable extent of the pollution plume and its likely pollutant content as well as pump tests of remaining (non-rehabilitated) boreholes (of both monitoring and functional boreholes).

Table 78: Summary of potential impacts post operations

Mining Area	Area (ha)	Potential impacted receptor	Estimated increase in concentrations during closure (mg/ℓ)	Rebound time (Years)	Potential decant (Yes/No)	Potential decant area
Northern Pit	208	Stream froming tributary of the Keeromspruit north west of the pit DF-BH3, Drie-BH3	200-400	30-40	No	~
South Eastern Pit	28.6	DF-BH1, DF-BH2, Drie-BH1, Drie-BH2	200-400	30-40	Yes	To the south west of the opencast

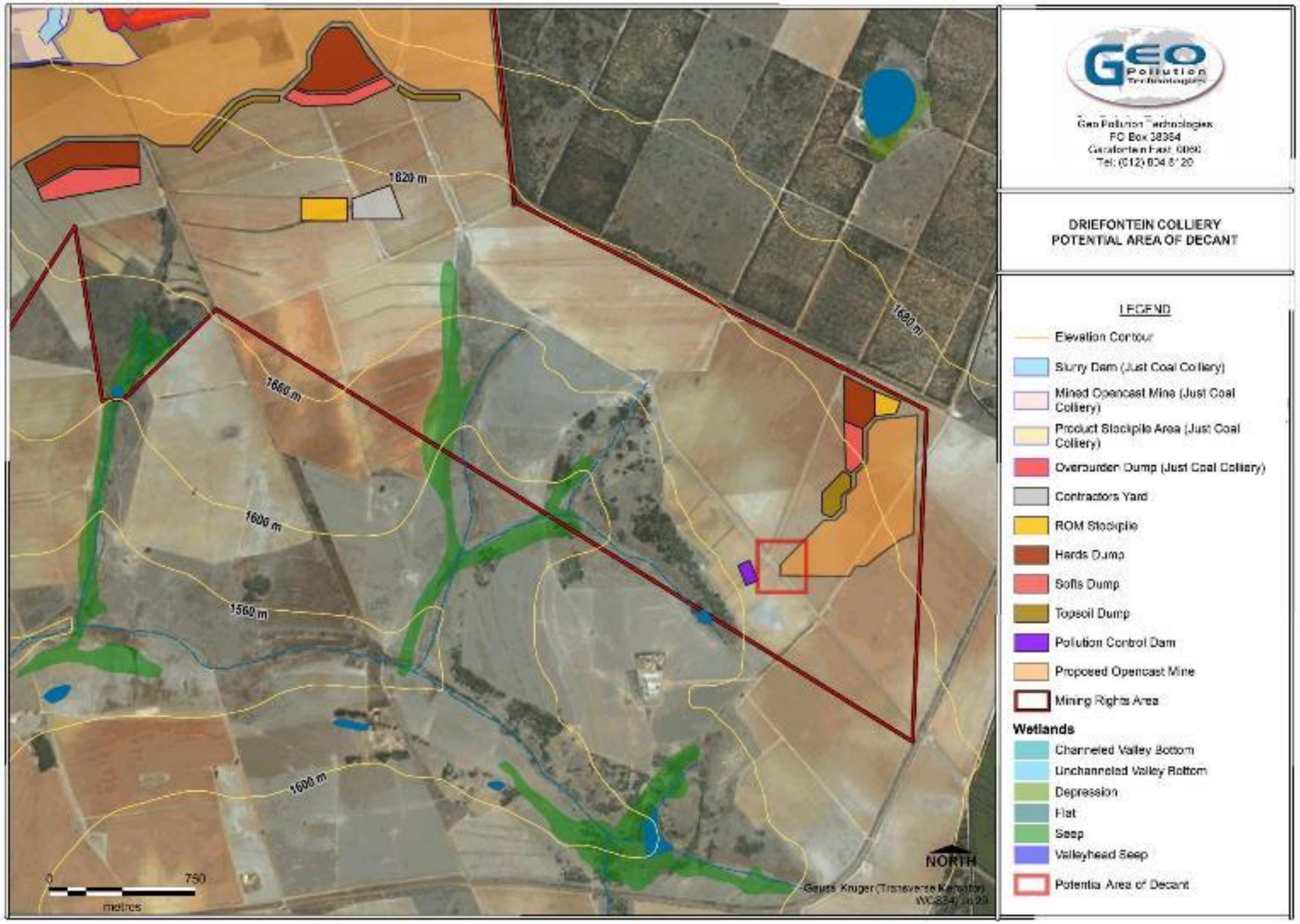


Figure 79: Predicted decant areas

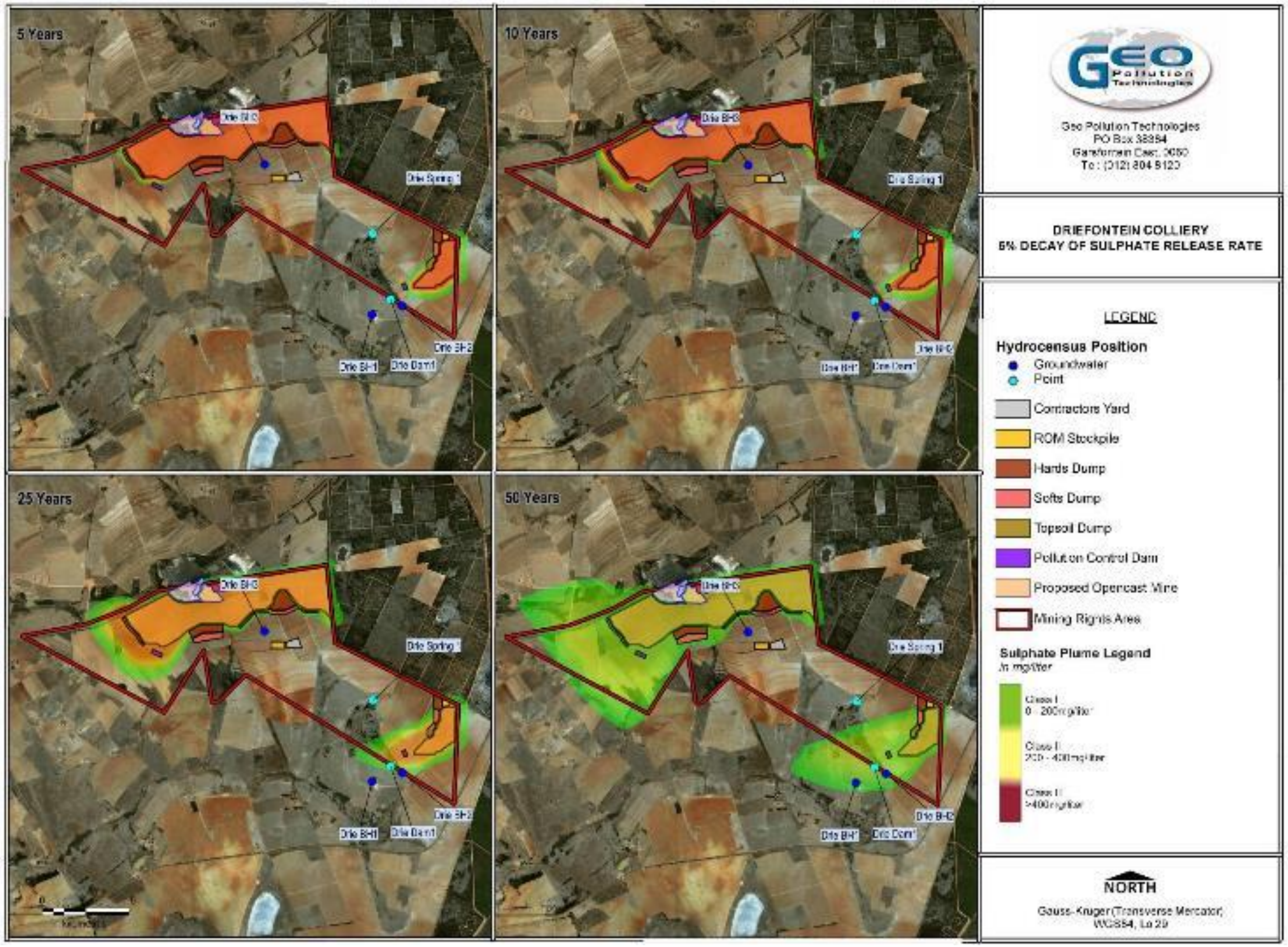


Figure 80: Predicted spread of pollution post-closure of mining with 5% decay

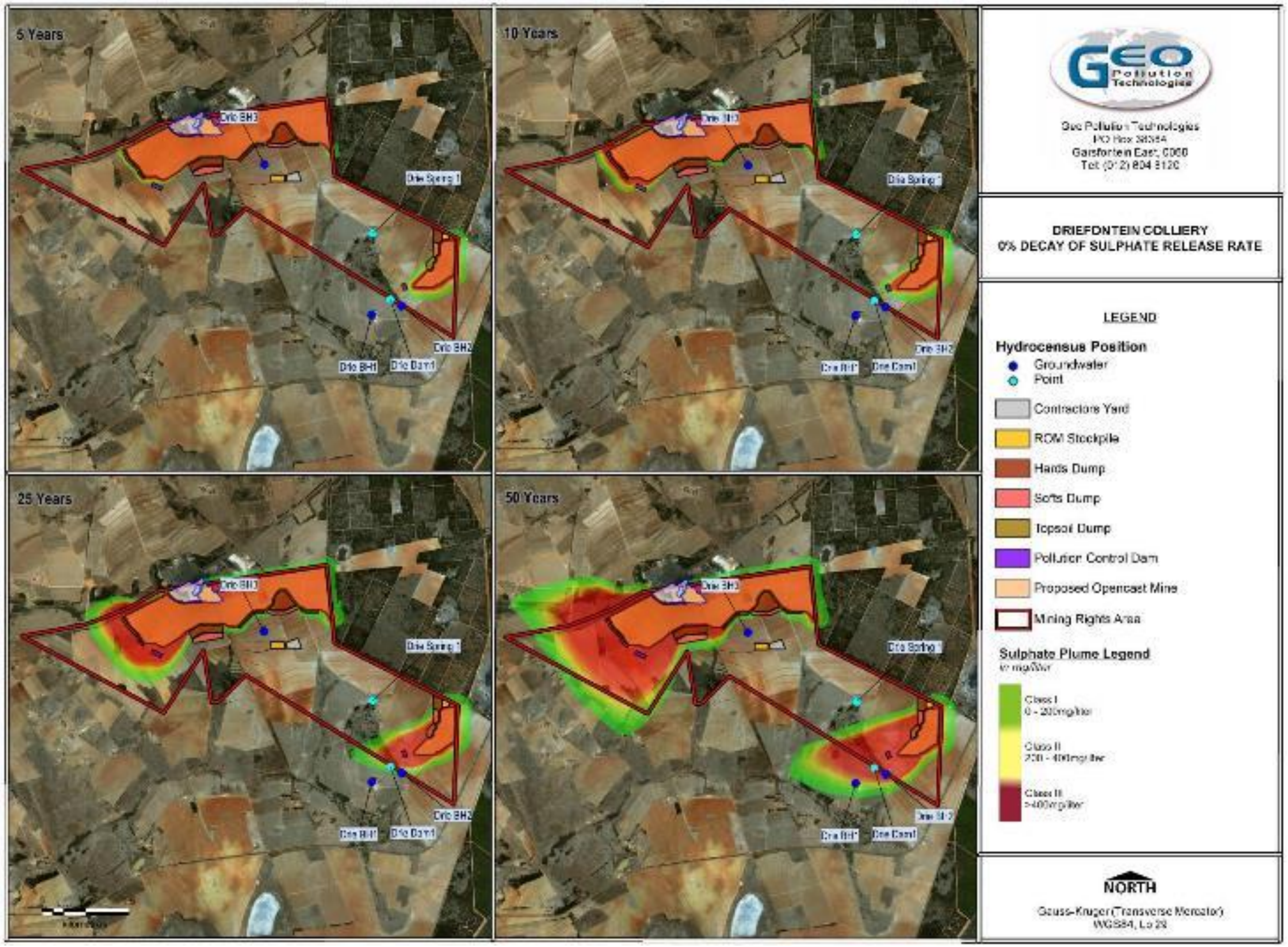


Figure 81: Predicted spread of pollution post-closure of mining with 0% decay

13.2.8 Air quality

Rayten Engineering Solutions Pty (Ltd) was appointed to compile an Air Quality Impact Assessment (AQIA) report (AQIA) for the proposed Driefontein Mine.

As mentioned under project description, the coal reserve at the proposed Driefontein Coal Mine occupies 267ha which are divided in two separate sections found in the northern part and South-Eastern corner of the mining right application area. However, mining will only be at one section at any given time. As part of the AQIA, it was assumed that mining will commence in the northern part of the mining right application. Activities associated with the Northern Pit was considered to represent the worst-case scenario, since the pit is much larger in extent. Therefore, only activities and stockpiles associated with the northern section of the proposed mine were included in this AQIA. Activities associated with the south-eastern section were all excluded.

In addition, since the possibility exist that ROM mined at Driefontein will be processed at the existing Hakhano Colliery, which belongs to the same mining company (i.e., Canyon Resources), activities taking place at the processing plant, were also taken into consideration and included in the AQIA.

To investigate the potential impact of operations associated with the proposed mine on local ambient air quality, the following air pollutants were chosen in the quantification of emissions for the construction and operational phases of the project:

- Dustfall.
- Particulate matter (PM_{10} and $PM_{2.5}$).

The AQIA focused on dust emissions as this is a key pollutant emitted associated with mining activities at the proposed mine.

A summary of the activities modelled is given below in Table 79.

Table 79: Modelled sources of emissions associated with the proposed Driefontein Mine

POLLUTANT	SOURCES OF EMISSIONS	
	CONSTRUCTION PHASE	OPERATIONAL PHASE
Dust-fall	Not modelled.	• **Mining Activity (Proposed Driefontein Coal Mine):** ○ Wind erosion from exposed areas, stockpiles (i.e. ROM coal, topsoil, softs & overburden) and open pit; ○ Material handling (loading/offloading operations); ○ FELs & excavators; ○ Bulldozing; ○ Drilling & blasting; and ○ Vehicle dust entrainment due to hauling material on-site and offsite (unpaved routes).
Particulate emissions (PM_{10} & $PM_{2.5}$)	Not modelled	• **Material Processing Activity (Hakhano Colliery):** ○ Material Handling (loading/offloading operations); ○ FELs; ○ Conveyor transfer points; ○ Screening material; ○ Primary & Secondary crushing; and ○ Wind erosion from rehabilitation areas and stockpile areas (i.e. ROM & product coal, topsoil and overburden).

Refer to Section 5 of the AQIA (attached as Appendix 6.6) for detailed information of how the dispersion models were constructed. Dispersion simulations were undertaken for the following scenarios to determine:

- Predicted ground-level impacts from all key sources for dust-fall, PM_{10}, and $PM_{2.5}$ for surface mining activities associated with the proposed Driefontein Mine and coal processing activities at Hakhano Colliery plant.

The Code of Practice for Air Dispersion Modelling in Air Quality Management in South Africa (DEA, 2014) recommends the use of the 99th percentile concentrations for short-term assessment with the National Ambient Air Quality Standards since the highest predicted ground-level concentrations can be considered outliers due to complex variability of meteorological processes. This might cause exceptionally high concentrations that the facility may never actually exceed in its lifetime.

Isopleth plots of predicted dust-fall rates and PM_{10} and $PM_{2.5}$ concentrations are given below. For short term averaging periods, the predicted 99th percentile concentrations are provided.

Comparison of the predicted PM_{10} and $PM_{2.5}$ ambient concentrations are made with the South African National Ambient Air Quality Standards to determine compliance. Comparison of the predicted dustfall rates is made with the South African National Dust Control Regulations, 2013 to determine compliance.

13.2.8.1 Construction phase

The construction phase was not modelled. It is assumed that dust will be created during this phase by land clearing, ground excavation, drilling and blasting, vehicle dust entrainment from construction vehicles resulting in similar impacts with a lower significance rating than the busier longer operational phase. Refer to Section 13.2.8.2 below.

13.2.8.2 Operational phase

The dispersion model output plots for dust-fall rates, PM_{10} and $PM_{2.5}$ concentrations due to proposed surface mining activities at the proposed Driefontein Mine (including the Hakhano processing plant) are given in Figure 82 to Figure 86. Mitigation measures that were considered during modelling were limited and included dust suppression using water sprays and chemical dust suppressants (dust-a-side) on all the unpaved haul routes (i.e., route from pit to ROM stockpile, route from the ROM stockpile area & route to the processing plant at Hakhano Colliery); primary rehabilitation at some areas at the processing plant; and scattered vegetation on some stockpiles at the processing plant.

Predicted incremental dust-fall rates and $PM_{2.5}$ concentrations comply with the relevant standards beyond, at most, 2.5km from the centre of the proposed Driefontein Mine. Within the proposed Driefontein mining area and processing plant area, higher dust-fall rates and $PM_{2.5}$ concentrations, including exceedances, are observed mostly around the proposed mining activities (open pit, drilling, blasting, loading & offloading operations and haul routes), processing plant activities (crushing, screening and material transfer points), as well as proposed and existing material stockpile/exposed areas.

Predicted incremental PM_{10} daily concentrations are high, with exceedances of the daily limit of 75 $\mu g/m^3$ observed within 15.8km from the centre of the proposed mine towards the north, south and west. This contrasts with predicted incremental PM_{10} annual concentrations, for which compliance with the annual limit of 40 $\mu g/m^3$ is observed over most of the project area. High predicted incremental annual PM_{10} concentrations, including exceedances, are only observed close to the modelled sources, within a maximum distance of 2.5km from the centre of the proposed mine.

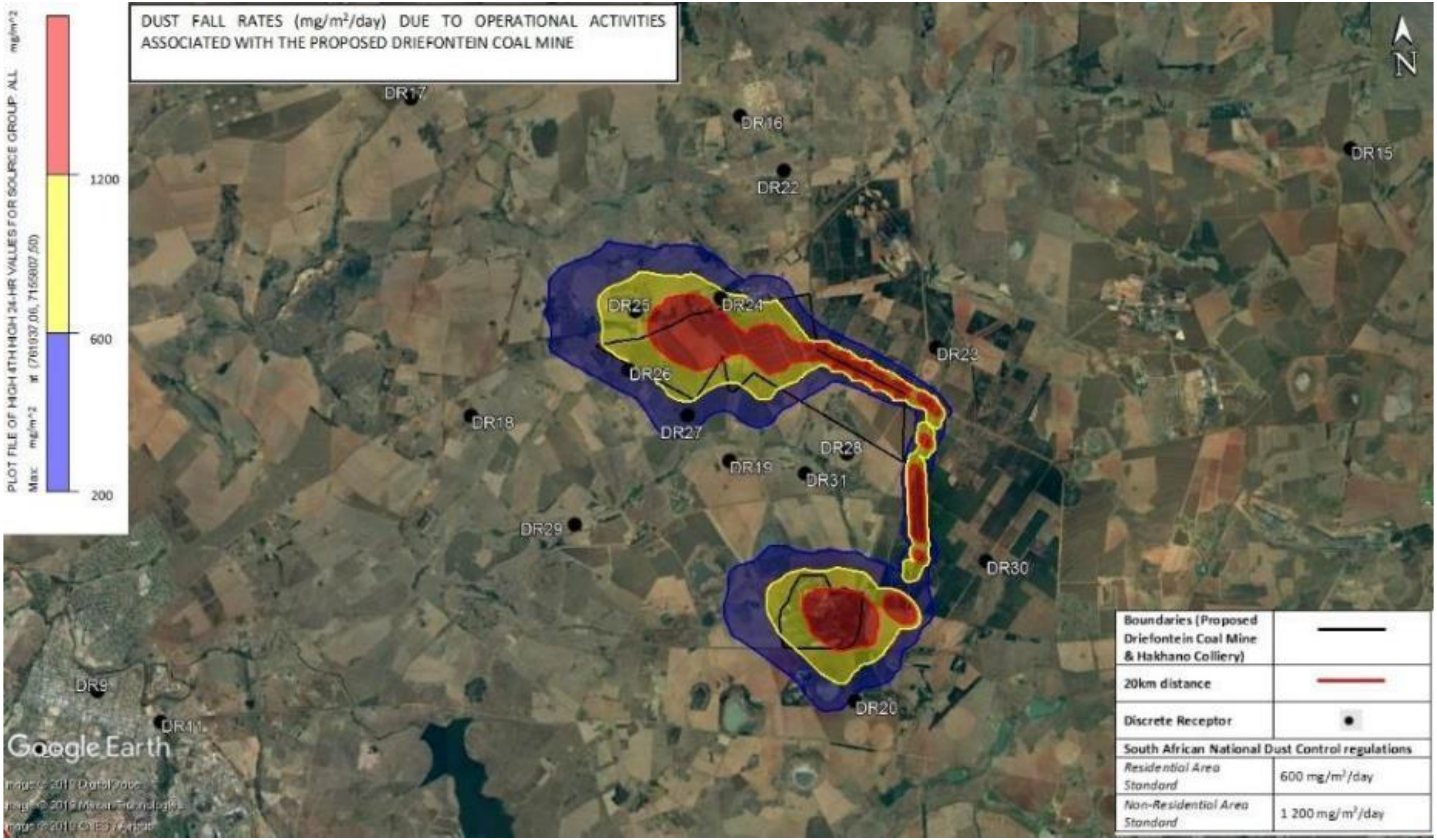


Figure 82: Predicted Dust-Fall Rates at the proposed Driefontein Mine

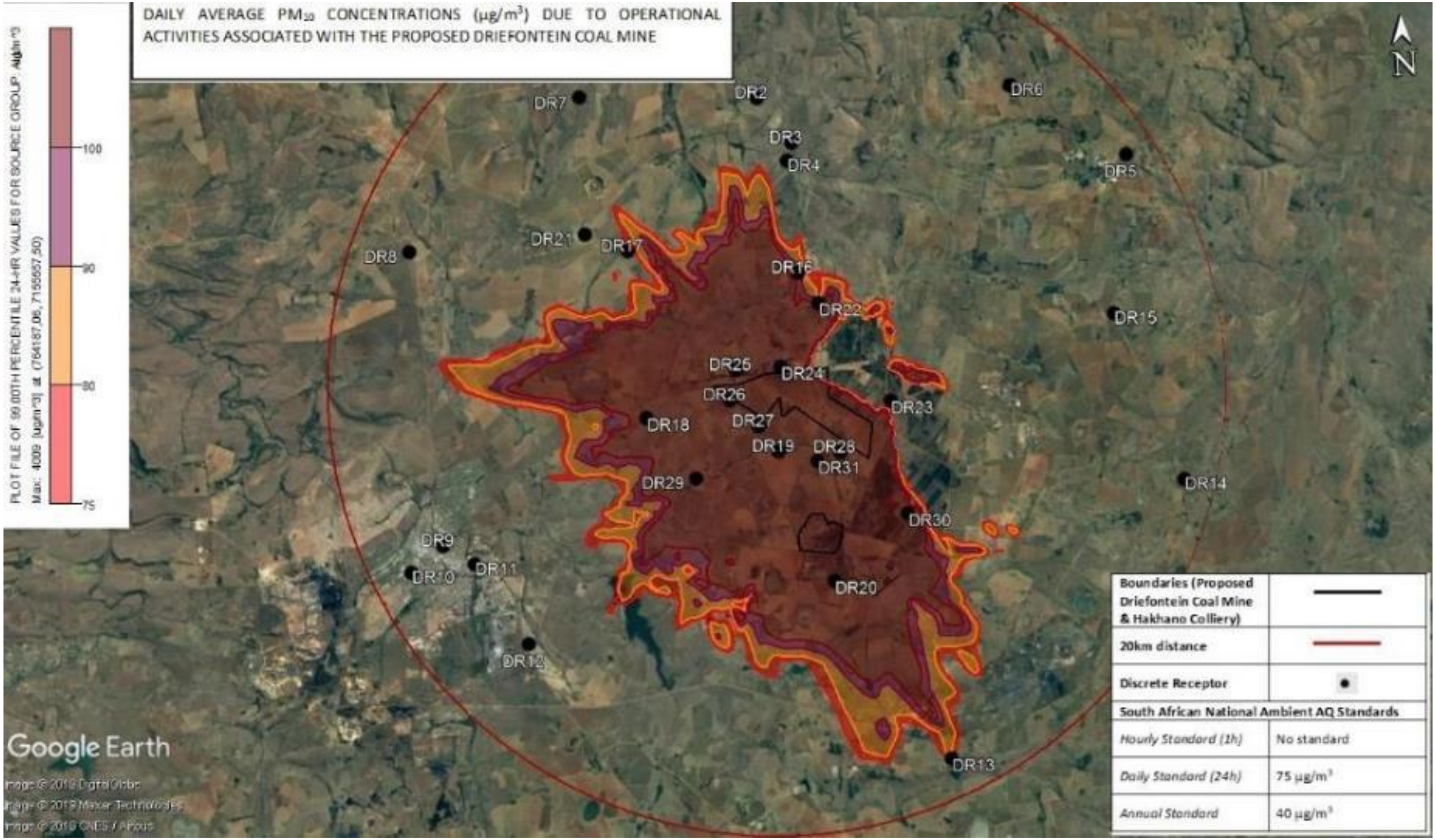


Figure 83: Predicted Daily Average PM_{10} Concentrations at the proposed Driefontein Mine

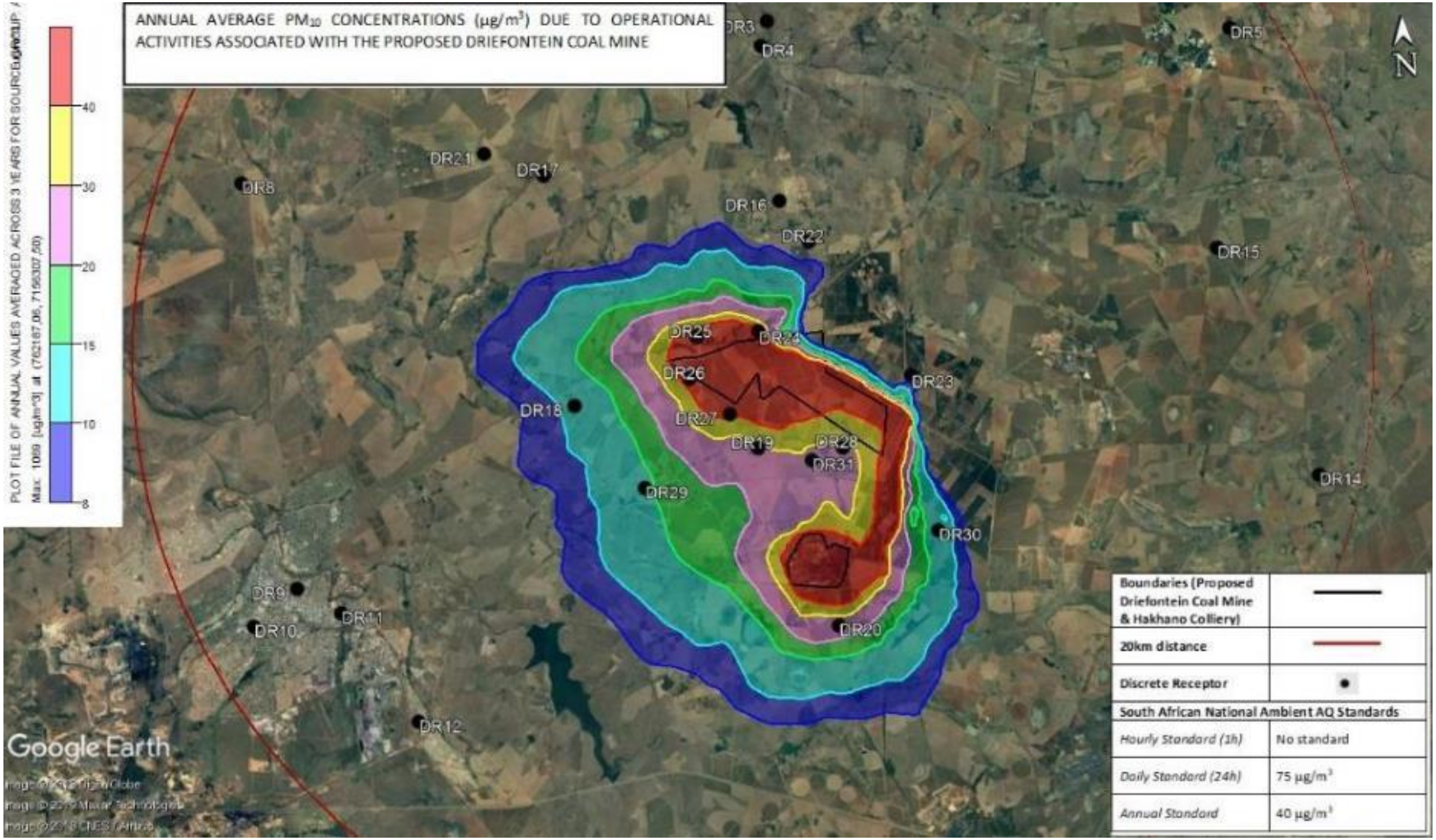


Figure 84: Predicted Annual Average PM_{10} Concentrations at the proposed Driefontein Mine

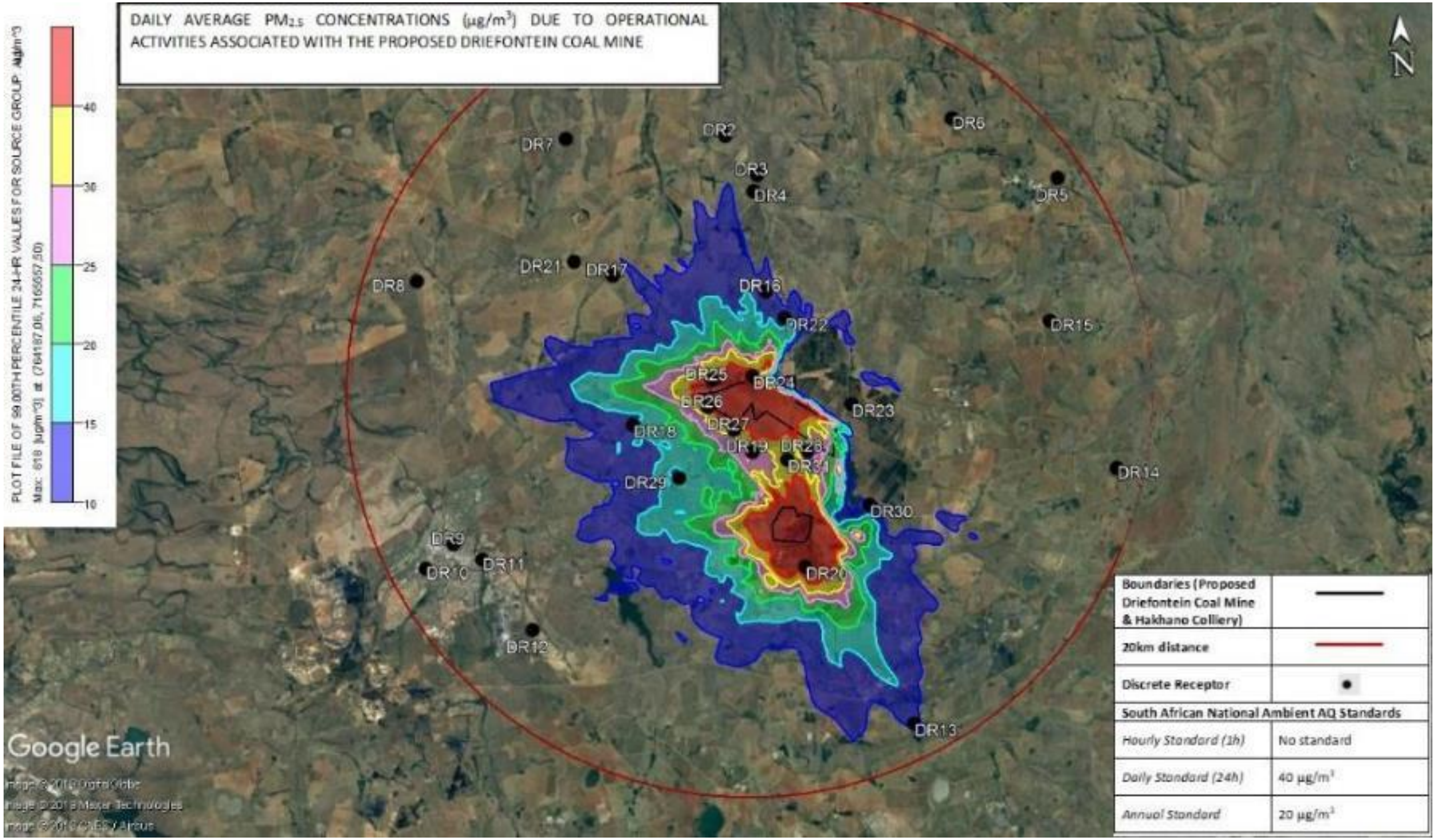


Figure 85: Predicted Daily Average $PM_{2.5}$ Concentrations at the proposed Driefontein Mine

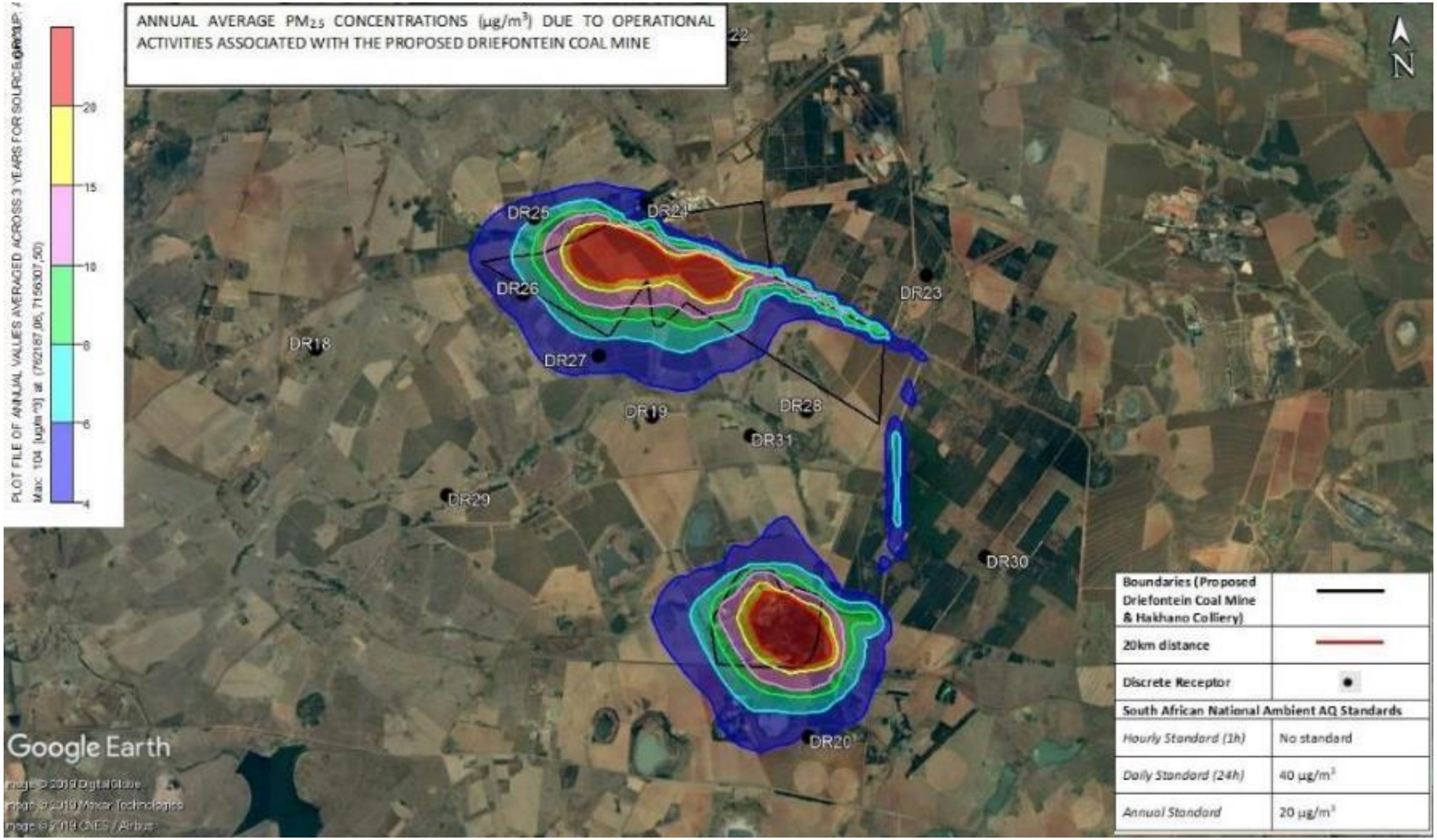


Figure 86: Predicted Annual Average $PM_{2.5}$ Concentrations at the proposed Driefontein Mine

Maximum predicted incremental concentrations at nearby sensitive receptors (represented as discrete receptors) located within a 20km radius from the proposed Driefontein Mine are given in Table 80 below.

The discrete receptor points are located at the centre of residential areas (mostly dwellings), or near schools, hospitals, old age homes and cemeteries, in order to determine the maximum concentrations that could be expected near sensitive receptors. A spatial representation of the identified discrete receptors is shown below in Figure 87.

Low predicted incremental concentrations of $PM_{2.5}$ and dust-fall rates are observed beyond 2.5km from the centre of proposed Driefontein Coal Mine/processing plant. Low predicted incremental PM_{10} concentrations are observed at discrete receptors beyond, at most, 15.8 km from the centre of the proposed mine.

The maximum predicted incremental PM_{10} and $PM_{2.5}$ concentrations and dust-fall rates at the boundary of the proposed Driefontein Mine are given in Table 81.

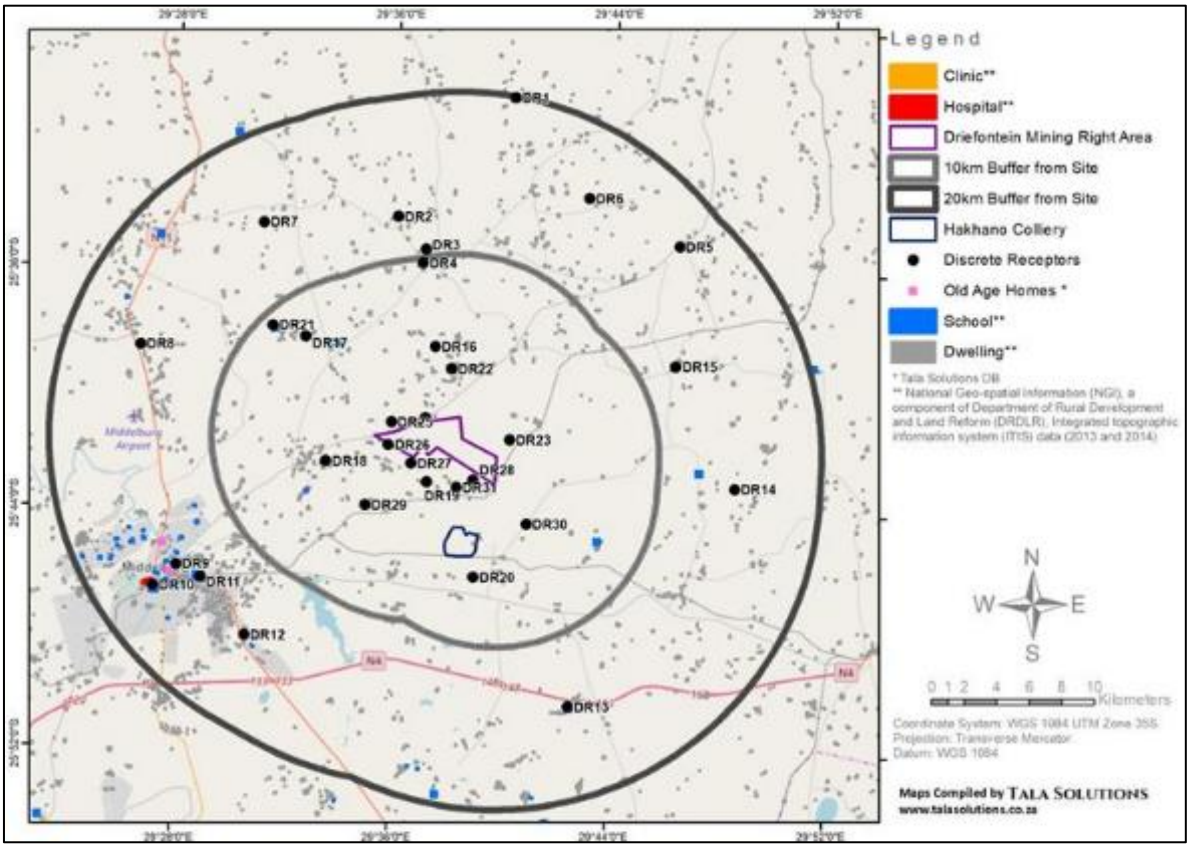


Figure 87: Spatial representation of discrete receptors included in dispersion model (<20km from the proposed Driefontein Mine

Table 80: Maximum predicted incremental PM_{10}, $PM_{2.5}$ concentrations and Dust-Fall rates at nearby sensitive receptors, located within 20km radius of the proposed Driefontein Mine

INCREMENTAL CONCENTRATIONS (µg/m3)								
Discrete Receptor	Dust fallout (mg/m²/day)	PM10 (24H)	PM10 (Annual)	PM2.5 (24H)	PM2.5 (Annual)	Co-ordinates		Elevation (m)
	Residential: 600mg/m²/day Non-residential: 1200 mg/m²/day	75	40	40	20	X (m)	Y (m)	
DR1	6.44	10.68	0.68	1.21	0.07	768452.2	7176578.69	1549.83
DR2	12.34	50.31	2.13	5.78	0.23	761221.92	7169287.38	1487.81
DR3	15.89	43.21	1.93	5.70	0.21	762919.33	7167285.96	1483.45
DR4	18.60	46.29	2.19	5.95	0.24	762741.99	7166449.93	1501.29
DR5	6.85	1.48	0.14	0.16	0.02	778509.41	7167408.12	1791.46
DR6	7.43	5.90	0.44	0.66	0.04	772970.25	7170385.71	1698.1
DR7	12.48	28.64	1.47	3.46	0.16	752957.97	7168976.44	1560.74
DR8	18.11	36.36	2.59	3.88	0.28	745363.73	7161496.4	1519.3
DR9	9.83	45.23	3.17	7.06	0.39	747511.29	7147979.62	1451.69
DR10	7.88	31.04	2.64	4.71	0.31	746088.34	7146687.49	1495.78
DR11	10.61	34.99	3.20	5.03	0.38	749009.39	7147194.2	1454.52
DR12	7.83	35.45	3.26	4.94	0.39	751692	7143617.4	1531.48
DR13	13.24	75.52	3.91	11.35	0.51	771573.08	7139146.39	1621.25
DR14	8.73	6.73	0.45	0.66	0.04	781856.49	7152509.67	1715.62
DR15	9.13	3.02	0.26	0.35	0.03	778249.15	7160037.16	1735.9
DR16	41.78	93.72	5.69	11.76	0.62	763466.17	7161289.11	1626.93
DR17	40.59	54.54	3.77	6.41	0.41	755519.84	7161961.45	1596.06
DR18	58.67	126.75	11.04	13.95	1.20	756726.56	7154290.21	1549.28
DR19	112.38	223.30	29.04	27.53	3.19	762930.84	7153001.12	1600.78
DR20	156.99	263.25	23.56	60.57	3.76	765774.88	7147127.44	1632.21
DR21	31.35	39.71	3.04	4.45	0.33	753502.09	7162647.12	1570.74
DR22	47.08	84.61	5.98	10.85	0.61	764482.03	7159941.72	1622.21
DR23	70.66	29.69	3.56	2.63	0.27	768021.35	7155562.24	1692.55
DR24	537.98	354.58	33.56	44.75	3.54	762853.76	7156919.18	1661.01
DR25	833.99	444.27	56.93	45.26	6.05	760773.6	7156674.45	1618.65
DR26	340.84	367.05	47.59	44.30	5.33	760569.63	7155272.95	1617.2
DR27	293.59	260.40	43.28	30.25	4.71	761954.68	7154123.65	1602.02
DR28	74.93	219.60	29.57	25.97	2.68	765781.97	7153082.52	1636.14
DR29	52.33	134.89	14.21	16.67	1.67	759147.99	7151592.03	1533.15
DR30	43.60	133.04	12.45	11.92	0.95	769057.4	7150385.98	1659.61
DR31	75.82	222.30	28.45	34.68	3.04	764749.72	7152640.76	1619.97

Notes:
*DR = discrete receptor
*Approx. 1 hospitals/healthcare/clinic facilities within 20km of site (located in surrounding areas).
*Approx >10 school/training/educational facilities within 20km of site (located in surrounding areas).
*no old age home facility identified within 20km of the project site.

Table 81: Summary of Predicted Maximum Modelled Incremental Concentrations at the boundary of the proposed Driefontein Coal Mine

POLLUTANT	AVERAGING TIME	MAXIMUM MODELLED CONCENTRATION ($\mu g/m^3$) [3]	COMPLIANCE AIR QUALITY STANDARD ($\mu g/m^3$)
Proposed Driefontein Coal Mine			
Dust-Fall	Daily	>1 200	1200[1 & 2]
PM_{10}	Daily	>75	75
	Annual	>40	40
$PM_{2.5}$	Daily	>40	40
	Annual	>20	20

Notes:
1. Dust-fall given in $mg/m^2/day$
2. Non-residential area dust-fall standard
3. Along the Proposed Driefontein Coal Mine Boundary.

13.2.8.2.1 Cumulative impacts

Emissions from sources need to be assessed in terms of the cumulative impacts in an area. The *Code of Practice for Air Dispersion Modelling in Air Quality Management in South Africa (DEA, 2014),* outlines the following for sources not influenced by background concentrations in isolated areas and non-priority areas:

- For annual averages, the highest predicted concentration (CP) must be less than the National Ambient Air Quality Standards, no exceedances allowed.
- For short-term averages (24 hours or less), the 99th percentile concentrations must be less than the National Ambient Air Quality Standards. Whenever one year is modelled, the highest concentrations shall be considered.

The Driefontein Mine is a proposed facility thus the modelled emissions do not yet contribute to background concentrations. Maximum predicted concentrations at nearby sensitive receptors (within 20km of the proposed mine boundary) are given in Table 80 above. Predicted dust fall rates, and $PM_{2.5}$ & annual PM_{10} concentrations decrease as you move further away from the emission source. Thus, cumulative impacts for these pollutants will be higher nearer to the proposed mine/processing plant's operations.

As part of the AQIA, dust dust-fall monitoring was undertaken at eight (8) sites around the proposed mine. A comparison of the maximum predicted dust-fall rates provided by the dispersion model with the maximum measured dust-fall rates at each site was done (Table 82). Dust-fall monitoring is undertaken at Hakhano Colliery at four (4) sites. However, information on bucket locality was not provided for the plant at the time of modelling. Therefore, comparison of dust-fall rates (i.e., measured versus modelled) was not possible for the site.

Table 82: Comparison of maximum predicted modelled dust-fall rates with the maximum measured dust-fall rates at dust bucket monitoring locations at the proposed Driefontein Coal Mine

Dust Bucket			Dust fallout (mg/m²/day)		Applicable limits (mg/m²/day)
No.	ID	Classification	Max measured dust-fall rate at site	Max Modelled Dust-fall rate	SA National limits: Residential: 600 Non-residential: 1200
1	DCM001	Non-residential	170	318.16	1200
2	DCM002	Non-residential	80	365.21	1200
3	DCM003	Non-residential	560	635.08	1200
4	DCM004	Non-residential	1 800	96.29	1200
5	DCM005	Non-residential	470	222.7	1200
6	DCM006	Non-residential	1 210	166.3	1200
7	DCM007	Non-residential	170	106.3	1200
8	DCM008	Non-residential	860	273.8	1200

13.2.8.3 Decommissioning/rehabilitation and post closure phase

The decommissioning/rehabilitation and closure phase was not modelled. It is assumed that dust will be created during this phase by the earth moving activities during closing of the open pit, replacement of topsoil, landscaping, and removal of infrastructure resulting in similar impacts with a lower significance rating than the busier longer operational phase.

13.2.9 Noise

Acoustech Engineering Consultants was appointed to determine the potential noise impact of the proposed mine. The procedures, as detailed in SANS 10328:2008 and SANS10103:2008 were applied to the noise measurements and assessments made in the Noise Impact Assessment (NIA). The results are discussed below (Refer to Section 5 of the NIA for more information on the approach and methodology to the study).

A worst-case controlled scenario was used to help identify potential issues, identify the significance rating and potential noise impacts in terms of legislation. The Sound Power Levels (SPL) were selected based on the noise levels (https://www.fhwa.dot.gov/Environment/noise/construction_noise/handbook/handbook09.cfm) presented in Appendix C of the NIA attached as Appendix 6.10 to this report. Daytime (06:00 – 22:00) and night-time (22:00 – 06:00) time periods are defined in terms of the SANS10103:2008.

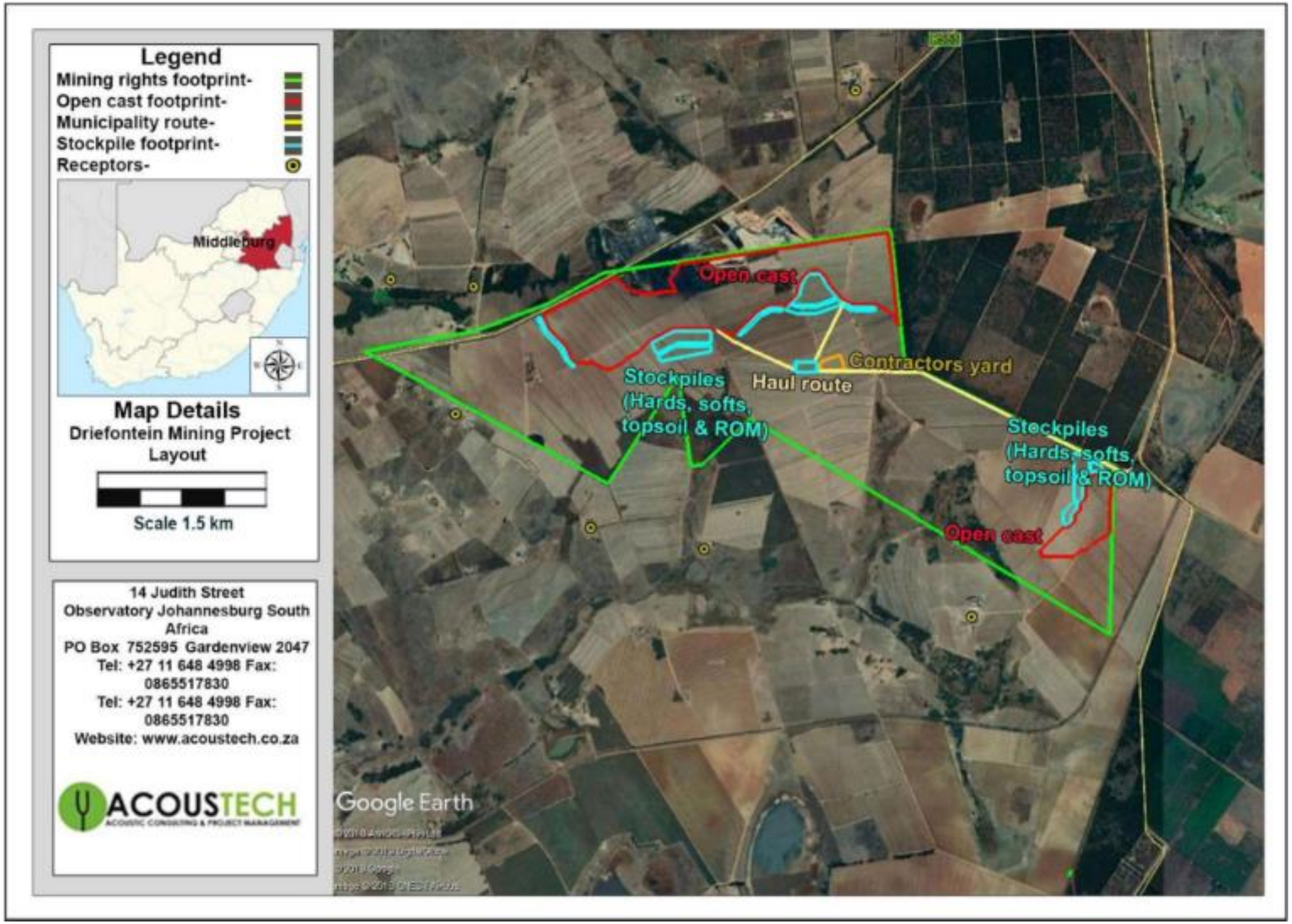


Figure 88: Assessed layout

13.2.9.1 Construction phase

The level and character of the construction noise will be highly variable as different activities with different equipment take place at different times, for different periods of time (operating cycles), in different combinations/sequences and on different parts of the construction site. The potential extent and impact of construction noises depends on a number of factors, including the prevailing ambient sound levels during the instance the maximum noise event occurred, as well as the spectral character of the noise and the ambient surroundings. The noise assessment made use of a heavy equipment operating at maximum capacity presented in a linear fashion (see Figure 89 below). The following main noise generating activities are expected during the construction phase and were considered as part of the modelled investigated scenario(s):

- Topsoil removal/clearance (open cast pits) - During the construction and preparations of open cast pits, a direct line-of-sight can be achieved from noise generating activities to receptors. Open cast construction activities may occur over a 24-hour cycle (day and night scenario). One or two heavy equipment operating at maximum capacity was modelled for this scenario (see figure below).
- The development of stockpiles (Run-Off-Mine (ROM), hards, softs, topsoil's etc.) will also take place during this phase. Stockpile activities may occur over a 24-hour cycle (day and night scenario). One or two heavy equipment operating at maximum capacity was modelled for this scenario (see Figure 89 below).
- Construction of haul routes connecting existing municipality routes to the project:
  - ➢ The development/upgrading of haul routes (daytime only) entails the clearance of the corridor to be compacted and potentially paved (if required). During the development of road corridors, topsoils are removed with earthworks conducted. The surface bed is compacted for the required density making use of aggregate (e.g., soils, gravel, crushed stone etc.).
  - ➢ Road surface may make use of various options, likely asphalt (bituminous binders) or concrete, however most mine haul routes are unpaved.
  - ➢ Equipment required for road construction would vary from placing equipment, pavers, vibration and compaction and finishing equipment etc. Noise levels and equipment specifications will greatly vary.
  - ➢ For this assessment the moderate noise levels generate from a heavy (noisy) piece of equipment was assessed. It is unlikely that heavy equipment will be in constant use during the entire construction phase. Haul routes corridors are presented in Figure 90 above.
- The implementation of concrete and surface related infrastructure (offices, stores etc.) –
  - ➢ General and civil construction related activities are generally kept to daytime hours (06:00 – 22:00).

- Noisy construction equipment may include vibration, mixing and placing equipment (cranage etc.). Small construction equipment also include drilling, compaction (vibration), grinding etc.
- During the night-times concrete and surface related infrastructure activities may be required as deadlines need to be met or pouring of concrete over extended hours may be required. These activities are usually short-term and occurring rarely.

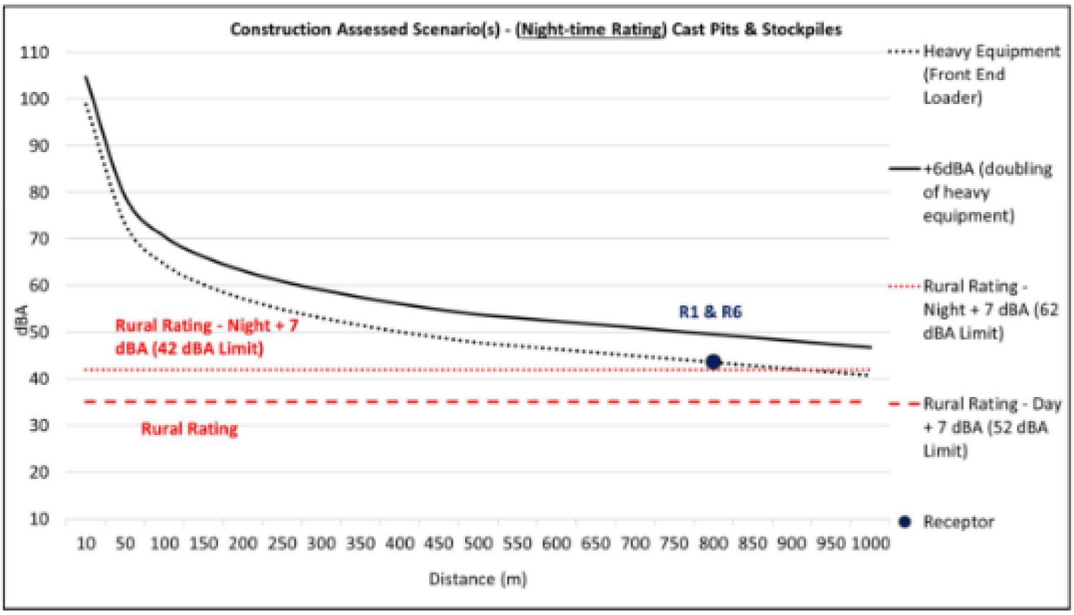


Figure 89: Construction noise levels – Linear representation construction activities

The increase in noise level during the construction phase cannot be avoided but it will be of short duration and will not have a permanent impact on the surrounding environment. Noise levels associated with construction activities during the day and night-time would have a Moderate significance rating for receptors R1 and R6 (night-time assessment) and Negligible significance for all other receptors. Refer to Table 83 below for the calculated noise and baseline rating levels for day/night construction.

Basic mitigation is recommended to ensure compliance with the Noise Control Regulations, specifically construction near receptors R1 near the night-time periods. Refer to Section 13.3 for the quantitative impact assessment and the proposed mitigation measures.

Table 83: Calculated Noise and Baseline Rating Levels – Day/night construction

Calculated Noise and Baseline Rating Levels				
I&AP	Rating level (Day/Night dBA)	Calculated $L_{Req,T}$ (dBA)	Increase above Rating (dBA)	Comment
R1	45/35	+41	+6	A worst-case maximum capacity free-field night scenario indicated legislation compliance, however calculable/measurable noise levels at receptor.
R6	50/40	+41	1 dBA	Minimal increase above night Rating.

13.2.9.2 Operational phase

The local area is relatively flat and there are little natural features that could act as noise barriers considering practical distances at which sound propagates. +110 SPL dBA was used for each mining noise source (presented in Appendix C of the NIA). The following main noise generating activities are expected during the operational phase and were considered as part of the modelled investigated scenario(s):

- Open cast truck and shovel operations – A typical truck and shovel mining operation could include wheel loaders, hydraulic excavators, and articulated dump trucks and through the overburden, interburden and ROM (Run-of-Mine) seams. Water dozers for dust suppression purposes are applied along pits and haul routes for the control of dust. Two noisy equipment was modelled for these scenarios.
- Stockpiles could consist of topsoil's, hards, softs, ROM etc. Stockpiles themselves may act as an acoustical shield in relation to receptors. This however does depend on the design of the stockpiles, slope of it in relation to receptors and berms implemented on the stockpiles.
- Berm and barriers (berm correction) around stockpiles were considered.
- The workshop/contractors yard made use of a general noise.
- Haul route. Calculations were based on specifications presented in Table 84 below. The haul route scenario is presented in Figure 90.

Both day and night assessments were conducted.

Table 84: Haul route specifications

Investigations	Haul Route Modelled scenarios	
Haul routes	**Paving**	Haul route likely unpaved. For this, the RL90 model considered +3 dB for cobblestones while the CoRTN considered +1 dB for TD.
	Traffic	**It has been indicated that peak trips could be up to 14 during daytime hours**. 10 heavy vehicles per hour was modelled to be representative of any hour during a 24-hour period.
	Traffic speeds	Constant 60 km/h, no stop junctions considered.
	% heavy vehicles	100%

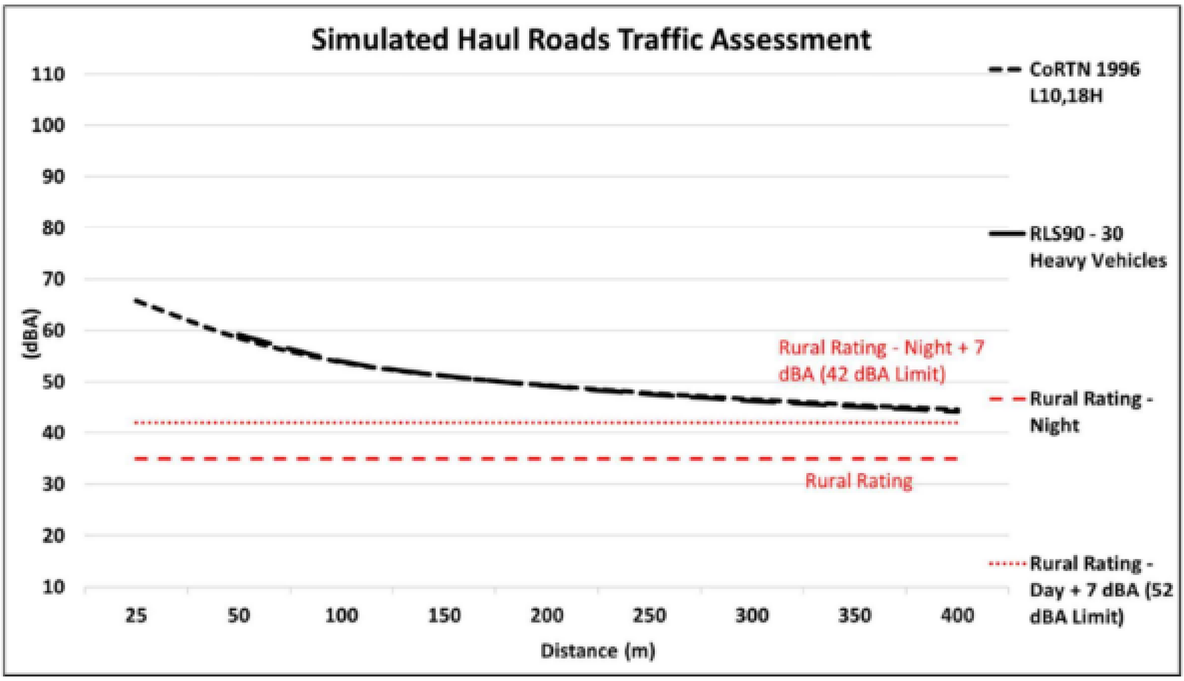


Figure 90: Haul route noise levels – Linear representation

Noise levels associated with night operations of the open cast pit and stockpiles behind a berm/open cast pit highwall will have a Low significance rating for receptor R1 and Negligible significance for all other receptors. Haul routes are too far from the identified receptors for a potential increase above Rating levels (see noise contours in Figure 91) below). It should be noted that haul trucks along municipal routes were not assessed. With the implementation of berms, open cast pit highwalls etc. the operations of the open cast pits may be audible, but within limits. Basic mitigation options are proposed to ensure compliance under circumstances. The most important mitigation measures will be the development of berms around open cast pits and in relation to receptors R1 and R6 (receptors within 1,000m of open cast footprint). Refer to Figure 92 below indicating the proposed location of these berms. With berms/barriers implemented the noise contours can be kept to within legislation requirements.

Refer to Table 85 below for the calculated noise and baseline rating levels for day/night construction.

Refer to Section 13.3 for the quantitative impact assessment and specifications for the proposed berms (and other basic mitigation measures) to ensure compliance.

Table 85: Calculated Noise and Baseline Rating Levels – Day/night Operational Phase

Calculated Noise and Baseline Rating Levels				
I&AP	Rating level (Day/Night dBA)	Calculated $L_{Req,T}$ (dBA)	Increase above Rating (dBA)	Comment
R1	45/35	38	3 dBA (night)	A worst-case maximum capacity free-field night scenario indicated legislation compliance, however calculable/measurable noise levels at receptor.

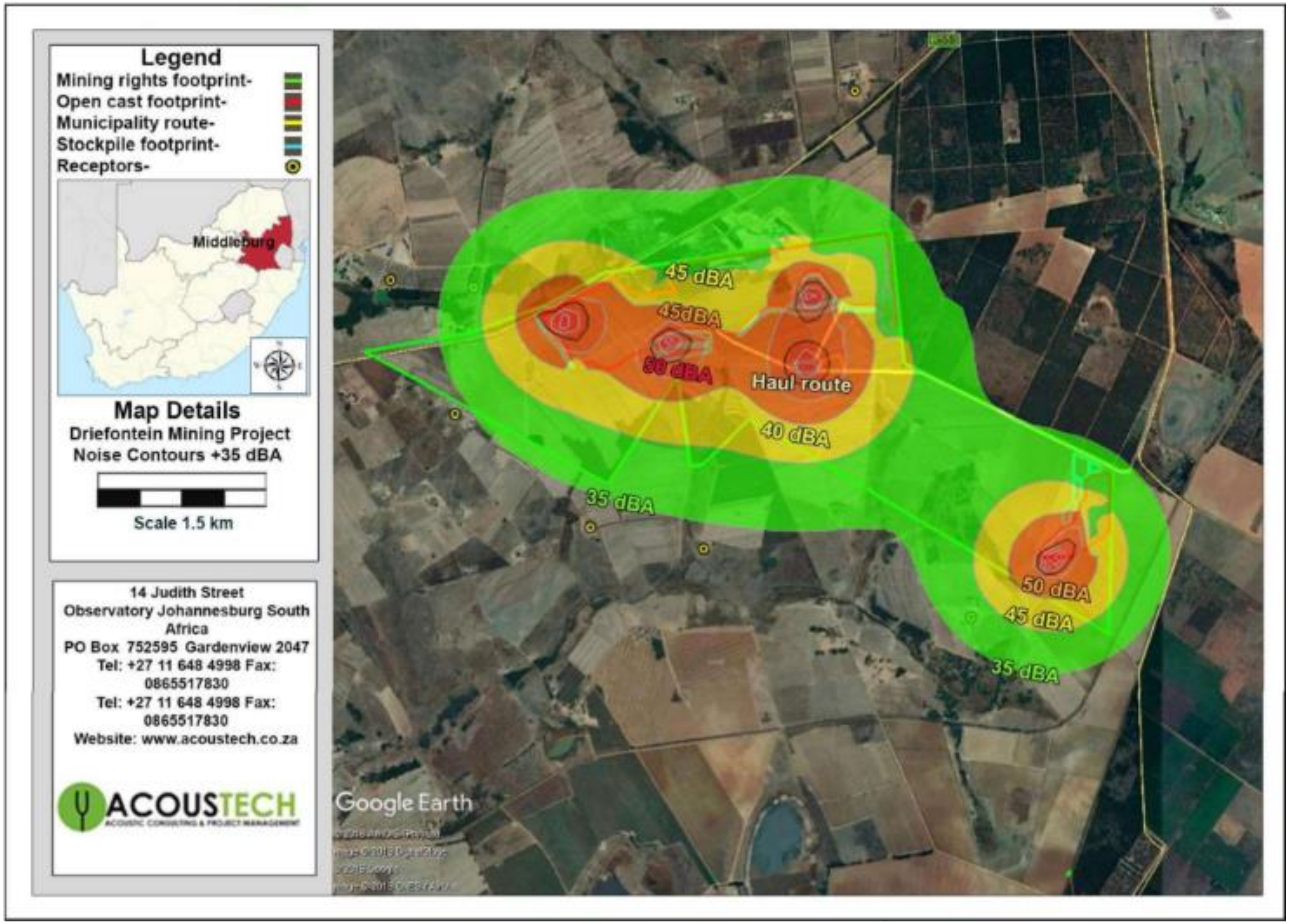


Figure 91: Equivalent Continuous Rating Level in terms of noise contours $L_{Req,T}$ – Operational Phase (plant/open cast area)

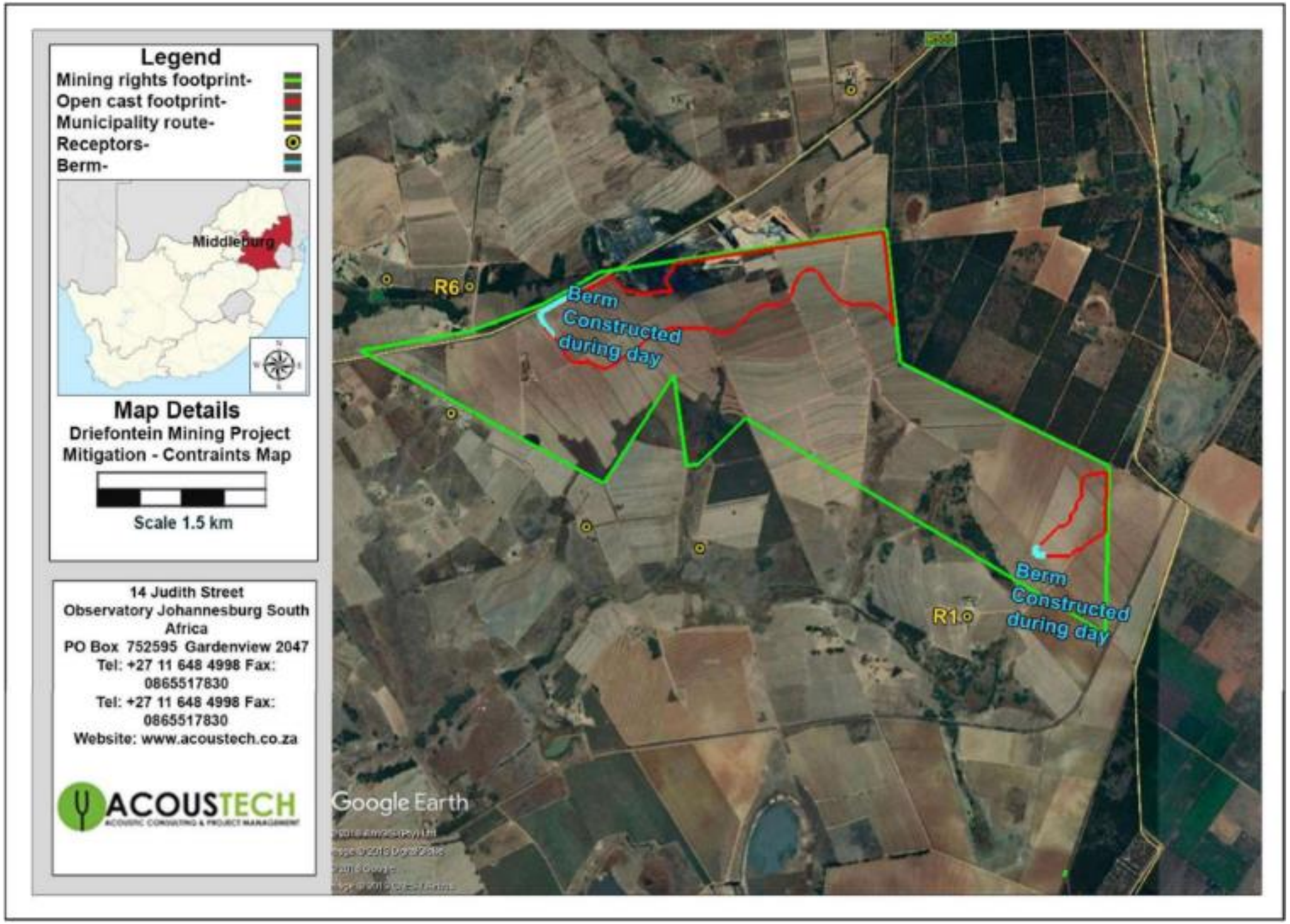


Figure 92: Mitigation and constraints map

13.2.9.3 Decommissioning/rehabilitation and post closure phase

The impact will be similar/lower than the busier/noisier construction phase (refer to Section 13.2.9.1 above) and were therefor not modelled. While the construction phase is deadline oriented (due to the proceeding operational phase), the closure and post-closure phases are usually less busy and noisier. The post-closure phase may require infrequent activities to maintain rehabilitation and would be the least noisy phase of the operation.

13.2.10 Visual aspects

uKhozi Environmentalists (Pty) Ltd conducted the Visual Impact Assessment dated Mar 2022 (attached as Appendix 6.8) for the proposed Driefontein Mine.

A survey was undertaken to determine the existence of significant view corridors associated with the project site. A view corridor is defined as 'a linear geographic area, usually along movement routes, that is visible to users of the route' (DEA&DP, 2005). Accordingly, three dominant view corridors were identified in the region, namely:

a) R555 district road which runs along the northern boundary of the application area.
b) D1433 gravel road, situated east of the application area, which will be used to transport ROM coal from the proposed Driefontein Mine to the Hakhano Colliery Hakhano Colliery washing plant or other licensed site for processing.
c) R104 which is situated approximately 7km from the application area.

When determining dominant view corridors, one must take into consideration the class of the road, the dominance and nature of the town/settlement in which direction it travels and the distance from the proposed activity. In this regard, the closest road is the R555 district road which runs along the northern boundary of the application area and travels towards Middelburg (situated west of the application area) and Stofberg (situated to the north-east of the application area).

Another key aspect affecting the potential visual impact of any proposed activity is the topography of the project site and the surrounding environment and the existence of prominent biophysical features from where the project site is visible. The topography and the major ridgelines of the area were subsequently determined through a Digital Elevation Model (DEM) created during this study which displays the relief of the topography surrounding the mining infrastructure (refer to Figure 93). The DEM information was then used to create viewshed maps which is the total area that has a direct visual connection to the mining infrastructure (refer to Figure 94 and 95 which spatially depicts the viewshed areas and the areas which could possibly have a direct visibility of the infrastructure). Key aspects of the viewsheds are as follows:

- It is based on single viewpoints from the highest points of the project site which for this assessment was taken from the overburden dumps located at the northern and southern opencast pits.
- It is calculated at an assumed 20m above the natural ground level to reflect the highest point of the proposed infrastructure.

- **It represents a 'broad-brush' designation, which implies that the zone of visual influence may include portions that are in a view of shadow, and it is therefore not visible from the project site and vice versa. This may be as a result of landscape features such as vegetation, buildings and infrastructure not taken into consideration by the viewshed tool.**

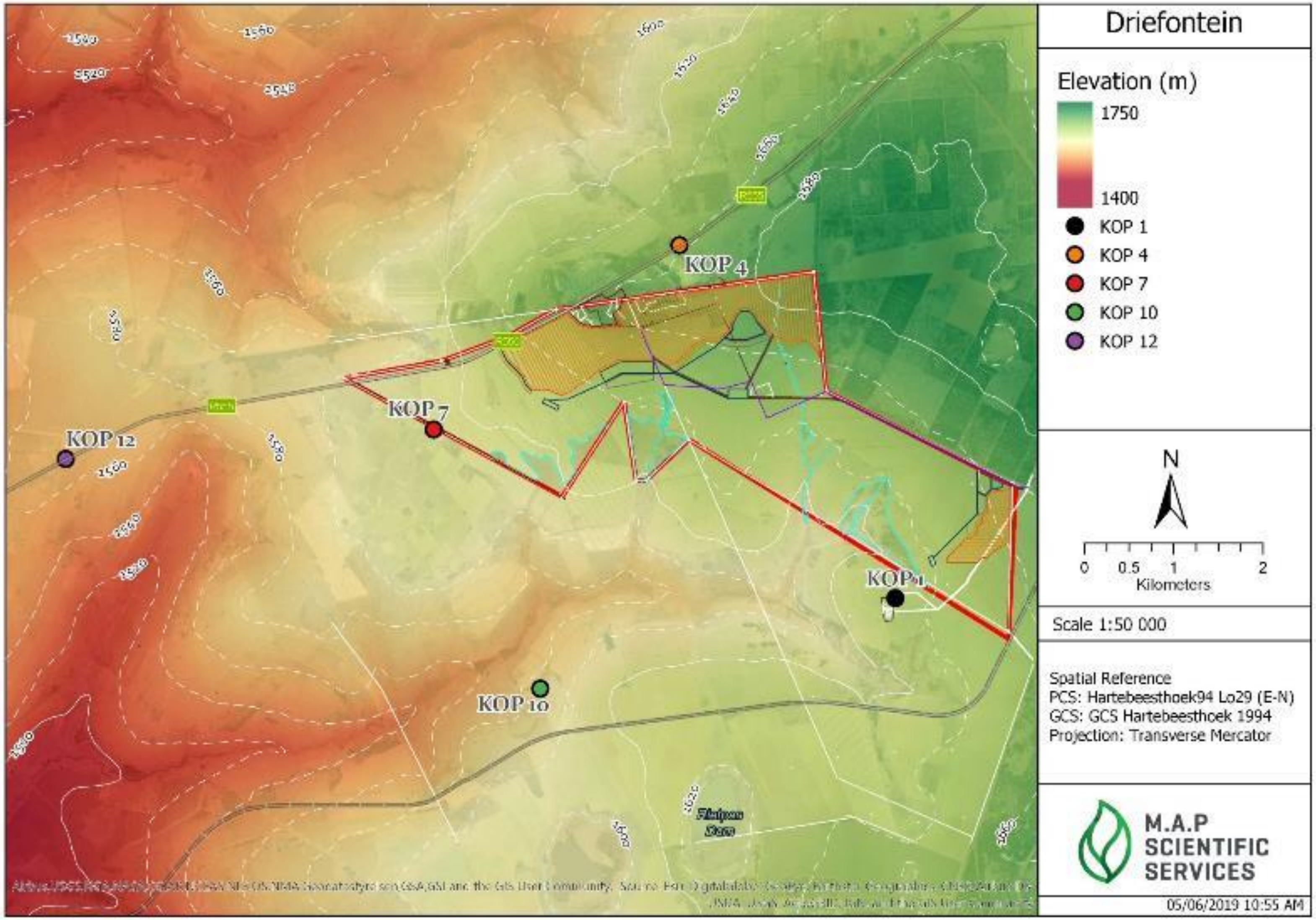


Figure 93: Digital Elevation Model (DEM)

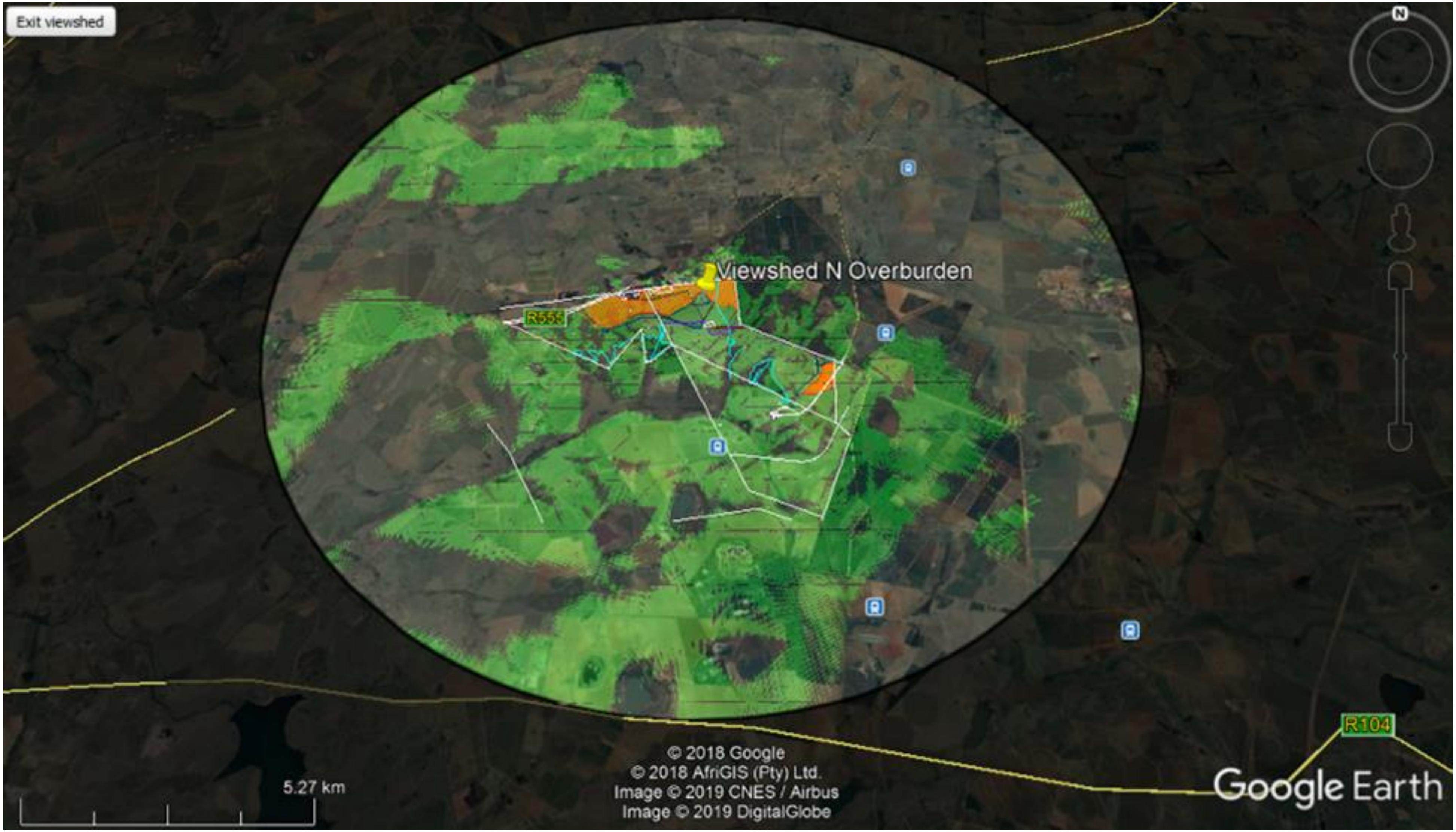


Figure 94: Viewshed map taken from the northern overburden dump

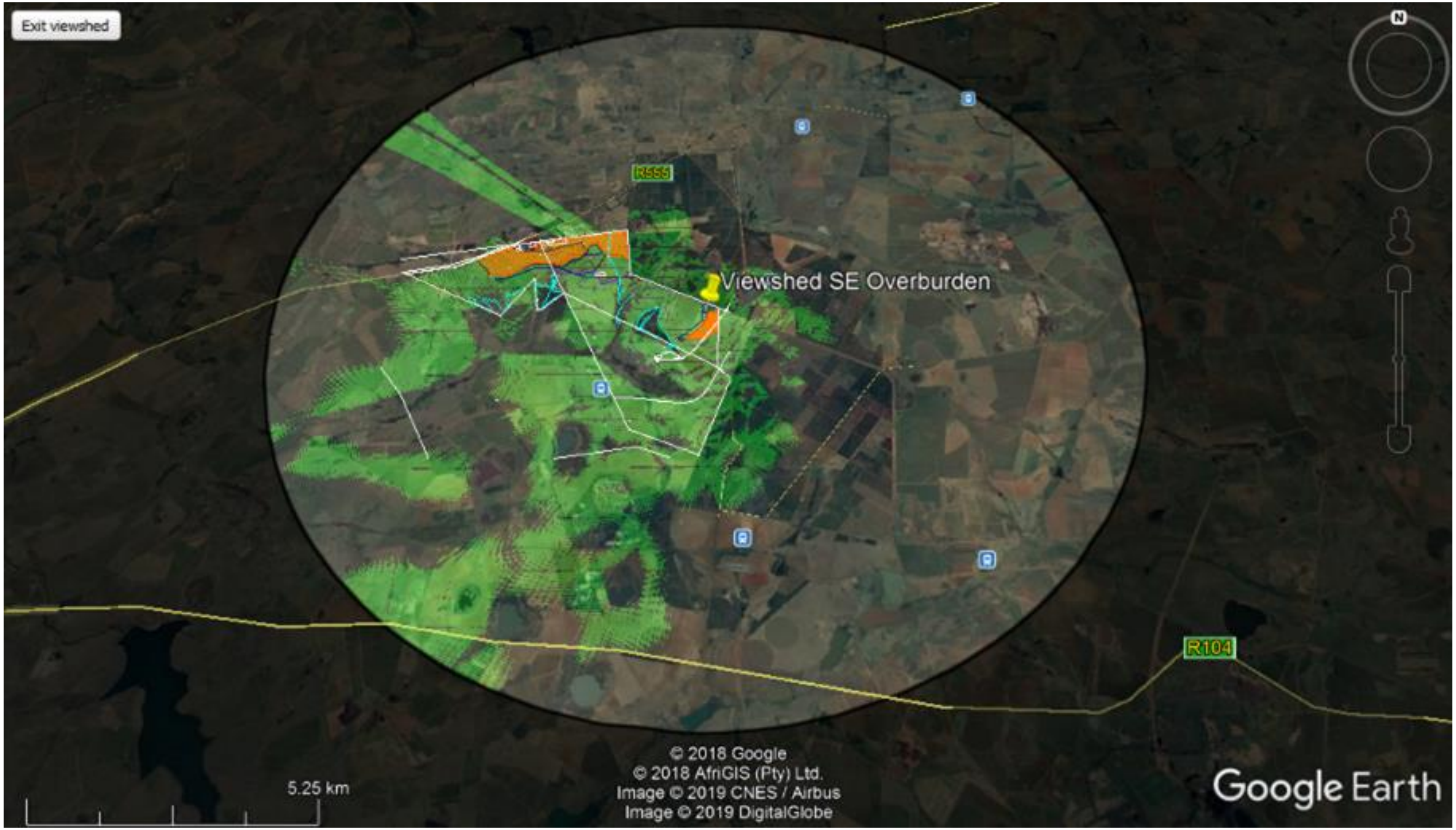


Figure 95: Viewshed map taken from the South-Eastern overburden dump

As illustrated by the generated viewshed maps, the zone of visual influence is in a broad band in a south-western direction. The viewshed is primarily associated with the major topographical features of the area but due to the undulating nature of the region, the viewshed from both viewpoints extend approximately 8km south/south-west, 6-7km west from both viewpoints and 2 – 3km east from both viewpoints.

Once the viewshed analysis has been performed it is important to analyse the visual prominence of the mine infrastructure. The relationship between exposure and distance is applied in order to determine the core area of influence of the mine infrastructure and open pit. The nature of the mining infrastructure compared to the surrounding environment does create a significant contrast due to the surrounding areas land use consisting mainly of agriculture. For this reason, the mine infrastructure could possibly have the following visual prominence:

- 0 – 500m: Short distance where the infrastructure will dominate the immediate landscape and constitute a very high visual prominence.
- 500 – 1000m: Medium distance where the infrastructure would be easily and comfortable visible and constitute a high visual prominence.
- 1 – 2km: Medium to longer distance where the infrastructure would become part of the visual environment but would still be visible and recognizable. This zone constitutes a medium visual prominence; and
- Greater than 2km: Long distance view of the infrastructure where it would still be visible but not as easily recognizable. This constitutes a low visual prominence.

The viewshed maps illustrate a theoretical zone of visual influence. This does not mean that the proposed activity would be visible from all observation points in this area. Based on the information from the viewshed analysis and the preceding sections, the envisaged visual impacts of the proposed activity are discussed below for each of the project phases.

13.2.10.1 Construction phase

Of the planned activities during the construction phase, transportation of construction equipment, presence of construction and operational vehicles on site, earthwork activities and removal of vegetation, construction of workshop, ROM stockpile and offices, topsoil stockpiling and security lighting will have an impact on the visual character of the area. The site is visible from the R555 district road, lying along the northern boundary of the mining right area. The new presence of mining equipment and the erection of infrastructure will change the aesthetics and “sense-of-place” of the area. Furthermore, dust from the construction activities and lighting from vehicles during night-time construction activities and security lights will also add to the visual impact.

The visual impact of the construction activities will be negative and can’t be avoided. The impact will occur from the construction through to the decommissioning phase. Most of the highly sensitive receptors, which include

different farm homesteads, lie to the west, south-west and south within a 1000m from the project site. The project site will be visible from the south and west for approximately 7km away since the topography rises towards the north-east where the site is situated. The visual disturbance of this mine does not lie over any main tourist routes and the existing Bankfontein Colliery act as a screen from the R555, reducing the visual impact from this road. The visual disturbance will however affect the permanent residents in the immediate vicinity. The establishment of the proposed mine is expected to contribute to the change in the sense of place of the local area by transforming the project area from agricultural land to mining, resulting in a visually unappealing environment.

13.2.10.2 **Operational phase**

The immediate surrounds of the project area are characterised by agricultural activities especially cultivated crop lands and forestry. The proposed development is an opencast coal mine which is categorised as a Category 5 development therefor it is expected to have a high visual intrusion. There are existing mining activities within the surrounding region such as the Bankfontein Colliery located on the northern boundary of the application area and the Hakhano Colliery located approximately 3.5km to the south which gives the regional area more of an industrial feel. However, since the project site is a greenfields area consisting of cultivated lands it has been assessed that the proposed mine will overall have a high visual intrusion. Of the planned operational activities, drilling, blasting and excavation of hard overburden, the presence of operational vehicles on site, transportation of ROM, the opencast pit, the ROM and overburden stockpiles and lighting from lighting masts, security lights and vehicles at night will have the biggest impact on the visual aspects.

The visual impact is definite and can't be avoided. The impact will occur from the construction to the decommissioning phase. The overburden stockpiles will contribute significantly to the visual exposure due to their height and uncharacteristic nature compared to the surrounding area. The topography of the region conceals the site almost completely from the north. There is only a small area to the north situated approximately 4km away from the application area which could be visible, and this is due to a rise in topography at that area, but the existing Bankfontein Colliery further acts as a screen to the project site from the north. The existing forestry plantations to the east completely absorbs the project site from more than 800m away. The topography and lack of vegetative cover to the south and west of the project site does not provide effective screening from the sensitive receptors. The agricultural activities surrounding the project area could potentially conceal parts of the project site during specific times during the year depending on what crops are planted but this could not be confirmed during the field inspection because of the time of year (June 2019). Due to the mining method proposed the stockpiling of the overburden can't be avoided. The overburden piles must be placed within the topography where they will have the least visual disturbance but also not in close proximity of a watercourse. The visual disturbance of this mine does not lie over any main tourist routes and the existing

Bankfontein Colliery act as a screen from the R555, reducing the visual impact from this road. The visual disturbance will however affect the permanent residents in the immediate vicinity. The establishment of the proposed mine is expected to contribute to the change in the sense of place of the local area by transforming the project area from agricultural land to mining, resulting in a visually unappealing environment.

13.2.10.3 Decommissioning/rehabilitation and post closure phase

The decommissioning programme itself will influence the aesthetics of the area negatively as the removal of infrastructure will leave a temporary bare "scar" on the landscape, creating a visual impact. The removal of the infrastructure and stockpile areas will greatly reduce the impact of those footprint areas. All areas affected by the activity will need to be rehabilitated and re-vegetated. This includes the areas beyond the immediate mining operations such as temporary access roads, etc.

Concurrent rehabilitation will occur throughout the life of mine and the final pit will be backfilled during the decommissioning phase. Soils will be replaced and shaped into a free-draining surface that fits in with the surrounding land levels. However, due to the nature of the project the visual impact will therefore remain post closure, albeit in a different form. Backfilling with the overburden materials and the resulting closure of the pit must be done in consultation with a professional land surveyor to create a free-draining surface that fits in with the surrounding land level in order to limit the long-term visual impacts of those disturbed areas.

13.2.11 Heritage Resources

PGS Heritage (Pty) Ltd was appointed to undertake a Heritage Impact Assessment (HIA) for the proposed Driefontein mine.

The HIA identified various heritage resources within the study area of which only the burial grounds and graves could be rated as having a high heritage significance and may require further mitigation work before the project can continue. Thirteen grave sites and burial grounds were present on the property during the first phase of the fieldwork in 2019. However, during the second phase of the fieldwork in 2022 it was evident that five of those thirteen previously identified graves sites has been destroyed. Also, during the second phase of the fieldwork a new grave site has been identified.

Refer to Figure 96 below showing the location of the identified heritage resources in relation to the proposed mine layout followed by a discussion of the potential impact during each of the project phases.

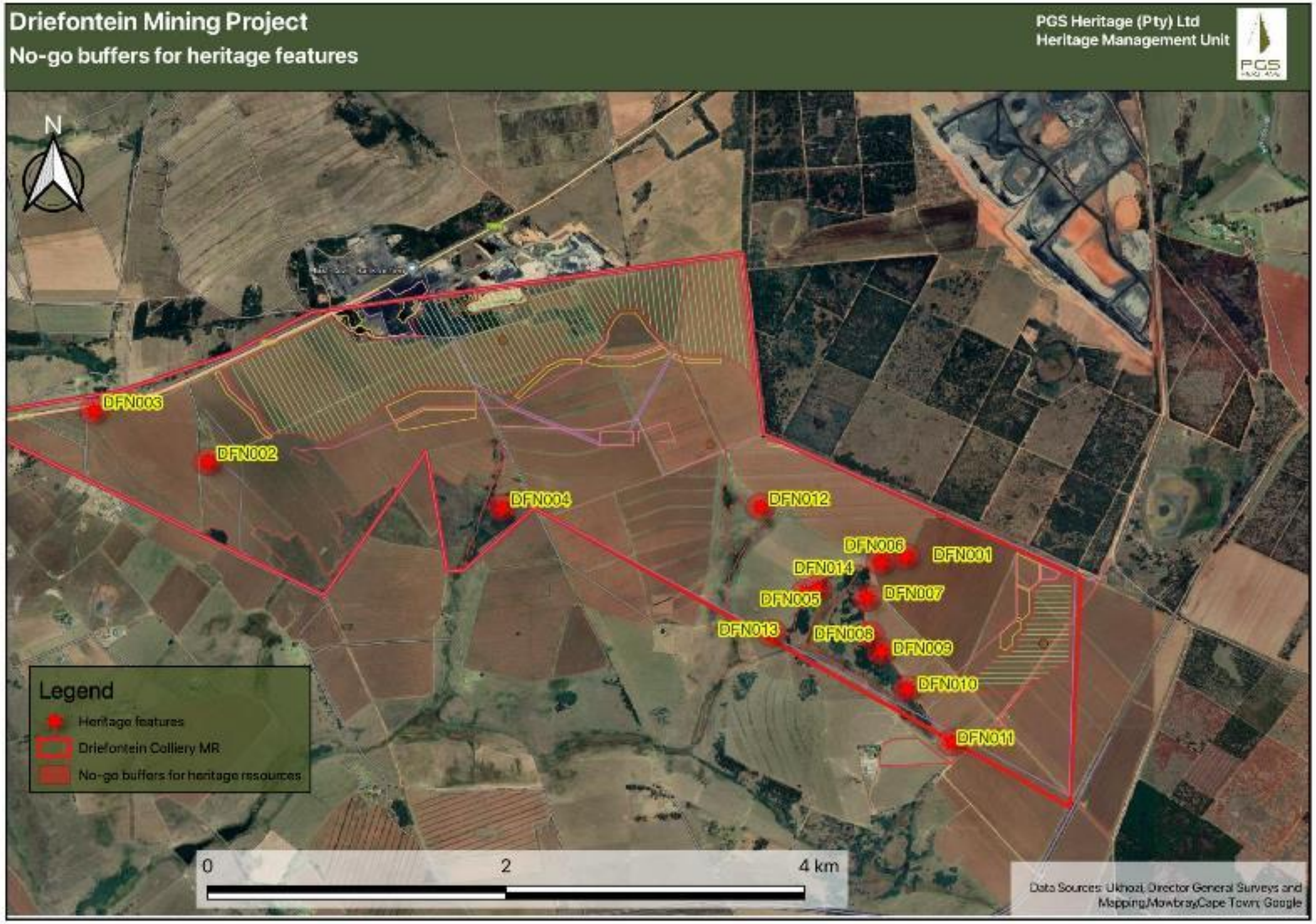


Figure 96: Identified heritage resources, with no go buffers, in relation to the proposed mine layout

13.2.11.1 Construction phase

13.2.11.1.1 Damage to burial grounds and graves

Currently there are nine burial grounds and graves which have high heritage significance and are given a Grade IIIA significance rating.

The potential impact would be damage to identified burial grounds and graves due to earth-moving or vegetation clearance activities during the construction phase, as well as site establishment and the construction of all infrastructure.

The nine identified burial grounds and graves will not be impacted directly by the planned mining activities based on the mine layout provided. These burial grounds should be demarcated and avoided through the implementation of a 100m no-go buffer zone. If this is not possible, the graves could be relocated after completion of a detailed grave relocation process, that includes a thorough stakeholder engagement component, adhering to the requirements of s36 of the NHRA and its regulations as well as the National Health Act and its regulations.

13.2.11.1.2 Damage to fossil resources

As mentioned above, the proposed mining development is underlain by the Vryheid Formation (Ecca Group, Karoo Supergroup). According to the SAHRIS PalaeoMap this Formation has a Very High Paleontological Sensitivity. Although no fossiliferous outcrop was identified during the site visit the possibility of finding fossils below the surface is high and therefor the implementation of a Chance Find Protocol is recommended should fossil remains be discovered, either on the surface or exposed by fresh excavations. The Chance Find Protocol must be implemented by the Safety, Health and Environmental (SHE) manager in charge of these developments. These discoveries ought to be secured (if possible, in situ) and the SHE manager ought to alert SAHRA so that appropriate mitigation (documented and collection) can be undertaken by a paleontologist. It is recommended that the following chance find procedure is implemented.

- If a chance find is made the person responsible for the find must immediately stop working and all work must cease in the immediate vicinity of the find.
- The person who made the find must immediately report the find to his/her direct supervisor which in turn must report the find to his/her manager and the SHE manager. The SHE manager must report the find to the relevant Heritage Agency.
- A preliminary report must be submitted to the Heritage Agency within 24 hours of the find and must include the following: 1) date of the find; 2) a description of the discovery and a 3) description of the fossil and its context (depth and position of the fossil), GPS co-ordinates. Photographs (the more the better) of the discovery must be of high quality, in focus, accompanied by a scale. It is also important to have photographs of the vertical section (side) where the fossil was found.

- Upon receipt of the preliminary report, the Heritage Agency will inform the ECO (site manager) whether a rescue excavation or rescue collection by a palaeontologist is necessary.
- The site must be secured to protect it from any further damage. No attempt should be made to remove material from their environment. The exposed finds must be stabilized and covered by a plastic sheet or sandbags. The Heritage agency will also be able to advise on the most suitable method of protection of the find.
- In the event that the fossil cannot be stabilized the fossil may be collected with extreme care by the SHE manager. Fossils finds must be stored in tissue paper and in an appropriate box while due care must be taken to remove all fossil material from the rescue site.
- Once Heritage Agency has issued the written authorization, the developer may continue with the development.

13.2.11.2 Operational phase

13.2.11.2.1 Damage to burial grounds and graves

The impacts will persist from construction through the operational phase as mining progresses however as mentioned above the nine identified burial grounds and graves will not be impacted directly by the planned mining activities based on the mine layout provided. During operations these sites could potentially be damaged through blasting vibrations and fly rock. Therefore, the recommended buffer of at least 100m should be maintained. If this is not possible, the graves could be relocated after completion of a detailed grave relocation process, that includes a thorough stakeholder engagement component, adhering to the requirements of s36 of the NHRA and its regulations as well as the National Health Act and its regulations.

13.2.11.2.2 Damage to fossil resources

The impact will persist from construction into the operational phase as mining progresses. Refer to Section 13.2.11.1.2 above.

13.2.11.3 Decommissioning/rehabilitation and post closure phase

No further impact envisaged.

13.2.12 Ground vibration, air blasts and fly rock

Blast Management & Consulting (BM&C) was appointed to perform an initial review of possible impacts with regards to blasting operations at the proposed Driefontein mine.

Ground vibration, air blast, fly rock and fumes are some of the aspects resulting from blasting operations. The effects yielded by blasting operations was evaluated over an area with a radius of 3500m from the proposed open pit areas. The 3500m range was selected by BM&C based on fact that effects from blasting may be experienced at significant distances from a blast and the exact range is not known prior to evaluation. The structures identified, which will require consideration during modelling of blasting operations, were houses, general structures, power lines, pipelines, reservoirs, mining activity, roads, shops, schools, gathering places, and possible heritage sites. Structures ranged from well-built structures, mining structures to informal building styles.

The structures are referred to as Points of Interest (POIs) in this section. The type of POIs identified is grouped into different classes. These classes are indicated as “Classification” in Table 86 below. The classification used is a BM&C classification and does not relate to any standard or national or international code or practice. Table 86 shows the descriptions for the classifications used.

Refer to Figure 97 and 98 indicating the location of these structures in relation to the northern and South-Eastern pit areas respectively.

Table 86: POI Classification used

Class	Description
1	Rural Building and structures of poor construction
2	Private Houses and people sensitive areas
3	Office and High-rise buildings
4	Animal related installations and animal sensitive areas
5	Industrial buildings and installations
6	Earth like structures – no surface structure
7	Graves & Heritage
8	Water Borehole

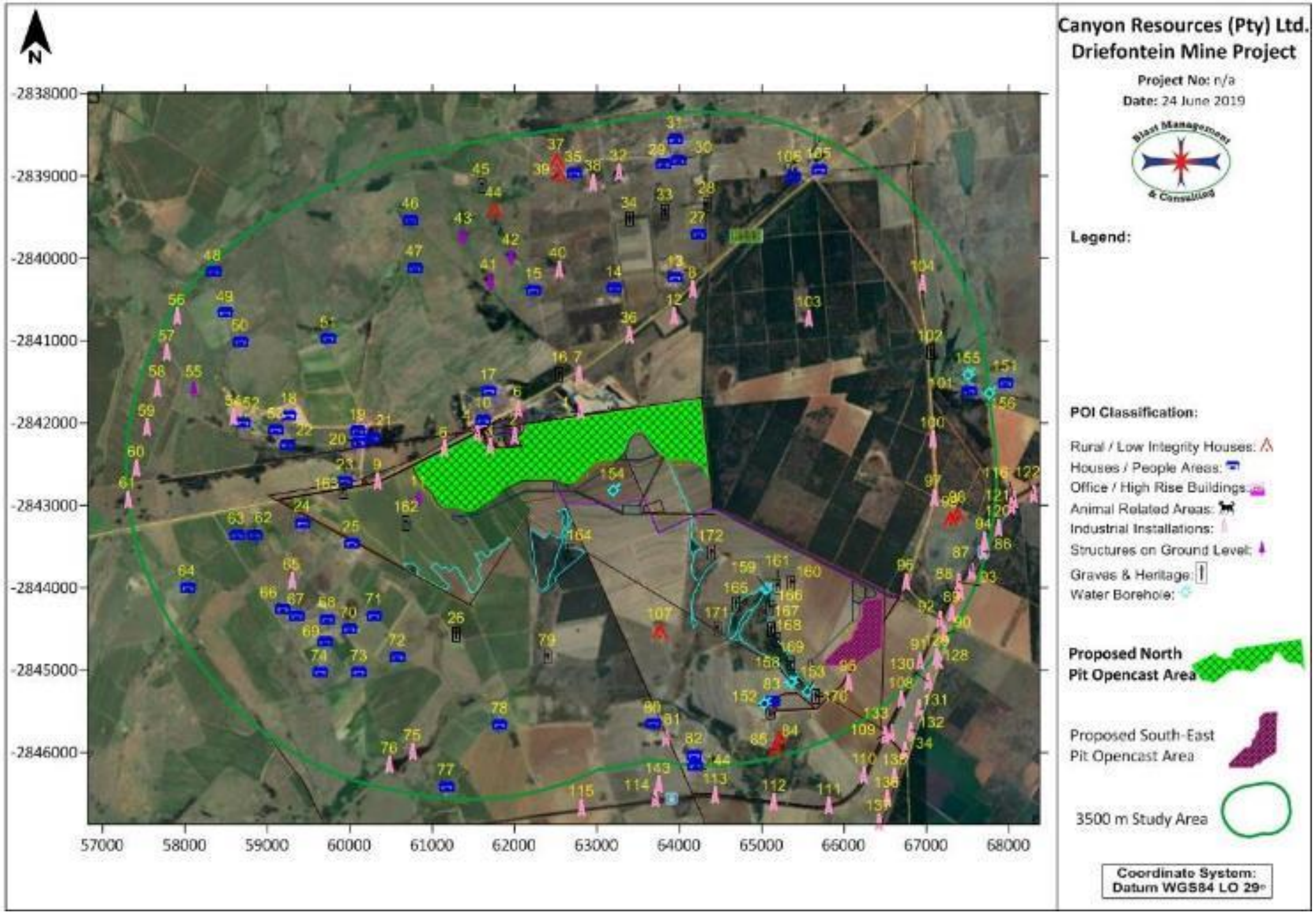


Figure 97: Aerial view and surface plan of the proposed Northern Pit in relation to POIs identified

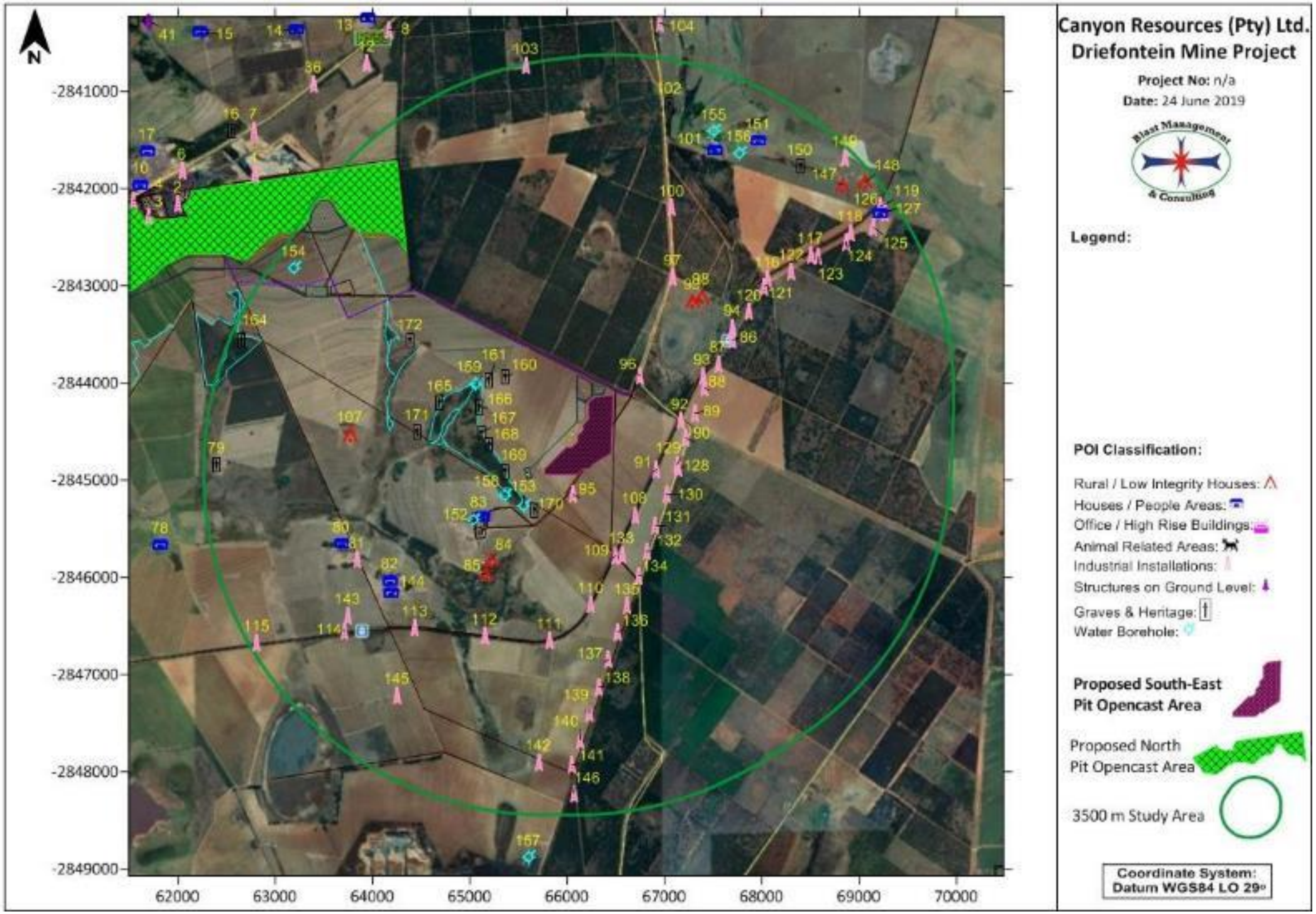


Figure 98: Aerial view and surface plan of the proposed South-Eastern Pit in relation to POIs identified

13.2.12.1 Construction phase

The construction phase was not modelled. It is assumed that the opening of the box cut will result in similar impacts with a lower significance rating than the operational phase since blasting will be limited to only a section of the proposed pit area. Refer to Section 13.2.12.2 below.

13.2.12.2 Operational phase

This section concentrates on the outcome of modelling the possible effects of ground vibration, air blast and fly rock specifically to the identified POIs. The evaluation of the blasting operations considered a minimum charge and a maximum charge with regards to ground vibration and air blast. Refer to Section 15 of the Blast and Vibration Impact Assessment (Appendix 6.11) for a detailed description of the blast operations used as part of the modelling.

Ground vibration and air blast was calculated from the edge of the pit outline, which is considered the worst case because blasting further away from the pit edge will certainly have lesser influence on the surroundings and modelled accordingly. Reference is only made to some of the identified structures and these references cover the extent of all structures surrounding the mine.

The following aspects are discussed under the headings below:

- Ground Vibration Modelling Results
- Ground Vibration and human perception
- Vibration impact on national and provincial road
- Vibration will upset adjacent communities
- Cracking of houses and consequent devaluation
- Air blast Modelling Results
- Impact of fly rock
- Noxious fumes Influence Results

Please note that this analysis does not take geology, topography or actual final drill and blast pattern into account. The data is based on good practice applied internationally and considered very good estimates based on the available information.

13.2.12.2.1 Effects of ground vibration on surrounding structures and human perception

Ground vibration is calculated and modelled for the two pit areas at the minimum and maximum charge mass at distances ranging from 50m to 3500m around the opencast mining area. These levels were then plotted and overlaid with current mining plans to observe possible influences at structures identified.

The simulation provided shows ground vibration contours only for a limited number of levels. The levels used are considered the basic limits that will be applicable for the type of structures observed surrounding the pit area. These levels are: 6 mm/s, 12.5 mm/s, 25 mm/s and 50 mm/s.

This enables immediate review of possible concerns that may be applicable to any of the privately-owned structures, social gathering areas or sensitive installations.

A summary of the findings is provided below in the form of vibration contours per pit, (minimum (215 kg) and maximum (1072 kg) charge mass), Figure 99 – 102, a discussion of the potential impacts caused by ground vibration and a table listing the POIs that would require mitigation. Please refer to Section 17 of the BIA report tables with predicted ground vibration values and evaluation for each POI.

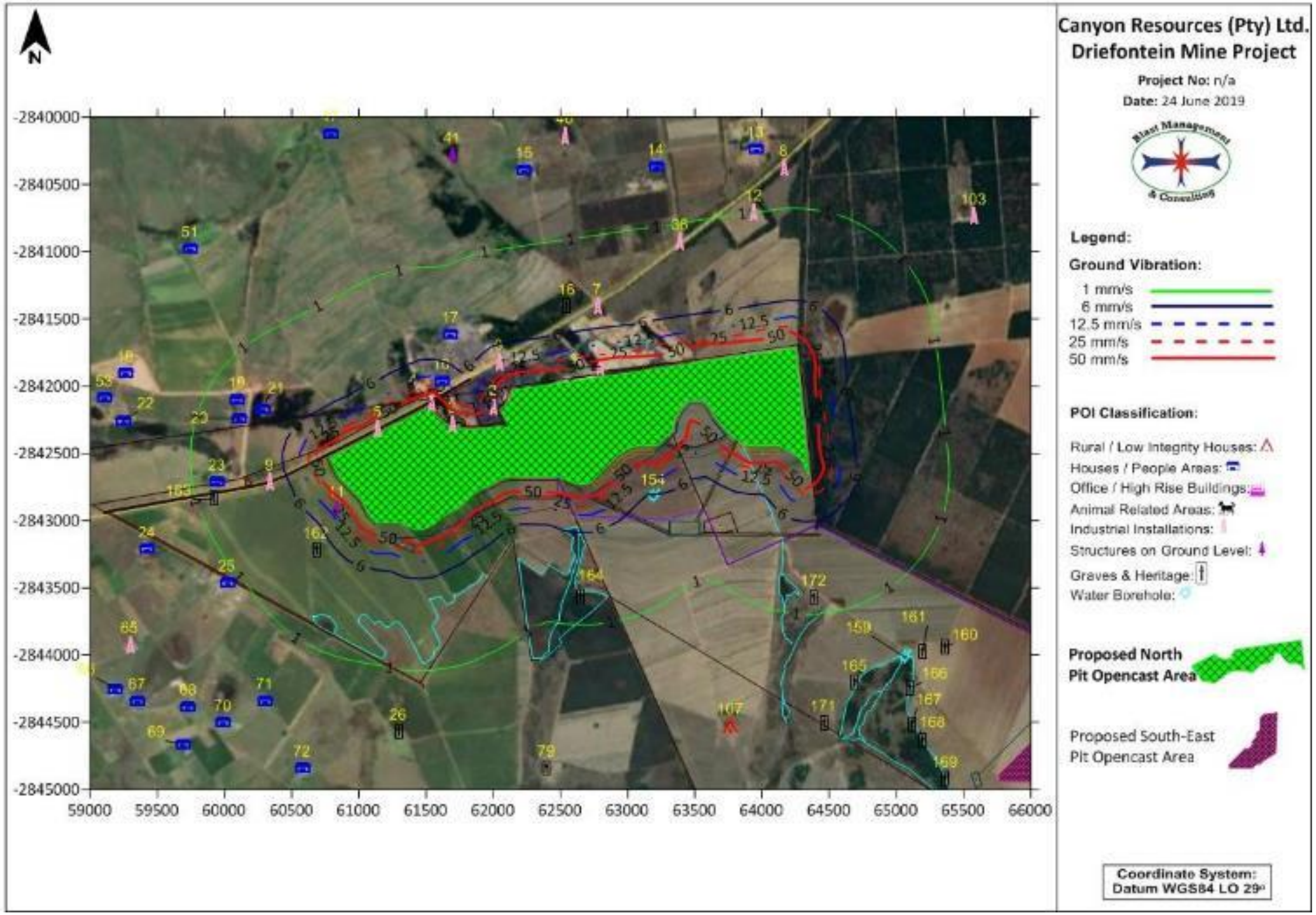


Figure 99: Ground vibration influence from minimum charge for Northern Opencast Pit

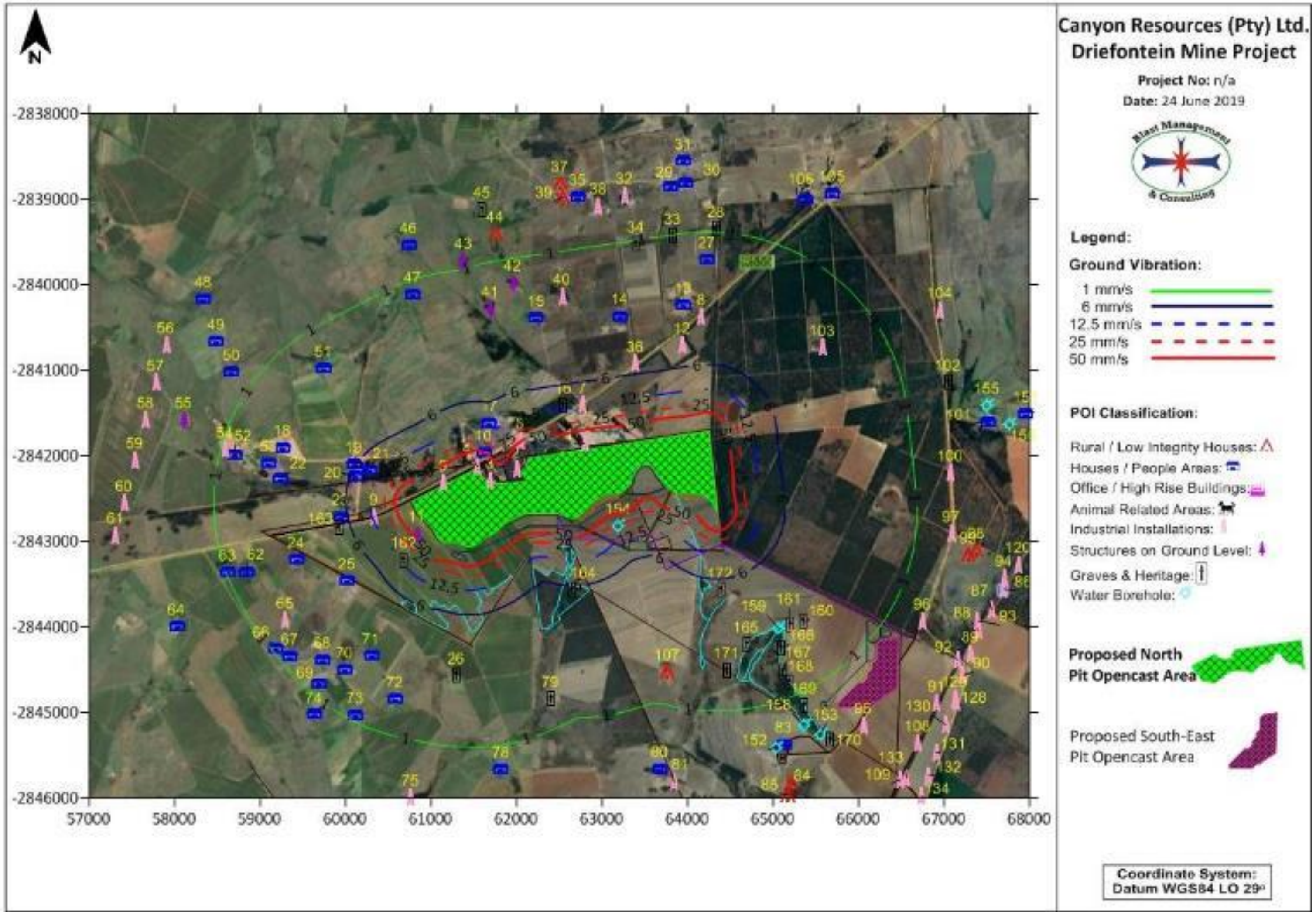


Figure 100: Ground vibration influence from maximum charge for Northern Opencast Pit

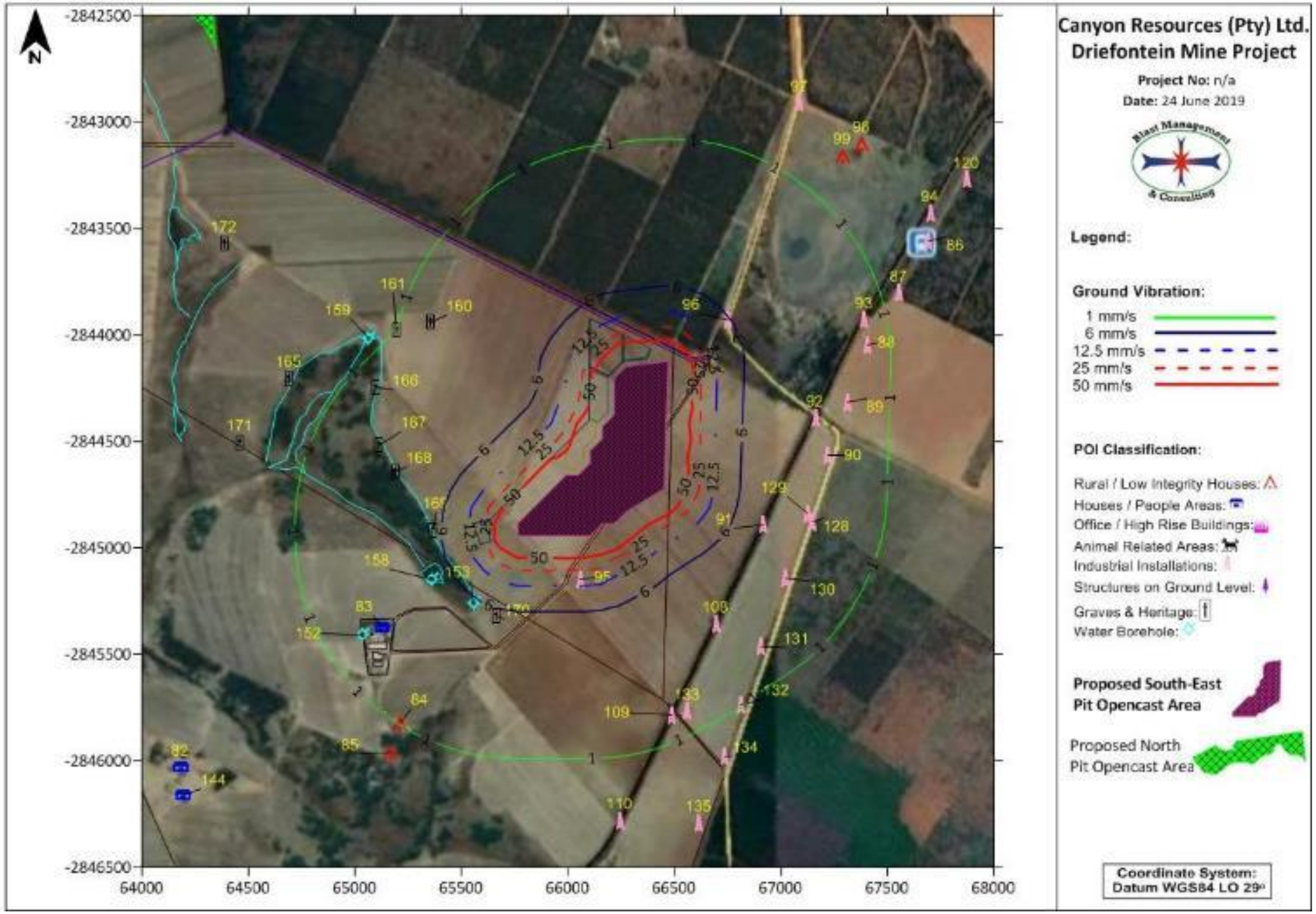


Figure 101: Ground vibration influence from minimum charge for South-Eastern Opencast Pit

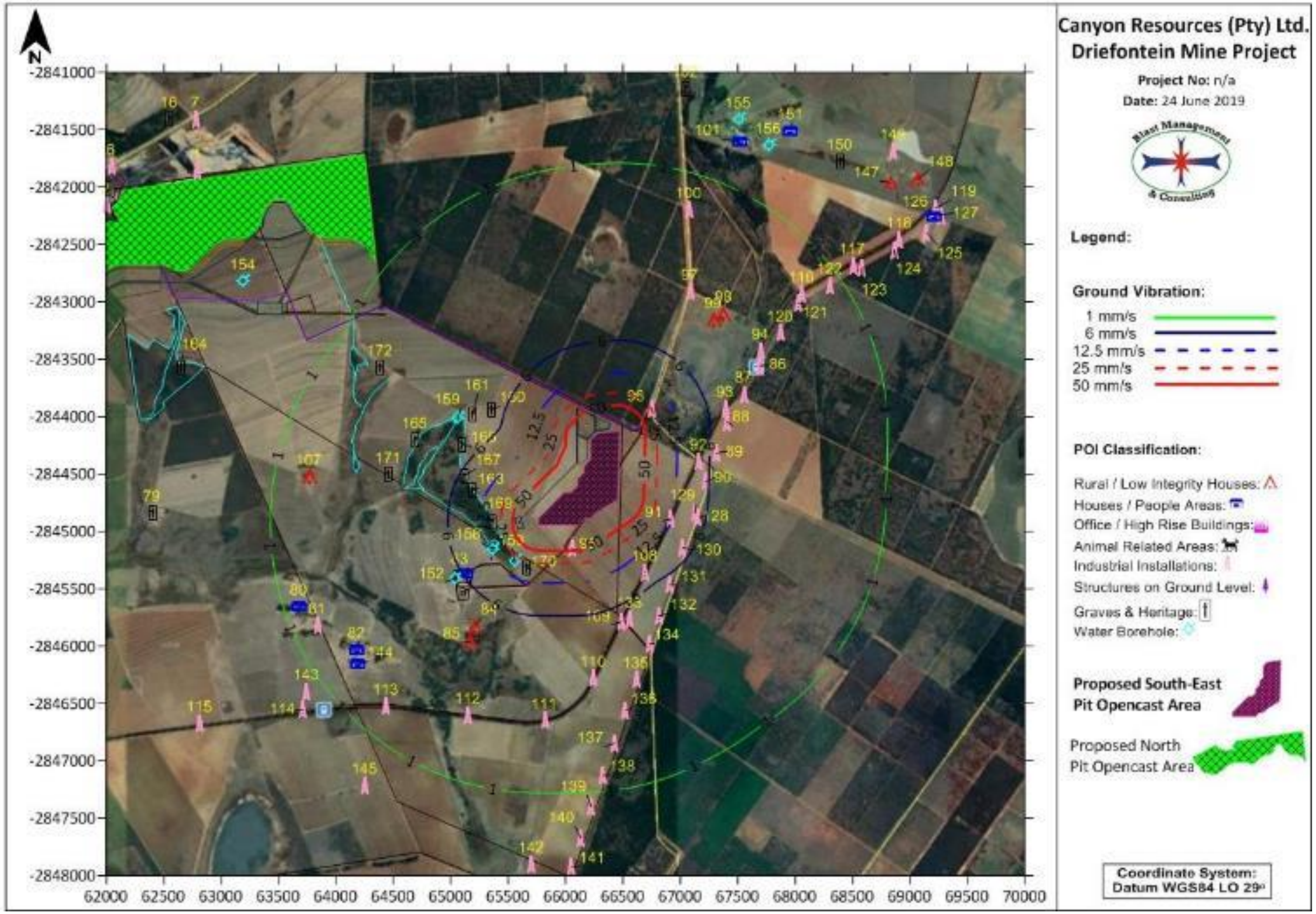


Figure 102: Ground vibration influence from maximum charge for South-Eastern Opencast Pit

The opencast operations were evaluated for expected levels of ground vibration from future blasting operations. Review of the site and the surrounding installations / houses / buildings showed that structures vary in distances from the pit areas and the influences will also vary with distance from the pit areas. The model used for evaluation does indicate acceptable levels. It will be imperative to ensure that a monitoring program is done to confirm levels of ground vibration to ensure that ground vibration levels are not exceeded.

The distances between structures and the pit areas are a contributing factor to the levels of ground vibration expected and the subsequent possible influences. It is observed that for the different charge masses evaluated those levels of ground vibration will change as well. In view of the minimum and maximum charge specific attention will need to be given to specific areas. Considering the limits for the type of structures, the evaluation shows that the minimum charge used may have influence on 5 POI's mainly for the Northern Pit where expected ground vibration levels will exceed limits. 7 POI's at the Northern Pit and 1 POI at the South-Eastern pit were identified as concern for the maximum charge in
relation to expected levels being greater than limits proposed.

On a human perception scale possible influence from ground vibration was evaluated. Perceptible levels of vibration may be experienced up to 2836m, unpleasant up to 819m and intolerable up to 220m based on the maximum charge for the blast designs applied. Based on the minimum charge 6 POI's (Northern Pit) and 3 POI's (South-Eastern Pit) were identified where vibration levels may be perceptible for the minimum charge. Based on the maximum charge 29 POI's (Northern Pit) and 9 POI's (South-Eastern Pit) shows levels associated of being at least perceptible. Higher concerned perceptions are also expected.

As mentioned above, the evaluation mainly considered a distance up to 3500 m from the pit areas. The highest concentration of structures is found up to 557m closest to the pit areas and the planned maximum charge evaluated showed that it could be problematic in terms of potential structural damage and human perception. The ground vibration levels predicted ranged between 0.1 mm/s and 1757.9 mm/s for structures surrounding the pit areas.

The nearest public houses are located 221m (Northern Pit) and 767m (South-Eastern Pit) from the pit boundaries. Ground vibration levels at the nearest buildings where people may be present is 49.0 mm/s. The nearest structures located north of the Northern pit considered in the evaluation showed high levels of ground vibration and could be experienced as problematic.

Thirteen (13) Heritage Sites which include burial grounds and graves were identified by the Heritage Specialist. One of these sites are at closest distance of 473m from the Northern pit boundary and 389m closest from the South-Eastern pit boundary. The Heritage Specialist recommended that these burial grounds should be retained

and avoided with at least a 30 - 50 m buffer. Refer to the Heritage specialists' findings & recommendations in Section 13.2.11 above regarding these sites.

Water boreholes identified are at close proximity for the pit areas. There are eight water boreholes identified within the application area and it is uncertain what the long-term plan will be for these boreholes.

Mitigation of ground vibration was considered and discussed further in Section 13.2.12.2.2 below. A detail inspection of the area and accurate identification of structures will also need to be done, prior to the first blast, to ensure the levels of ground vibration allowable and limit to be applied. Detail of areas to be inspected are provided in Section 8.1.7 of Part B: EMPr.

13.2.12.2.1.1 Ground vibration and human perception

Considering the effect of ground vibration with regards to human perception, vibration levels calculated were applied to an average of 30Hz frequency and plotted with expected human perceptions on the safe blasting criteria graph (see Figure 103 below). The frequency range selected is the expected average range for frequencies that will be measured for ground vibration when blasting is done. Based on the maximum charge and ground vibration predicted over distance it can be seen from Figure 103 that up to a distance of 2836 m people may experience levels of ground vibration as perceptible, up to 819 m as unpleasant and up to 220 m as intolerable.

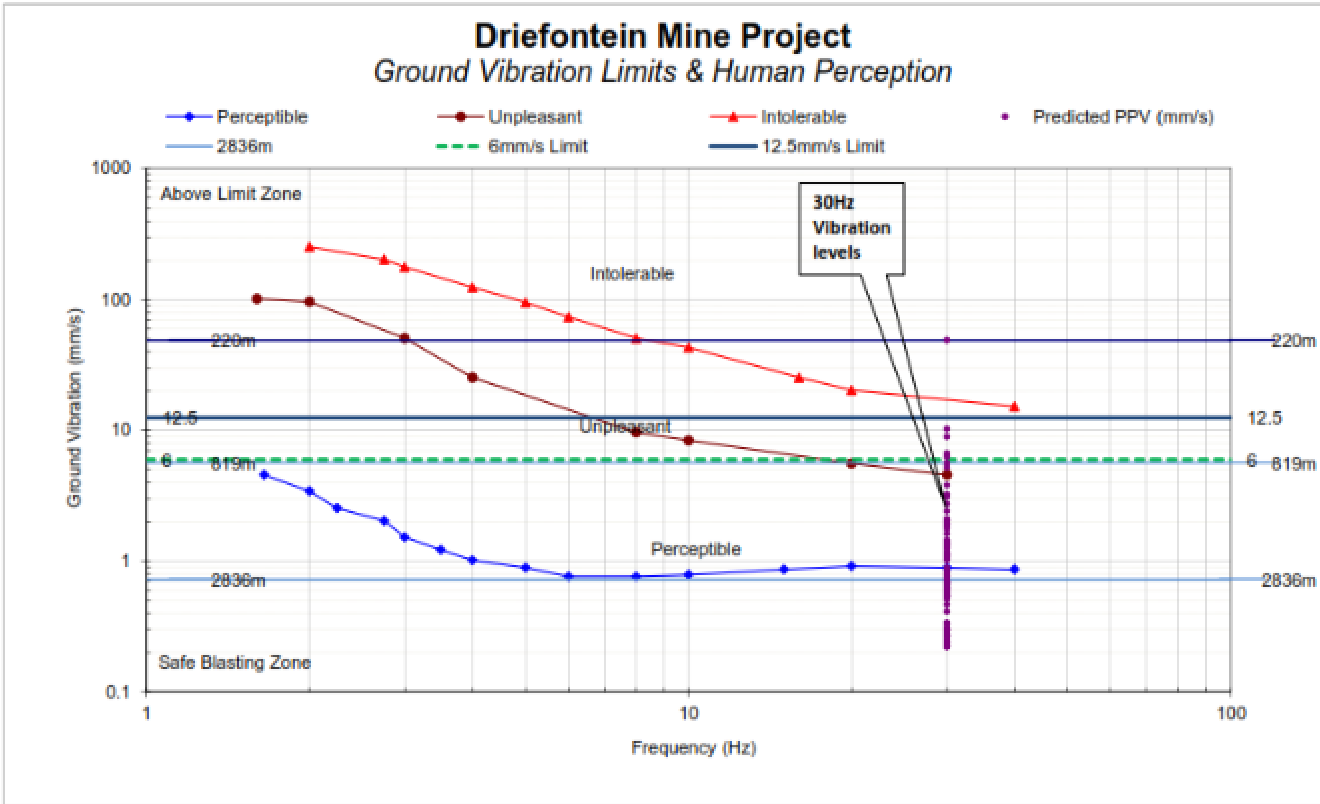


Figure 103: The effect of ground vibration with human perception and vibration limits

13.2.12.2.1.2 Vibration impact on roads

The R555 Provincial Road is in the vicinity of the project area and needs to be considered. This provincial road is at closest point at 36 m in the vicinity of the Northern Pit. Expected ground vibration levels at the R555 road are higher than the recommended limits for the minimum and maximum charge at shortest distance. Mitigations regarding charge mass per delay will be required. Further it will be required that clearance distances are set, and road travel managed during blasting operations. There are gravel roads that link the different farming areas and running close to the pit areas. These routes are specifically of concern when blasting is done. There may be people and animals on these routes and will require careful planning to main safe blasting radius.

13.2.12.2.1.3 Potential that vibration will upset adjacent communities

Ground vibration and air blast generally upset people living in the vicinity of mining operations. The nearest settlement of people is farmsteads located approximately 221m from the Northern Pit and 767m from the South-Eastern Pit. 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 possibility to be perceptible up to 2836m. It is certain that lesser charges will reduce this distance for instance at minimum charge this distance is expected to be 1250m. Within these distance ranges there are no 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.

13.2.12.2.1.4 Cracking of houses and consequent devaluation

The structures found in the areas of concern ranges from informal building style to brick-and-mortar structures. There are various buildings found within the 3500 m range from the mining area. Building style and materials will certainly contribute to additional cracking apart from influences such as blasting operations.

The presence of general vertical cracks, horizontal and diagonal cracks that are found in all structures does not need to indicate devaluation due to blasting operations but rather devaluation due to construction, building material, age, standards of building applied. Thus, damage in the form of cracks will be present. Exact costing of devaluation for normal cracks observed is difficult to estimate. Mining operations may not have influence to change the status quo of any property if correct precautions are considered.

The proposed limits as applied in the Blast & Vibration Impact Assessment (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.

13.2.12.2.1.5 Damage to boreholes

Eight (8) Hydrocensus boreholes were identified within the influence area surrounding the pits based on information from the Groundwater Impact Assessment (GPT, 2019). A mitigation plan will be required to determine if this borehole will be retained or replaced. Table 87 shows all the identified boreholes and Figure 104 shows the location of the boreholes in the area.

Table 87: Identified boreholes

Tag	Description	Y	X	Specific Limit (mm/s)	Distance (m) to nearest Pit	Predicted PPV (mm/s)
152	Hydrocencus Borehole (DRIE-BH1)	-65036.97	2845409.14	50	865	5.2
153	Hydrocencus Borehole (DRIE-BH2)	-65555.59	2845258.80	50	379	20.1
154	Hydrocencus Borehole (DRIE-BH3)	-63192.57	2842818.80	50	377	20.3
155	Hydrocencus Borehole (DRIE-BH4)	-67505.22	2841410.85	50	2906	0.7
156	Hydrocencus Borehole (DRIE-BH5)	-67767.10	2841635.98	50	2808	0.7
157	Hydrocencus Borehole (DRIE-BH6)	-65600.89	2848878.57	50	3939	0.4
158	Hydrocencus Borehole (DRIE Dam 1)	-65362.62	2845150.38	50	453	15.0
159	Hydrocencus Borehole (DRIE-SPRING 1)	-65061.38	2844013.52	50	1114	3.4

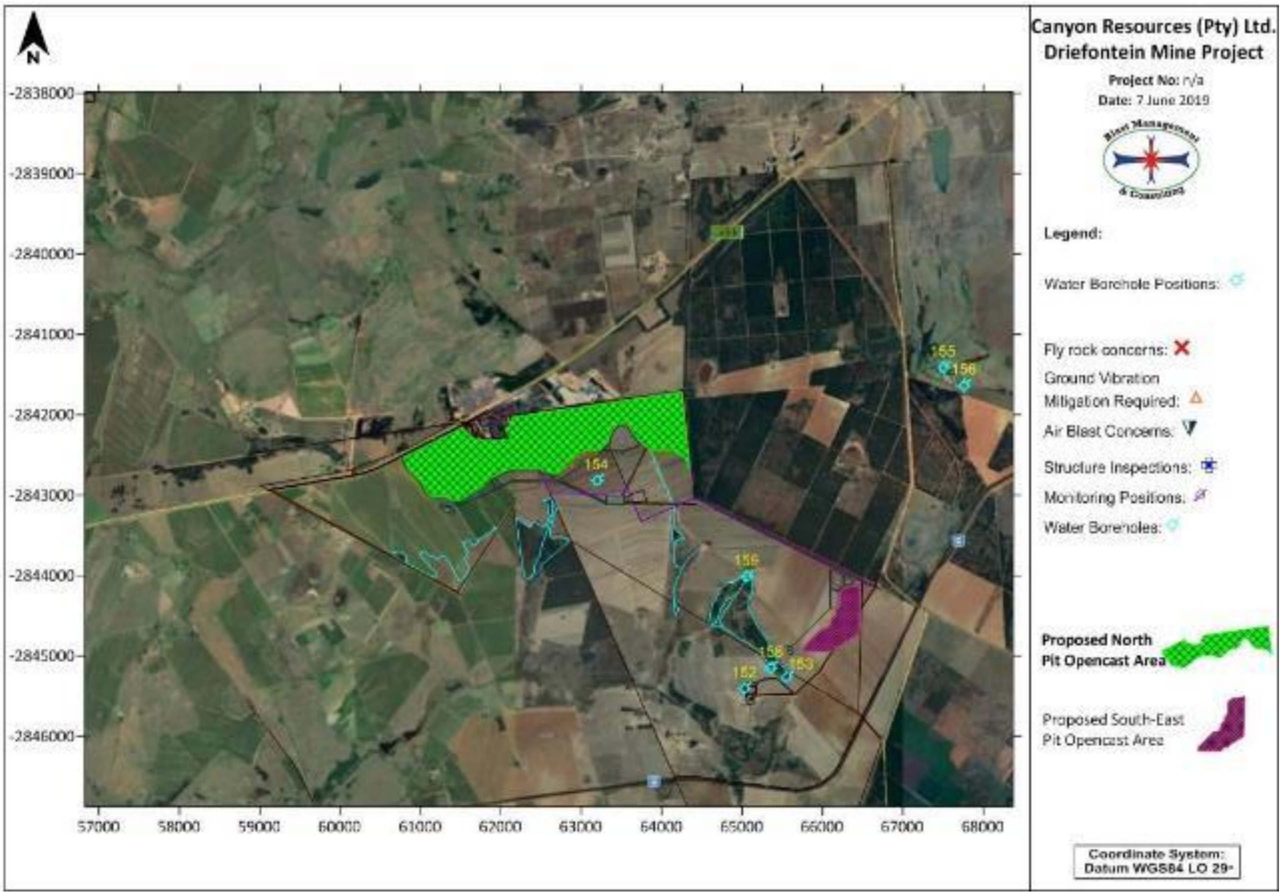


Figure 104: Location of the boreholes within the influence area

13.2.12.2.2 Specific mitigation required for ground vibration

In review of the above evaluations, it is certain that specific mitigation will be required with regards to ground vibration. Ground vibration is the primary possible cause of structural damage and requires more detailed planning in preventing damage and maintaining levels within accepted norms therefor forms the focus for mitigation measures.

Table 88 shows list of POI's that will need to be considered due to the location in relation to the pits (Figure 105).

Table 88: Structures at Driefontein Mine Pit areas identified as problematic

Tag	Description	Y	X	Specific Limit (mm/s)	Distance (m)	Total Mass/Delay (kg)	Predicted PPV (mm/s)	Structure Response @ 10Hz
	North Pit							
1	Mine Activity	-62796.13	2841856.66	200	76	1072	284.6	Problematic
2	Dam	-62001.81	2842156.71	50	57	1072	453.5	Problematic
3	Dam	-61697.03	2842283.55	50	25	1072	1757.9	Problematic
4	Dam	-61543.26	2842124.55	50	40	1072	808.3	Problematic
5	R555 Road	-61143.07	2842314.47	150	36	1072	988.1	Problematic
10	Buildings/Structures	-61617.94	2841960.16	12.5	221	1072	49.0	Problematic
16	Ruins	-62548.04	2841406.55	6	557	1072	10.7	Problematic
	South-East Pit							
95	Reservoir	-66056.65	2845147.86	50	205	1072	55.5	Problematic

Mitigation of ground vibration for this can be done by applying the following methods:

- Do blast design that considers the actual blasting, and the ground vibration levels to be adhered too.
- Only apply electronic initiation systems to facilitate single hole firing.
- Do design for smaller diameter blast holes that will use fewer explosives per blasthole.

Table 89 shows mitigation in the form of maximum charge mass that will be allowed to maintain safe levels of ground vibration and minimum distance between blast and POI required for the maximum charge to yield safe levels of ground vibration. Review of the data clearly indicates that these POI's are too close to facilitate blasting operations without the necessary controls on ground vibration.

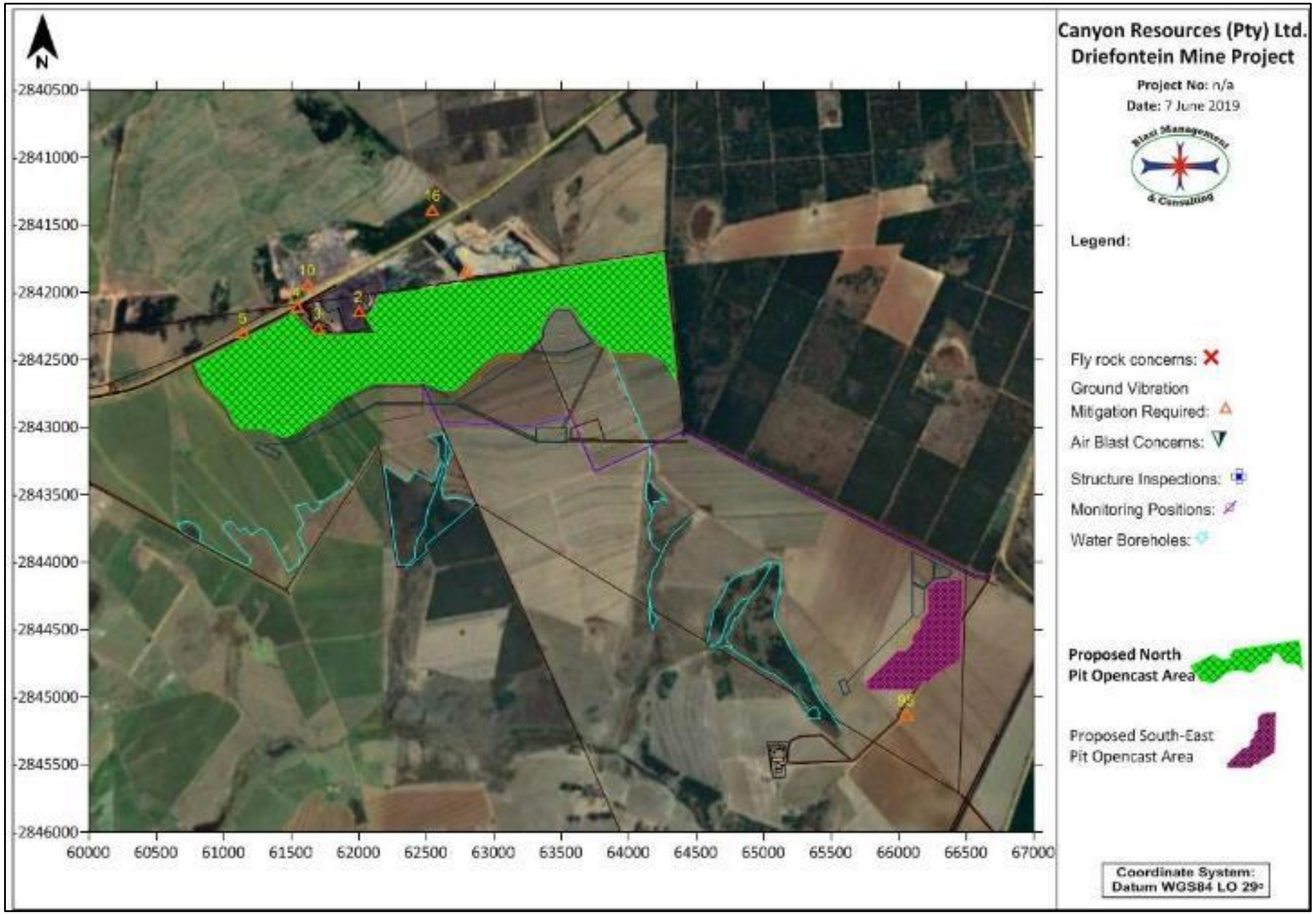


Figure 105: Structures identified at the pit areas where ground vibration mitigation will be required

Table 89: Mitigation measures for ground vibration at problematic POIs

Current problematic POI's

Pit Area	Tag	Description	Y	X	Specific Limit (mm/s)	Distance (m)	Total Mass/Delay (kg)	Predicted PPV (mm/s)	Structure Response @ 10Hz
North Pit	1	Mine Activity	-62796.13	2841856.66	200	76	1072	284.6	Problematic
North Pit	2	Dam	-62001.81	2842156.71	50	57	1072	453.5	Problematic
North Pit	3	Dam	-61697.03	2842283.55	50	25	1072	1757.9	Problematic
North Pit	4	Dam	-61543.26	2842124.55	50	40	1072	808.3	Problematic
North Pit	5	R555 Road	-61143.07	2842314.47	150	36	1072	988.1	Problematic
North Pit	10	Buildings/Structures	-61617.94	2841960.16	12.5	221	1072	49.0	Problematic
South-East pit	95	Reservoir	-66056.65	2845147.86	50	205	1072	55.5	Problematic

Maximum allowable charge for current distance

Pit Area	Tag	Description	Y	X	Specific Limit (mm/s)	Distance (m)	Total Mass/Delay (kg)	Predicted PPV (mm/s)	Structure Response @ 10Hz
North Pit	1	Mine Activity	-62796.13	2841856.66	200	76	699	200.0	Acceptable
North Pit	2	Dam	-62001.81	2842156.71	50	57	74	50.0	Acceptable
North Pit	3	Dam	-61697.03	2842283.55	50	25	14	50.0	Acceptable
North Pit	4	Dam	-61543.26	2842124.55	50	40	37	50.0	Acceptable
North Pit	5	R555 Road	-61143.07	2842314.47	150	36	109	150.0	Acceptable
North Pit	10	Buildings/Structures	-61617.94	2841960.16	12.5	221	205	12.5	Acceptable
South-East pit	95	Reservoir	-66056.65	2845147.86	50	205	944	50.0	Acceptable

Minimum distance required for maximum charge

Pit Area	Tag	Description	Y	X	Specific Limit (mm/s)	Distance (m)	Total Mass/Delay (kg)	Predicted PPV (mm/s)	Structure Response @ 10Hz
North Pit	1	Mine Activity	-62796.13	2841856.66	200	94	1072	200.0	Acceptable
North Pit	2	Dam	-62001.81	2842156.71	50	218	1072	50.0	Acceptable
North Pit	3	Dam	-61697.03	2842283.55	50	218	1072	50.0	Acceptable
North Pit	4	Dam	-61543.26	2842124.55	50	218	1072	50.0	Acceptable
North Pit	5	R555 Road	-61143.07	2842314.47	150	112	1072	150.0	Acceptable
North Pit	10	Buildings/Structures	-61617.94	2841960.16	12.5	505	1072	12.5	Acceptable
South-East pit	95	Reservoir	-66056.65	2845147.86	50	218	1072	50.0	Acceptable

Minimum distance required for minimum charge

Pit Area	Tag	Description	Y	X	Specific Limit (mm/s)	Distance (m)	Total Mass/Delay (kg)	Predicted PPV (mm/s)	Structure Response @ 10Hz
North Pit	1	Mine Activity	-62796.13	2841856.66	200	42	215	200.0	Acceptable
North Pit	2	Dam	-62001.81	2842156.71	50	98	215	50.0	Acceptable
North Pit	3	Dam	-61697.03	2842283.55	50	98	215	50.0	Acceptable
North Pit	4	Dam	-61543.26	2842124.55	50	98	215	50.0	Acceptable
North Pit	5	R555 Road	-61143.07	2842314.47	150	50	215	150.0	Acceptable
North Pit	10	Buildings/Structures	-61617.94	2841960.16	12.5	226	215	12.5	Acceptable
South-East pit	95	Reservoir	-66056.65	2845147.86	50	98	215	50.0	Acceptable

13.2.12.2.3 Effects of air blasts on surrounding structures

Presented are simulations for expected air blast levels from minimum (215kg) and maximum (1072kg) charge masses at both pits (Figures 106 - 109) and a discussion of the relevant influences.

Expected air blast levels were calculated for each POI identified surrounding the mining area and evaluated with regards to possible structural concerns. Tables are provided in Section 17.7 of the BIA for each of the different charge models with regards to Tag No., Description, Distance, Air Blast (dB), and possible concern.

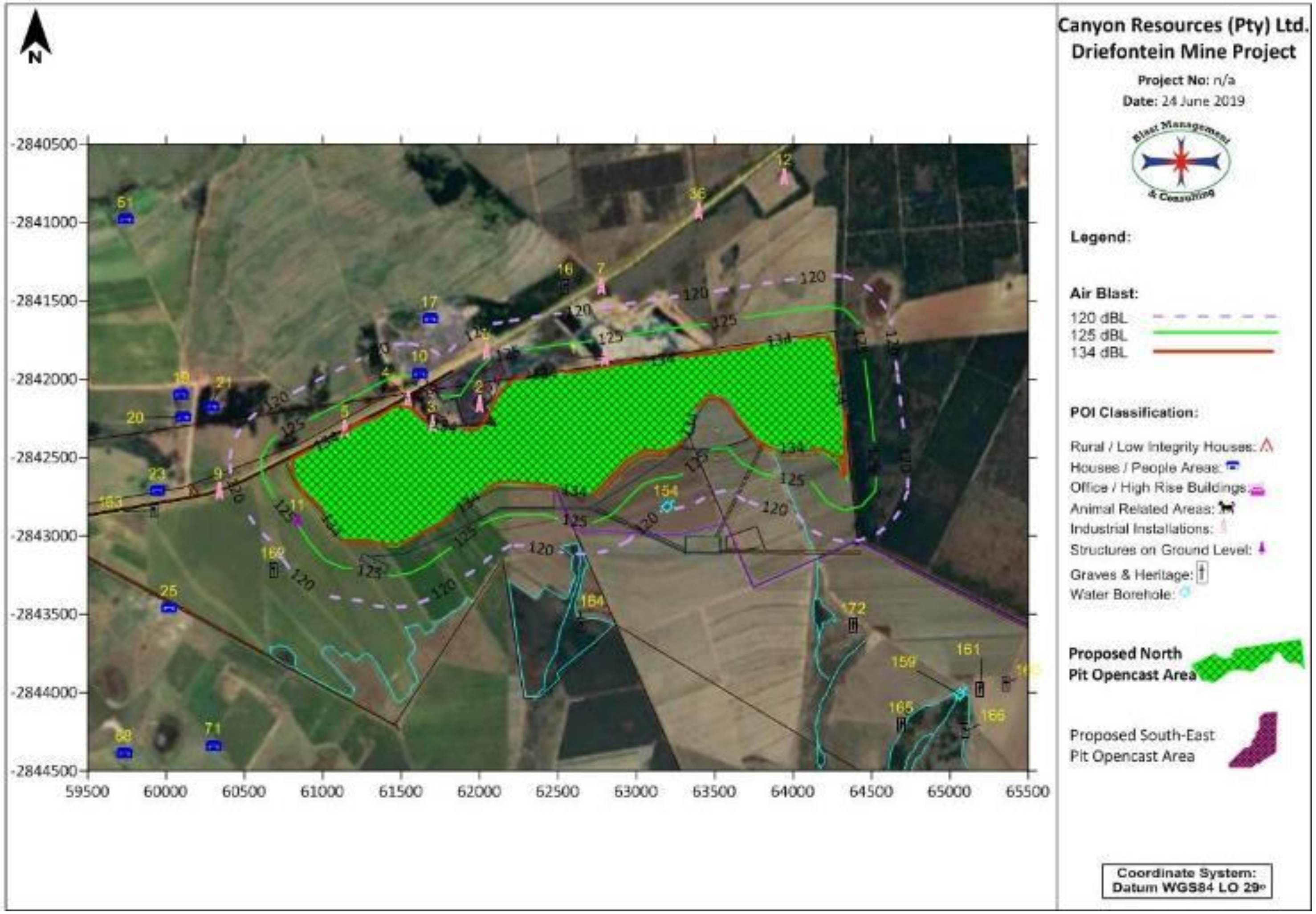


Figure 106: Air blast influence from minimum charge (215 kg) for Northern Opencast Pit

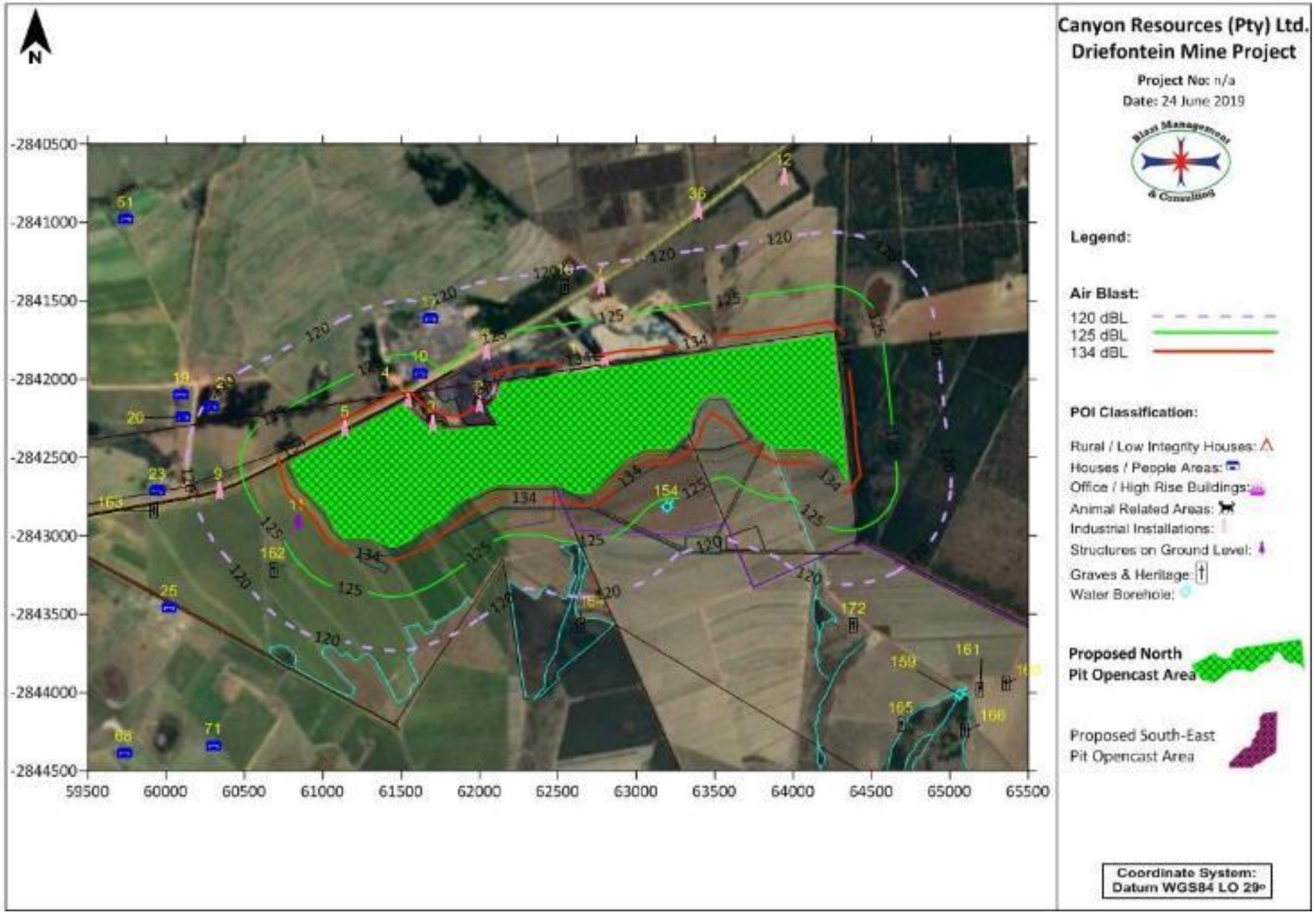


Figure 107: Air blast influence from maximum charge (1072 kg) for Northern Opencast Pit

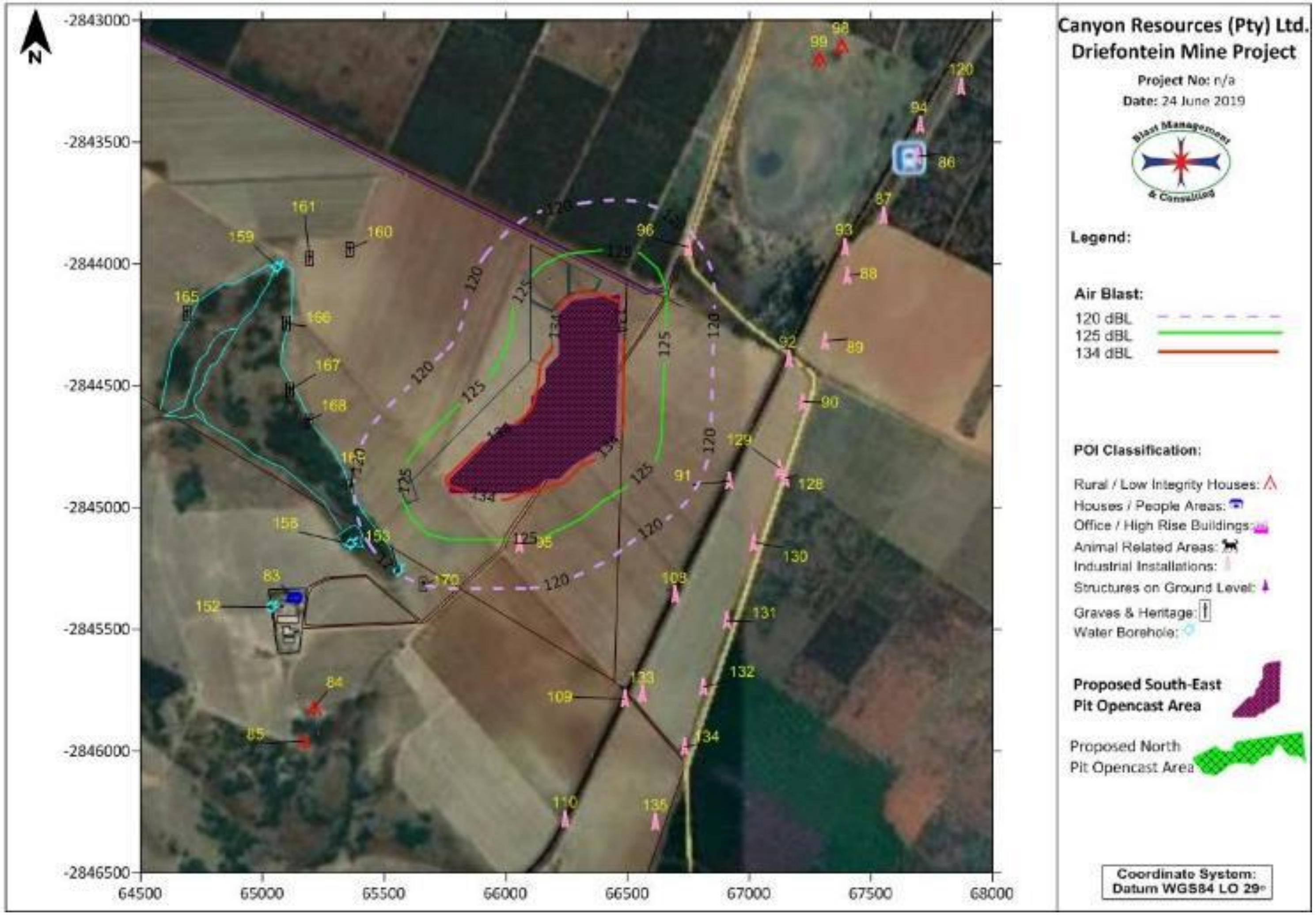


Figure 108: Air blast influence from minimum charge (215 kg) for South-Eastern Opencast Pit

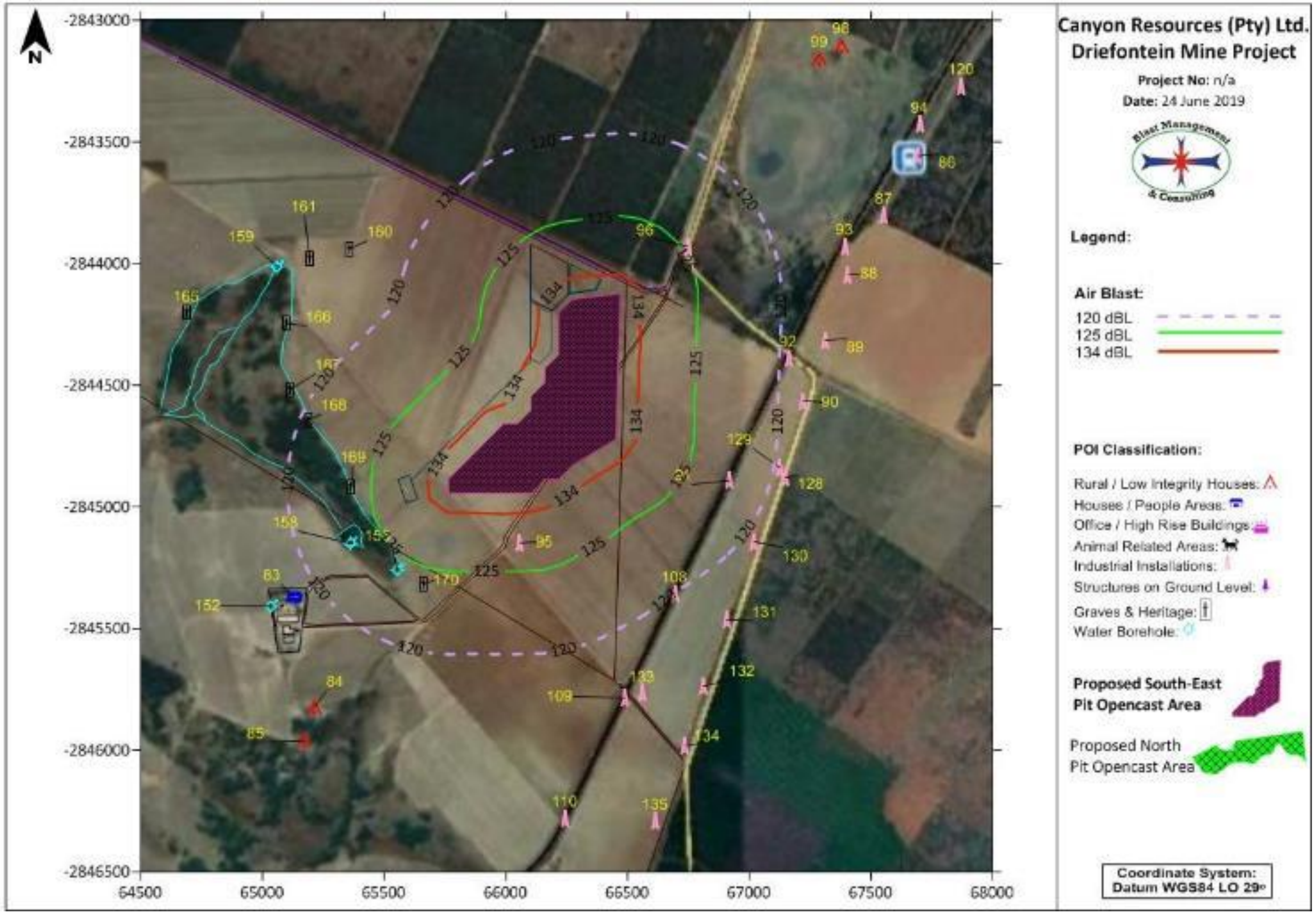


Figure 109: Air blast influence from maximum charge for South-Eastern Opencast Pit

Review of the air blast levels indicates the following potential complaint concerns:

- Air blast predicted for the maximum charge for both pit areas range between 102.2 and 127.5 dB for all the POI's considered which includes the nearest points such as the Buildings/Structures. These levels may contribute to effects such as rattling of roofs, doors or windows that could lead to complaints at POI 10, POI 17 and POI 21 (closest to North Pit) though expected air blast is less than 134dBL at 127.5 dBL.

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 distance of 86m and closer to the pit boundaries. Infrastructure at the pit area such as roads, heritage sites, power lines/pylons and Hydrocensus boreholes are present, but air blast does not have any influence on these installations.

The possible negative effects from air blast are expected to be greater than that of ground vibration. It is maintained that if stemming control is not exercised this effect could be greater with greater range of complaints or damage. The pits are located such that "free blasting" – meaning no controls on blast preparation – will not be possible.

13.2.12.2.4 Damage and injuries caused by fly rock

The occurrence of fly rock in any form will have a negative impact if found to travel outside the unsafe zone. This unsafe zone may be anything between 10m or 1000m. A general unsafe zone applied by most mines is normally considered to be within a radius of 500m from the blast; but needs to be qualified and determined as best possible.

A safe distance from blasting is calculated following rules and guidelines from the International Society of Explosives Engineers (ISEE) Blasters Handbook. Using this calculation, the minimum safe distances can be determined that should be cleared of people, animals, and equipment. Figure 110 shows the results from the ISEE calculations for fly rock range based on a 165 mm diameter blast hole and 3.5 m stemming length. Based on these values a possible fly rock range with a safety factor of 2 was calculated to be 402m. The absolute minimum unsafe zone is then the 402 m. This calculation is a guideline and any distance cleared should not be less.

The occurrence of fly rock can however never be 100% excluded. Best practices should be implemented at all times. The occurrence of fly rock can be mitigated but the possibility of the occurrence thereof can never be eliminated.

Figure 111 and Figure 112 shows the area around both opencast pits that incorporates the 402 unsafe zone.

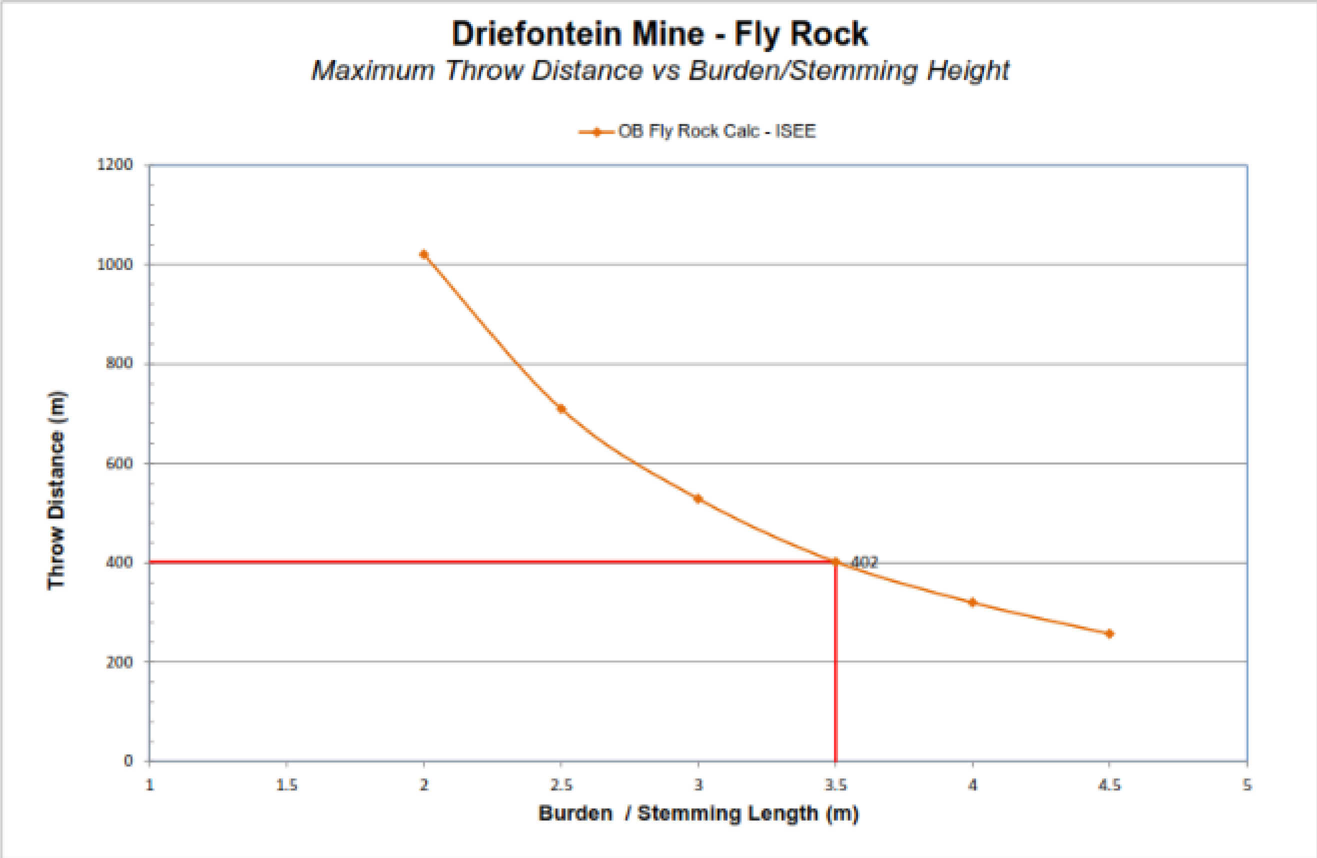


Figure 110: Fly rock prediction calculation

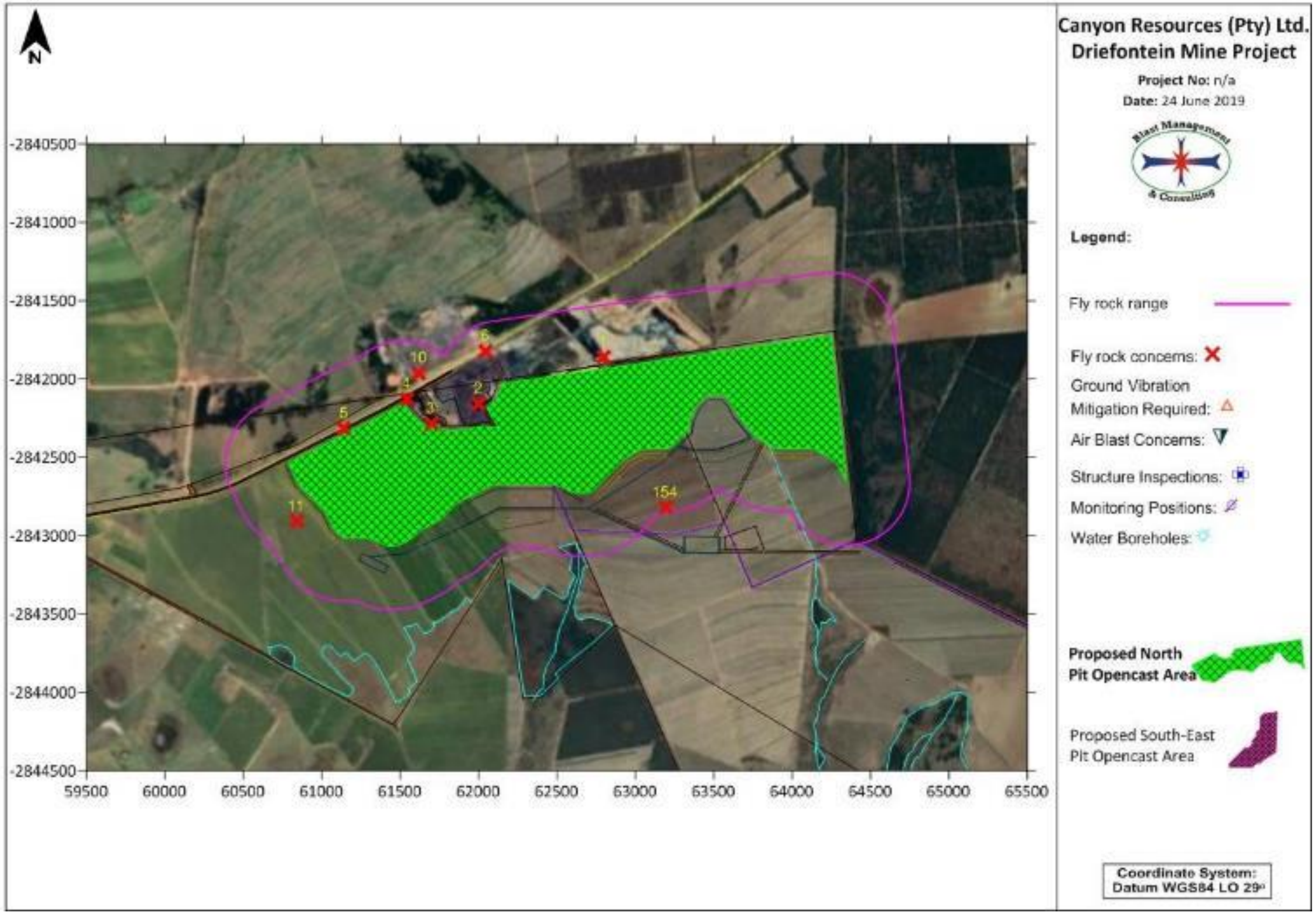


Figure 111: Predicted Fly Rock Exclusion Zone for Northern Opencast Pit

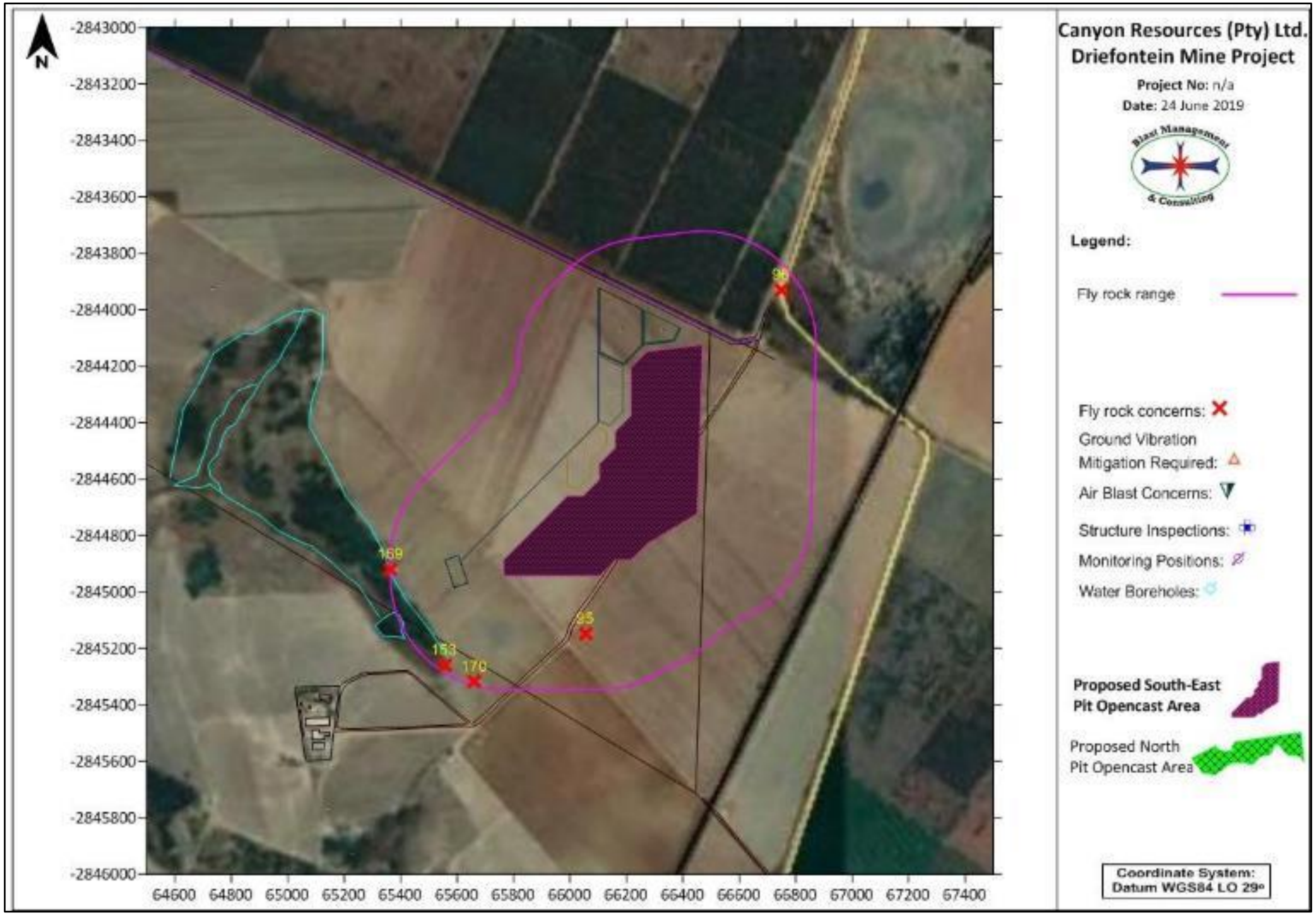


Figure 112: Predicted Fly Rock Exclusion Zone for South-Eastern Opencast Pit

Review of the calculated unsafe zone showed nine POI's for the Northern Pit and five POI's for the South-Eastern Pit are within the unsafe zone. This includes mainly the Buildings/Structures, Boreholes, Graves and the R555 road. Table 90 below shows the POI's of concern and coordinates.

Table 90: POI's located in the fly rock unsafe zone

Tag	Description	Y	X
	North Pit		
1	Mine Activity	-62796.13	2841856.66
2	Dam	-62001.81	2842156.71
3	Dam	-61697.03	2842283.55
4	Dam	-61543.26	2842124.55
5	R555 Road	-61143.07	2842314.47
6	R555 Road	-62045.16	2841819.72
10	Buildings/Structures	-61617.94	2841960.16
11	Cultivated Fields	-60838.38	2842908.31
154	Hydrocencus Borehole (DRIE-BH3)	-63192.57	2842818.80
	South-East Pit		
95	Reservoir	-66056.65	2845147.86
96	Road	-66749.48	2843929.97
153	Hydrocencus Borehole (DRIE-BH2)	-65555.59	2845258.80
169	Heritage Site (DFN010 - Homestead Foundation or a Grave)	-65364.90	2844919.58
170	Heritage Site (DFN011 - Graves)	-65662.36	2845318.05

13.2.12.2.5 Occurrence of noxious fumes

Explosives used in the mining environment are required to be oxygen balanced. Oxygen balance refers to the stoichiometry of the chemical reaction and the nature of gases produced from the detonation of the explosives. The creation of poisonous fumes such as nitrous oxides and carbon monoxide are particular undesirable. These fumes present themselves as red brown cloud after the blast has detonated. It has been reported that 10ppm to 20ppm can be mildly irritating. Exposure to 150 ppm or more (no time period given) has been reported to cause death from pulmonary oedema. It has been predicted that 50% lethality would occur following exposure to 174ppm for 1 hour. Anybody exposed must be taken to hospital for proper treatment.

Factors contributing to undesirable fumes are typically: poor quality control on explosive manufacture, damage to explosive, lack of confinement, insufficient charge diameter, excessive sleep time, water in blast holes, incorrect product used, or product not loaded properly, and specific types of rock/geology can also contribute to fumes.

Nothing can be stated as to fume dispersal to nearby farmsteads because the occurrence of fumes in the form the NOx gas is not a given and very dependent on various factors as discussed above. However, the occurrence of fumes should be closely monitored. The occurrence of fumes is not always certain – specifically the formation of NOx gas. NOx is dependant of various factors such as geology, water, oxidised ground and explosive product quality at the time of blast preparation. In the occurrence of NOx fumes the wind direction and strength will determine how and where distribution of the fumes will occur. It will be dependent on the concentration of the fumes on an action plan to be applied. In high concentrations as indicated if anybody is present in the path of the fume cloud it could be problematic.

13.2.12.3 Decommissioning/rehabilitation and post closure phase

No further impact envisaged because no mining, drilling, and blasting operations is expected during this phase. It is uncertain if any blasting will be done for demolition. If any demolition blasting will be required, it will be reviewed as civil blasting and addressed accordingly.

13.2.13 Traffic

Mining will take place at Driefontein, and processing of the mined material will take place at Hakhano Colliery or other licensed site or ROM will be sold raw. The mined material will then be transported towards the east of Middleburg via the D1433 and R104. Access to the proposed mine will be provided off the D1433. There will be one access gate located on the eastern boundary of the proposed mine – connecting Driefontein and the D1433. During the operation phase, the access from the Hakhano Colliery to the D1433 will be mostly used. The access road is proposed with one inbound lane and one outbound lane and will be controlled by a boom gate with a security attendant.

Figure 113 shows the proposed mine route between the proposed Driefontein Mine and Hakhano Colliery.

Koleko Engineering Solutions (Pty) Ltd conducted the Traffic Impact Assessment (TIA) for the proposed mine. The impact assessment of the transportation aspects related to the proposed mine activities was determined based on the evaluation of the following worst-case traffic scenarios:

- **Construction phase - Total AM and PM Peak Hour Traffic Volumes with development traffic.**
- **Operational phase - Total AM and PM Peak Hour Traffic with development traffic during steady state production.**

During decommissioning phase, the traffic impact is negligible, therefore, a capacity analysis was not conducted for this scenario.

Refer to Section 3 of the TIA attached as Appendix 6.9 for a detailed description of the methodology used.

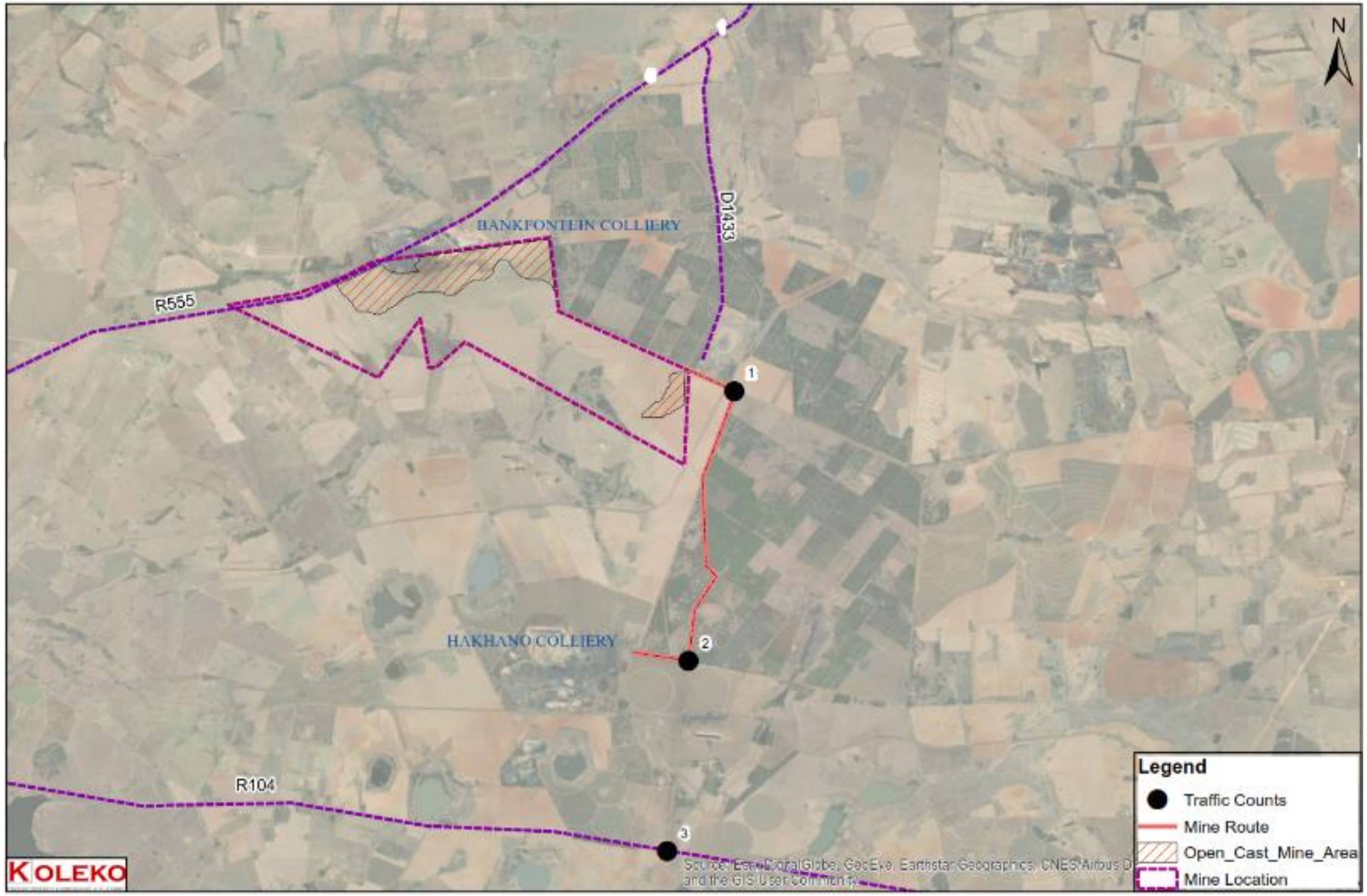


Figure 113: Proposed mine route in relation to the surrounding roads

13.2.13.1 Construction phase

It is expected that the construction vehicles will travel from Middleburg Town via the R104 to the proposed mine. Construction equipment that will consist of trucks, excavators, dumpers, compactors and pick-ups would be deployed at the site and remain on site, as far as possible, for the duration of the construction period. There will be supervisors at the site to guide the construction processes.

Additional 20 vehicle trips will be generated during the peak hour periods by the proposed development onto the external roads. As a result, the following potential impacts were identified:

- Road safety conditions could be impacted negatively by an increase in heavy vehicles.
- Impact on pedestrians and cyclists – potential conflict of site vehicles with pedestrians that may be walking on the external roads.
- An increase in traffic on the road which increases the chances of deteriorating the road.

The capacity analysis results show that the intersections under investigation are anticipated to operate at acceptable Level of Service (LOS) and under capacity i.e., the surrounding road network has sufficient capacity to accommodate the future traffic demand generated by the proposed development during the construction phase.

13.2.13.2 Operational phase

During the operational period, the materials will be transported by 34-ton tipper trucks and a maximum capacity of 90 000 tons/month ROM will be produced at the mine. The transport requirement, during the operational phase, for the proposed mine would consist of transportation of mined materials, public transport for employees as well private vehicles of supervisors.

Additional 58 vehicle trips will be generated during the peak hour periods by the proposed development onto the external roads. As a result, the following potential impacts were identified:

- Road safety conditions could be impacted negatively by an increase in heavy vehicles.
- Impact on pedestrians and cyclists – potential conflict of site vehicles with pedestrians that may be walking on the external roads.
- An increase in traffic on the road which increases the chances of deteriorating the road.

The capacity analysis results show that the intersections under investigation are anticipated to operate at acceptable Level of Service (LOS) and under capacity i.e., the surrounding road network has sufficient capacity to accommodate the future traffic demand generated by the proposed development during the operational phase.

13.2.13.3 Decommissioning/rehabilitation and post closure phase

The decommissioning phase is expected in the year 2030 and will take place for a period of 6 months. The traffic volumes during this phase will be considerably lower than the construction and operational phases and therefore it is expected that the traffic impact will be negligible.

13.2.14 Socio Economic

CHEMC Environmental was appointed to undertake a Socio-Economic Impact Assessment (SEIA) for the proposed Driefontein Mine. This section discusses the potential socio-economic impacts anticipated during all three phases of the project in terms of:

- Local economy
- Influx of jobseekers
- Community /institutional arrangements
- Individual and family needs
- Infrastructure and services
- Health

13.2.14.1 Construction phase

The construction phase should take place over approximately 8 months. Although temporary in nature, possible positive and negative impacts could manifest. The potential impacts are discussed under the headings below.

13.2.14.1.1 Creation of local employment opportunities

The significance of the impact on the local economy will depend on the number of locals employed; preference given to local contractors and service providers; the duration of the construction period; and policies of the mining company with regards to procurement so that the local SMMEs can prepare for the tender process. For this project's construction phase employees will be sourced from the current Canyon Mining Services workforce (such as Hakhano Colliery) as far as possible, along with contractors for specialised construction tasks. Therefor minimal impact on local employment is anticipated as exiting workers and contractors will be sourced from Canyon Mining existing labour sending areas. Positive consequences of the impact could increase if locals and contractors from Ward 9 or the wider STLM are employed for construction and specialised tasks.

13.2.14.1.2 Utilization of new HDSA supplies, SMME and other small businesses as a result of local procurement

Local SMMEs and other local contractors required for construction would typically include labour for trenching, digging and erection of infrastructure, catering, transport and so forth. Procurement from international companies for major components and engineering services will most likely be required. Canyon Resources has an existing Preferential Procurement Policy and Plan (Draft Project SLP) and also need to comply with the Mining Charter, 2018 (***Broad-based socio-***

economic empowerment Charter for the Mining and Minerals Industry, 2018) Scorecard, which aims to benefit local SMMEs and suppliers:

- Procure 70% locally manufactured mining goods with a 60% local content, of which:
  - 21% spent on SA manufactured goods produced by HDSA persons / companies;
  - 5% spent on SA women or youth company; and
  - 44% spent on BEE compliant company.
- Procure 80% Services from local service providers, of which:
  - 50% spent on HDSA Persons.
  - 15% spent on women owned / controlled companies.
  - 5% spent on youth owned companies; and
  - 10% spent on BEE compliant companies.

It is anticipated that existing contractors of Canyon Resources will be utilised for specialised construction activities and positive impacts on new HDSA suppliers, SMMEs and other small businesses are anticipated to be minimal but can be enhanced through the implementation of the recommended mitigation measures.

13.2.14.1.3 Income generated through the sale of agricultural land for mining purposes

The land is privately owned by three entities and Mr. Jan Roux (Trustee of Driefontein 398 Trust – Portion 5 of Driefontein 398-JS; and landowner of Portion 6 of Driefontein) also leases Portion 6 of Sterkstroom 400-JS from this landowner. The largest part of the proposed project area is cultivated and is classed as high potential arable land. Current market value of the land is unknown but will be impacted by the high agricultural value of the land. The high net farm annual income (7,4 million over the entire farm or R3.5 million over 471 ha mining area) will most likely also impact the amount budgeted to acquire the land. This impact should be assessed in more detail by a Valuer, if so required. It is the intent of Canyon Resources to acquire the directly affected land at market related prices, but this will only be negotiated with the landowners at the relevant time (Project MWP). Although an income will be generated ('positive impact') through sales agreements, affected parties will experience the impact as 'negative' due to the loss of livelihoods.

13.2.14.1.4 Increase in salaries and wages, and local procurement of goods (limited) and service

As a result of new contracts with HDSAs, SMMEs and local service providers, an increase in salaries and wages, and local procurement of goods (limited) and services, a positive impact on the local economy is usually expected. However, in the case of the Driefontein Mine's construction phase these impacts are deemed to be limited. Local economic spin-offs as a result of the construction phase could further include contractors that reside in local B&B's and guesthouses; positive impacts for local merchants and grocery stores as a result of higher spending power; and a possible increase in informal traders.

There is a low probability that the construction phase will impact slightly on the general local economy of the STLM. Apart from the appointment of locals and local Contractors where new people need to be recruited, mitigation will not change the outcome of the impact.

13.2.14.1.5 Loss of agricultural income

The construction and erection of surface infrastructure; loss of land; the movement of construction vehicles; and construction of new access roads, the construction camp and so forth could have a negative impact on farming (dust, noise, security and theft, etc.) during the construction phase.

13.2.14.1.6 Influx of jobseekers

Informal settlements in the broader NDM are evident near mines which developed as a result of an influx of "outsiders" and jobseekers. Negative impacts include:

- An increase in local unemployment, especially amongst the youth and unskilled, if jobseekers remain post-construction.
- Potential conflict between locals and "outsiders" that compete for employment opportunities and other resources.
- Increase in the number and size of informal settlements.
- A potential increase in crime and other social issues in the direct vicinity of the application area and in the STLM area (drug abuse, prostitution, etc.).
- Impacts on spatial planning (retail space, office space, industrial land, residential units); and
- Additional pressure on local government to provide housing, services, employment and so forth.

Discussions with members of council indicated that this impact is unlikely to manifest if the mining company is transparent in their communication with the STLM to avoid unrealistic job expectations.

13.2.14.1.7 Increase in conflict as a result of construction related and employment issues

Conflict during the construction process, resulting in labour disputes and strikes, as well as negative attitude formation towards Canyon and the local Council, could manifest as a result of:

- Beneficiary communities and individuals that feel excluded from the process if they were not considered for construction jobs.
- Outsiders that receive preference for construction related opportunities.
- Poor communication with the local communities in terms of the needs and requirements of SMMEs and insufficient training for small businesses, resulting in SMMEs from outside the impact area that are awarded contracts; and
- Unsatisfactory salaries and wages.

A lack in transparency with regards to the construction and employment processes, and so forth. Canyon aims to deploy current workers and contractors from their existing labour sending areas and this impact, should it manifest, will have minimal overall significance for the region.

13.2.14.1.8 Disruptions in daily living and movement patterns for surrounding landowners and communities due to higher traffic volumes and intrusion impact (dust, noise, light pollution, etc.)

Disruptions in daily living and movement patterns for surrounding communities, landowners, tenants and road users could manifest in the form of higher traffic volumes and intrusion impacts (dust, noise, light pollution, etc.) due to an increase in construction vehicles, resulting in short-term disruptions and safety hazards.

Damage to road surfaces could result in road accidents and temporary road closures (unforeseen) could contribute to an increase in frustration levels. For this project construction will involve the operation of construction equipment which will consist of trucks, excavators, dumpers, compactors and pick-ups. Equipment will remain on site during the construction period but according to the TIA an additional 20 vehicle trips will be generated during the peak hour periods by the proposed development onto the external roads during construction. To gain access to the site, the R104 district road and the D1433, existing gravel road, which connects the R555 and R104, will be used. Trucks and construction vehicles that transport coal to and from the surrounding mines already make use of these roads. At this stage it seems that the landowner and construction vehicles will use the same entrance to gain access to the Project Area and broader farm; and the haul roads will traverse farmland before reaching the construction site.

Intrusion impacts refer to noise, visual and light pollution, aesthetic impacts and dust/air pollution during the construction phase, as a result of emissions, movement of construction vehicles on site, earthworks, blasting and general construction activities. These impacts are investigated and rated individually in a scientific manner by the respective Specialists as part of this EIAR. From a Socio-Economic perspective, intrusion impacts as perceived by the community and affected parties are assessed. Although short-term in nature, the severity of the impact would increase if sensitive receptors are located close to the construction areas. Consequences of the impact may only be partially reversible as permanent health impacts (respiratory diseases due to air pollution) may result.

There is an existing mine (Bankfontein) north of the application area and intrusion impacts have most likely already manifested for road users on the R555 as well as for crops and livestock. During the construction phase of this project, these negative impacts could increase. At the southern mining area, construction activities, blasting and so forth could impact on the farmstead and its residents located on Portion 6 of Farm Driefontein 398-JS (dust, noise, aesthetic impacts and so forth). Refer to Section 13.2.12 for a detailed discussion regarding the potential blasting and vibration impacts.

13.2.14.1.9 Damage to surrounding road infrastructure

Road infrastructure could be impacted and damaged as a result of an increase in the number and movement of large trucks and construction vehicles. Financial impacts could manifest for the STLM in terms of road maintenance. Safety and financial impacts are possible for road users should private vehicles be damaged.

13.2.14.1.10 Health and safety risks for workers

Inadequate management of the construction process and general construction related activities could result in health and safety risks for workers, manifesting in the following ways:

- Construction related accidents due to structural safety of project infrastructure, which could result in death.
- Dust generation and air pollution resulting in respiratory diseases.
- High ambient noise levels caused by machinery and construction equipment, resulting in loss of hearing or other similar health issues.
- Pollution problems, flies, rodents and pests and possible contamination of water sources due to poor management of the construction activities (e.g., insufficient sanitation facilities, littering and refuse).
- Dehydration, sunburn, and related issues due to unsafe and insufficient drinking water and high temperatures during summer months; and
- An increase in HIV/AIDS and other STDs due to prostitution activities and temporary sexual relationships with local women, unwanted pregnancies that place further pressure on Basic Health Care Services.

Construction related accidents and other health issues due to construction processes could result in serious injury and even death, but proper mitigation and management of the construction process will significantly decrease the probability of the impact occurring.

13.2.14.1.11 Community health and safety risks

Community health and safety impacts as a result of poor management of the construction site and activities could include:

- Road accidents, subsequently placing pressure on local emergency, disaster management and health services (fire, ambulance, police services, etc.).
- Unauthorized access / trespassing at the construction site, resulting in theft, public safety issues and even death.
- Fire hazards at the construction site and the possibility of fires spreading and damaging surrounding farmland and infrastructure.
- High ambient noise levels that damage hearing (blasting); and
- Dust generation and air pollution caused by gravel roads, construction activities, blasting and machinery resulting in respiratory diseases.

The risk/likelihood of the impact manifesting as well as its severity will, to a large extent, depend on the proximity of sensitive receptors (residences, farming activities, livestock, etc.) to the construction site. It is required of the mining company to comply with all the provisions of the Occupational Health and Safety Act 85 of 1993 in order to mitigate potential health and safety issues.

Although community health and safety risks could result in death and severe damages the duration of the potential impacts is short-term, and the probability can significantly be reduced through proper mitigation and management of the construction process.

13.2.14.2 Operational phase

The potential impacts of socio-economic nature foreseen for the 7-year LoM are discussed below.

13.2.14.2.1 Creation of local employment opportunities

Once operational the planned labour force is envisaged to be 240 to 250 employees. Of these, nine will be permanent mine employees and approximately 240 will be mine and core business contractor employees (Driefontein SLP).

Table 91: Employment breakdown

Position		Breakdown
Mine employees		
Skilled	Directors Mine Manager Engineer Financial & HR manager Accountant Weighbridge operators SHE officer	3,6%
Mine and core business contractor employees		
Skilled Semi-skilled Unskilled	Coal Handling and Loading: 18 employees Services: 18 employees Railway siding: 18 employees Transport: 36 employees Opencast Mining: 150	96,4%

It is expected that the mine workforce will be recruited once the mining right is granted. Three months prior to mining commences, approximately 240 employees will be appointed by the main mining contractor.

In line with the Mining Charter 2018, Driefontein Mine will implement a Human Resource Development Programme and Skills Development Plan to address the operational requirements and to respond to an employee’s future employment aspirations, to enable HDSA’s to apply for increasingly senior level and management positions at the mine. On the job training will also be provided and due to the relatively small labour force, absentees in certain categories of work will have another employee executing their required task. For this reason, several categories of employees will be trained in two or more categories of work (Driefontein SLP).

In could be expected that temporary employment will also become available periodically for civil works and site maintenance, site clearance, painting of buildings and small maintenance jobs, such as plumbing. The employment of these temporary workers would usually be done through a contractor and the numbers cannot accurately be determined at this stage.

The number of employees (240 to 250) is not significant and social functions and processes are only temporarily altered. The number of employees required are fixed and as such no mitigation is proposed. However, the positive economic spin-offs of employment could be enhanced if the maximum number of locals from the STLM are considered for the job opportunities.

13.2.14.2.2 Utilization of new HDSA supplies, SMME and other small businesses as a result of local procurement

The Mining Charter sets standards for mining companies to give preferred supplier status to BBEEE companies in its aim to enhance local economic impacts. During the operational phase, contracts with small local businesses could include contractors to transport and dispose of domestic and industrial waste; equipment cleaning (trucks, machinery, etc.); maintenance and repairs of infrastructure and roads; operation of tuck shops and recreational facilities; laundry and catering services; gardening; security; logistics; etc.

Canyon’s SMME promotion and development business model addresses the promotion of this group of enterprises in the development and operation of the mine. Strategies that will be implemented for Driefontein Mine’s procurement needs include (Driefontein SLP):

- Develop a Procurement Policy, commitments and mechanism by accessing the Department of Trade and Industry’s (“DTI”) assistance programmes within one month of obtaining a mining right.
- Consult STLM to identify potential local SMME/BEE suppliers from their vendor/BEE/SMEE databases; and
- Proof of BEE Verification Certificates, tax clearances and so forth to confirm the status of the SMME/BEE companies.

The Procurement Policy will investigate the possibility of breaking down larger contracts into smaller manageable contract portions to be awarded to HDSAs; and the intention is for the mine committee to purchase the required equipment, provide materials to start operations and set up the required systems as well as LED projects (Driefontein SLP). This policy will be finalised once the mining right has been awarded and will be aligned with the new Mining Charter, 2018 Scorecard (refer *Section 13.2.14.1.2* above on new HDSA suppliers, SMMEs and other small businesses, for the Scorecard breakdown).

The amount allocated towards procurement in the operational phase is unknown at this stage however implementation of the new Mining Charter local procurement targets would increase the probability of the impact occurring.

13.2.14.2.3 Increase in salaries and wages, and local procurement of goods (limited) and service

During the operational phase, the local economy could benefit in the following ways:

- A possible increase in municipal rates and taxes, as the land would be rezoned from "Agriculture" to "Special Use for Agriculture and Mining", resulting in higher levels of rateable income.
- Local communities would benefit economically through the SLP programmes and LED projects.
- The establishment of new local suppliers and services established and possibly trained by the mine. Canyon is committed to ensuring the growth of HDSA suppliers, local empowerment groups and local BEE companies through an affirmative procurement strategy with the purpose to enhance real transformation of the mining industry supplier community (*Driefontein SLP*).
- An increase in wages, salaries and spendable income and economic spin-offs for general dealers, transport services, informal traders and so forth.

13.2.14.2.4 Loss of high potential farmland

The 'Agricultural Potential Assessment of the Driefontein Mine Area' (INDEX, April 2019) concluded that the application property is a productive farming unit. The largest part of the proposed mining area is cultivated and is classed as high potential arable land. Assuming that the agricultural income loss will be on the full MRA (907ha) since agricultural activities will most likely not proceed due to the fragmentation of agricultural land within the 7-year LoM and the uncertainly regarding future land-use within the MRA a gross income of R18,1 million per year and a net farm income of R7,4 million, after depreciation and overhead costs will be lost. It is the intent of Canyon Resources to subdivide and purchase the affected portions for mining purposes and implement a sequence approach to mining which could allow agricultural activities to continue alongside operations. This will be largely dependent on the adherence to correct mitigation and management measures and whether the landowner will be willing to continue farming on the MRA, but should agricultural activities continue alongside mining the economic impact will be significantly reduced to R9,595 million gross and R3,05 million net farm income lost.

13.2.14.2.5 Loss of access to livelihoods

A loss of access to livelihoods is thus imminent as a result of loss of high potential farmland and job losses, and could further be impacted by the following mining related activities and impacts:

- Impacts on ground- and surface water quantities and potential water pollution, affecting livestock and crops.
- Noise and dust generation on access roads and near the surface infrastructure that damage crops and grazing and affecting livestock and human health.
- Possible mismanagement of waste, coal spills and insufficient hazardous substance storage that causes dust and water pollution and impacts livestock and human health.
- An increase in stock theft (security impacts) as a result of the influx of jobseekers and jobless people.
- Livestock being killed due to speeding and negligent driving; and so forth.

It is estimated that the loss in productive agricultural land will result in approximately 65% job losses of current farm workers. As of May 2019, the farmer employs 21 workers and approximately 13 to 14 employees could be retrenched once the mine is operational (*Mr. Jan Roux, Landowner. 7 May 2019 interview)*. Negative economic impacts on current employees and their families as a result of job losses are highly probable and is regarded as permanent, as it will occur beyond the lifespan of this project.

Mitigation will address the possible impacts that could manifest (water pollution, dust, crime and so forth), but cannot address the loss of incomes/livelihoods experienced as a direct loss of agricultural land.

13.2.14.2.6 Decrease in land values

A variety of factors could impact land values of directly affected farm portions and surrounding farmland:

- The quality and availability of water for domestic and farming purposes.
- Intrusion impacts, such as noise and dust, which could have an impact on crops and livestock.
- Criminal activities (theft, vandalism, etc.).
- Occurrence of informal settlements, trespassing on private land, illegal grazing.
- Pre-requirements and restrictions set by the mining company in terms of new infrastructure developments on private properties.
- Fragmentation of agricultural land (subdivisions); and so forth.

Although a few existing mines are operational in and around the study area, the study area is still mostly characterised by rural land uses, farming activities and high potential soil. According to the ECBA (June, 2022), based on a number of interviews conducted with property valuers in the local area, there is a risk that property values in the local area could depreciate due to a mine in close proximity. Current agricultural land value adjacent to the mine varies between R13 000 to R 15 000 per hectare. According to property agents these values could decline by around 20% for land areas about 10 km from the opencast mine and mining infrastructure. The decline in property values could be ascribed to disamenity factors such as increases in traffic and large vehicles; blasting activities; dust and noise impacting negatively on sense of place.

The negative impacts on property values are more likely to negatively affect the southern, western and eastern areas adjacent to the mine and, to a lesser extent, the areas north of MRA due to other disamenity sources already present in the areas north of the mine.

One small holding (22 hectares) was identified approximately 1km from opencast mining activities on Portion 6 of Sterkstroom 400-JS. This property hosts 5 housing units and 3 workshops and would most likely suffer a high disamenity (and property value impact) due to the mining activities, even if environmental management measures are strictly adhered to in order to minimise the nuisance impacts on the property. While these disamenity impacts are only expected to last for the duration of the mining operations (7 years), the severity of the impacts would necessitate active mitigation measures.

13.2.14.2.7 Influx of outsiders/migrant workers

The prospect of work opportunities could attract jobseekers, contractors and migrant workers into the area. This occurrence is visible throughout the wider NDM where numerous villages and informal settlements have established in close proximity to mines and power plants (*Examples: Mahlathini community at Goedehoop South; Masakhane Village at Mooifontein Colliery*). Since these settlements are usually established on private land, neither the mines nor the municipalities are willing to take responsibility of evictions at the early stages of the project, nor provision of services to these settlements at the later stages. This results in numerous long-term negative impacts for the private landowners, municipality and the local communities alike.

In addition to the above, the proposed Driefontein Mine’s provisional labour sending areas are (Driefontein SLP):
30% would be drawn from the STLM area, as the direct sending region.
35% would be drawn from the Mpumalanga sending region; and
35% would be drawn from other sending regions in South Africa.

The employment of an outside workforce and contractors from outside the municipal boundaries could attract family members and other jobseekers, thereby contributing to the associated negative impacts, listed below:

- Conflict due to locals and ‘outsiders’ competing for the same resources and locals perceiving that their ‘jobs’ are being stolen.
- Additional pressure on the STLM to provide housing and social services, resulting in the erection of illegal structures, backyard shacks and informal settlements.
- Security impacts and an increase in criminal activities due to an increase in local unemployment; and

- Population impacts placing demands on the provision of services (water, sewerage, electricity) and resulting in environmental degradation.

13.2.14.2.8 Skills development, training and capacity building

The Mining Charter, amongst others, enforces the implementation of a SLP. This document is in line with and compliant to the local municipality's IDP and LED objectives and does therefore not function in isolation. Once the SLP is approved and Canyon is granted the mining right, Canyon will be legally required to comply with it. It is revised every 5 years and sets out how the company intends to share some of the benefits that flow from mining. Outputs of the SLP community projects are usually streamlined with the IDP priorities and co-operation and collaboration with the LED Unit of STLM is thus required.

The primary objective of human resource development programme is to ensure development of requisite skills in respect of learnerships, bursaries (of core and critical skills), artisans, ABET training (level I, II, III, IV and NQF 1), other training initiatives reflective of demographics as defined in the amended Mining Charter. Driefontein Mine's 5-year financial provision for Human Resource development is reflected in the Table below.

Table 92: Financial provision for human resource development (*Driefontein SLP*)

Programme	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
Learnerships	92 700	92 700	92 700	92 700	92 700	463 500
Bursaries	450 000	450 000	450 000	450 000	450 000	2 250 000
Internships	112 320	112 320	112 320	112 320	112 320	561 600
Portable skills	20 000	20 000	20 000	20 000	20 000	100 000
ABET	62 500	62 500	62 500	62 500	0	250 000
TOTAL	**737 520**	**737 520**	**737 520**	**737 520**	**675 020**	**3 625 100**

13.2.14.2.9 Upliftment of communities through LED programs

The purpose of the LED programme and projects is to seek upliftment opportunities and to alleviate poverty within the labour sending area of the project, but simultaneously to ensure that livelihoods created during the LED phase will be able to survive independently after Canyon has exited each programme and more specifically after the mine has closed. The focus is thus on long-term sustainability of entrepreneurship, job creation and incomes.

It is strongly recommended that discussions with the STLM LED Unit be conducted to determine needs within Ward 9. Ward 9 is directly impacted by the project and benefits of the project, such as infrastructure development and community development projects, should aim to accrue to beneficiaries within this ward prior to rippling to the wider STLM (*Mr. J Nkosi, LED Manager: STLM. 3 May 2019*).

With mitigation locals closer to the project (project impact area) could benefit.

13.2.14.2.10 Income generation and contract opportunities for HDSA's

Canyon is committed to ensuring the growth of HDSA suppliers and undertakes to maximize the value of cost effective and reliable procurement of capital goods, consumables and services from companies owned and controlled by HDSAs of the affected communities from the area in which the Project operates.

Although the exact numbers and amount allocated to HDSA procurement during the operational phase have not been calculated, the targets for HDSA Procurement based on Mining Charter, 2018 Scorecard are used. At least 70% will be spent on HDSA services, 50% HDSA spent on consumables and 40% HDSA spent on capital goods at the mine. The contract between the mining right holder and the supplier must be for a minimum of five years and terms may not be less favourable than for larger well-established companies. With mitigation and by ensuring that the HDSA guidelines of the Mining Charter are implemented, the impact will almost certainly occur.

13.2.14.2.11 Negative community mobilization against the project

No negative community mobilisation against the project has been observed. The landowner and adjacent landowners are, however, not positive towards the project as it is highly likely that this project will result in loss of incomes and livelihoods; intrusion impacts due to dust and noise; and the potential of environmental degradation and water pollution, which will further impact his farming activities and livelihood of his workers, land values and quality of life.

Additional factors that could contribute to failed processes for consultation and subsequent community mobilisation against the project include:

- Beneficiary communities and other locals who perceive that the benefits of jobs do not accrue to them.
- Tensions due to limited local procurement contracts.
- Unrealistic expectations regarding SLP outputs, community projects, timeframes, etc.
- Differences in customs between the mining company and the local communities and a CLO that does not understand local customs; and
- Negative impacts on the environment, an influx of outsiders, and the perception that the mine does not take responsibility.

On-going consequences of failed processes for consultation and negotiations could then result in:

- Temporary disruptions at the project, resulting in temporary mine closures and loss of income for Canyon.
- Financial implications for both Canyon, local community(ies) and private landowners should legal recourse be pursued.

- Fragmentation of community leadership, divisions amongst the locals and destruction of their local customs, which could result in further environmental and social degradation (increase alcohol and drug abuse, crime, prostitution etc.).

Continuous engagement with relevant parties through the CLO and Future Forum / an Environmental Monitoring Committee and commitment to implement actions and address issues are imperative management tools.

13.2.14.2.12 Labour disputes during operations

Labour disputes and strikes during the operational phase are always a possibility. Conflict in SA's mining environment is, amongst others, usually the result of the workers / Unions perception of:

- Promises made by the mining company that are not being fulfilled.
- Unfair labour practices and unsatisfactory salaries and wages.
- The intended positive impacts of the SLP that do not reach beneficiaries or when the SLP projects and process move too slow; and
- Poor communication with the workers should the HR Manager, mine management and CLO not be transparent, understand local customs and so forth.

The result of conflict / labour disputes and strikes could extend beyond financial implications for the project as job losses, economic impacts for locals, environmental degradation and even death could occur due to violent protests however, the impact can be mitigated through proper communication and transparency.

13.2.14.2.13 Increase in crime and security issues

Crime and security issues during operational phase are often associated with the influx of outsiders and an increase in jobless people into the area. An increase in human activities, roads that become more accessible for the wider public, and materials and equipment that are brought to site could attract criminals.

13.2.14.2.14 Change to the sense of place

Sense of place refers to the way that the affected parties perceive their social and biophysical environment and to what extent this perception will be altered as a result of the development. The proposed mine is located on private land owned by the families for at least two generations. The properties are productive farming units (crops and livestock) and approximately 51% of arable land will be lost to mining. Mining related activities such as increases in traffic and large vehicles; potential influx of workers and erection of illegal structures; blasting activities; safety and security issues; pollution of air and groundwater resources; as well as loss of livelihoods will undoubtedly impact negatively on sense of place.

It is almost certain that 'sense of place' will be significantly negatively altered but the significance of the impact can be reduced through the implementation of the recommended mitigation measures.

13.2.14.2.15 Relocation of individuals and households

No families and households will be forced to relocate as a result of the project. However, factors associated with the mining operations (intrusion impacts, loss in incomes, job losses on the farm, etc.) could encourage the landowner and farm workers to relocate due to downscaling and the sale of the farm portions, if it occurs.

13.2.14.2.16 Disruptions in daily living and movement patterns for surrounding landowners and communities due to higher traffic volumes and intrusion impacts (dust, noise, light pollution, etc.)

ROM coal will be transported for processing to the Hakhano Colliery (south of the Project Area) or another licensed site using haulage trucks with a loading capacity of 34 tons each. The TIA indicated that an additional 58 vehicle trips will be generated during the peak hour periods by the proposed development onto the external roads. The gravel access road that connects the R555 and R104 will be used and at this stage it seems that the farmer and mine vehicles/haulage trucks will make use of the same access gate onto the property. In addition to this, the farm road that connects the farmstead on Portion 6 of Driefontein 398-JS with the farm entrance, runs through the proposed southern mining area, making road users especially vulnerable for road safety and other impacts associated with traffic.

Dust, noise, road safety issues and environmental degradation due to oil spills could manifest for the residents on the property, surrounding landowners, road users and livestock.

It is almost certain that traffic and negative impacts associated with an increase in vehicular movement will occur. Mitigation will reduce the severity of the impact but will not stop the impact from manifesting.

13.2.14.2.17 Decrease in the quality of life due to intrusion impacts (dust, noise, light pollution, etc.)

General intrusion impacts could manifest for residents on the farm and surrounding landowners, negatively impacting their quality of life:

- **Dust/air pollution (health issues for humans and livestock, negative impacts on crop production, etc.).**
- **Noise pollution; and**
- **Light/aesthetic pollution.**

The severity of this impact will increase if sensitive receptors are located in close proximity to the activities generating the impacts.

- The farmstead on Portion 6 of Driefontein 398-JS could potentially be impacted, as it is located approximately 650m from the southern opencast mining area.
- The farmstead on Portion 6 of Sterkstroom 400-JS is situated approximately 1 km from the northern mining area and could potentially experience intrusion impacts.
- Cumulative impacts could impact for road users on the R555 as the existing Bankfontein Colliery undoubtedly already contributes to dust and other intrusion factors.

13.2.14.2.18 Health and safety risks for workers

Occupational health and safety guidelines aim to promote and maintain the highest degree of physical, mental and social well-being of workers; the prevention of departures from health caused by working conditions; the protection in their environment from health risks; and the placing and maintenance of workers in an occupational environment adapted to his/her physiological and psychological capabilities. Possible health and safety risks for workers at the proposed mine would mainly revolve around respiratory diseases as a result of dust; exposure to machinery and blasting where high noise levels occur; and possible accidents on site that could result in death.

13.2.14.2.19 Community health and safety risks

Mismanagement of the mining operations could result in community health and safety issues for surrounding landowners and residents. Possible impacts during the operational phase are similar to those that could be experienced during construction and could include:

- Unauthorized access / trespassing at the mining area, resulting in theft, public safety issues and even death of people and livestock.
- Veld fires and the possibility of fires spreading and damaging private land and structures, mine infrastructure, livestock and crops.
- Dust generation and air pollution caused by gravel roads, vehicle emissions and the mining activities resulting in respiratory diseases, especially for residents close to the project area and along access roads.
- Contamination of ground and surface water resources for humans and livestock; and
- An increase in STDs, HIV/AIDS and other communicable diseases, as a result of an increase in prostitution activities and so forth.

13.2.14.3 Decommissioning/rehabilitation and post closure phase

Decommissioning is expected to take place over a period of 6 months. However, rehabilitation will have to be completed prior to the DMRE issuing a Closure certificate. Infrastructure will be removed, and the mining area will be rehabilitated according to best practice and most viable options as determined in the closure plan. Impacts similar to those experienced during the construction phase are anticipated and similar mitigation and management measures to be applied.

- Traffic and intrusion impacts.
- Potential security issues.
- Impacts on road infrastructure; and
- Health and Safety impacts.

In addition, large scale job losses and retrenchments will occur and if not well managed during decommissioning phase, the proposed mine may also pose injury risks, for example via falls, drowning, land slips and derelict buildings.

13.3 Assessment of each identified potentially significant impact pre and post mitigation

Please refer to the tables below for an impact assessment for each phase of the activity as per the DMRE's requirements. The Impact Assessment below assesses the significance of the potential environmental impacts pre- and post-mitigation as described under Section 13.2 above and numbered accordingly. The table also distinguishes between different alternatives if the potential impacts and/or significance rating will change.

Please note, the different specialists did not have a uniform impact assessment methodology therefore the results from each studies impact assessment have been incorporated into the quantitative findings presented in the impact assessment tables using uKhozi's impact assessment methodology.

Table 93: Construction Phase - Impact Assessment

Potential Impact Description per Environmental Aspect: Construction phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation Measures	Significance Post-Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
Geology															
Disturbance of geological profile.	Direct Negative	12.2.1.1	1	5	6	(12)	5	Medium (60)	Mining must be conducted strictly according to the MWP submitted to the DMRE. Comply with the recommendations made by the blasting and vibration specialist.	1	5	4	(10)	5	Medium (50)
Topography															
Alteration of the natural topography.	Direct Negative	12.2.2.1	2	2	4	(8)	5	Low (40)	Site establishment and soil stripping must only take place in designated areas.	1	2	4	(7)	5	Low (35)
Soils, land use and capability															
Soil erosion	Direct Negative	12.2.3.1.1	2	2	8	(12)	4	Medium (46)	Land clearance must only be undertaken immediately prior to construction activities and only within the development footprint. Stockpile different soil horizons in different areas and keep inventory of stockpiles. Trucks, equipment, and other vehicles must park on designated parking areas and not create additional areas at risk of soil erosion by parking outside of the demarcated areas. Where possible, conduct the construction activities outside of the rainy season. Reduce storm water runoff on roads by installing cut-off strips on dirt roads.	1	2	8	(11)	3	Low (33)
Soil compaction	Direct Negative	12.2.3.1.2	2	2	8	(12)	4	Medium (46)	Vehicles and equipment must travel within demarcated areas and not outside of the construction footprint. Materials must be delivered to a designated laydown area.	1	2	8	(11)	3	Low (33)
Soil pollution	Direct Negative	12.2.3.1.3	1	1	6	(8)	3	Low (24)	Maintenance must be undertaken regularly on all vehicles and construction/maintenance machinery to prevent hydrocarbon spills. Drip trays must be used when working on vehicles. Any waste generated during construction, must be stored into designated containers and removed from the site by the construction teams.	1	1	6	(8)	2	Very low (16)

Potential Impact Description per Environmental Aspect: Construction phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation Measures	Significance Post-Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
									Any left-over construction materials must be removed from site.						
Loss of soil quality	Direct Negative	12.2.3.1.4	2	4	8	(14)	5	High (70)	Implement mitigation measures under soil erosion, compaction and pollution listed above. Stockpile soils per horizon (not mixing different soil horizons) and vegetate stockpiles.	2	3	8	(13)	4	Medium (52)
Terrestrial Biodiversity (Flora & Fauna)															
Loss of natural vegetation and intact floral habitat.	Direct Negative	12.2.4.1	1	2	8	(11)	4	Medium (44)	Construction vehicles should only use existing access roads as far as possible. Demarcate construction areas by semi-permanent means/ material, in order to control movement of personnel and vehicles, and ensure that all construction activities remain within this footprint. The proposed development footprint area should remain as small as possible.	1	2	8	(11)	2	Low (22)
Loss of plant species, floral diversity and floral SCC.	Direct Negative		2	2	8	(12)	4	Medium (48)	Avoid direct and indirect disturbance of high and intermediate sensitivity floral habitat during the construction phase by establishing the recommended buffer zones (67m for construction). No new access roads are to be allowed within ecologically sensitive areas. All the natural grassland areas along the southern boundary of the study area and within adjacent areas should be designated as No-Go areas for personnel and construction vehicles, with the exception being should personnel require access on foot for alien and invasive species control. The collection of plant material for medicinal or other purposes within the study area should be strictly prohibited. Open fires by construction personnel, unless within areas designated for this purpose, should be prohibited.	1	2	8	(11)	2	Low (22)
Degradation of vegetation within the study area and surrounds due to dust, alien invasive floral species and erosion	Indirect Negative		3	2	6	(11)	4	Medium (44)	Dust suppression procedures should be implemented during the construction phase of the project to reduce and control dust on the access roads and within operational areas. Topsoil stockpiles should be vegetated and managed accordingly to avoid dust generation.	2	2	6	(10)	3	Low (30)

Potential Impact Description per Environmental Aspect: Construction phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation Measures	Significance Post-Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
									A rehabilitation plan for the mine must be developed as soon as possible, taking concurrent rehabilitation and re-vegetation requirements into consideration. An alien and invasive species eradication strategy should be developed at the onset of the project for implementation throughout all development phases. The volume of vegetation cleared should be limited to that which is required for construction.						
Loss of faunal habitat.	Direct Negative		1	2	8	(11)	4	Medium (44)	Avoid construction in areas designated as having increased ecological sensitivity. Locate construction camps away from highly sensitive areas. Before construction, demarcate the servitude of infrastructure and mining activities and ensure that construction impacts are contained within this area. If necessary, these areas may be fenced or, alternatively, that nearby Highly Sensitive areas are fenced to ensure no access. Use existing roads as far as possible and ensure that unnecessary impacts on natural vegetation do not occur, e.g., driving around remaining natural areas.	1	2	8	(11)	2	Low (22)
Fragmentation of faunal habitats.	Cumulative Negative		3	2	8	(13)	4	Medium (52)	Ensure that natural habitats within the study area are kept intact – specifically those that are connected to other natural areas outside the study area extent. Allow for the movement of faunal species through the human modified matrix to maintain metapopulation dynamics and prevent local extinctions.	2	2	8	(12)	2	Low (24)
Harm to faunal SCC.	Direct Negative		2	2	8	(12)	3	Low (36)	All personnel should undergo induction with regards to fauna to ensure particular awareness about not harming or collecting species such as snakes, skinks, birds and tortoises. Any fauna threatened by the construction activities should be removed to safety by the environmental control officer or appropriately qualified environmental officer. Collection of any species, eggs or nests should not be tolerated.	2	2	6	(10)	2	Very low (20)

Potential Impact Description per Environmental Aspect: Construction phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation Measures	Significance Post-Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
Disturbance of nesting avifaunal species in natural areas	Direct Negative		3	2	6	(11)	4	Medium (44)	Disturbance (e.g., noise, dust) should be avoided near areas identified as sensitive in this assessment. Noise emanating from construction machinery and equipment should be kept at a minimum by the fitting of exhaust silencers and through the regular maintenance of construction vehicles and equipment.	2	2	6	(10)	3	Low (30)
Surface water															
Alteration of water quality	Direct Negative	12.2.5.1.1	4	2	8	(14)	3	Medium (42)	Provision of adequate sanitation facilities located outside of the wetland/riparian area or its associated buffer zone. Establishment of buffer zones to reduce nutrient inputs in diffuse flow. After construction, the land must be cleared of rubbish, surplus materials, and equipment, and all parts of the land shall be left in a condition as close as possible to that prior to use. Vehicles must be kept in good working order and leaks must be fixed immediately on an oil absorbent mat.	3	2	8	(13)	2	Low (26)
Altering the amount of sediment entering water resource and associated change in turbidity	Cumulative Negative	12.2.5.1.2	4	2	8	(14)	3	Medium (42)	A temporary fence or demarcation must be erected around the works area to prevent water runoff and erosion of the disturbed or heaped soils into wetland areas. Formalise access roads and make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas. Retain vegetation and soil in position for as long as possible, by removing it immediately ahead of construction/earthworks in that area (DWAF, 2005). A vegetation rehabilitation plan should be implemented. Remove only the vegetation where essential for construction and do not allow any disturbance to the adjoining natural vegetation cover. Cordon off areas that are under rehabilitation as no-go areas using danger tape and steel droppers. If necessary, these areas should be fenced off to prevent vehicular, pedestrian and livestock access.	3	2	8	(13)	2	Low (26)

Potential Impact Description per Environmental Aspect: Construction phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation Measures	Significance Post-Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
									Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas. Runoff from roads must be managed to avoid erosion and pollution problems. Buffer zones should be maintained to trap sediments.						
Altering the flow regime of a watercourse	Direct Negative	12.2.5.1.3	4	2	8	(14)	3	Medium (42)	No unlicensed activities should take place in the watercourses and associated buffer zone. Any activities within 500m of riparian areas are subject to authorization by means of a water use license. Construction in and around watercourses must be restricted to the dryer winter months. A temporary fence or demarcation must be erected around the works area to prevent access to sensitive environments. The works areas generally include the servitude, construction camps, areas where material is stored and the actual footprint of the infrastructure. Prevent pedestrian and vehicular access into the riparian areas and buffer areas. Planning of the construction and mining site must include eventual rehabilitation / restoration of indigenous vegetative cover in footprint area. Alien plant eradication and follow-up control activities prior to mining, to prevent spread into disturbed soils, as well as follow-up control during construction, operation and decommissioning / closure. The amount of vegetation removed should be limited.	3	2	8	(13)	3	Low (39)
Loss of aquatic biota	Cumulative Negative	12.2.5.1.4	4	5	8	(17)	3	Medium (51)	Implement all management procedures listed above for the change in hydrological regime, change in water quality, and sedimentation/siltation. Weed control in buffer zone. Monitor the establishment of alien invasive species within the areas	3	5	8	(15)	2	Low (30)

Potential Impact Description per Environmental Aspect: Construction phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation Measures	Significance Post-Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
									affected by the construction and take immediate corrective action where invasive species are observed to establish.						
Wetlands															
Change in hydrological function	Cumulative Negative	12.2.6.1.1	3	3	6	(12)	2	Low (24)	Critical recharge areas should be determined in a hydropedological assessment. A temporary fence or demarcation must be erected around No-Go Areas outside the proposed works area prior to any construction taking place as part of the contractor planning phase when compiling work method statements to prevent access to the adjacent portions of the watercourse. Direct the maximum amount of clean water runoff to the natural drainage lines through the establishment of clean water trenches around the construction site. High energy stormwater input into the watercourses should be prevented at all costs. Changes to natural flow of water (surface water as well as water flowing within the soil profile) should be taken into account during the planning phase and mitigated effectively	2	2	4	(8)	1	Very low (8)
Sedimentation and siltation	Cumulative Negative	12.2.6.1.2	3	3	6	(12)	2	Low (22)	Increased runoff due to removal of vegetation and increased soil compaction must be managed to ensure the prevention of siltation and the maximum stream bank stability. Silt traps can be placed down-slope of where vegetation stripping will take place to minimise siltation in watercourses. All exposed surfaces must be stabilised once the covering vegetation has been removed. Removed soil and stockpiling of soil must occur outside the extent of the watercourse to prevent siltation and increased runoff during construction. Select construction methods and equipment that will have the least impact on watercourses. Remove only the vegetation where essential for construction and do not allow any disturbance to the adjoining natural vegetation cover.	2	2	4	(8)	1	Very low (8)

Potential Impact Description per Environmental Aspect: Construction phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation Measures	Significance Post-Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
									Rehabilitation of damage/impacts that arise as a result of construction must be implemented immediately upon completion of construction. Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas. Monitoring should be done to ensure that sediment pollution is timeously dressed.						
Introduction and spread of alien vegetation	Direct Negative	12.2.6.1.3	4	3	6	(13)	2	Low (26)	An alien vegetation eradication programmed should be implemented on the site to remove the alien vegetation from the wetland areas as priority. Retain vegetation and soil in position for as long as possible, removing it immediately ahead of the proposed activity/earthworks in that area and returning it where possible afterwards.	3	2	4	(9)	2	Very low (18)
Changes in water quality	Direct Negative	12.2.6.1.4	3	3	6	(12)	2	Low (24)	Vehicles must be kept in good working order and leaks must be fixed immediately on an oil absorbent mat. Spill kits must be stored on site: In case of accidental spills of oil, petroleum products etc., good oil absorbent materials must be on hand to allow for the quick remediation of the spill. Vehicles and machinery must use existing roads to access the project area as far as possible. Provide adequate facilities for litter disposal. Chemical toilets must be provided which should always be well serviced and spaced as per occupational health and safety laws and placed outside the buffer and 1:100-year flood lines. The development footprint must be fenced off from the watercourses and no related impacts may be allowed into the watercourse e.g., water runoff from cleaning of equipment, vehicle access etc. Maintenance of construction vehicles / equipment should not take place within the watercourse or watercourse buffer.	2	2	4	(8)	1	Very low (8)

Potential Impact Description per Environmental Aspect: Construction phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation Measures	Significance Post-Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
Groundwater															
Contamination of groundwater through hydrocarbon spillages	Direct - Negative	12.2.7.1	2	2	4	(8)	3	Low (24)	Refuelling of vehicles will only be allowed in designated areas. Vehicles must be kept in good working order and leaks must be fixed immediately on an oil absorbent mat. Proper storage, handling and monitoring of fuel and chemicals. Remove any spills as soon as it occurs along with the polluted soil and dispose of it in the appropriate manner, depending on the size of the spill. Spill kits must be available on site. Provide adequate facilities for waste disposal.	1	2	2	(5)	2	Very low (10)
Air quality															
Decrease in the ambient air quality due to emissions (dustfall, PM_{10} and $PM_{2.5}$) associated with construction activities	Direct Negative	12.2.8.1	2	2	4	(8)	4	Low (32)	Dust suppression procedures should be implemented to reduce and control dust on the access road and construction sites. The construction vehicles must remain on site as far as possible during the construction period. Define routes for the circulation of heavy machinery and vehicles and restrict machines' movement to the necessary areas. Control the number of trucks on the road, weight of trucks and travelling speed limits. Switch off engines whilst not in use. Establish a maintenance schedule to ensure proper maintenance of the trucks & mobile equipment. Time construction activity strategically and avoid carrying out activities with high dust-causing potential during strong wind conditions. Pre-water all areas to be disturbed during dry and windy weather conditions. Where possible, the original vegetation, e.g., trees, shrubs and grass cover	2	2	2	(6)	4	Low (24)

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			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
									must be maintained for as long as possible to dissipate wind velocity at the ground surface, where dust lift off occurs. Conduct regular visual site inspections to ensure the dust mitigation measures are being implemented and assess whether further mitigation is required for any of the dust emission sources. Conduct monthly dustfall monitoring and continuous PM10 monitoring.						
Noise															
Increase in ambient noise levels at Receptor 1 (Night-time)	Direct Negative	12.2.9.1	2	2	10	(14)	4	Medium (56)	A berm designed to act as acoustical screen or barrier must be constructed during the day, at the pit areas in relation to receptors R1 and R6 according to the following specifications: • The berms should be solid (aggregate, brick etc. no foliage e.g., trees). • The height should be a minimum of one (1) meter higher than the highest noise source from the noise area to the receptors visual. • Berms or the selected acoustical barrier should enclose all sides of the mining area when facing a receptor with no gaps, entrances or apertures facing I&AP's. • Berm/barriers can be constructed (if feasible) along overburden/interburden (hards, softs, topsoil) line. Equipment should consider silencers on exhaust ports, to lower the nosiest points on the heavy vehicles. The construction vehicles must remain on site as far as possible during the construction period. If a stockpile is to be sloped, it should be done with the slope gradient facing away from a receptor (R1). If technically feasible, the tip of the sloped stockpiles (e.g., discard dumps/mineral residue deposits etc.) should have a berm implemented on them (to be discussed with team engineers).	2	2	2	(6)	2	Very low (12)
Increase in the ambient noise levels at Receptor 6 (Night-time)	Direct Negative		2	2	6	(10)	3	Low (30)		2	2	2	(6)	2	Very low (12)
Visual															
Increased visual intrusion and change to sense of place through dust plumes	Cumulative Negative	12.2.10.1	1	2	6	(9)	5	Medium (45)	Implement wet suppression in combination with chemical surfactants to provide more extensive wetting on the access roads. Have clearly defined hauling routes/vehicle access areas.	1	2	4	(7)	4	Low (28)

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			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
									Speed limits must be established and adhered to by all vehicles. All main hauling roads should be treated for dust suppression. Control the number of trucks on the road, weight of trucks and the travelling speed.						
Deterioration of visual quality and sense of place for sensitive receptors within 500m of the project area.	Direct Negative	12.2.10.1	1	2	8	(11)	5	Medium (55)	Keep disturbed areas as small as possible and if practically possible, establish construction camp in areas that are already disturbed. Eradication of vegetation should be done in a 'natural manner', avoiding harsh straight lines. Establish vegetative screens along the western and southern boundaries of the project site using indigenous plant species. Keep the construction site neat, clean, and organised in order to maintain a tidy appearance. Remove rubble off site as soon as possible or place it in a container in order to keep the site free from additional unsightly elements;	1	2	6	(9)	5	Medium (45)
Deterioration of visual quality and sense of place for sensitive receptors between 500 - 1500m of the project area.	Direct Negative	12.2.10.1	1	2	6	(9)	5	Medium (55)	The minimum amount of existing vegetation and topsoil should be removed from construction areas. Reduce the Project Area and Mining Area to the smallest area possible; locate the ROM stockpile and contractor's yard as close as possible to the Mining Area. Keep stockpile heights as low as possible	1	2	4	(7)	3	Low (21)
Deterioration of visual quality and sense of place for surrounding road users and tourists.	Cumulative Negative	12.2.10.1	2	2	6	(10)	4	Low (40)	Refer to the mitigation/management measures above.	2	2	4	(8)	3	Low (24)
Increased visual intrusion and change to sense of place through night-time illumination	Direct Negative	12.2.10.1	1	2	4	(7)	4	Low (28)	Refrain from installing permanent lighting where light is required intermittently. Security flood lighting should only be used where necessary and carefully directed, preferably away from sensitive viewing areas, i.e., the farmhouses falling within the viewshed and the roads near the site. Downward facing lights should be installed on the site	1	2	2	(5)	3	Very low (15)

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Heritage and palaeontological resources															
Damage to burial grounds and graves	Direct Negative	12.2.11.1.1	1	5	10	(16)	4	High (64)	Demarcate sites with at least a 100m buffer and avoid them. A Grave Management Plan should be developed for the graves, to be implemented during the construction and operation phases (which needs approval by SAHRA BGG). All work must cease immediately, if graves or burial grounds are uncovered, within the development footprint. If theses can't be avoided, the graves could be relocated after completion of a detailed grave relocation process, that includes a thorough stakeholder engagement component, adhering to the requirements of s36 of the NHRA and its regulations as well as the National Health Act and its regulations.	1	5	2	(8)	2	Very low (16)
Damage to fossil resources	Direct Negative	12.2.11.1.2	1	5	10	(16)	4	High (64)	In the event that fossil remains are discovered, either on the surface or exposed by fresh excavations the Chance Find Protocol must be implemented.	1	5	10	(16)	3	Medium (48)
Traffic															
Road safety conditions could be impacted negatively by an increase in heavy vehicles.	Cumulative Negative	12.2.13.1	2	2	4	(8)	3	Low (33)	The drivers of all trucks should be equipped with specialised road safety and driving training. The D1433 road should be upgraded and widened to 3.5 meters per direction in order to accommodate the construction vehicles. The D1433 should be upgraded with a sufficient shoulder for pedestrians to safely walk on – a recommended minimum of 1.5 meters can be provided.	2	1	2	(5)	1	Very low (5)
Impact on pedestrians and cyclists – potential conflict of site vehicles with pedestrians that may be walking on the external roads.	Direct Negative		2	2	4	(8)	3	Low (33)		2	1	2	(5)	1	Very low (5)
An increase in traffic on the road which increases the chances of deteriorating the road.	Cumulative Negative		2	2	4	(8)	3	Low (33)		2	1	2	(5)	1	Very low (5)
Blasting															
Ground vibration causing structural damage and/or nuisance at the following POI's: • Mine activity (POI 1) • Dam (POI 2, 3 and 4) • R555 (POI 5, 6, 7, 8, 9) • Building/structures (POI 10)	Direct Negative	12.2.12.1	2	2	6	(10)	5	Medium (50)	Specific blast design must be done, using shorter and smaller diameter blast holes. Use electronic initiation instead of shock tube systems to obtain single hole firing. Implement specific mitigation measures described in Section 13.2.12.2.2 for problematic POIs.	2	2	4	(8)	3	Low (24)
Ground vibration causing damage at the Ruins (POI	Direct		2	2	4	(8)	5	Low (40)	Specific blast design must be done, using shorter and smaller diameter	2	2	2	(6)	3	Very low

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16)	Negative								blast holes. Use electronic initiation instead of shock tube systems to obtain single hole firing.						(18)
Ground vibration causing structural damage and/or nuisance at the following POI's: • Communication Tower • Farm Buildings/Structures • Structures • Road • Informal Housing • Dams • Building/Structure • Power Lines/Pylons • Hot Houses • Power Line/Pylon • Railway Line • Reservoir • Cement Dams • Structure • Hydrocensus Borehole • Heritage Site	Direct Negative		2	2	2	(6)	1	Very low (6)	No mitigation required.	2	2	2	(6)	1	Very low (6)
Air blasts causing structural damage at • Mine activity (POI 1) • Dam (POI 2, 3 and 4) • R555 (POI 5, 6, 7, 8, 9) • Building/structures (POI 10)	Direct Negative	12.2.12.1	2	2	4	(8)	2	Very low (16)	Implement the mitigation measures listed above for ground vibration.	2	2	2	(6)	2	Very low (12)
Air blasts causing structural damage for all the other POIs considered.	Direct Negative		2	2	4	(8)	2	Very low (16)	No mitigation required.	2	2	2	(6)	2	Very low (12)
Damage/injuries caused by fly rock at the following POI's: • Dam (POI 2, 3 and 4) • R555 (POI 5, 6) • Building/structures (POI 10) • Road (POI 96)	Direct Negative	12.2.12.1	2	2	4	(8)	4	Low (32)	Implement the mitigation measures listed above for ground vibration and air blasts. Make use of increased stemming lengths and specific stemming material to manage fly rock - crushed aggregate of specific size. Specific blast design must be done, with shorter and smaller diameter	2	2	2	(6)	3	Very low (18)

Potential Impact Description per Environmental Aspect: Construction phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation Measures	Significance Post-Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
• Reservoir (POI 95) • Heritage site (POI 169 and 170)									blast holes. Used of specific stemming Ensure use of correct explosive product. Charge and blast the same day. Ensure use of water-resistant product in wet holes. A minimum unsafe zone of 402m must be cleared of people, animals, and equipment before blasting. Clearance distances must be set, and road travel managed during blasting operations specifically when blasting is done within 500m of the R555, D1433 and gravel roads.						
Damage/injuries caused by fly rock at the following POI's: • Ruins • Communication Tower • Farm Buildings/Structures • Structures • Informal Housing • Dams • Building/Structure • Power Lines/Pylons • Hot Houses • Power Line/Pylon • Railway Line • Cement Dams • Structure • Hydrocensus Borehole	Direct Negative		2	2	2	(6)	2	Very low (12)	Not mitigation required.	2	2	2	(6)	2	Very low (12)
Socio Economic															
Creation of local employment opportunities	Direct Positive	12.2.14.1.1	2	2	2	(6)	1	Very low (6) +	Appoint locals and contractors from Ward 9 or the wider STLM for construction and specialised tasks where possible. Set targets for local procurement, employment, and enterprise development. Appoint a Community Liaison Officer (CLO) for the duration of the	3	2	4	(9)	2	Very low (18) +

Potential Impact Description per Environmental Aspect: Construction phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation Measures	Significance Post-Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
									construction phase.						
Utilization of new HDSA supplies, SMME and other small businesses as a result of local procurement (Positive)	Direct Positive	12.2.14.1.2	2	2	2	(6)	2	Very low (12) +	Establish a Forum prior to construction commencing, represented by Canyon Resources, community groupings (i.e., Youth, Land, Women and so forth), Ward Councillor and the STLM LED Department, that makes the targets of procurement and employment clear to the local communities and promotes transparency. Use the Municipality's database of existing SMMEs (*Mr. Nkosi. LED Manager: STLM. 3 May 2019*) if the need arises. Make the requirements (skills, procurement opportunities, women and youth minimum thresholds and so forth) available to the Forum and the STLM LED Unit in advance, (e.g., four months prior to construction commencing) to ensure that locals are trained and prepared to tender. Implement training for HDSA small businesses and make it compulsory for suppliers to form partnerships with HDSAs and local SMMEs to provide mentorship and ensure skills transfer. Once appointed, monitor the social performance of contractors and determine how contractors fair on each key performance area (KPI).	3	2	4	(9)	3	Low + (27)
Income generated through the sale of agricultural land for mining purposes	Direct Positive/ Indirect Negative	12.2.14.1.3	1	5	8	(14)	5	High (70)	If required, appoint an independent Valuer to determine the market value of the land and to ensure fair compensation for land acquired for mining purposes.	1	4	8	(13)	4	Medium (52)
Increase in salaries and wages, and local procurement of goods (limited) and service	Indirect Positive	12.2.14.1.4	2	2	2	(6)	2	Very low (12) +	Maximise the local content of the construction phase by using local labour, local contractors, SMMEs and local service providers, wherever possible, and make this compulsory for the main contractor by including minimum thresholds in the Contractor Services Management plan (CSMP). As part of the tender documents the Contractor has to provide subcontracting values per package and the plan on how to meet BEE procurement and SMMEs targets assigned, as defined in the social management plan that he submits as part of his tender document. Implement relevant measures should the contractors not comply (impose penalties, termination where necessary, review of future prospective work etc.)	3	2	2	(7)	2	Very low (14) +
Loss of agricultural income	Direct & Indirect	12.2.14.1.5	1	2	8	(11)	4	Medium (44)	Fence off the construction areas to restrict movement of cattle into construction sites.	1	2	6	(9)	4	Low (36)

Potential Impact Description per Environmental Aspect: Construction phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation Measures	Significance Post-Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
	Negative								Regular dust suppression to minimise dust settling on crops and on grazing vegetation. Erect the contractor's camp as close as possible to the open pit/surface infrastructure or to an area with low agricultural potential to minimise the negative impacts on productive farming land. Implement all road safety measures as proposed in this report to ensure safety of livestock.						
Influx of jobseekers	Indirect Negative	12.2.14.1.6	3	2	4	(9)	2	Very low (18)	Take care not to create unrealistic job expectations and communicate details of the construction period to the STLM by using the Forum. Should local SMMEs and local employment be required, set clear goals and ensure that the CSMP reflects targets with regards to local SMMEs and local employment. Implement the guidelines of the CSMP for the duration of the construction period. Each contractor is required to submit its own accommodation and transport plan. Apart from security personnel, no workers/contractors to be housed on site. No recruitment of temporary workers at the entrance of the construction site or project area.	2	2	2	(6)	2	Very low (12)
Increase in conflict as a result of construction related and employment issues	Indirect Negative	12.2.14.1.7	3	2	4	(9)	2	Very low (18)	Include the Ward Councillor, LED Manager, and local community representatives of Ward 9 in the needs assessment and LED project identification for the SLP. Also include these role-players when the SLP is updated and reviewed and give feedback on targets achieved. Ensure transparency and communication with the affected communities through the Forum. Establish a communication protocol whereby construction and employment related information is transferred to local communities. Ensure that the appointed CLO understands customs and traditions of the	3	2	2	(7)	2	Very low (14)

Potential Impact Description per Environmental Aspect: Construction phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation Measures	Significance Post-Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
									local communities, is fluent in the local languages, and is accessible for workers and other locals.						
Disruptions in daily living and movement patterns for surrounding landowners and communities due to higher traffic volumes and intrusion impacts (dust, noise, light pollution, etc.)	Cumulative Negative	12.2.14.1.8	3	2	6	(11)	4	Medium (44)	Announce disruptions, road closures (if any) and so forth by using the local media, road sign boards and other Municipal structures. Provide a schedule of the construction and blasting activities to landowners and relevant I&APs. Erect signboards indicating accesses to the construction site. Impose penalties for reckless drivers to enforce compliance to traffic rules. Inspect trucks and other heavy vehicles on a regular basis to avoid oil spillages and unroadworthy vehicles that could lead to accidents. Limit all activities to the development footprint of the proposed construction site. Fence off the development footprint of the construction site prior to the commencement of site clearing and other construction activities. Keep the local SAPS, other emergency services and Ward Councillors informed about the construction progress, timelines and blasting schedule. Provide workers with identity tags and instate strict security measures at the access points to discourage unauthorised people entering the construction site. Workers should not be allowed to remain in the construction area when they are off duty. Implement safety and security measures, such as fencing, 24-hour security guards, CCTV cameras, random security checks and access control. Generally, construction activities should not take place before 8am and after 5pm and not on Sundays and public holidays. This would however not always be realistic, as deadlines and specific construction activities could take longer.	3	2	4	(9)	4	Low (36)

Potential Impact Description per Environmental Aspect: Construction phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation Measures	Significance Post-Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
									Ensure that all construction machinery is well maintained and has the required silencers, if required. Vehicles carrying dusty materials should be securely covered before leaving the site. Appropriate and regular dust alleviation with water on gravel and dirt areas and roads. Consider the predominant wind direction when siting stockpiles to reduce the likelihood of affecting sensitive receptors and monitor the dust fall out concentrations.						
Damage to surrounding road infrastructure	Cumulative Negative	12.2.14.1.9	2	2	6	(10)	3	Low (30)	Communicate with the STLM with regards to potholes and possible repairs to the road surfaces that might be required and repair access roads that have been damaged because of construction vehicles. Make a complaints' register available at the entrance to the construction site and address complaints speedily.	2	2	4	(8)	3	Low (24)
Health and safety risks for workers	Direct Negative	12.2.14.1.10	1	2	8	(11)	4	Medium (44)	Provide employees with first aid training to prepare them to respond to accidents on site. Make first aid kits available at various strategic locations of the operation. Construction workers to wear protective clothing (e.g., masks that minimize dust inhalation and clothing that protects against sunburn). Enforce the use of earplugs where relevant. Lock away dangerous plant, equipment and material when not supervised or in use. Provide safe and clean drinking water and instil regular water breaks to keep workers hydrated. Provide sufficient ablution facilities (chemical/portable toilets, etc.) at strategic locations that are cleaned regularly. Utilise and increase existing mine security and procedures and 24-hour security in and around the construction area.	1	2	8	(11)	2	Low (22)

Potential Impact Description per Environmental Aspect: Construction phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation Measures	Significance Post-Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
									Designate a suitable area for cooking fires (if required). Ensure good visibility at the accesses to the site.						
Community health and safety risks	Direct Negative	12.2.14.1.10	2	2	8	(12)	3	Low (36)	Join existing community policing forums and/or similar community structures. Make the contact details of the main Contractor available to surrounding landowners and attend to any matters expediently. Implement measures to suppress dust, such as spraying water on gravel roads, surfaces, and stockpiles on a regular basis. Dispose of the various types of waste generated in the appropriate manner at licensed waste landfill sites at regular intervals. Erect a safety fence around the entire construction site to prevent illegal trespassing of humans and livestock. Display "danger" warning signs and "no public access" signs at all potential accesses, paths and along the periphery of the construction areas in English and the local languages. Make the procedure to lodge complaints available to the surrounding property owners and Ward Councillor to enable them to lodge complaints when problems with regards to community and/or environmental health arise.	2	2	8	(12)	2	Low (24)

Table 94: Operational Phase – Impact Assessment

Potential Impact Description per Environmental Aspect: Operational Phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation measures	Significance Post Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
Geology															
Disturbance of the geological profile	Direct Negative	12.2.1.2	3	5	6	(14)	5	High (70)	Mining must be conducted strictly according to the MWP submitted to the DMRE. Optimally exploit the resource in terms of tonnage of rock mined and cost as provided for in the mine plan. Comply with the recommendations made by the blasting and vibration specialist.	2	5	6	(13)	5	High (65)
Topography															
Alteration/modification of the surface topography	Direct Negative	12.2.2.2	2	4	6	(12)	5	Medium (60)	Limit the height of the overburden dumps as far as possible and ensure dumps are placed in the designated areas. Implement the mitigation measures recommended under visual impacts.	2	4	4	(10)	5	Medium (50)
Soils, land use and capability															
Soil erosion	Direct Negative	12.2.3.2.1	2	4	8	(14)	4	Medium (56)	Unnecessary land clearance must be avoided. Stockpile different soil horizons in different areas, keep inventory, and revegetate stockpiles. The slope of the topsoil stockpiles must not be more than 15% in order to limit erosion from the stockpiles. Trucks, equipment, and other vehicles must park on designated parking areas and not create additional areas at risk of soil erosion by parking outside of the demarcated areas. The stormwater management plan should be followed in order to protect surrounding land from erosion that may occur during thunderstorms.	1	4	8	(13)	3	Low (39)
Soil compaction	Direct Negative	12.2.3.2.2	2	4	8	(14)	4	Medium (56)	Vehicles and equipment must travel within demarcated areas and not outside of the operational footprint. Develop a designated parking area for coal trucks that will be queuing to collect coal in order to avoid trucks parking in nearby agricultural areas. Use specific tracks for the tipping trucks when restoring the topsoil, to diminish	1	4	8	(13)	3	Low (39)

Potential Impact Description per Environmental Aspect: Operational Phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation measures	Significance Post Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
									the compacted soil area. Rip replaced soils when it reaches a depth of 500 mm, and again once all soil has been replaced.						
Soil pollution	Direct Negative	12.2.3.2.3	1	4	6	(11)	4	Medium (44)	Maintenance must be undertaken regularly on all vehicles and operational machinery to prevent hydrocarbon spills. Drip trays must be used when working on vehicles to avoid contamination. Ensure drivers follow required safety precautions and road rules Clean-up of hydrocarbon spills if it occurs, test soils for contamination and perform best clean up method. Any waste generated during operation, must be stored into designated containers and removed from the site by registered contractors. Reduce coal dust blowing on stockpiles, by minimizing dust generation from roads (by keeping them moist) and limiting dust from blasts. Soil pollution monitoring must be conducted annually around all possible sources of soil contamination on site such as the ROM stockpiles, PCDs and along the haul roads. Manage dirty and polluted water on site through storage and treatment with suitable infrastructure such as pollution control dams.	1	4	6	(11)	3	Low (33)
Loss of soil quality	Direct Negative	12.2.3.2.4	2	5	8	(15)	5	High (75)	Implement mitigation measures under soil erosion, compaction and pollution listed above. Preventing wind blowing coal dust onto stockpiles, by minimizing dust generation through implementation of mitigation measures listed under air quality.	2	4	8	(14)	4	Medium (56)
Loss of high potential cultivated land and crop production	Direct Negative	12.2.3.2.5	2	5	8	(15)	5	High (75)	Implement mitigation measures under soil erosion, compaction and pollution listed above. If required, appoint an independent Valuer to determine the market value of the land and to ensure fair compensation for land acquired for mining purposes or compensate the farmer for annual loss of income during the life of mine.	1	4	6	(11)	5	Medium (55)

Potential Impact Description per Environmental Aspect: Operational Phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation measures	Significance Post Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
									The following measures must be implemented during concurrent rehabilitation: • Topsoil and subsoil should be replaced in the correct sequence on soft overburden material to ensure that subsurface limiting layers are not created. • Reshaping of footprint area to allow for naturally free draining topography. • Soil should be spread, treated with fertilizer or ameliorants (if required) and revegetated, naturally or with indigenous seeds (as required), in one consecutive operation, to reduce the potential for soil loss to wind and water erosion. Crop yields of the adjoining fields should be monitored and compared to land further away to assess the impact of dust and air pollution caused by the mine activities.						
Loss of grazing land and animal production	Direct Negative	12.2.3.2.6	2	5	6	(13)	5	High (65)	Implement mitigation measures under soil erosion, compaction and pollution listed above. The area utilized for mining must be kept to the minimum needed for the successful implementation of the operation. Fence the mining area to restrict access and prevent injuries to livestock. If required, appoint an independent Valuer to determine the market value of the land and to ensure fair compensation for land acquired for mining purposes or compensate the farmer for annual loss of income during the life of mine.	1	4	4	(9)	5	Medium (45)
Loss of agricultural employment opportunities	Direct Negative	12.2.3.2.7	3	4	4	(11)	3	Low (33)	Employ farm employees at the mine. Provide training and support to assist farm employees to find suitable employment opportunities elsewhere.	3	3	4	(10)	2	Very low (20)
Terrestrial Biodiversity (Flora and Fauna)															
Loss of natural vegetation and intact floral habitat.	Direct Negative	12.2.4.2	2	4	8	(14)	4	Medium (56)	Only areas earmarked for immediate opencast mining (per section) should be cleared of vegetation to limit erosion potential. Contamination of natural habitat from any potential source must be prevented and a suitable waste management plan must be developed and implemented. A concurrent rehabilitation and re-vegetation plan should be implemented as	1	4	8	(13)	2	Low (26)

Potential Impact Description per Environmental Aspect: Operational Phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation measures	Significance Post Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
									and when areas become available for rehabilitation. Topsoil should be removed prior to opencast mining, stored separately and adequately, and replace adequate topsoil (at least to a depth of 1m) during rehabilitation. Implement an alien and invasive plant species management and eradication plan during the operational phase to prevent spread of alien species into surrounding natural grasslands.						
Loss of plant species, floral diversity and floral SCC.	Direct Negative		2	4	8	(14)	4	Medium (56)	The operational footprint must be clearly demarcated by semi-permanent means in order to provide protection against peripheral impacts. Areas beyond the designated operational areas should remain No-Go areas for mining personnel and vehicles. Effluents of any nature must be prevented from entering wetland related habitat. Implement a fire management programme, providing protection for natural grassland and wetland areas. The collection of plant material for medicinal or other purposes within the study area should be strictly prohibited.	1	4	8	(13)	2	Low (26)
Degradation of vegetation within the study area and surrounds due to dust, alien invasive species and erosion.	Indirect Negative		3	4	8	(13)	4	Medium (42)	Implement an alien and invasive plant species management and eradication plan during the operational phase to prevent spread of alien species into surrounding natural grasslands. Dust suppression procedures should be implemented to reduce and control dust emitting from the access road and stockpile areas.	2	4	8	(14)	2	Low (28)
Loss/harm to faunal SCC.	Direct Negative		2	4	6	(12)	3	Low (36)	Speed limits must be established and adhered to by all vehicles. All onsite traffic must be restricted to designated roads. The illegal collection and hunting of any animals should be strictly forbidden by anyone except landowners with the appropriate permits where required. Any dams or evaporation ponds (e.g., PCO) should be covered or fenced to prevent larger animals from accessing these areas.	2	4	6	(12)	2	Low (24)

Potential Impact Description per Environmental Aspect: Operational Phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation measures	Significance Post Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
Disturbance of nesting avifaunal species in natural areas.	Direct Negative		2	4	6	(12)	4	Medium (48)	Areas beyond the designated development footprint areas should remain No-Go areas for mining personnel and vehicles. Dust suppression procedures should be implemented to reduce and control dust emitting from the access road and stockpile areas. Noise emanating from construction machinery and equipment should be kept at a minimum by the fitting of exhaust silencers and through the regular maintenance of construction vehicles and equipment.	2	4	6	(12)	3	Low (36)
Change in ecological processes maintaining faunal habitat	Cumulative Negative		3	4	8	(15)	3	Medium (45)	Implement a fire management programme, providing protection for natural grassland and wetland areas.	2	4	6	(12)	2	Low (24)
Surface water															
Alteration of water quality	Direct Negative	12.2.5.2.1	4	3	8	(15)	4	Medium (60)	After construction, the land must be cleared of rubbish, surplus materials, and equipment, and all parts of the land shall be left in a condition as close as possible to that prior to use. Maintain the recommended buffer zones to trap sediments with associated toxins. Provision of adequate sanitation facilities located outside of the wetland/riparian area or its associated buffer zone. A storm water cut-off drain should be constructed between the mining area and the aquatic system to ensure that storm water flowing through the site is prevented from entering downstream watercourses.	3	3	8	(14)	3	Medium (52)
Altering the amount of sediment entering water resource and associated change in turbidity	Cumulative Negative	12.2.5.2.2	3	3	6	(12)	4	Medium (48)	Activities should not impact on rehabilitated areas and where soil or vegetation disturbances took place, this should be rehabilitated immediately. Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the work areas. Runoff from roads must be managed to avoid erosion and pollution problems. Implementation of best management practices.	2	3	6	(11)	2	Low (22)

Potential Impact Description per Environmental Aspect: Operational Phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation measures	Significance Post Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
									Source-directed controls. Buffer zones should be maintained to trap sediments.						
Altering the flow regime of a watercourse	Direct Negative	12.2.5.2.3	4	3	6	(13)	4	Medium (52)	Operational activities should not take place within watercourses or buffer zones. Operational vehicles must stay on dedicated roads/servitudes. Adapt mining process to ensure continuous rehabilitation during operational phase by rehabilitating all areas as soon as they are not required for further operations for the life of the mine.	2	3	6	(11)	2	Low (22)
Loss of aquatic biota	Cumulative Negative	12.2.5.2.4	4	5	8	(17)	2	Low (34)	Implement all management procedures listed above for the change in water quality, altering the amount of sediment and flow regime.	3	5	8	(16)	2	Low (32)
Wetlands															
Changes in hydrological function	Cumulative Negative	12.2.6.2.1	4	4	8	(16)	4	High (64)	Development should include measures to ensure that the flow paths and storage mechanisms in the soil should be disturbed as little as possible, to sustain hydrological and biogeochemical connectivity. A wetland offset strategy should be formulated should loss of hydrological zonation be detected in downslope wetlands Implement a SWMP whereby clean storm water runoff is diverted to the natural drainage lines and dirty storm water runoff is contained and recycled.	4	4	6	(14)	4	Medium (56)
Sedimentation and siltation	Cumulative Negative	12.2.6.2.2	4	4	8	(16)	4	High (64)	Maintain buffer zones in which no activities can take place to trap sediments. Make use of a single access road during operations. Implement a program whereby diverted storm water runoff is contained and recycled. If any water is released into the receiving environment the velocity of storm water must be attenuated and spread by making use of trench breakers and gabion structures. Adapt mining process to ensure continuous rehabilitation during operational phase by rehabilitating all areas as soon as they are not required for further operations for the life of the mine.	4	4	6	(14)	3	Medium (42)

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			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
									Prevent runoff from the haul roads from entering the receiving environment. Monitoring should be done to ensure that sediment pollution is timeously addressed.						
Introduction and spread of alien vegetation	Direct Negative	12.2.6.2.3	4	4	8	(16)	4	High (64)	An alien vegetation eradication programmed should be implemented on the site to remove the alien vegetation from the wetland areas as priority. Monitor the establishment of alien invasive species within the areas affected by the operation and take immediate corrective action where invasive species are observed to establish. Rehabilitate or re-vegetate disturbed areas throughout the life of mine.	4	4	6	(14)	3	Medium (42)
Loss and disturbance of watercourse habitat and fringe vegetation	Direct Negative	12.2.6.2.4	4	4	8	(16)	4	High (64)	Apply and maintain the recommended buffer zones around wetlands. If surface water monitoring shows that the surrounding watercourses are affected by mine dewatering, discharge of clean water into the tributaries should be considered. Loss of wetland habitat resulting from loss of shallow interflow must be offset through improvements to downslope wetlands. Regular monitoring for wetland integrity and function should be undertaken in the long-term.	4	4	6	(14)	3	Medium (42)
Change in water quality	Direct Negative	12.2.6.2.5	4	4	8	(16)	4	High (64)	Runoff water from the overburden dumps, ROM stockpiles and any other contaminated stormwater should be channelled into PCDs. Seepage drains should be maintained and channelled into the PCDs. Bunded areas must be connected to the PCD system. Implement and maintain a closed sewage reticulation system. Ensure waste management is done within good practice guidelines. Implement good housekeeping in terms of hazardous materials storage. Spill kits must be stored on site: In case of accidental spills of oil, petroleum products etc., good oil absorbent materials must be on hand to allow for the quick remediation of the spill.	4	4	6	(14)	3	Medium (42)

Potential Impact Description per Environmental Aspect: Operational Phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation measures	Significance Post Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
									Vehicles must be kept in good working order and leaks must be fixed immediately on an oil absorbent mat. No maintenance (including refuelling) or storing of machinery near the aquatic areas. Domestic waste must be collected in waste bins that are located on site. The collected waste must be disposed of at a municipal landfill facility. The waste bins must be marked clearly indicating what waste must be disposed of in what bin. Employees must be encouraged to re-use, recycle, and reduce waste where possible. The runoff should be routinely monitored for acidity and salinity as an early warning for potential increases in salinity or acidic drainage water. Water quality should be routinely monitored at aquatic ecosystems associated with the mining activities.						
Groundwater															
Lowering of groundwater levels	Direct Negative	12.2.7.2.1	3	4	6	(13)	4	Medium (52)	If it can be proven that the mine is indeed affecting the quantity of groundwater available to certain users, the affected parties should be compensated. Water stored in pit should be utilised locally for dust suppression, as far as possible. The numerical model should be updated during operation of the opencast by using the measured inflows, water levels and drilling and pump test information to recalibrate and refine the impact prediction. Groundwater monitoring must be conducted according to the monitoring plan described in the EMPr. The numerical model must be updated during operation to re-calibrate and refine the impact prediction.	3	4	6	(13)	4	Medium (52)
Aquifer contamination caused by polluted	Direct	12.2.7.2.2	2	4	8	(14)	3	Medium	Mining should remove all coal from the opencasts and separate acid forming	2	4	6	(12)	2	Low (24)

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water migrating away from the mining area (leachate plume)	Negative							(42)	and non-acid forming material. Major underground fractures encountered while mining must be sealed by grouting, both on inflow and outflow areas. The capacity to rapidly pump water out of the pit into storage dams should be maintained to minimise water quality deterioration due to long-term retention of storm water in contact with acid generating materials. Berms should be constructed around the opencast pits to minimise the flow of any surface water or floodwater into mine workings. Apply passive water management measures within the operations that are aimed at minimising the potential for water quality deterioration. Deposit acid forming material at the base of the pit during concurrent rehabilitation. All mined areas should be flooded as soon as possible to minimise oxygen from reacting with the remaining pyrite. Where possible, reduce the extent of the opencast pit in potential decant areas.						
Leaching/seeping of contaminants into the sub surface	Direct Negative	12.2.7.2.3	2	4	8	(14)	4	Medium (56)	All waste storage facilities must be lined according to the geochemical waste classifications and relevant regulations. Water that has been in contact with residue must be kept within the confines of the MRD until evaporated, treated to rendered acceptable for release, or re-used in some other way. The storm water management plan (SWMP) must make provision for the maximum precipitation to be expected over a period of 24 hours with a probability of once in one hundred years. Where leachate is generated, it must be contained separately from water which is only slightly polluted through contact with the waste. A freeboard of at least 0.5 m must be provided for the PCDs above the predicted maximum water level.	2	4	8	(14)	2	Low (28)

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									Implement the groundwater monitoring program described in this EMPr. Monitor water storage facilities, particularly pollution control dams, to manage the risk of spillage from the dams Concurrent rehabilitation should be planned to promote free drainage and to minimise or eliminate ponding of storm water.						
Air Quality															
Decrease in the ambient air quality due to emissions (24H dustfall, annual PM_{10} and 24H and annual $PM_{2.5}$) associated with operational activities	Cumulative Negative	12.2.8.2	2	4	6	(12)	4	Medium (48)	Implement wet suppression in combination with chemical surfactants on haul roads. Implement water sprays for material handling operations (e.g., wet material before conveying coal and while offloading trucks), drilling, blasting, bulldozing activities, stockpiles and material storage areas. Have clearly defined hauling routes/vehicle access areas. Control the number of trucks on the road, weight of trucks and the travelling speed. Establish a maintenance schedule to ensure proper maintenance of the trucks & mobile equipment. Use of 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. Regular visual site inspections are recommended to assess whether further mitigation is required for any of the dust emission sources.	2	4	4	(10)	4	Low (40)
Decrease in the ambient air quality due to emissions (24H PM_{10}) associated with operational activities	Cumulative Negative		2	4	8	(14)	4	Medium (56)		2	4	6	(12)	4	Medium (48)
Noise															
Increase in the ambient noise levels	Direct Negative	12.2.9.2	2	4	8	(14)	3	Medium (42)	Ensure that the acoustical berms, constructed in relation to receptors R1 and R6, as indicated under the mitigation measures of the construction phase are implemented. Use overburden stockpiles to assist as acoustical screens. Contractors should install acoustical mufflers on the exhaust outlets of all heavy	2	2	2	(6)	2	Very low (12)

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									vehicles. Any area where a tip is to be implemented should not be higher than a berm (and in relation to a receptor). Tips should be placed as close to a berm as possible in relation to a receptor's locality. Equipment should consider silencers on exhaust ports, to lower the nosiest points on the heavy vehicles. Ensure all equipment is well maintained and functioning optimally. The daytime use of reverse alarms must be minimised. To minimise the noise nuisance caused by reverse alarms, the implementation of less tonal, more broadband character etc. reverse alarms should be considered. A Biannual Environmental Noise Measurement Programme (Monitoring Programme) needs to be implemented. Onsite noise measurements should be considered on a frequent basis, to help identify any fault or loud equipment that may require enclosures or maintenance. A contact line should be made available whereby receptors could lodge a complaint (and documented).						
Visual															
Increased visual intrusion and change to sense of place through dust plumes	Cumulative Negative	12.2.10.2	2	4	6	(12)	5	Medium (60)	Dust generated from material handling operations and mining operations can be significantly reduced by wet suppression in combination with chemical surfactants to provide more extensive wetting. The loading, transfer and discharge of materials should take place with a minimum height of fall. Have clearly defined hauling routes/vehicle access areas. All main hauling roads should be treated for dust suppression. Control the number of trucks on the road, weight of trucks and the travelling speed.	2	4	6	(12)	3	Low (36)

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Deterioration of visual quality and sense of place for sensitive receptors within 500m of the project area.	Direct Negative	12.2.10.2	1	4	8	(13)	5	High (65)	The design of the slopes should be as gradual as possible. Keep stockpile heights as low as possible (<20m) Trees and shrubs can be used to screen structures and break stark contrasting lines if carefully planned and positioned. Introduce landscaping measures such as vegetated berms. Maintain the landscape to a high aesthetic standard to retain a high visual quality for visitors and observers. Start the rehabilitation of disturbed areas as soon as practically possible in order to restrict long stages of exposed soil and possible erosion.	1	4	6	(11)	4	Medium (44)
Deterioration of visual quality and sense of place for sensitive receptors between 500 - 1500m of the project area.	Direct Negative	12.2.10.2	2	4	6	(12)	5	Medium (60)	Refer to the mitigation/management measures above.	2	4	4	(10)	4	Low (40)
Deterioration of visual quality and sense of place for sensitive receptors between 1500m – 4000m.	Cumulative Negative	12.2.10.2	2	4	6	(12)	4	Medium (48)	Refer to the mitigation/management measures above.	2	4	4	(10)	3	Low (30)
Deterioration of visual quality and sense of place for surrounding road users and tourists.	Cumulative Negative	12.2.10.2	2	4	6	(12)	4	Medium (48)	Refer to the mitigation/management measures above.	2	4	4	(10)	3	Low (30)
Increased visual intrusion and change to sense of place through night-time illumination	Direct Negative	12.2.10.2	2	4	6	(12)	4	Medium (48)	Outdoor lighting must be strictly controlled to prevent light pollution. Sources of light must as far as possible be shielded by physical barriers such as a planted trees and shrubs or built structures. Use should be made of down-lighting to prevent excessive light from shining up into the night sky. Where possible, use should be made of directional lighting which uses devices to direct light at the areas of activity, also preventing unnecessary illumination of the surrounding area. Consider installing anti-reflective coating on metal surfaces to reduce the sunlight that is reflected and increase the amount of sunlight that is absorbed during daytime, to reduce the effect of glare and reflection of metal	1	4	4	(9)	2	Very low (18)

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									infrastructure. Lights should be mounted at an appropriate height, to provide maximum illumination while minimizing light pollution into the surrounding area. The use of outdoor fixtures high up on tall structures should be limited or avoided.						
Heritage and Palaeontological Resources															
Damage to burial grounds and graves	Direct Negative	12.2.11.2.1	1	5	10	(16)	4	High (64)	Demarcate sites with at least a 100m buffer and avoid them. A Grave Management Plan should be developed for the graves, to be implemented during the construction and operation phases (which needs approval by SAHRA BGG). All work must cease immediately, if graves or burial grounds are uncovered, within the development footprint. If theses can't be avoided, the graves could be relocated after completion of a detailed grave relocation process, that includes a thorough stakeholder engagement component, adhering to the requirements of s36 of the NHRA and its regulations as well as the National Health Act and its regulations.	1	5	2	(8)	2	Very low (16)
Damage to fossil resources	Direct Negative	12.2.11.2.2	2	5	10	(17)	4	High (68)	In the event that fossil remains are discovered, either on the surface or exposed by fresh excavations the Chance Find Protocol must be implemented.	2	5	10	(17)	3	Medium (51)
Blasting and vibration															
Ground vibration causing structural damage and/or nuisance at the following POI's: • Mine activity (POI 1) • Dam (POI 2, 3 and 4) • R555 (POI 5, 6, 7, 8, 9) • Building/structures (POI 10)	Direct Negative	12.2.12.2.1 12.2.12.2.1.1 12.2.12.2.1.2 12.2.12.2.1.3 12.2.12.2.1.4	2	3	8	(13)	5	High (65)	Specific blast design must be done, using shorter and smaller diameter blast holes. Use electronic initiation instead of shock tube systems to obtain single hole firing. Implement specific mitigation measures described in Section 13.2.12.2.2 for problematic POIs. Do not blast during the following times: - too early in the morning or too late in the afternoon in winter. - When there is fog and/or low overcast clouds.	2	3	6	(11)	3	Low (33)

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									- In the dark. - When wind is blowing strongly in the direction of an outside receptor.						
Ground vibration causing damage at the Ruins (POI 16)	Direct Negative	12.2.12.2.4	2	3	6	(11)	5	Medium (55)	Specific blast design must be done, using shorter and smaller diameter blast holes. Use electronic initiation instead of shock tube systems to obtain single hole firing.	2	3	4	(9)	3	Low (27)
Ground vibration causing structural damage and/or nuisance at the following POI's: • Communication Tower • Farm Buildings/Structures • Structures • Road • Informal Housing • Dams • Building/Structure • Power Lines/Pylons • Hot Houses • Power Line/Pylon • Railway Line • Reservoir • Cement Dams • Structure • Hydrocensus Borehole Heritage Site	Direct Negative	12.2.12.2.1.5	2	3	2	(7)	1	Very low (7)	Develop a mitigation plan to determine if the boreholes located in the area of influence will be retained or replaced.	2	3	2	(7)	1	Very low (7)
Air blasts causing structural damage at the following POIs: • Mine activity (POI 1) • Dam (POI 2, 3 and 4) • R555 (POI 5, 6, 7, 8, 9) • Building/structures (POI 10)	Direct Negative	12.2.12.2.3	2	3	4	(9)	2	Very low (18)	Implement the mitigation measures listed above for ground vibration.	2	3	4	(9)	2	Very low (18)
Air blasts causing structural damage for all the other POIs considered.	Direct Negative	12.2.12.2.3	2	3	4	(9)	2	Very low (18)	No mitigation required.	2	3	4	(9)	2	Very low (18)

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Damage/injuries caused by fly rock at the following POI's: • Dam (POI 2, 3 and 4) • R555 (POI 5, 6) • Building/structures (POI 10) • Road (POI 96) • Reservoir (POI 95) • Heritage site (POI 169 and 170)	Direct Negative	12.2.12.2.4	2	3	6	(11)	4	Medium (44)	Implement the mitigation measures listed above for ground vibration and air blasts. Make use of increased stemming lengths and specific stemming material to manage fly rock - crushed aggregate of specific size. Specific blast design must be done, with shorter and smaller diameter blast holes. Used of specific stemming Ensure use of correct explosive product. Charge and blast the same day. Ensure use of water-resistant product in wet holes. A minimum unsafe zone of 402m must be cleared of people, animals, and equipment before blasting. Clearance distances must be set, and road travel managed during blasting operations specifically when blasting is done within 500m of the R555, D1433 and gravel roads.	2	3	4	(9)	3	Low (27)
Damage/injuries caused by fly rock at the following POI's: • Ruins • Communication Tower • Farm Buildings/Structures • Structures • Informal Housing • Dams • Building/Structure • Power Lines/Pylons • Hot Houses • Power Line/Pylon • Railway Line • Cement Dams • Structure • Hydrocensus Borehole	Direct Negative	12.2.12.2.4	2	3	2	(7)	2	Very low (14)	Not mitigation required.	2	3	2	(7)	2	Very low (14)

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Traffic															
Road safety conditions could be impacted negatively by an increase in heavy vehicles.	Cumulative Negative	12.2.13.2	2	4	4	(10)	3	Low (30)	The drivers of all trucks should be equipped with specialised road safety and driving training.	2	1	2	(5)	1	Very low (5)
Potential conflict of site vehicles with pedestrians that may be walking on the external roads.	Direct Negative		2	4	4	(10)	3	Low (30)	Appropriate road markings and warning signs should be implemented during the mine operating phase for safety purposes.	2	1	2	(5)	1	Very low (5)
An increase in traffic on the road which increases the chances of deteriorating the road.	Cumulative Negative		2	4	4	(10)	3	Low (30)	Communicate with the STLM with regards to potholes and possible repairs to the road surfaces that might be required and repair access roads that have been damaged because of haul trucks. The D1433 road should be upgraded and widened to 3.5 meters per direction in order to accommodate the trucks transporting materials. The D1433 should be upgraded with a sufficient shoulder for pedestrians to safely walk on – a recommended minimum of 1.5 meters can be provided. Public transport facilities should be provided along the D1433 close to the access to the mine and at the intersection of the D1433/R104 and D1433/R555 for taxis to drop and pick up employees.	2	1	2	(5)	1	Very low (5)
Socio Economic															
Creation of local employment opportunities	Direct Positive	12.2.14.2.1	3	4	4	(11)	4	Medium (44) +	Formulate and implement the affirmative procurement strategy once the mining right has been awarded. Maximise the number of locals sourced for employment.	3	4	4	(11)	5	Medium (55) +
Utilization of new HDSA supplies, SMME and other small businesses as a result of local procurement	Direct Positive	12.2.14.2.2	3	4	6	(13)	4	Medium (52) +	Maximise the number of locals sourced for SMME development, local procurement and local supporting industries. Give preference to local communities and gradually extend the labour sending area to the wider municipality, district and province.	3	4	6	(13)	5	High (65) +
Increase in salaries and wages, and local procurement of goods (limited) and service	Indirect Positive	12.2.14.2.3	3	4	4	(11)	4	Medium (44) +	Specifically provide opportunities for workers from disadvantaged backgrounds and target local communities for economic, social and educational development. Supply a Value Chain Analysis and needs requirement to the STLM so that they can assist in preparing the youth, women, and entrepreneurs.	3	4	6	(13)	4	Medium (52) +

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									Assist the SMMEs and other small businesses with training, equipment and other "gaps" identified during the needs assessment. Provide feedback to the communities and the STLM when tenders have been awarded to ensure transparency throughout the process.						
Loss of high potential farmland	Direct Negative	12.2.14.2.4	2	5	10	(17)	5	Very High (85)	Engage with the landowners to draw up a map with no-go areas to minimise negative impacts on current land use.	1	4	10	(15)	5	High (75)
Loss of access to livelihoods	Indirect Negative	12.2.14.2.5	1	5	8	(14)	5	High (70)	Reduce the project area and development footprint to the smallest area possible; locate the ROM stockpile and contractor's yard as close as possible to the mining area.	2	5	4	4		Medium (44)
Decrease in land values	Direct Negative	12.2.14.2.6	2	5	6	(13)	4	Medium (52)	Implement all the mitigation and management measures as proposed in the Geohydrological Report and Air, Visual and Noise Impact Assessments to address intrusion and pollution impacts that could result in degradation of agricultural land. Potential negative impacts because of the mine (dust, noise, land invasions, security issues, etc.) should be addressed pro-actively, to avoid it having an impact on land values. Ensure that all surrounding landowners are familiar with the procedures to lodge complaints and attend to the issues at hand expediently.	2	5	6	(13)	3	Low (39)
Influx of outsiders/migrant workers	Indirect Negative	12.2.14.2.7	3	5	6	(14)	3	Medium (42)	Ensure transparency during the employment processes and make use of the correct channels (Ward Councilor, the Forum and relevant STLM structures) when SMMEs and local businesses are identified. Provide feedback when tenders are awarded. Do not create unrealistic job expectations and set clear goals with regards to local employment, career progression and so forth. Make this information available to the Ward Councilor to distribute to local communities. Contractors to submit a transport plan ensuring that employees can be transported to and from their places of residence. Draw up a housing plan that sets out how Canyon will be dealing with employees from outside the Municipal boundaries. Link with the STLM and IDP	2	4	6	(12)	2	Low (24)

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									in this regard and implement the SLP guidelines (Project SLP). Monitor the above goals of SLP implementation and housing provision through the Forum. Establish a clear communication channel between the private landowners and mine and maintain good relations. Deal with illegal structures expediently, follow the correct legal procedures and support the landowners in this regard.						
Skills development, training and capacity building	Direct Positive	12.2.14.2.8	2	4	6	(12)	4	Medium (48) +	Maximise the local content of the SLP recommendations and projects. Do a needs assessment of Ward 9 with the STLM LED Unit and align the projects with the IDP to ensure that real community-based needs are addressed. Involve the LED Unit, Ward Councilor, and other community groups (Youth groups, Community development workers, etc.) in the SLP processes and draw up a 'Community Engagement Plan' (CMP) which should include principles and guidelines with the purpose to guide the management of community related issues. Publish LED projects in English and one other local language as prescribed by the new Mining Charter. The Applicant's SLP Manager / CLO must communicate with the authorities on issues pertaining to the SLP and submit annual reports as required in the Mining Right. Make gender-based issues a definite focus of the needs assessment/skills development action plan and ensure that equity of minority groups (women, youth and the disabled) are included in the SLP for bursaries, training and employment opportunities. Focus on the local communities (specifically Ward 9) when students are identified for bursaries, internships and so forth. Be transparent and provide feedback to the communities and the STLM when tenders, bursaries, training opportunities etc. are awarded. Identify and record the level of procurement from HDSA companies on a quarterly basis, as well as geographical sources of procurement.	2	4	6	(12)	5	Medium (60) +
Upliftment of communities through LED programs	Direct Positive	12.2.14.2.9	3	4	4	(11)	4	Medium (44) +		2	4	6	(12)	5	Medium (60) +
Income generation and contract opportunities for HDSA's	Direct Positive	12.2.14.2.10	3	4	4	(11)	4	Medium (44) +		3	4	4	(11)	5	Medium (55) +

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									Encourage and set goals for established companies to form partnerships with HDSAs. Where necessary and feasible, provide mentoring and capacity building assistance to HDSA suppliers. Establish Future Forum, as stipulated in the SLP and Mining Charter, and hold regular meetings/feedback sessions so that the employees, local communities and Unions are aware of the goals, strategies and progress of SLP implementation. Mobilize the Department of Labour Social Plan Services (e.g., Technical assistance, Job Advice Centre, Retrenchment Response Team etc.).						
Negative community mobilization against the project	Direct Negative	12.2.14.2.11	3	4	4	(11)	3	Low (33)	Appoint a dedicated CLO that understands local customs and is proficient in the local languages and make the communication procedures and channels clear to the community, if required.	3	4	4	(11)	2	Low (22)
Labour disputes during operations	Direct Negative	12.2.14.2.12	2	4	6	(12)	3	Low (36)	Attend to issues as soon as they occur and conduct meetings with the community leadership / Ward Councilor / STLM structures to provide feedback on previous matters. Be vigilant not to raise unrealistic expectation amongst the local communities with regards to employment, skills requirements, and new community projects. Ensure transparency through the regular feedback meetings of the Future Forum and/or an Environmental Management Committee.	2	4	6	(12)	2	Low (24)
Increase in crime and security issues	Indirect Negative	12.2.14.2.13	2	4	6	(12)	3	Low (36)	Establish a clear communication channel between the private landowners and mine and maintain good relations.	2	4	4	(10)	3	Low (30)
Change to the sense of place	Direct Negative	12.2.14.2.14	2	4	8	(14)	5	High (70)	Clearly identify all sensitive receptors of ground vibration and sound; and survey the quality of the housing and infrastructure prior to blasting activities commencing. Implement all recommendations made by the Blasting Specialist. Consult with the affected parties on the most effective ways that blasting schedules be communicated to them (notice boards, text messages, verbal notifications, etc.). Notify affected parties in advance.	2	4	6	(12)	4	Medium (48)

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									Conduct ongoing engagements, to ensure that blasting for the project occurs in a manner that has the least impact on people and the environment. Ensure that locals are aware of the channels to raise complaints (complaints' register at the entrance to the Project Area/Surface Layout Area, Environmental Monitoring Committee, etc.) Where relevant install silencers on machinery and trucks.						
Disruptions in daily living and movement patterns for surrounding landowners and communities due to higher traffic volumes	Direct Negative	12.2.14.2.16	2	4	6	(12)	5	Medium (60)	Implement all recommendations of the Traffic Impact Assessment Report, to reduce and mitigate potential road safety issues, pedestrian safety, and traffic congestion. Impose penalties for reckless drivers, to enforce compliance to traffic rules and speed limits. Inspect trucks and other heavy vehicles on a regular basis to avoid oil spillages and unroadworthy vehicles that could result in accidents. Display a contact number on trucks where motorists can report reckless driving. Provide suitable pick-up and drop-off areas for public transport (buses and taxis). Limit operations and the movement of trucks on the access and haul roads to reasonable daytime hours and when possible, not on Sundays and public holidays. Access and haul roads regularly graded; and measures implemented to suppress dust (spraying of water on road surfaces).	2	4	4	(10)	5	Medium (50)
Decrease in the quality of life due to intrusion impacts (dust, noise, light pollution, etc.)	Direct Negative	12.2.14.2.17	2	4	6	(12)	4	Medium (48)	Implement the mitigation measures listed above.	2	4	4	(10)	3	Low (30)
Health and safety risks for workers	Direct Negative	12.2.14.2.18	1	4	8	(13)	4	Medium (52)	Operational Health and Safety procedures and requirements of the Mining Right as well as the Water Use License to be implemented and monitored as prescribed by the guidelines of the MPRDA and the National Water Act 36 of 1998 (NWA). Dust monitoring and implementation of sufficient dust suppression methods.	1	4	8	(13)	3	Low (39)

Potential Impact Description per Environmental Aspect: Operational Phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation measures	Significance Post Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
									Employees are to be provided with dust masks that minimize dust inhalation. Issue employees with earplugs and instruct them how to use it. Provide safe and clean drinking water and instill regular water breaks to keep workers hydrated. Implement awareness campaigns (HIV/AIDS/TB, blood pressure, Body Mass Index, Fatigue management, overall emphasis on healthy lifestyle, chronic disease management and wellness), to improve knowledge in the workplace and in the surrounding communities, provision of homebased care and counselling; and educating the people at schools and in the community about the pandemics. Ensure knowledge and implementation of the mine's Environmental Emergency Procedures. Finance awareness campaigns through funds allocated to through the SLP. Ensure that the personnel on the proposed mine are trained in first aid and procedures to follow, in case of fire breakouts and other emergency situations.						
Community health and safety risks	Direct Negative	12.2.14.2.19	2	4	8	(14)	3	Medium (42)	Limit the number of access gates and ensure 24-hour security and other relevant security measures. Post information boards about public safety hazards and emergency contact information. Implement fire breaks to prevent the spreading of veld fires. Fence the entire surface infrastructure area and PCDs and erect signboards in English and the local languages that warn of the dangers of trespassing at the accesses and along the periphery. Implement SWMP to prevent contaminated or dirty water from escaping the mine area.	2	4	8	(14)	2	Low (28)

Table 95: Decommissioning/rehabilitation and post closure phase – Impact Assessment

Potential Impact Description per Environmental Aspect: Decommissioning/rehabilitation and post closure phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation measures	Significance Post Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
Topography															
Restoration of the pre-mining topography	Direct Positive	12.2.2.3.1	2	5	4	(11)	3	Low (33) +	Backfill and level the disturbed site's excavated areas in line with the recommendations made by the groundwater specialist. Topsoil and subsoil should be replaced in the correct sequence on soft overburden material to ensure that subsurface limiting layers are not created. The rehabilitated areas must be shaped to emulate the pre-mining topography as close as possible.	2	5	4	(11)	4	Medium (44) +
Subsidence of the rehabilitated area	Residual Negative	12.2.2.3.2	2	5	10	(17)	4	High (68)	Conduct on-going monitoring for subsidence and or cracking to surface. Where needed, implement backfilling of cracks and landscaping of collapsed areas.	2	5	8	(15)	3	Medium (45)
Soils, Land use and capability															
Soil erosion	Direct Negative	12.2.3.3.1	2	5	8	(15)	4	Medium (60)	Trucks, equipment, and other vehicles must park on designated parking areas and not create additional areas at risk of soil erosion by parking outside of the demarcated areas.	1	5	8	(14)	3	Medium (42)
Soil compaction	Direct Negative	12.2.3.3.2	2	5	8	(15)	4	Medium (60)	Vehicles and equipment must travel within demarcated areas and not outside of the disturbed footprint. Use deep ripper equipment during the decommissioning and rehabilitation phase to alleviate deep compaction as effectively as possible.	1	5	8	(14)	3	Medium (42)
Soil pollution	Direct Negative	12.2.3.3.3	2	5	6	(13)	3	Low (39)	Maintenance must be undertaken regularly on all vehicles and decommissioning machinery to prevent hydrocarbon spills. Remove all contaminated soil to recognised and licensed waste sites if not able to be contained below groundwater levels in final void. Any waste generated during decommissioning, must be stored into designated containers, and removed from the site by registered contractors.	1	3	6	(10)	2	Very low (20)
Loss of soil quality	Residual Negative	12.2.3.3.4	2	5	8	(15)	5	High (75)	Implement mitigation measures under soil erosion, compaction and pollution listed above.	1	4	8	(13)	4	Medium (52)

Potential Impact Description per Environmental Aspect: Decommissioning/rehabilitation and post closure phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation measures	Significance Post Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
									Soil should be spread, treated with fertilizer or ameliorants (if required) and re-vegetated, naturally or with indigenous seeds (as required). Remove all unwanted infrastructure including haul roads. Conduct on-going monitoring for subsidence and or cracking to surface. Where needed implement backfilling of cracks and landscaping of collapsed areas. Implement proposed soil management plan and closure plan compiled by ENVASS (refer to Appendix 6.12)						
Return to arable land and crop production	Residual Positive	13.2.3.3.5	2	5	6	(13)	2	Low (26) +	Implement proposed soil management plan and closure plan compiled by ENVASS.	2	5	8	(15)	4	Medium (60) +
Terrestrial Biodiversity (Flora & Fauna)															
Degradation of vegetation within the study area and surrounds due to unsuccessful rehabilitation	Residual Negative	12.2.4.3	3	5	6	(14)	4	Medium (56)	Rehabilitation of natural vegetation should proceed in accordance with a rehabilitation plan. This rehabilitation plan should consider all development phases of the project indicating rehabilitation actions to be undertaken concurrently and during/ after mine closure. Concurrent rehabilitation efforts should be documented in terms of species used, soil amelioration and other variables, acting as rehabilitation trials in order to determine the efficiency of rehabilitation methods and the suitability of plant species used for final revegetation purposes. All infrastructure footprint areas should be rehabilitated to a point where natural processes will allow an appropriate level of ecological functioning and biodiversity of the area to be re-instated. All soils compacted as a result of mining activities should be ripped, profiled and revegetated as required. Special attention should be paid to alien and invasive control within these areas. Rehabilitation success and plant species establishment on mining areas must be monitored during the post-closure	2	4	6	(12)	3	Low (36)

Potential Impact Description per Environmental Aspect: Decommissioning/rehabilitation and post closure phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation measures	Significance Post Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
									phase of the project for a period of three years.						
Alien Infestation resulting from the introduction of species not naturally occurring in the area.	Direct Negative		3	5	6	(14)	4	Medium (56)	An alien and invasive plant species management programme must be implemented. The use of herbicides in alien eradication should be avoided to prevent contamination of water sources and inadvertent loss of indigenous species. Any erosion noted within natural grassland areas must be rectified immediately through soft engineering techniques if noted. Rehabilitation success and plant species establishment on mining areas must be monitored during the post-closure phase of the project.	2	4	6	(12)	2	Low (24)
Disturbance or persecution of faunal SCC	Direct Negative		2	3	6	(11)	3	Low (33)	Faunal species threatened by decommissioning activities should be removed to safety by the SHE manager or appropriately qualified independent botanist.	2	3	6	(11)	2	Low (22)
Return of flora and faunal species to rehabilitated areas	Residual Positive		2	5	6	(13)	2	Low (26) +	Avoid repeated burning and grazing new growth immediately after a burn every year. Prevent prolonged over-grazing over rehabilitated areas, which may lead to a loss of vigour in the sward, altered species composition and veld degradation, and a resultant change or decrease in bird diversity. Avoid grazing new growth immediately after a burn every year. Any priority floral species rescued and relocated during the mining process, should be monitored to determine their re-establishment success.	2	5	6	(13)	4	Medium (52) +
Surface water															
Alteration of water quality	Residual Negative	12.2.5.3.1	4	5	8	(17)	2	Low (34)	Implement the mitigation measures described under groundwater below to reduce the nature (strength) and volume of AMD. The water storage facilities that are not needed for future use must only be breached and rehabilitated when the water qualities are such that the water can be released.	3	5	8	(15)	2	Low (30)

Potential Impact Description per Environmental Aspect: Decommissioning/rehabilitation and post closure phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation measures	Significance Post Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
									All stockpile areas must be cleaned, ripped, and contaminated soil disposed of site. Waste should be removed off-site by specialist contractors for disposal. In the event of spillage, the spill must be cleaned as soon as possible.						
Altering the amount of sediment entering water resource and associated change in turbidity	Residual Negative	12.2.5.3.2	3	5	6	(14)	2	Low (28)	Decommissioning activities around watercourses must be restricted to the dryer winter months. Re-vegetate areas with a suitable mix of grass species, where required, taking cognisance of locally endemic species. Maintain silt traps until the disturbed area has been re-vegetated to contain silt transported downslope during rainfall events. Cordon off areas that are under rehabilitation as no-go areas using danger tape and steel droppers. If necessary, these areas should be fenced off to prevent vehicular, pedestrian and livestock access. Buffer zones, around wetland areas, should be maintained to trap sediments. Any new erosion gullies must be remediated immediately.	2	5	6	(13)	2	Low (26)
Altering the flow regime of a watercourse	Residual Negative	12.2.5.3.3	3	5	6	(14)	2	Low (28)	Continue with effective storm water management during the decommissioning phase. Topography should be engineered such that runoff is directed away from the opencast areas.	2	5	6	(13)	2	Low (26)
Loss of aquatic biota	Residual Negative	12.2.5.3.4	4	5	8	(17)	2	Low (34)	Implement the mitigation measures described under groundwater below to reduce the nature (strength) and volume of AMD. Implement decant treatment system approved by DWS.	3	5	8	(16)	2	Low (32)
Wetlands															
Change in hydrological function	Cumulative Negative	12.2.6.3	3	2	6	(11)	2	Low (22)	Continue with effective storm water management during the decommissioning phase.	2	2	4	(8)	1	Very low (8)

Potential Impact Description per Environmental Aspect: Decommissioning/rehabilitation and post closure phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation measures	Significance Post Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
									Topography should be engineered such that runoff is directed away from the opencast areas.						
Sedimentation and siltation	Cumulative Negative	12.2.6.3	3	2	6	(11)	2	Low (22)	Decommissioning activities around watercourses must be restricted to the dryer winter months. Re-vegetate areas with a suitable mix of grass species, where required, taking cognisance of locally endemic species. Maintain silt traps until the disturbed area has been re-vegetated to contain silt transported downslope during rainfall events. Cordon off areas that are under rehabilitation as no-go areas using danger tape and steel droppers. If necessary, these areas should be fenced off to prevent vehicular, pedestrian and livestock access. Buffer zones, around wetland areas, should be maintained to trap sediments. Any new erosion gullies must be remediated immediately.	2	2	4	(8)	1	Very low (8)
Introduction and spread of alien vegetation	Direct Negative	12.2.6.3	2	3	6	(11)	2	Low (22)	An alien vegetation eradication programmed should be implemented on the site to remove the alien vegetation from the wetland areas during decommissioning and after closure.	2	2	4	(8)	1	Very low (8)
Changes in water quality	Direct Negative	12.2.6.3	3	2	6	(11)	2	Low (22)	Implement the mitigation measures described under groundwater below to reduce the nature (strength) and volume of AMD. The water storage facilities that are not needed for future use must only be breached and rehabilitated when the water qualities are such that the water can be released. All stockpile areas must be cleaned, ripped, and contaminated soil disposed of site. Waste should be removed off-site by specialist contractors for disposal. In the event of spillage, the spill must be cleaned as soon as possible.	2	2	4	(8)	1	Very low (8)

Potential Impact Description per Environmental Aspect: Decommissioning/rehabilitation and post closure phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation measures	Significance Post Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
Groundwater															
Groundwater rebound and potential decant	Residual Negative	12.2.7.3.1	3	5	6	(14)	4	Medium (56)	All sulphate containing waste material should be stored at the bottom of the opencast and flooded as soon as possible to exclude oxygen. Backfill material should be compacted, and surface water flow should be routed around the backfilled opencasts to reduce recharge to a maximal extent. Should seepage or decant occur, the water should be redirected via trenching to an evaporation dam that is sanitarily lined with secondary containment.	2	5	4	(11)	3	Low (33)
Aquifer contamination caused by polluted water migrating away from the mining area (pollution plume)	Residual Negative	12.2.7.3.2	3	5	8	(16)	4	High (64)	The acid producing material must be placed as low in the pits as possible, followed by the non-acid generating material. All mined areas should be flooded as soon as possible to minimise oxygen from reacting with the remaining pyrite. The final backfilled opencast topography should be engineered such that runoff is directed away from the mining areas. The final layer (just below the topsoil cover) should be as clayey as possible and compacted if feasible, to reduce recharge to the decommissioned mines. Natural berms must be constructed to allow free drainage of surface water around the rehabilitated pit. Surface and groundwater quality and quality monitoring should be continued until a steady state is reached.	2	4	8	(14)	3	Medium (42)
Air Quality															
Decrease in the ambient air quality due to emissions (dustfall, PM_{10} and $PM_{2.5}$) associated with construction activities	Direct Negative	12.2.8.3	2	2	4	(8)	4	Low (32)	Implement mitigation measures listed above under construction phase.	2	2	2	(6)	4	Low (24)
Visual															
Increased visual intrusion and change to sense of place through dust plumes	Cumulative Negative	12.2.10.3	1	5	6	(12)	3	Low (36)	Dust suppression measures should be in place at all times.	1	5	4	(10)	2	Very low (20)

Potential Impact Description per Environmental Aspect: Decommissioning/rehabilitation and post closure phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation measures	Significance Post Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
Deterioration of visual quality and sense of place for sensitive receptors within 500m of the project area.	Direct Negative	12.2.10.3	1	5	6	(12)	3	Low (36)	Overburden stockpiled on site must be used for backfilling of the previous mined-out void to limit the number of overburden stockpiles visible.	1	5	6	(12)	2	Low (24)
Deterioration of visual quality and sense of place for sensitive receptors between 500 - 1500m of the project area.	Direct Negative	12.2.10.3	2	5	6	(13)	3	Low (39)	Remove all built infrastructure. Stabilise and backfill the opencast pit, and contour to ensure it is free draining. Ensure that all disturbed areas are re-vegetated. Restore disturbed surfaces as closely as possible to their original topography and revegetate using locally occurring grass species. Conduct on-going monitoring and maintenance of the rehabilitated pits to ensure that vegetation establishes successfully, and that erosion does not occur. Start the rehabilitation of disturbed areas as soon as practically possible in order to restrict long stages of exposed soil and possible erosion. Ensure that rubble, litter, and disused materials are managed and removed regularly. Where new vegetation is proposed to be introduced to the site, an ecological approach to rehabilitation, as opposed to a horticultural approach should be adopted. Appoint a registered landscape architect (with SACLAP) to draw up a planting plan along these principles.	2	5	4	(11)	2	Low (22)
Socio Economic															
Job losses and retrenchments	Residual Negative	12.2.14.3	2	5	4	(11)	5	Medium (55)	Implement training programs throughout the life of the mine in order to promote long term sustainability of employees.	2	5	2	(9)	5	Medium (45)

Potential Impact Description per Environmental Aspect: Decommissioning/rehabilitation and post closure phase	Type and Nature of Impact	Number	Significance Pre-Mitigation						Mitigation measures	Significance Post Mitigation					
			Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)		Extent (E)	Duration (D)	Severity (S)	Consequence (E+D+S = C)	Probability (P)	Significance (CXP)
									All recommendations of the SLP that relates to retrenchments, job losses and responsibilities of the Future Forum to be implemented.						
Injuries caused by falls, drowning, land slips and derelict buildings.	Direct Negative		2	5	10	(17)	3	Medium (51)	Implement the closure plan and mitigation measures described under the environmental aspects above. Develop a clear policy for the management of emergencies or accidents in the community as a direct result of the projects activities.	1	5	8	(14)	2	Low (28)

13.4 Summary of Specialist Reports

The table below presents the recommendations made in the specialist studies, where applicable. The proposed mitigation measures, monitoring programs, management objectives and conditions of authorisation in Sections 13.3, 14.3 and 15 were informed by these recommendations.

Table 96: Summary of Specialist Reports

List of Studies Undertaken	Recommendations of Specialist Reports
Wetland/Riparian Delineation and Functional Assessment	• The no-go areas identified must be pegged in the field in collaboration with the surveyor for precise boundaries. • Maintain the recommended buffer zones (40m for construction and 67m for operation) to trap sediments with associated toxins. • Permanent changes to regional hydrology, particularly interflow should be quantified by a hydropedologist. • Control of alien invasive plants should form part of the maintenance plan • Demonstrate adherence to the Mitigation hierarchy. • A wetland offset strategy should be formulated should loss of hydrological zonation be detected in downslope wetlands. • Independent monitoring of wetland integrity and water quality should be conducted throughout the life of the mine.
Terrestrial fauna and flora assessment	• The Natural grassland: open grassland and Wet Moist grassland vegetation units must be conserved as far as possible and disturbance within these areas is strongly discouraged. • Conservation of the Natural grassland: degraded vegetation unit should take place and ecological improvements considered. • Development within this vegetation unit will lead to a loss of floral biodiversity and habitat within the larger region, however it should be noted that a high level of disturbance has already occurred in this area. The ecological condition of this vegetation unit may be improved should the number of grazing units/ha be controlled, and eradication/control of listed alien floral species be undertaken. It is recommended that conservation of the vegetation unit take place and that ecological improvements be considered. • The vegetation unit should be conserved due to its high contribution to biodiversity and ecological functioning, and disturbance within these areas should be avoided. Edge effects from proposed mining activities must be strictly managed and rehabilitation and eradication/ control of listed alien invasive floral species within these areas must be considered, with particular reference to improving the vegetation associated with the watercourse located within Portion 6 of the Farm Sterkstroom 400JS. • Should the end land use be determined as grazing, it is recommended that a mixture of grass species indigenous to the region and Rand Highveld Grassland Vegetation Type be utilised in re-vegetation and rehabilitation.

List of Studies Undertaken	Recommendations of Specialist Reports
	• Any floral or faunal SCC encountered within the proposed development footprint areas, must be rescued and relocated under the supervision of a qualified ecologist to areas falling outside of the proposed development footprint, such as the Natural Grassland or Wetland/ Moist Grassland vegetation units which should remain excluded from development. Where required, and upon consultation with the relevant specialist, permits should be obtained to do so from the local authorities. • Monitor changes in faunal habitat extent and productivity via remote sensing.
Aquatic Assessment Report.	• Construction activities should use existing bridges and roads wherever possible instead of clearing vegetation to create new transport roads and bridges. • All mitigation measures proposed by the wetland specialist must be adhered to should the development commence. • During the construction period, aquatic bio monitoring should be conducted on a quarterly basis and during the operational phase, aquatic bio monitoring should be conducted on a bi-annual basis. This assessment should include the latest version of SASS, IHAS, VEGRAI, FRAI and additionally diatoms should be considered as a bio monitoring tool.
Groundwater Impact Assessment	• Additional geophysical investigation is required around the boundaries of the proposed opencasts in order to site drilling targets for monitoring boreholes. • Update the numerical and geochemical model against monitored data during operations. • Water quantity and quality data should be collected on a regular, ongoing basis during mine operations. These data will be used to recalibrate and update the mine water management model, to prepare monitoring and audit reports, to report to the regulatory authorities against the requirements of the IWWMP and other authorisations and as feedback to stakeholders in the catchment, perhaps via the CMA. • The newly drilled boreholes should be incorporated into a groundwater monitoring network and monitoring should be conducted as specified in the IWWMP. • Monitoring of the spruit on the Bankfontein 375 property north of the Northern opencast mine as well as the spruit flowing to the south-west of both opencasts on the Driefontein 398 and Sterkstroom 400 properties must be performed on a quarterly basis during mining. • The hydrocensus and risk assessment should at least be repeated once before closure to evaluate any impacts. • The proposed monitoring network should be established prior to operation and implemented when operations at the mine commences. • A regional study be undertaken to quantify impacts on at least a quaternary scale, or a data sharing agreement should be reached with neighbouring mines.
Noise Impact Assessment	• If a stockpile is to be sloped, it should be done with the slope gradient facing away from a receptor R1 (see map below). If technically feasible, the tip of the sloped stockpiles (e.g., discard dumps/mineral residue deposits etc.) should have a berm implemented on them (to be discussed with team engineers).

List of Studies Undertaken	Recommendations of Specialist Reports
	• Any area where a tip is to be implemented should not be higher than a berm (and in relation to a receptor). Tips should be placed as close to a berm as possible in relation to a receptor's locality. • Contractors should install acoustical mufflers are recommended on the exhaust outlets of all heavy vehicles. • If the project proposes to alter (expand or extend) a local municipality route(s), a noise assessment should be conducted (GN R154 legislation requirement). Expansion or extend refers to a municipal road that the project engineers require to add an extra lane or change the specifications of the road paving etc. Minimise night-time construction and operational activities. • The mine should consider reverse alarms that do not generate a high noise nuisance due to its tonality. Although heavy vehicle reverse alarms are exempt from noise legalisation (GN R154) and needs to meet occupational health and safety standards, certain reverse alarms are less intrusive (less tonal more broadband character etc.). • Onsite noise measurements should be considered on a frequent basis, to help identify any fault or loud equipment that may require enclosures or maintenance. It should be conducted at a frequency determined by the project team or environmental coordinator (or risk assessment team etc.).
Visual Impact Assessment	• Ensure overburden piles are vegetated and are placed within the topography where they will have the least visual disturbance. • Rehabilitation must be done according to the post-mining topographical plan to ensure that the visual impact is minimised post-mining. • Minimising the long-term visual impact by creating landforms which are compatible with the surrounding landscape. • The proposed activity must not be established closer than 100m from the western and southern boundaries to allow for sufficient planted buffers to be established as screens. • Where the overburden dumps and opencast pits cannot be returned to their natural state, it is recommended that a professional landscape architect / rehabilitation specialist is consulted in order to limit the long-term visual impacts of those disturbed areas.
Wetland Assessment	• The operational plan must make provision for an accurate topographical survey of the mining area before any mining operations are to commence. The intention of this is to determine the topographical baseline that the area will need to be returned to during the rehabilitation phase. • A detailed soil stripping plan must be drawn up as well as a detailed soils replacement plan to facilitate the rehabilitation of the mining site.
Agricultural Potential Assessment	• Crop yields of the adjoining fields should be monitored to compare that to land further away. This will indicate the impact of dust and air pollution caused by the mine activities. • Water quality should be monitored and measured against criteria of DWS and SABS regarding suitability for livestock health.

List of Studies Undertaken	Recommendations of Specialist Reports
Traffic Impact Assessment	• D1433 should be upgraded to a 2-lane paved road to allow for vehicles to safely and comfortably travel in and out of the site. The road should be 3.5m per direction in width. • The D1344 should be upgraded with a sufficient shoulder for pedestrians to safely walk on – a • recommended minimum of 1.5 meters can be provided. • Public transport facilities should be provided along the D1433 close to the access to the mine and at the intersection of the D1433/R104 and D1433/R555 for taxis to drop and pick up employees. • The access intersection should be designed with a sufficient turning radius for vehicles to easily manoeuvre in and out of the site
Hydrology and civil engineer designs	• It is recommended to supply drinking and potable water at Class I standard according to SANS 241 and water for showers etc. at minimum Class II standards. • Sewage management using a plastic conservancy tank is recommended due to the short life of mine.
Air Quality Impact Assessment	• A Dust Management Plan (DMP) must be developed for onsite activities, incorporating dust control measures as recommended by the air quality specialist, which can be integrated into the design stages of the project. • Conduct regular site inspections to ensure the dust mitigation measures are being implemented and to assess whether further mitigation is required for any of the dust emission sources. • Dust fallout and PM_{10} monitoring must be conducted pre-operation (required to determine baseline dustfall rates and PM_{10} concentrations) and during operation to assess the real-time impacts of proposed mining operations on air quality.
Socio Economic Assessment	• Canyon engages with the landowners during the planning phase to draw up a map with no-go areas and possibly decreasing the northern open cast mine area to minimise negative impacts on the farming activities that will still be taking place once mining commences. • Canyon engages with the landowner regarding the mining area on the south-eastern portion to establish effective means to minimise negative impacts on the access road and for the farmstead. • Canyon investigates the possibility of a socio-economic offset to purchase additional land for farming purposes, so that the current farm workers do not lose jobs and livelihoods. • Negotiations with the landowners take place as soon as possible to determine land values and reach a suitable agreement with regards to the sale of land. • Discussions with the STLM LED Unit be conducted to determine the needs within Ward 9.
Heritage Impact Assessment	• Demarcate sites with a 100-meter buffer as per SAHRA guidelines and avoid them. • A Grave Management Plan should be developed for the graves, to be implemented during the construction and operation phases (which needs approval by SAHRA BGG). • If burial grounds or graves can't be avoided, a detailed grave relocation process must be implemented as required

List of Studies Undertaken	Recommendations of Specialist Reports
	under the NHRA and National Health Act regulations. Stakeholder engagement will need to be implemented in the case where the graves are to be relocated. • The ECO for this project must be informed that the Paleontological Sensitivity of the Vryheid Formation (Ecca Group, Karoo Supergroup) is Very High. • If Paleontological Heritage is uncovered during surface clearing and excavations the Chance find Protocol must be implemented immediately.
Blasting and vibration	• Blast designs must be reviewed prior to first blast and a first test blast must be conducted to confirm levels of ground vibration and air blast. Detailed monitoring must be done during such a blast and used to help define blasting operations going forward. • Stemming length should range between 20 and 30 times the blast hole diameter. In cases for better fly control this should range between 30 and 34 times the blast holes diameter. • Calculated minimum safe distance for fly tock is 402 but the use of minimum 500 m exclusion zone is recommended, and evacuation be negotiated when blasting is done • A photographic survey of all structures up to 1500 m from the pit areas must be conducted. • Blasting must not be conducted when weather conditions (i.e., early morning or late afternoon, foggy conditions, overcast and when wind is blowing strongly) could influence the effects yielded by blasting operations. • A standard blasting time must be fixed and blasting notice boards setup at various routes around the project area that will inform the community of blasting dates and times.

14 Environmental Impact Statement

14.1 Summary of the key findings of the environmental impact assessment

The proposed mining operation will have positive and negative impacts on the environment. The key positive and negative impacts, based on the detailed impact assessment in Section 13, are summarised below.

14.1.1 Key positive impacts

14.1.1.1 Socio Economic

As a result of migration to the STLM (jobseekers), a significant portion of the population growth is between 20 and 34 years of age and approximately 50% of the labour force is youth. In 2011, 27% of the youth group was unemployed. In Ward 9, however, the percentage of children below 14 years and pensioners older than 65 years of age are higher than in the broader STLM. It is clear that the limited employment opportunities in Ward 9 discourage the economic active population to settle here. There is a definite need to bridge the study-work divide in order to equip youth with the necessary skills, and this project, through the SLP initiatives, has the potential to address this gap.

Extraction of the coal resource will contribute positively to the South African Economy but the benefits of the mining to the community largely centre on the Social and Labour Plan. The socio-economically depressed and geographically marginalised communities would benefit directly from the commissioning of the mine.

During the construction phase, limited employment opportunities will become available as workers will be sourced from existing labour sending areas. Some SMME and small business opportunities may manifest as a result of procurement and service requirements. During the operational phase (7 years) positive local economic impacts of medium to high overall significance is possible as a result of:

- Job creation of approximately 250 employees.
- Local procurement, small business and SMME development.
- Employment equity of HDSA's, especially women and youth.
- General local economic impacts for the broader municipality; and
- LED project investments in the STLM.

The positive outcome of these impacts will increase if the number of locals to be considered for the above opportunities are maximised. Canyon is committed to ensuring the growth of HDSA suppliers and its targets, as reflected in the Driefontein SLP, are based on the new Mining Charter Scorecard, 2018. Skills development, training and capacity building is another positive output for the STLM as a result of this project.

14.1.2 Key negative impacts

14.1.2.1 Geology

By the nature of mining projects, the geology is exploited for the target minerals therefore the impact of the proposed project on the target ore body and the overburden and rock above this ore body is necessary for the project and unavoidable. As indicated on the preliminary layout plan the MRA will be divided into two (2) open pits. The disturbance of the geological profile over these areas is definite and non-reversible as the mineral resource will be removed from the geology. The impact can't be mitigated so the Applicant must aim to optimally exploit the resource in terms of tonnage of rock mined and cost as provided for in the mine plan. Mining must be conducted strictly according to the MWP and comply with the recommendations made by the blasting and vibration specialist.

14.1.2.2 Topography

Opencast mining and earthworks inside the MRA will ultimately result in the alteration/modification of the surface topography. This negative impact is unavoidable but can be mitigated during the operational phase and reversed after mining. The aim during decommissioning/rehabilitation is to restore the natural topography in such a way as to allow the natural drainage lines to return as close as practically possible to its pre-mining state. The impact post closure will be positive if this occurs as surface water drainage is restored and topography returned to functioning state. However, bulking of the reinstated materials or possible subsidence are realistic conditions of rehabilitation that will result in the ponding of surface water if the compaction of the materials and final landscaping are not well managed and implemented. Ponding will result in inundation of low-lying areas by surface water (clean and possibly dirty) which will potentially sterilise, contaminate, or salinize the soils, and render the land unusable for any natural functions. The impact will be highly significant and will in turn affect the future land use and capability of the area negatively. If this impact occurs the area must be graded again in order to achieve the post mining objectives before applying for closure.

14.1.2.3 Soils, land us and capability

The largest part of the proposed mining area is cultivated and is classed as high potential arable land which is currently operated as a productive farming unit. The cultivated land is 907 hectares of which 471 ha will be directly disturbed by the proposed mining activities. In terms of the grazing land, 177 ha could be potentially transformed from rangeland to mining land. The significance of the potential impacts is moderate to high post mitigation because based on the current mine layout the loss of high potential land cannot be mitigated. In consultation with the landowner and through correct implementation of the recommended mitigation and management measures the Applicant must ensure that agricultural activities can continue on the adjacent farmland situated within the MRA throughout the LoM.

Agricultural production could resume in the areas not directly affected by mining after year 7 (436 hectares) while the 471 ha within the mining area must be rehabilitated to grazing land potential from year 9 to year 20 after which it could return to current agricultural yields. In order for this to be achieved, the Applicant must develop and implement a soil management plan throughout the life of mine and ensure that rehabilitation is done according to the Closure Plan (ENVASS, May 2022) to restore the soil and land capability to its present condition. Should this happen the loss of high potential agricultural land will not be permanent.

14.1.2.4 Terrestrial biodiversity

The proposed mine infrastructure, in terms of the current layout, is located outside of all areas of increased floral and faunal ecological sensitivity and therefore direct impacts on floral and faunal habitat, SCC and overall species diversity will be limited.

Even though the ecologically sensitive habitat is located outside of the proposed mining footprint area, it is important to note that the natural grasslands and associated wetlands occurring along the southern boundary of the study area play an important role in ecosystem maintenance and contribute significantly to biodiversity in the larger region, which is characterised by extensive cultivation activities and existing mining operations. Important mitigation measures to conserve these areas include limiting the mining and disturbance footprint as far as possible and actively managing of dust, as well as edge effects such as erosion and alien and invasive plant species proliferation (with emphasis on the eradication of NEMBA listed Category 1b species) during all development phases. In addition, the concurrent rehabilitation and revegetation of opencast areas and other areas impacted as a result of the proposed mining project, should take place in order to contribute towards a self-sustaining ecosystem once mining has been completed. Should revegetation be successful and the mining area, which currently comprises cultivated land, be returned to grassland, this could result in a positive impact post-closure, with the potential for these areas to provide indigenous floral habitat.

It is further recommended that any floral or faunal SCC encountered within the proposed development footprint areas, be rescued and relocated under the supervision of a qualified ecologist to areas falling outside of the proposed development footprint, such as the Natural Grassland or Wetland/ Moist Grassland vegetation units which should remain excluded from development. Where required, and upon consultation with the relevant specialist, permits should be obtained to do so from the local authorities.

The proposed project is considered favourable from a terrestrial biodiversity perspective, provided that the mitigation measures as set out in this report are implemented.

14.1.2.5 Surface water

The aquatic ecosystems in and around the study area were largely natural, with few modifications, to moderately modified, and they were located in the headwaters of the non-perennial tributaries to the Klein Olifants River. They were earmarked for conservation on a national or provincial planning level and hence are critical for meeting conservation goals.

The proposed Driefontein Mine will have several impacts on the surrounding environment, however the impacts on aquatic ecosystems are not deemed to be high. Generally, a decrease in water quality will potentially occur if waste materials are not managed correctly, construction work is done within the water source, as well as if there is clearing of the surrounding vegetation. Increased sedimentation can occur instream if adjacent soils are disturbed during construction and during the mining operation, particularly during rainfall events.

If mitigation measures to address the possible impacts are implemented, the significance of potential impacts can be mitigated and reduced especially considering that the proposed mining operation will be concentrated in an area that is furthest away from the drainage system.

The proposed project is considered favourable from a surface water perspective, with the condition that all the recommendations and mitigation measures be strictly adhered to.

14.1.2.6 Wetlands

Significant impacts to the wetlands resulting from the proposed coal mining are expected to be related to loss of recharge areas upslope of the wetlands. Both construction and operational phases of the opencast mine in close proximity to wetlands fall in the Medium risk category. Activities which fall within this category should be authorised through a Water Use Licence and therefor it is recommended that a hydropedological assessment is conducted as part of the WULA process to confirm whether significant regional interflow supports the downslope wetlands.

Changed runoff characteristics will further alter hydrological and geomorphological processes as the topography becomes altered when the site is mined. Potential pollution of wetlands may compromise water quality however with the implementation of the recommended buffer zones and other mitigation measures the significance of the potential impacts can be reduced to medium-low. If independent monitoring highlight possible loss of wetland habitat it should be addressed through offsetting.

14.1.2.7 Groundwater

The main impact during the operational phase will be caused by the dewatering of the open pits which will result in the lowering of the groundwater table in-and adjacent to the mine. The flow in the aquifer will be directed towards the mine at this stage and very little groundwater pollution is thus expected.

Following closure of the mine, the groundwater within the mined areas is expected to deteriorate due to chemical interactions between the geological material and the groundwater. The resulting groundwater pollution plume is expected to commence with downstream movement. Based on the numerical flow and transport modelling performed, the following hydrogeological impacts were identified:

Based on the numerical flow and transport modelling performed, the following hydrogeological impacts were identified:

Drawdown During Mining

- The Northern Opencast is expected to receive inflows of 370 m^3/d. The drawdown from this pit is expected to influence water levels in DFBH3 and DRIE-BH3. Expected water level decline at these receptors is expected to range between 13 and 18m.
- The South-eastern opencast is expected to receive inflows of 480 m^3/d. The drawdown from this pit is expected to influence water levels in DF-BH1, DF-BH2, DRIE-BH1 and DRIE-BH2. Expected water level decline at these receptors is expected to range between 3 and 22m.

Spread of Pollution During Mining

- Contamination from the Northern Opencast is expected to affect the tributary of the Keeromspruit north of the pit with expected concentration increases of 200 – 400 mg/L with regards to sulphate.

Post-Mining

- Contamination from the Northern Opencast is expected to affect the tributary of the Keeromspruit north of pit with expected concentration increases of up to 200 mg/L with regards to Sulphate. The Northern opencast is expected to rebound within 35 years. No decant is predicted.
- Contamination from the South-eastern Opencast is expected to affect DFBH1 and DRIE-BH1 with expected concentration increases of up to 200 mg/L with regards to sulphate. The South-eastern pit is expected to rebound within 40 years. Decant from this mine is expected to take place to the south-west of the pit, at a rate of 1-2 l/sec.

The significance level of the potential impacts can be reduced to low – medium through the implementation of the mitigation measures and recommendations by the groundwater specialist.

14.1.2.8 Air quality

The application area is classified as rural in nature and is located in the Highveld Air Quality Priority Area (HPA). Existing key sources of airborne emissions surrounding the project site have been identified as follows:

- Forestry/Plantation activity (surrounding areas).

- Mining activity (north, east, south-east and south-west of the proposed mine).
- Vehicle dust entrainment on unpaved roads (surrounding areas); and
- Agricultural activity and potential biomass burning (surrounding areas)

Dust-fall, PM_{10} and $PM_{2.5}$ are key pollutants of concern associated with operations at the proposed Driefontein Mine. Based on the prevailing wind fields for the period January 2016 to December 2018, emissions from activities at the proposed Driefontein Mine will likely be transported towards the westerly, west, north-westerly and south-easterly quadrants.

The dispersion modelling results, which considered limited mitigation measures provided by the Applicant at the time, indicate low predicted dust-fall rates and incremental $PM_{2.5}$ & annual PM_{10} concentrations over most of the project area. High predicted incremental $PM_{2.5}$ & annual PM_{10} concentrations and dust fall rates are only observed near the proposed mining & existing Hakhano processing plant activities, as well as the proposed and existing material stockpile/exposed areas, with exceedances of the applicable standards observed. Moreover, high predicted incremental daily PM_{10} concentrations, including exceedances, are observed. While the exceedances extend beyond the proposed Driefontein Mine and processing plant boundaries, the exceedances are only within (at most) 15.8km radius from the centre of the proposed mine. The implementation of dust mitigation measures at the proposed Driefontein Mine and Hakhano processing plant is advised to reduce dust emissions as far as possible. The proposed project is considered favourable from an air quality perspective, with the condition that all the recommendations and mitigation measures be strictly adhered to.

14.1.2.9 Noise

The following receptors will experience an increase in the ambient noise levels during the construction and operational phases:

- R1 (Moderate significance pre mitigation during construction and low significance during operation)
- R6 (Low significance pre mitigation during construction.

To ensure that the noise compliance is achieved under all circumstances, to minimise the potential of a disturbing noise, and to ensure compliance of the footprint boundary limits, the following key mitigation options should be implemented:

- Development of a berm/barrier around open cast footprints in relation to R1 and
- Implementation of a bi-annual noise measurements programme during operation.

With mitigation measures implemented the mine would comply GN R154 legislation requirements (Government Gazette 13717 10 January 1992) and Gauteng Noise Control Regulations GN 5479 of 1999 (Provincial Gazette Extraordinary, 20 January

1999). In terms of noise the project does not present a fatal flaw. International Finance Corporation (IFC) guidelines targets will also be achieved should mitigation be implemented.

The mine operation can ensure compliance with noise legislation if mitigation options are implemented and adhered to. The project should be authorised in terms of noise, with mitigation measures adhered to.

14.1.2.10 Visual aspects

The land on which the mining application is made is under intensive dryland cultivation and the larger region is characterised by commercial farming activities, plantations, smallholdings and existing mining activities with Middelburg serving as a larger urban centre. Infrastructure forming part of the existing Bankfontein Colliery, located within the northern part of the study area, act as a significant visual intrusion and screens part of the project site from the north. The existing forestry plantations to the east and north-east of the study site, screens the project site from the east (although temporary as the screen will disappear after harvesting). Limited visual intrusion or screens exist from the western and southern directions.

Visual impacts will occur from construction through to decommissioning/rehabilitation and closure phases of the project. More specifically, impacts will result from the earth work activities, establishment of the northern and southern overburden dumps, ROM stockpiling, opencast pits, transportation of ROM coal resulting in dust pollution. The visual disturbance of the proposed Driefontein Mine does not lie over any main tourist routes and the existing Bankfontein Colliery act as a screen from the R555, reducing the visual impact from this road. The visual disturbance will however affect the permanent residents in the immediate vicinity. The establishment of the proposed mine is expected to contribute to the change in the sense of place of the local area by transforming the project area from agricultural land to mining, resulting in a visually unappealing environment. It is recognised that the expected visual impact of the opencast mine would be negative in nature, but the impacts can be reduced to a medium – low significance level if the recommended mitigation measures are implemented.

14.1.2.11 Heritage and Palaeontological Resources

A total of thirteen (14) burial grounds and graves (DFN-01, DFN-02, DFN-03, DFN-04, DFN-05, DFN-06, DFN-07, DFN-08, DFN-09, DFN-10, DFN-11, DFN-12, DFN-13, DFN-14) were identified. However, five (5) of the previously identified burial grounds (DFN-01, DFN-02, DFN-07, DFN-09 and DFN-10) have been destroyed by ground clearing and deforestation activities in the area as well as newly established maize fields, since the initial survey in 2019.

Burial grounds and graves have high heritage significance and are given a Grade IIIA significance rating and should be retained and avoided by establishing a 100m no-go buffer as per SAHRA guidelines. The pre-mitigation impact significance is rated as high but with the implementation of the required mitigation measures the post-mitigation impact will be very low considering the mine layout plan in relation to the identified burial grounds and graves.

In terms of Palaeontology, no visible evidence of fossiliferous outcrops was found. However, the proposed mining development is underlain by the Vryheid Formation (Ecca Group, Karoo Supergroup) which according to the SAHRIS PalaeoMap has a Very High Palaeontological Sensitivity and therefor the possibility of finding fossils below the surface is high. A moderate Palaeontological Significance is thus allocated to the development (post mitigation) with the implementation of the recommended Chance Find Protocol.

14.1.2.12 Blast and vibration

Ground vibration, air blast, fly rock and fumes are some of the aspects as a result from blasting operations. The evaluation of effects yielded by blasting operations was evaluated over an area as wide as 3500m from the mining area considered.

Ground vibration was evaluated for various limits according to the types of structures observed. The closest structures observed are the R555 road, Buildings/Structures, Hydrocensus Boreholes, Graves, Dams, Reservoir and Railway Line. Specific attention will be required for adjustments in the blasting operations to ensure expected levels of ground vibration and air blast are within the required limits.

Ground vibration levels predicted ranged between 0.1 mm/s and 1757.9 mm/s for structures surrounding the pit areas. The expected levels of ground vibration for some of these structures are high and will require specific mitigations in the way of adjusting charge mass per delay to reduce the levels of ground vibration. Ground vibration at structures and installations other than the identified problematic structures is well below any specific concern for inducing damage.

Air blast predicted showed the same concerns for opencast blasting. High levels may contribute to effects such as rattling of roofs or door or windows with limited points that are expected to be damaging and others could lead to complaints. Damages are only expected to occur at levels greater than 134dB therefor the current accepted limit on air blast is 134 dBL. It is maintained that if stemming control is not exercised this effect could be greater with greater range of complaints or damage. The pits are located such that “free blasting” – meaning no controls on blast preparation – will not be possible. On charges considered it is expected that air blast will be greater than 134 dB at a distance of 86 m and closer to pit boundaries. Infrastructure at the pit areas such as roads, heritage sites and Hydrocensus boreholes are present, but air blast does not have any influence on these installations

An exclusion zone for safe blasting was also calculated as fly rock remains a concern at blasting operations. The exclusion zone was established to be at least 402 m. The use of the normal practice observed in mines of 500 m exclusion zone will include the Buildings/Structures, Boreholes, Graves and the R555 road which all falls within the Pit Areas. The use of minimum 500 m exclusion zone is rather recommended, and it will be required that evacuation be negotiated when blasting is done.

Specific actions will be required for the pit area such as Mine Health and Safety Act requirements when blasting is done within 500 m from structures and mining with 100 m for structures.

Closure of roads and considering the farming community around the pit area must also be considered.

The pit areas are located such that specific concerns can be addressed through the implementation of the recommended mitigation measures.

14.1.2.13 Traffic

The proposed development will gain access from the D1433 and will be controlled by a boom gate with attendants. Using the Driefontein Coal Mine transport requirements, 20 vehicle trips are expected to be generated during a typical weekday AM and PM peak hour of the Construction Phase and 58 vehicle trips are expected to be generated during a weekday AM and PM peak hour during the Operational Phase. The capacity analysis results show that the intersections under investigation are anticipated to operate at acceptable LOS and under capacity i.e., the surrounding road network has sufficient capacity to accommodate the future traffic demand generated by the proposed development.

The additional traffic volumes will not have a significant impact on the performance of the existing intersections surrounding the proposed development. The results of the assessment show that the significance of the impact will be low during the Construction and Operational phase. However, the D1433 road proposed to be used to transport ROM from the proposed mine is unpaved and narrow. In order to ease the movement of the vehicles, a smoother surface would be ideal. It is therefore recommended that the D1433 is upgraded to a paved one-lane per direction. It should be noted that this recommendation is made for the ease of movement and safety on the road and not for capacity reasons. The access intersection should also be designed with a sufficient turning radius for vehicles to easily manoeuvre in and out of the site. When the proposed mitigation measures and upgrades are implemented, the impact significance is expected to be very low and therefor the proposed development should be favourably considered from a traffic engineering point of view.

14.1.2.14 Socio Economic

Whilst emphasis is often placed on the economic advantages of a mining project, many negative long-term impacts may manifest for locals. Historically mining has caused significant environmental and social harm in South Africa. It has the potential to pollute water and soil, resulting in negative impacts on ecosystems and violating the rights to life and a healthy environment. The largest part of the proposed mining area is cultivated and is classed as high potential arable land. A large portion will be lost to the mining activities and the following negative socio-economic related impacts are foreseen:

- Assuming that the agricultural income loss will be on the full MRA (907ha) since agricultural activities will most likely not proceed due to the fragmentation of agricultural land within the 7-year LoM and the uncertainly regarding future land-use within the MRA a gross income of R18,1 million per year and a net farm income of R7,4 million, after depreciation and overhead costs will be lost. It is the intent of Canyon Resources to subdivide and purchase the affected portions for mining purposes and implement a sequence approach to mining which could allow agricultural activities to continue alongside operations. This will be largely dependent on the adherence to correct mitigation and management measures and whether the landowner will be willing to continue farming on the MRA, but should agricultural activities continue alongside mining the economic impact will be significantly reduced to R9,595 million gross and R3,05 million net farm income lost. If required, appoint an independent Valuer to determine the market value of the land and to ensure fair compensation for land acquired for mining purposes or compensate the farmer for annual loss of income during the LoM.
- The loss in productive agricultural land will result in approximately 65% job losses. At present the farmer employs 21 workers and approximately 13 to 14 employees could be retrenched once the mine is operational.
- A loss of access to livelihoods for the farmer, workers and their families are thus imminent, and could further be impacted by potential ground and surface water pollution, affecting domestic water, livestock and crops; dust generation that damages crops and affecting livestock and human health; an increase in stock theft (security impacts) as a result of the influx of jobseekers and jobless people; and livestock being killed due to speeding and negligent driving on access and haul roads.
- Impacts on land values due to fragmentation of agricultural land (subdivisions).
- Mining related activities such as increases in traffic and large vehicles; potential influx of workers and erection of illegal structures; blasting activities; safety and security issues; pollution of air and groundwater resources; as well as loss of livelihoods will undoubtedly impact negatively on sense of place.

Whilst it is possible to mitigate most of the negative impacts associated with the operational phase to be less significant, the impacts will still manifest.

14.2 Final Site Map

The location of the project site is constrained to the location of the open cast minable coal reserve. By considering the location of the mineral resource the aim is to place the infrastructure in an area which will have the least impact on the current land use and sensitive environmental features on site.

14.2.1 Pit layout

The Driefontein Opencast Pits as shown in Figure 114 are dictated by the mining costs, the thickness and grades of the coal seams, the required environmental management measures and, to a lesser extent, by the mining equipment chosen.

14.2.2 Infrastructure layout

14.2.2.1 Location of ROM stockpiles and Hard Park

One ROM stockpile area will be established at each open pit. The ROM stockpile areas must be situated next to the haul roads to allow for easy transportation. The sites will be located more than 100m away and outside the 1:100-year flood line of any watercourse. The ROM stockpiles should be situated at a high elevation point to allow storm water to follow the gradient through the dirty water drains into the PCDs. The ROM stockpile area and hard park, indicated on the preliminary layout plan, at the northern opencast pit is located far from the mining area and together with the haul roads, dust and air pollution; has the potential to sterilise larger areas than what is required for mining purposes. Therefore, the ROM stockpile area and hard park has been moved to the end of the main haul adjacent to the northern pit's overburden dumps. By moving the location further north it could allow farming to continue in the area between the main haul road and northern pit.

14.2.2.2 Pollution control dams

Two PCDs are required since there will be two open pits and ROM stockpile areas which dirty water runoff must be contained. The PCDs will be located outside the 1:100-year flood line or more than a 100m away from the nearest watercourse.

The PCD at the northern pit has been moved further east to be situated closer to the overburden dumps and ROM stockpile area which will decrease the size of the disturbed area.

The PCD at the South-Eastern pit has been moved further north next to the overburden dumps to be situated outside the delineated wetland buffer.

14.2.2.3 Topsoil stockpiles and overburden dumps

The topsoil and overburden recovered from the box cut areas is to be placed in separate resource dumps (topsoil, hard and soft dumps) along the boundary of the open pits so the cost of having to haul from the overburden locations is offset.

14.2.2.4 Haul road, culverts and access control

The main haul road will be established from the D1433 gravel road and run along the northern boundary of the application area between the northern and South-Eastern open pits. Culverts will be constructed to manage storm water runoff at the locations determined by the civil engineer. The location of the guardhouse will be at the mine entrance on the eastern boundary of the application area.

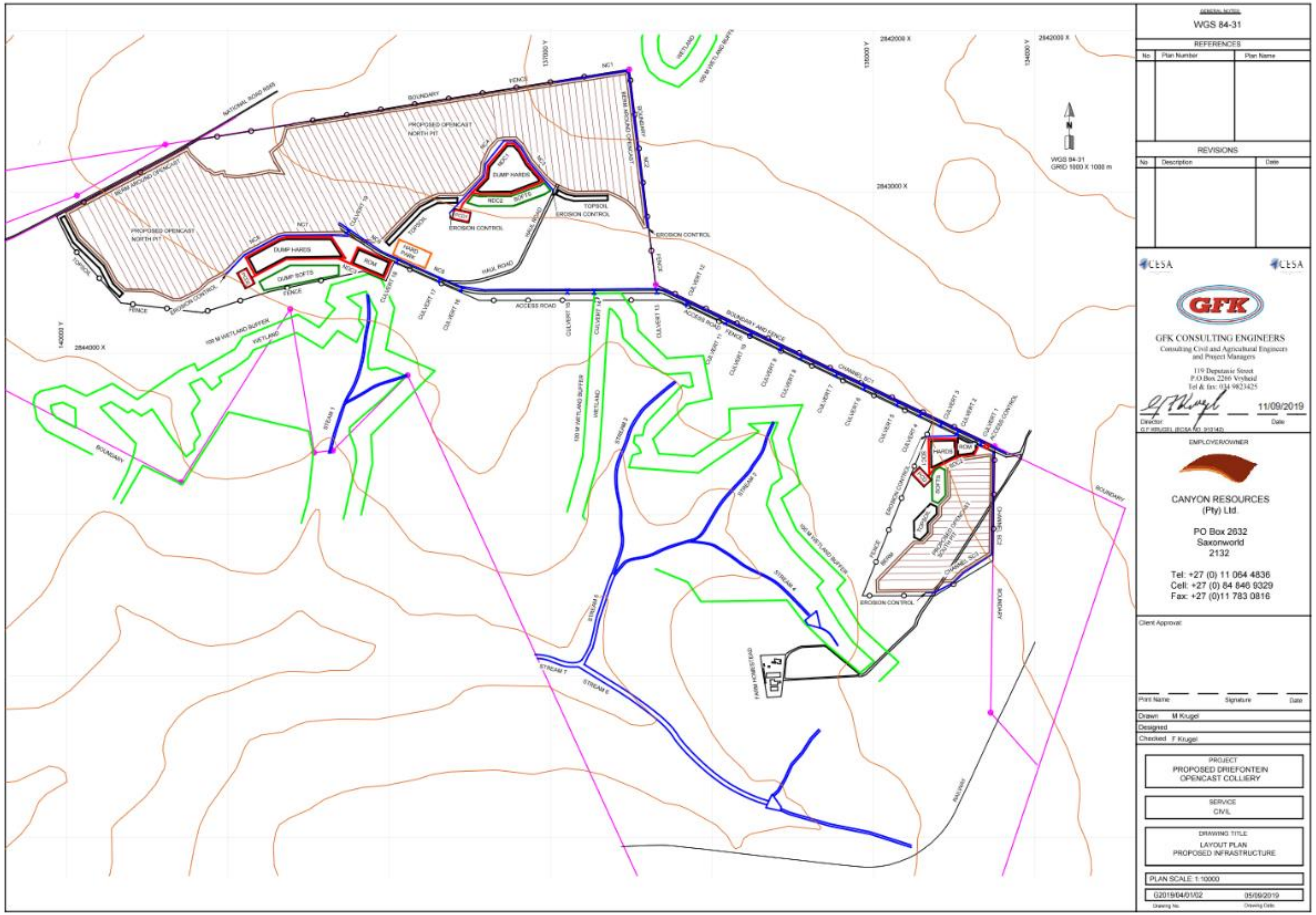

Figure 114: Final Site Map

14.3 Impact management objectives and the impact management outcomes for inclusion in the EMPr

The overall Environmental Management objective is to minimize the potential negative environmental and societal impacts and maximise the positive socio-economic impacts of the proposed Driefontein Mine. The proposed impact management objectives to guide and control all phases of the mining operation are presented under the headings below. These objectives must be attained and/ or maintained to ensure satisfactory environmental (social, economic, and biophysical) management outcomes are achieved throughout the life of mine.

14.3.1 Construction phase

The main impact management objectives for the construction phase are:

- Minimise the size of the disturbed area and remain within the designated construction footprint by prohibiting movement of machinery in certain areas, using existing roads as far as possible and establishing construction camps, contractors' laydown areas and other temporary infrastructure within areas that have already been modified.
- Locate construction camps within areas where no natural habitat remains.
- Develop a soil management plan which sets out a clear set of actions and responsibilities for the control of impacts affecting the soil, land use and land capability within the operations' development footprint.
- Relocate SCC to suitable similar habitat within the vicinity of their occurrence, with the process overseen by a suitably qualified botanist.
- Construction activities must comply with the GN704 Regulations.
- Establish and maintain the recommended buffer zones around the wetland areas.
- Minimize the risk of spillages through proper storage, handling and monitoring of fuel and chemicals used on site.
- Conduct dust fallout and PM_{10} monitoring pre-operation to determine baseline dustfall rates and PM10 concentrations.
- Comply with the National Ambient Air Quality Standards and Dust Control Regulations, 2013 at all discrete receptors.
- Comply with GN R154 legislation requirements in terms of noise levels.
- A Grave Management Plan should be developed for the graves, to be implemented during the construction and operation phases (which needs approval by SAHRA BGG).
- Ensure that all infrastructure and the site and general surroundings are maintained in a neat and appealing way.
- Comply with the commitments made in the SLP.
- Manage recruitment process to control expectations and unnecessary in-migration.
- The D1433 should be upgraded as recommended by the traffic engineer to allow for vehicles to safely and comfortably travel in and out of the site.
- A detail inspection of the area and accurate identification of structures must be conducted, prior to the first blast, to ensure the levels of ground vibration allowable and limit to be applied.

14.3.2 Operational phase

The main impact management objectives for the operational phase are:

- Retain stripped soils biological, chemical, and physical characteristics as far as possible for successful use during rehabilitation by stockpiling different soil horizons in different areas, vegetating stockpiles and keeping inventory of stockpiles.
- Modified grasslands should be optimised for development and the development footprint should be located within this vegetation unit as far as possible, and as per the proposed layout provided.
- Maintain the recommended buffer zones around the wetland areas.
- Any faunal SCC encountered within the proposed development footprint areas, will be rescued, and relocated.
- Only areas earmarked for immediate opencast mining (per section) will be cleared of vegetation to limit erosion potential.
- Minimise fragmentation and disturbance of agricultural activities.
- Rectify early signs of erosion as soon as such is noted.
- Reduce sediment deportation and surface water quality deterioration through effective storm water management.
- Contain all dirty water and divert the maximum amount of clean water to the surrounding drainage lines.
- Prevent the ingress of leachate from waste streams (ROM stockpiles, PCDs, overburden dumps) into the soil and groundwater by appropriate engineering design, construction and management in terms of GNR.633 to R.636.
- Ensure that the water quality of the identified watercourses comply with the DWS target water quality objectives.
- Eradicate weeds and alien invaders by implementing a weed control program throughout the life of mine.
- Develop a DMP for onsite activities, incorporating dust control measures as recommended by the air quality specialist, which can be integrated into the design stages of the project.
- Comply with the National Ambient Air Quality Standards and Dust Control Regulations, 2013 at all discrete receptors.
- Comply with GN R154 legislation requirements in terms of noise levels.
- Equipment operating outdoors and not behind a berm/acoustical shield (in relation to a receptor) and within 500m of a receptor should not generate a noise level higher than 85dBA.
- Comply with the recommendations made by the Blasting and Vibration Specialist in terms of maximum charge mass, minimum distance between blasts and POI's, unsafe zones for fly rock and explosive quality controls.
- Comply with the regulatory requirements of the Mine Health and Safety Act.
- If new burial grounds or graves are identified during mining and the site is going to be impacted directly a detailed grave relocation process must be implemented as required under the NHRA and National Health Act regulations.

- Fossils may not be excavated, broken, moved, or destroyed without prior assessment and without a permit from the relevant heritage resources authority.
- Implement concurrent rehabilitation of the pits using the roll over method to pre-determined maximum gradient/s to prevent erosion and allow for adequate vegetation growth while taking the appearance of the natural topography into consideration.
- Adhere to the commitments made in the SLP.
- Enhance positive socio-economic impacts through good management practices.
- Ensure good public relations and communications.
- Public transport facilities should be provided at the locations recommended by the traffic engineer.

14.3.3 Decommissioning/rehabilitation and post closure phase

The goal of rehabilitation, with respect to the area from which the product has been extracted, is to leave the area level and even, containing no foreign debris or other materials. The main impact management objectives for the decommissioning, rehabilitation and post closure phase are:

- The overburden material (carbonaceous and non-carbonaceous) used for backfilling, must be backfilled in the same sequence as removed during the mining phase.
- Backfilled carbonaceous overburden must be followed by non-carbonaceous overburden and capped with topsoil to ensure effective revegetation of disturbed areas.
- Topsoil and subsoil should be replaced in the correct sequence on soft overburden material to ensure that subsurface limiting layers are not created.
- All impacted areas should be ripped, covered with topsoil and revegetated with an indigenous grass species mixture comprising species representative of the Rand Highveld Grassland vegetation type.
- Topography must be shaped to ensure that natural topographic conditions are attained prior to replacement of stockpiled soil.
- Storm water leaving the site downstream must be clean and of the same quality as in situ before it enters the site (upstream),
- Depending on the end land use, which is currently is indicated to be grazing, all impacted areas should be covered with topsoil and revegetated with an indigenous grass species mixture containing species representative of the Rand Highveld Grassland vegetation type as far as possible.
- Ensure that the required rehabilitation of pollution control measures is undertaken in accordance with the closure objectives and the mine closure plan (developed in terms of the Minerals and Petroleum Resources Development Act and the Mining Environmental Series (MEM) and guidelines on closure prepared by the Department of Water Affairs and Forestry.
- The hydrocensus and risk assessment should at least be repeated once before closure to evaluate any impacts and to ensure that the groundwater quality within the study area will comply with the DWS target water quality objective

and will be of sufficient quality that can still be used by surrounding groundwater users.
- Implement decant management strategy to ensure that the surface water leaving the rehabilitated site complies with the DWS target water quality parameters.

14.4 Final proposed alternatives

The preferred alternative is the development of the proposed Driefontein Mine on Portion 6 of the farm Sterkstroom 400 JS, Portion 5 and a section of Portion 6 of the farm Driefontein 398 JS. The project will include:

- Opencast coal mining will be conducted with a phased approach, using the conventional truck and shovel rollover method.
- Two opencast pits referred to as the Northern and South-Eastern pits
- Concurrent rehabilitation will take place.
- Berms will be constructed around the opencast pits.
- The remaining overburden material consisting of separate topsoil, soft and hard waste material stockpiles stored in eleven (11) locations around the pits.
- Two ROM stockpile areas will be established (one at each pit).
- ROM will be transported via the D1433 gravel road to the existing Hakhano Colliery or other licensed site for processing via the existing gravel road (D1433) or sold raw.
- Storm water runoff will be managed through a series of clean and dirty water channels, temporary berms, and contour banks.
- Dirty storm water from the ROM stockpile areas and overburden dumps will be directed to two (x2) Pollution Control Dams (one at each pit).
- Water required for dust suppression will be sourced from groundwater inflow into pits recycled from the PCDs.
- Access to the MRA will be gained from the D1433 gravel road.
- One main haul road will be constructed inside the MRA between the Northern and South-Eastern opencast pits.
- A weighbridge will be established at the entrance of the mine.
- Administration facilities will consist of site and security offices with a hard park area and ablution facilities.
- Domestic water will be obtained from boreholes.
- A plastic conservancy tank is proposed with approved Contractors removing the sewage to a suitable municipal sewage treatment works.
- A fence will be erected around the operational areas.
- Mining and logistical services will be provided by contractors.
- Decant management will be implemented (active or passive treatment depending on outcome of investigations during the operational phase). More detail will be provided as part of the WULA.

14.4.1 Alternative option

The alternative option is the No Go alternative which will entail not mining the coal reserve and the status quo of the MRA will remain the same.

15 Aspects for inclusion as conditions of Authorisation

The impact assessment focussed on the project scope as described in Section 5 which was based on the information supplied by the Applicant. The mitigation measures identified to manage the potential impacts during the life of mine are contained in the EMPr. The implementation of the EMPr is a requirement in terms of NEMA and will be a condition of the Environmental Authorisation. In addition, the Applicant must ensure compliance with all relevant legislation including but not limited to:

- NWA, 1998 (Act No.36 of 1998)
- National Environmental Management: Air Quality Act (Act No. 39 of 2004) GNR 893 (22 November 2013)
- NAAQS and the National Dust Control Regulations.
- National Atmospheric Emissions Inventory System (NAEIS)
- National GHG Emission Reporting Regulations (Government Gazette No. 40762 of 3 April 2017)
- National Environmental Management: Biodiversity (Act No.10 of 2004).
- National Forest Act (No. 84 of 1998)
- Conservation of Agricultural Resources Act (No. 43 Of 1983)
- National Heritage Resources Act (No. 25 of 1999)
- Hazardous Substances Act (No. 15 of 1973)
- Mine Health and Safety Act (No. 29 of 1996)
- Gauteng Noise Control Regulations (GN 5479)
- Noise Control Regulations (GN R154 of 1992)

It is recommended that the following conditions should be included as part of the Environmental Authorisation:

- The EMPr must be enforced throughout the life of mine.
- Undertake weekly internal auditing of environmental performance during the construction phase.
- Undertake monthly external auditing of environmental performance during the construction phase.
- Undertake bi-annual internal auditing of environmental performance during the operational phase.
- Undertake annual external auditing of environmental performance during the operational phase.
- A soil management plan must be developed which sets out a clear set of actions and responsibilities for the control of impacts affecting the soil, land use and land capability within the operations' development footprint.
- No mining activities can commence without the necessary authorisations from DWS.
- Implement a Stormwater management plan in line with the provisions of GNR 704.
- Provide final engineer designs for the Storm Water Management infrastructure, PCDs, coal stockpile areas, and overburden dumps based on safety classification and hazard ratings to the DMRE and DWS.
- The monitoring programs described in the EMPr must be implemented.

- **No listed or protected species or trees must be removed and/or relocated without the required permits.**
- **No heritage resources, including grave sites and historical structures, must be relocated, and/or destroyed without obtaining the required permits from SAHRA.**
- **If Palaeontological Heritage is uncovered during surface clearing and excavations the Chance Find Protocol must be implemented**
- **The numerical groundwater model must be updated annually by calibrating the model with monitoring data.**
- **An extended hydrocensus should be performed around the perimeter of the mine boundary in order to identify legitimate groundwater users before operations commence.**
- **Critical recharge areas should be determined in a hydropedological assessment.**
- **Comply with the specific regulatory requirements for all non-mining structures and installations within 500m from the mining operation.**
- **Obtain the necessary authorisations as prescribed in various acts, and specifically the Mine Health and Safety regarding blasting within 100m and 500m from private installations.**
- **Appoint an internal Safety, Health and Environment (SHE) Officer with the appropriate training and experience to monitor the implementation of the EMPr during the construction and operational phases of the project.**
- **A berm designed to act as acoustical screen or barrier must be constructed during the day, at the pit areas in relation to receptors R1 and R6 according to the specifications recommended by the noise specialist.**

16 Description of any assumptions, uncertainties, and gaps in knowledge

The scope of this investigation was limited to assessing the environmental impacts associated with the proposed mine using the available information. It is therefore assumed that the information provided by the Applicant with regards to the layout of the mining area and mining infrastructure is considered to be the final layout. Furthermore, it is assumed that the mineable coal resource of 7.286 Mt taken from the Mining Work Program submitted as part of the MR Application, is accurate. If any changes to the layout or minable coal resource is made, the findings of this assessment will not be valid.

uKhozi used the information from various specialist studies in the compilation of the EIA/EMPr. All specialist studies were conducted to certain levels of confidence, and in all instance's known methodologies have been used and confidence levels are generally high. This means that in most cases the situation described in the pre-mining environment is accurate at high certainty levels, but there exists a low probability that some issues have not been identified during the studies. Such situations cannot be avoided simply due to the nature of field work and have therefore not been further discussed below. Furthermore, statistical analyses and mathematical models are merely tools which assist the researcher in assessing field observations and have innate assumptions which can reduce objectivity of the results obtained. This is not seen as a major flaw but should always be considered when assessing results. Although all efforts were made by the EIA project team to identify all environmental, social and health aspects, impacts and mitigation measures, errors and omissions may have occurred.

It was not always possible to involve all IAPs individually, however every effort has been made to involve as many affected stakeholders as possible. Communication channels must be established by Canyon to ensure that there are open, transparent, and good relations with surrounding landowners and affected parties during the life of the project. This is an essential aspect to the successful management and mitigation of environmental impacts.

The assumptions, limitations, gaps in knowledge and exclusions applicable to the different specialist studies are described under the headings below.

16.1 Agricultural Potential Assessment

Refer to Section 10.17 above for the assumptions made as part of the financial analysis. No gaps in knowledge were found.

16.2 Terrestrial biodiversity

The following assumptions and limitations are applicable to the assessment:

- The desktop component is based on information gathered and databases consulted at the time of investigation.
- Due to the complexity of natural ecosystems and seasonality of species, it is possible that some floral aspects, including certain floral species, may have been overlooked,

however all effort was made by the consultant to gather and convey accurate information.

- The field assessment was conducted over a period of two (2) days (21 and 22 February 2019) during the summer season and as such does not account for seasonal variation or long-term temporal changes in floral biodiversity. The season during which the field assessment took place is however considered suitable for the observation of many flowering species and recent rains were experienced in the region prior to the field assessment.
- Vegetation mapping, including the mapping of individual floral SCC, is based on data obtained through Global Positioning System (GPS) mapping during the field survey, in conjunction with aerial imagery. Potential geo-referencing errors, including limitations in GPS accuracy may result in slight discrepancies in the maps; and
- The majority of floral SCC are extremely seasonal and only flower during specific periods of the year, while faunal SCC are usually rare and difficult to locate. Compiling lists of species that could potentially occur in an area is therefore limited by the lack of records due to the naturally low density of such species. Because it is difficult to predict the occurrence of threatened species, prior information on potential threatened flora was obtained from the Mpumalanga Tourism and Parks Agency (MPTA) and special emphasis was placed on searching for species indicated to occur within the relevant QDGS (2529DA) and within a 20km radius of the Farm Driefontein 398JS during the field assessment. Further lists of potential SCC were obtained from South African National Biodiversity Institute (SANBI) in line with the Department of Forestry, Fisheries and the Environment's (DFFE) screening tool.
- Although the methodology used was designed to reduce the risk of omitting any species, it is possible that a species that may be unexpectedly located in an area, even though the literature and field surveys may suggest that it should be absent.
- The lists of birds, amphibians, reptiles and mammals for the study area are based on those observed at the site as well as those likely to occur in the area based on their distribution and habitat requirements. This represents a conservative and cautious approach that takes the study limitations into account.
- Discussions and proposed mitigation measures are made on reasonable and informed assumptions based on available information sources and deductive reasoning. Since environmental impact studies deal with dynamic natural systems, additional information may be discovered at a later stage, which may alter some of the conclusions in this report.

16.3 Wetland/Riparian Delineation and Functional Assessment Report

The following project limitations and assumptions were applicable for the investigations:

- Access to all wetlands on the study site was restricted by a lack of access roads and stands of Wattle trees.
- Aquatic instream aspects of the watercourses are not addressed in this report.
- The information provided by the client forms the basis of the planning and layouts discussed.

- All wetlands within 500 m of any developmental activities should be identified as per the DWS authorization regulations. In order to meet the timeframes and budget constraints for the project, wetlands within the study sites were delineated on a fine scale based on detailed soil and vegetation sampling. Wetlands that fall outside of the site, but that fall within 500 m of the proposed activities were delineated based on desktop analysis of vegetation gradients visible from aerial imagery.
- The detailed field study was conducted from a once off field trip and thus would not depict any seasonal variation in the wetland plant species composition and richness.
- Description of the depth of the regional water table and geohydrological and hydropedological processes falls outside the scope of the current assessment
- Flood line calculations fall outside the scope of the current assessment.
- A Red Data scan, fauna and flora, and aquatic assessments were not included in the current study
- Species composition described for landscape units aimed at depicting characteristic species and did not include a survey for cryptic or rare species.
- The recreation grade GPS used for wetland and riparian delineations is accurate to within five meters.
- Wetland delineation plotted digitally may be offset by at least five meters to either side. Furthermore, it is important to note that, during the course of converting spatial data to final drawings, several steps in the process may affect the accuracy of areas delineated in the current report. It is therefore suggested that the no-go areas identified in the current report be pegged in the field in collaboration with the surveyor for precise boundaries. The scale at which maps, and drawings are presented in the current report may become distorted should they be reproduced by for example photocopying and printing.
- The calculation of buffer zones does not take into account climate change or future changes to watercourses resulting from increasing catchment transformation.

16.4 Aquatic Assessment

The following project limitations and assumptions were applicable for the investigations:

- No additional site visit was conducted in 2022 and the report is based on field assessments conducted in 2019.
- Findings, recommendations and conclusions provided in this report are based on the authors' best scientific and professional knowledge and information available at the time of compilation. The methods used for biomonitoring often require the author to make a predicted estimation based on prior knowledge and learning. These are however the methods as requested by the client and also accepted methods in the field of aquatic ecology.
- In order to obtain a comprehensive understanding of the dynamics of the aquatic ecosystem in an area, ecological assessments should always consider investigations at different time scales (across seasons/years) and through replication, as river systems are in constant change.
- All information provided to ISS was accurate and up to date.
- The position of study area was accurate.

- The wetland report compiled by Limosella 2022 which indicated that there was no change in land use of change in PES of the wetlands was accurate.

16.5 Groundwater Impact Assessment

The following project limitations and assumptions were applicable for the investigations:

- The modelling was done within the limitations of the scope of work and the amount of data available. Although all efforts have been made to base the model on sound assumptions and has been calibrated to observed data, the results obtained from this exercise should be considered in accordance with the assumptions made to construct the model. Especially the assumption that a fractured aquifer will behave as a homogeneous porous medium can lead to error. However, on a large enough scale (bigger than the REV, Representative Elemental Volume) this assumption should hold reasonably well.

16.6 Air Quality Impact Assessment

The key assumptions, limitations and exclusions of the study are given below:

<u>Assumptions</u>

- Data/information provided by the Applicant and used as input into the model were assumed to be accurate and complete at the time of modelling.
- All mining activities and plant operations, except bulldozing, drilling, blasting, hauling, loading at ROM stockpile and unloading of trucks at processing plant were assumed to occur for 24 hours a day for 7 days a week
- Drilling and blasting were both assumed to occur twice a week (based on information provided by the Applicant) between 08:00 – 16:00 and 15:00-16:00, respectively.
- Hauling, loading at ROM stockpile and unloading of trucks at processing plant were assumed to occur for 18 hours a day for 7 days a week (based on information provided by the Applicant).
- Bulldozing was assumed to occur for 12 hours a day for 7 days a week.
- A total of 30 drill holes were estimated as information on the number of drill holes were not known at the time of modelling.
- Blasting area size was assumed to be 10 000m2 (100m x 100m) as information on blast area size was not known at the time of modelling. This was based on blasting area size at a similar mine.
- Dimensions, exact footprints and locality for stockpile areas at Hakhano Colliery were assumed based on google earth; maximum heights were assumed based on maximum heights of stockpiles at a similar mine;
- Material throughputs are based on the information provided by the Applicant and include:
  - Maximum monthly production rate of 90 000 tonnes of coal from the opencast pit at the proposed Driefontein Mine.
  - Maximum monthly production rate of 350 000 tonnes of overburden from the opencast pit at the proposed Driefontein Mine.

- **An hourly throughput of 400 tonnes of coal processed at the primary crushing and screening units: and**
- **An hourly throughput of 150 tonnes of coal processed at the secondary crushing unit**

- **Information on dust suppression measures at Hakhano Colliery was not provided at the time of modelling. Therefore, no control efficiencies were applied for all activities associated with the processing plant.**
- **The location and dimensions for some of the modelled sources were assumed as information was not provided at the time of modelling.**
- **Models of equipment sources (trucks, bulldozers, front-end-loaders and excavators) were assumed as information was not provided at the time of modelling.**

Limitations

- **Emission sources included in this model are limited to surface activities associated with the northern section of the proposed Driefontein Mine, including existing stockpile/exposed areas & processing activities at Hakhano Colliery.**
- **Detailed information for each emission source is required for input into the model, such as the dimensions, material throughputs, material characteristics and the exact locality of the sources. In some instances, not all these details are known. To account for the emissions, assumptions and estimates were made where necessary.**
- **The study is limited by the amount of detailed information that could be provided at the time of modelling.**

Exclusions

- **Mining activity at the northern and south-eastern sections of the proposed mine will not take place concurrently. Therefore, it was assumed that mining activity will commence at the northern section and therefore modelling focussed on the northern section only.**
- **Activities that are not associated with the project and occur outside the scope of the proposed Driefontein Coal Mine were not included in the assessment. These may include any potential background emission sources. Background sources are excluded as detailed information for these is required for input into the model and is not readily available. Furthermore, the assessment focused on the impact of emissions attributable to emission source activities associated with the proposed mine and Hakhano Colliery, specifically.**

16.7 Noise Impact Assessment

There are limitations and uncertainties regarding acoustical measurements. Noise levels has the potential to fluctuate based on numerous components, including:

- **The noise level may change from day to day due to activities within a community (e.g., road traffic fluctuations, see point below) or even at a singular dwelling itself.**
- **Dwelling related infrastructure (e.g., air-conditioning units, swimming pool pumps etc.) that has the potential to influence noise levels in terms of dB.**
- **Faunal communication measurement fluctuations due to seasonal, time of day or night etc. Certain fauna communicates during certain hours e.g., cicada may only**

audible during night-hours, crepuscular birds are only audible during evening or night hours, crickets may be more audible active as seasons get hotter etc.

- Measurements near mining and industries fluctuates depending on equipment in use, capacity load in use, unforeseen equipment in care and maintenance. Certain equipment may not be running optimally, with the consequence been excessive elevated noise levels (e.g., gas leaks, conveyor pulley roller squeaking, excessive vibrations (and associated noise) from unmaintained dampers on equipment etc.
- Metrological conditions can influence noise measurements. These include inversion and diffraction in the temperature layer, change in temperature and humidity etc.
- The original fieldwork was conducted on the 12th – 14th March 2019, with time intervals and protocol adhering to legislation during given time.

16.8 Visual and Aesthetics Assessment

The following assumptions and limitations are applicable to this study:

- This assessment was undertaken during the conceptual stage of the project and was based on information available at the time.
- Determining the visual and sense of place characteristics of an area were inherently subjective and, as such, subjectivity cannot be excluded in this assessment.
- The viewshed map does not take into consideration vegetation screening of the proposed site. As a result, the indicated area of visual disturbance could possibly be less than depicted in this map.

16.9 Heritage and Palaeontological Assessment

16.9.1 Heritage Impact Assessment

Not detracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the area. Various factors account for this, including the subterranean nature of some archaeological sites and the current dense vegetation cover. It should be noted that a few small areas were not accessible due to a fence. The far west corner particularly was indicated by the farmer as not being part of their land.

16.9.2 Palaeontological Impact Assessment

When conducting a PIA several factors can affect the accuracy of the assessment. The focal point of geological maps is the geology of the area, and the sheet explanations were not meant to focus on palaeontological heritage. Many inaccessible regions of South Africa have not been reviewed by palaeontologists and data is generally based on aerial photographs. Locality and geological information of museums and universities databases have not been kept up to date or data collected in the past have not always been accurately documented.

Comparable Assemblage Zones in other areas is used to provide information on the existence of fossils in an area which has not yet been documented. When similar Assemblage Zones and geological formations for Desktop studies is used it is generally assumed that exposed fossil heritage is present within the footprint.

16.10 Socio Economic Impact Assessment

The following assumptions and gaps in knowledge were applicable for the investigation:

- Some of the details with regards to the construction phase are at this stage still uncertain and could change. Where this is the case, it is indicated and specified that confidence in the rating is low.
- A SEIA is largely framed by people’s perceptions and as such the magnitude and overall significance of the various impacts on the local communities and other role-players could alter during the course of time. The results of this analysis are therefore not stagnant and could change due to future developments in the area, policy changes, perceptions and so forth.
- During the construction phase existing employees of Canyon Resources will be deployed from other labour sending areas. It is assumed that existing contractors will also be used for specialized construction activities.

16.11 Traffic Impact Assessment

The following project assumptions were applicable for the investigations:

- Only Traffic volumes generated by the development will be assigned to network as this will be the peak scenario.
- It was assumed that the vehicles make trips inbound and equal trips in the opposite direction.
- Taxis with a capacity of 14 passengers will transport employees to and from the proposed Driefontein Mine.
- A Private Vehicle Occupancy rate of 1.5 people/car was used based on TMH 16 (COTO, 2012).

16.12 Blasting and Vibration Impact Assessment

The following assumptions and limitations are applicable to the investigation:

- The project is evaluated as a new operation with no blasting activities currently being done inside the application area.
- There is an existing operation adjacent to the project area, but no information is available for this operation and information is not shared between the operations.
- The anticipated levels of influence estimated in this report are calculated using standard accepted methodology according to international and local regulations.
- The predictions are a good estimate with significant safety factors to ensure that expected levels are based on worst case scenarios. These will have to be confirmed with actual measurements once the operation is active.
- Sufficient data is not available from this operation for a specific confirmation of the predicted values as no blasting activities is currently being done.
- Blast Management & Consulting was not involved in the blast design. The information on blast design applied was provided by the Applicant.
- The work done is based on the author’s knowledge and information provided by the project applicant.

16.13 Economic Cost Benefit Analysis

The limitations and assumptions applied to ECBA is listed under the headings below.

16.13.1 Limitations

The following limitations apply to economic cost benefit analyses:

- Analysis of secondary impacts such as changes in productivity, changes in prices resulting from shifts in supply and demand, and changes in macroeconomic variables (such as employment and output) falls outside the scope of a traditional ECBA local employment and output impacts are included in the Socio-Economic Impact Report.

- ECBA deals mainly with economic efficiency or gains from a project, it typically does not account for distributional impacts of a project
- While the ECBA does take social, economic and environmental issues into consideration through the inclusion of externalities, it does not necessarily include the total value the community attached to the loss of a natural asset as could for instance potentially be done through direct approaches such as the Contingent Valuation Methods (CVM) where the community is surveyed directly to assess their Willingness to Pay (WTP) for the natural asset versus their Willingness to Accept (WTA) compensation for the loss of the natural asset (Zysik, 2001). These approaches are however still relatively unexplored in South Africa and pose their own shortcomings in determining the value of natural resources
- The ECBA model's conclusion in terms of intergenerational equity is indeterminate. The impact on future generations hinges on more complex arguments outside the scope of the ECBA. It depends on opportunities for public funds (tax revenue and other social funds) and infrastructure development for long term development foregone (if the project does not proceed) relative to long term environmental costs related to the project
- It should be noted that costs used in the models are high level estimates only to illustrate the net impacts of two land-uses over the long term and is not meant for operational planning or compensation purposes.

16.13.2 General assumptions

The following general assumptions apply to the ECBA:

- The ECBA was conducted over a 50-year period to allow for a comparison with the lower but more stable revenues of agricultural activities over a longer time horizon.
- Economic prices are expressed in constant (2022) terms over the 50-year period.
- Economic costs exclude taxes and depreciation.
- Three discount rates were used, namely the 4%, 6% and 8% in order to test for sensitivity in terms of valuations of earlier net income streams. Higher discount rates implies that the net income of the project at later stages/years are discounted at a higher rate. Therefore, a project that experiences a low net income at the early stages only to be made up with high profits at a later stage will have a lower net present value at higher discount rates than at lower discount rates.
- The shadow price coefficient for unskilled labour was calculated as 0.50 based on the differential between the average unskilled wages in other industries and entry-level wages for the mining industry.

16.13.3 Assumptions related to mining costs and benefits

The following assumptions related to mining costs and benefits apply to the ECBA:

- The financial income and cost streams for the mine revenues and costs obtained from the Mine Works Programme (MWP) of the mine amended figures for 2022. The price of coal was assumed at R 320 per ton.
- The Life of Mine (LoM) is assumed at 7 years.

- Assumptions related to external costs (social and environmental costs) of the mine were based on the specialists' reports conducted as part of the Environmental Impact Assessment (EIA) for the project.
- Pre-mitigation environmental management costs only include acquisition of farmland as well as rehabilitation costs (R46m as per the MWP) while post-mitigation environmental management costs of the mine include internalised costs related to potential blasting damage and groundwater impact costs (R51m total costs).
- Acquisition of land for mitigation purposes could be considered an asset that can be sold after mining operations. As mitigation measure it is assumed that the farmland affected by the mine area in the MRA will be acquired by Canyon Coal. It is assumed that these assets will be sold a year after mine closure.

16.13.4 Assumptions related to agricultural costs and benefits:

The following assumptions related to agricultural costs and benefits apply to the ECBA:

- The financial income and costs streams for current land-use (no-go option) was based on estimates of agricultural yields from the Agricultural Impact Assessment Report (Index, 2022) that forms part of the (EIA), agricultural producer prices from various market reports as well as stakeholder interviews.
- Since the figures in the Agricultural Impact Assessment Report was for 2021, an agricultural inflator of 7% was used based on the production price index increase in the agricultural sector between 2021 and January 2022 (Stats SA, 2022).
- It is assumed that agricultural production will resume in the areas not directly affected by mining after year 7 while the disturbed area will be rehabilitated to grazing land potential from year 9 to year 20 after which it should return to current agricultural yields, implying zero agricultural losses after year 20.
- While agricultural production could also impose some external costs on the local community (e.g., increased traffic, use of pesticides, use of energy), the external costs associated with agricultural activities were assumed to be zero.

16.14 Rehabilitation, Decommissioning and Closure Report

Refer to Section 9 – 13 of the Rehabilitation, Decommissioning and Closure Report (ENVASS, 2022) which lists numerous assumptions with regards to the physical, biophysical, social, socio economic and legal context on which the report and costs were based. The following additional assumptions and limitations are applicable to the report:

- Aftercare is assumed to be for a minimum of 5 years post mining.
- It is assumed that on average the landscape will be lowered by on average 1,5 m below NGL.
- The report was prepared within the scope of the proposal and its intended use only and based on information as provided by the Driefontein Mine management.
- This report is based on prescribed legal methodologies and applications, the report contains interpretations and assumptions documented and contextualised to the

best ability of the writer. Particular, with relation to futuristic and predictive matters associated with scheduled closure.

- **Notice is taken of changing circumstances and associated report qualifications, which at the time of the report might be different from the time of the assessment. This report therefore represents a snapshot view of the operation at the time and date of the assessment.**
- **No warranty is included with this report, either express or implied, that the actual described conditions will conform exactly to the assessment and results contained in this report.**
- **Where data supplied by the Applicant or other external sources, have been used, it has been assumed that the information is correct.**

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

17.1 Reasons why the activity should be authorized or not

The main aspects assessed as part of Environmental Impact Assessments are the social, the economic, and the environmental aspects. These aspects must be in balance and that if one outweighs another, good reasoning be sought to ensure the balance is restored

The positive impacts of the proposed project centres around the economic benefits of exploiting the coal reserve inside the MRA which will assist the ongoing development of the socio-economic structure in the area.

Whilst emphasis is often placed on the economic advantages of a mining project, many negative long-term impacts may manifest. Mining has the potential to pollute water and soil, resulting in negative impacts on ecosystems and violating the rights to life and a healthy environment. Provided that all the environmental management measures described in the EMPr are applied diligently, the proposed Driefontein Mine is not expected to have any unacceptable permanent environmental impacts.

However, there is concern over the marginal Net Present Value (net benefit stream) advantage that the new (higher risk) mining activity holds over existing land-use in the area under the worst-case scenario (loss of cultivated land within entire MRA). This is due to the short timespan for the planned mining activity as well as the relatively high agricultural yields associated with farms particular to this project.

The Applicant plans to implement a sequence approach to mining with the aim to allow agricultural activities to continue alongside mining. As shown in the Economic Cost Benefit Analysis, the continuation of agricultural production on the MRA that is not mined (best case scenario) will significantly improve the Net Present Value of the proposed mine which underlines the need to mitigate against the loss of agricultural production across the entire MRA during mining operations. Therefore, the granting of the environmental authorisation of Driefontein mine is recommended if the risk of losing high value agricultural land within the entire MRA is effectively mitigated. In addition to the implementation of the recommended mitigation measures this will further involve land use arrangements with the farm owner which will only be investigated during the sale agreement of the land.

17.2 Description of any aspects that were conditional to the findings of the assessment

The following aspects were conditional to the findings:

- Mining activity at the northern and south-eastern sections of the proposed mine will not take place concurrently.
- The Applicant will implement a sequence approach to mining with the aim to allow agricultural activities to continue alongside mining on the farmland situated within the MRA for the LoM.
- A clear agreement on the land uses and schedule of mining activities, as well as the compensation to the farmer for his loss and inconvenience must be in place before mining commences.
- The development footprint will be located within the modified grassland areas as per the proposed layout provided.
- The proposed mine will comply with the regulatory requirements of the Mine Health and Safety Act and submit the necessary blasting application to the DMRE for bench deliveries, mining within 100m of structures, as well as blasting within 500m from structures to be protected.
- The Applicant will make provision for concurrent rehabilitation as part of the operational costs.
- A wetland offset strategy should be formulated should loss of hydrological zonation be detected in downslope wetlands.
- Agricultural production will resume in the areas not directly affected by mining after year 7 while the mining area will be rehabilitated to grazing land potential from year 9 to year 20 after which it should return to current agricultural yields, implying zero agricultural losses after year 20.
- The EMPr, including the proposed soil management plan, and closure plan will be followed, and rehabilitation done in such a way to restore the soil, land use and land capability within the operations' development footprint to a condition fit for its current use, which is farming.

17.3 Rehabilitation requirements

The affected land should be rehabilitated to arable land potential, free draining and in line with the Natural Ground Level (NGL) to have a minimum effect on the aquatic and wetland receiving environments down gradient and maintain a sustainable arable land use post closure. Refer to Appendix 6.13 for the Rehabilitation, Decommissioning and Closure Plan (ENVASS, May 2022). The rehabilitation of the project will aim to:

- Ensure that the final post mining topography free draining to minimise the potential of water to accumulate and ingress into the spoils.
- Implement concurrent backfilling during the mining sequence by placing the overburden from the active cut into a mined out cut.
- Ensure that the overburden material (carbonaceous and non-carbonaceous) used for backfilling, is backfilled in the same sequence as removed during the mining phase.

- Ensure that the topsoil and subsoil is replaced in the correct sequence to prevent the creation of subsurface limiting layers.
- Prepare the final surface suitable for revegetation using the stockpiled soil material
- Revegetate the rehabilitated areas with an indigenous grass species mixture comprising species representative of the Rand Highveld Grassland vegetation type.
- Ensure no-net loss in land capability and biodiversity.
- Ensure that sacrificial layers and contaminated soils are removed and that runoff from the area is returned to the natural catchment.
- Ensure that weeds/exotic/alien vegetation is eradicated over the rehabilitated area until a closure certificate is granted.
- Ensure that soft materials are stripped under the guidance of the ECO, separated into the orthic and topsoil layers and stockpiled accordingly. These stockpiles should have signs showing the volumes, origin and destination.
- Ensure that the overburden which is taken from drilling and blasting are separated clearly from soft soils and stockpiled on predetermined overburden dump areas, with clearly market sign boards to identify the volume, the origin and destination of the material.
- Ensure that all infrastructure will be demolished with the view that the only salvage will be scrap value.

The following closure objectives should be met:

- Demolish all mine related buildings and return the area to arable land.
- Demolish all channels, drains and PCDs at the point of aftercare.
- Areas to be rehabilitated to support cultivation and arable land use, including total removal of sacrificial layers and creation of a free draining landscape.
- Total removal of topsoil stockpiles, incorporated with the rehabilitation programme. Placement of berms, pending the content in as overburden (hard and most likely with high AMD potential) in at lower levels followed by surface shaping and placement of soft material and topsoils sequentially.
- The main access road and parking area will be rehabilitated to arable land, partial removal of access road.
- All other roads and linear removals not required by end users will be rehabilitated to cultivation land status, free draining.
- The landform will be free draining, rehabilitated to secure a land use status compatible with arability, safe for human access and visually non-intrusive.
- Follow a 5-year post closure monitoring and modelling programme to report on physical and biophysical stability prior to the formal closure application
- Annually re-assess closure risk, particular associated with landform and land use, as well as shallow and deep ground water aquifer pollution due to any source of pollution

Refer to Part B Section 7.1 for more detail regarding the specific closure objectives, relinquishment criteria and design principles which will guide the manner of decommissioning, rehabilitation and ultimately the final closure activities.

18 Period for which the Environmental Authorisation is required

Environmental Authorisation is required for a period of 7 years because based on the coal resource the life of mine is expected to be 7 years including the construction and decommissioning phases.

19 Undertaking

Agency declaration: This document was completed by uKhozi Environmentalists (Pty) Ltd on behalf of the Applicant: Canyon Resources (Pty) Ltd.

We hereby confirm that the Applicant have studied and understand the contents of this document in its entirety and duly undertake to meet the requirements of the Environmental Impact Assessment Report and the Environmental Management Programme Report.

20 Financial Provision

The risk based unscheduled closure cost, in the event of unplanned closure after Year 1 is calculated and reported at R68 158 286.00 incl. VAT which includes P&G, Contingencies and VAT, aftercare costs, closure risk responses and cost of closure applications. It is updated and reported on annually and reflects on liability intake and or reduction based on respectively expansions on the mine and or concurrent rehabilitation or decommissioning. Refer to Part B Section 7.5 of this report for the Sum of the closure liability associated with each of the domains assessed.

The Scheduled closure cost assessment for year 1, accepting that the liability intake on surface infrastructure as reported on under Domains 1 to 5 will not need to be removed is calculated at R43 130 988.00 inclusive of P&G, Contingencies and VAT. This allocation is largely linked to the anticipated mining area of approximately 36 ha which will require concurrent rehabilitation.

A total scheduled liability of R300 805 048 (including P&G and VAT) is estimated over the entire LOM as displayed in the table below. This includes the following expected annual allocations described in more detail in Part B Section 7.5 of the report.

- Year 1: R43 130 988
- Year 2: R43 130 988
- Year 3: R43 130 988
- Year 4: R43 130 988
- Year 5: R29 952 075
- Year 6: R38 275 783
- Year 7: R16 922 250

Table 97: Total liability scheduled closure (P&G/VAT included)

	Domain	Scheduled over LOM
1	Offices and Admin buildings	R340 648
2	Water, Stormwater management and Pollution control Infrastructure	R1 764 195
3	Product, ROM, Discard and Overburden stockpiles	R3 564 770
4	Topsoil stockpiles and berms	R85 425
5	Fencing, Roads, Electricity and linear Infrastructure	R177 755
6	North Pit	R153 709 864
7	South Pit	R42 697 185
	Subtotal 1	**R202 339 842**
	Contingency (10%)	R20 233 984
	Preliminary and general allowances (12%)	R24 280 781
	Subtotal 2	**R246 854 607**
8	Post Closure Aspects	R9 150 000
9	Risk Based and regulatory allowances	R5 565 000
	Total	**R261 569 607**
	Vat (15%)	R39 235 441
	Grand Total	**R300 805 048**

20.1 Explain how the aforesaid amount was derived

The closure report was developed and costed by ENVASS in accordance with GN R.1147 (Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations) (FPR), which commenced on 20 November 2015. The methodology used is summarized below and the complete Rehabilitation, Decommissioning and Closure Plan compiled by ENVASS attached as Appendix 6.13.

This Driefontein Rehabilitation, Decommissioning and Closure Plan is founded on the following process approach, and brough to be in line with the ICMM Good practice mine closure guidelines (Version 2):

- **Gathering and verifying available information from the project knowledge base to devise the project closure context.**
- **Securing additional information (interviews and site visits), on new and or changed infrastructural layouts and mine planning.**
- **Updating the itemization list, based on the available information at the time of this costing.**
- **Confirming the use of historical and or areas specific unit rates (benchmarking), assessment of categories and assessment of application.**
- **Determining and updating (CPI) applicable unit rates for the costing.**
- **Updating the costing spreadsheets, structured in terms of the high-level structure reported.**
- **Conducting a closure risk assessment and identifying aspects (closure options and activities) for consideration in the closure plans.**
- **Developing closure plan frameworks for annual implementation.**
- **Developing closure plan frameworks for final closure.**

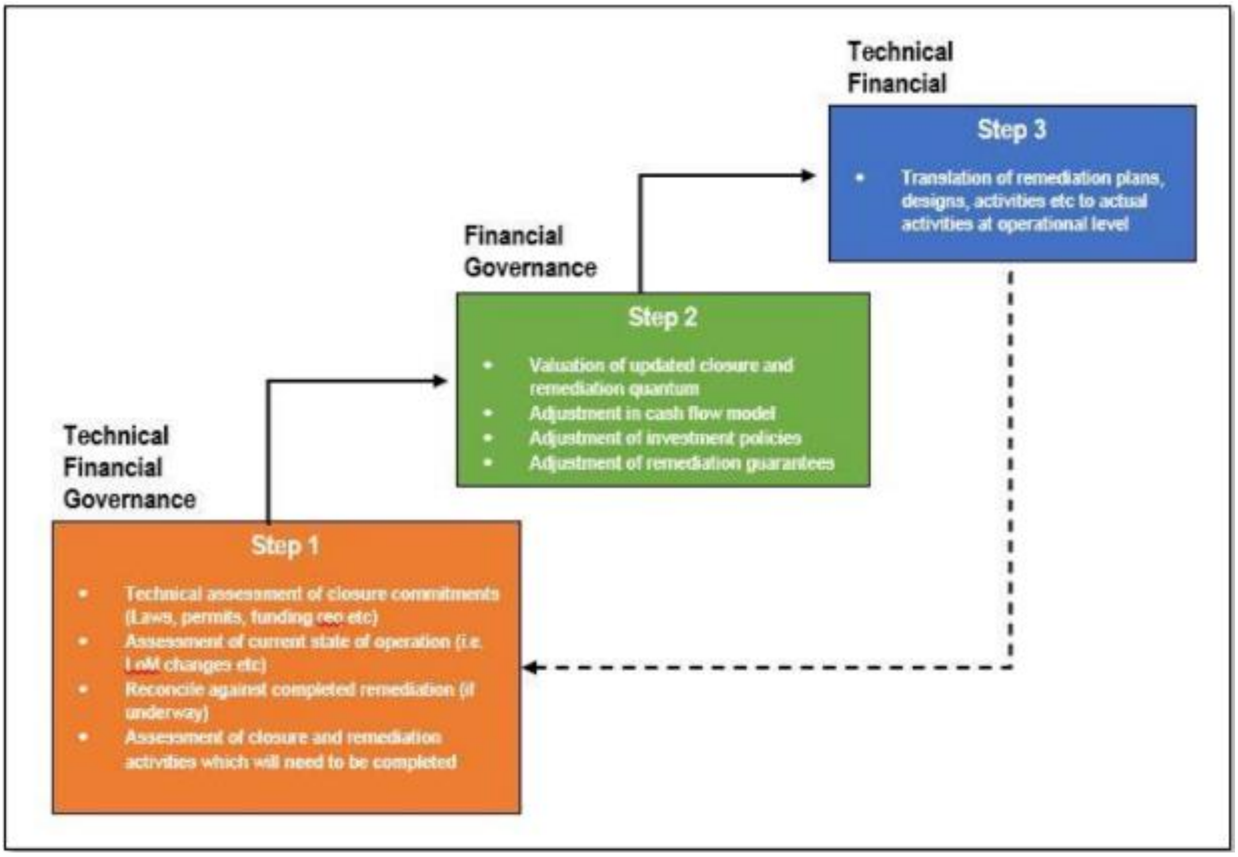

Figure 115: Schematic of Approach and method (Adopted Deloitte / ENVASS (ES van Druten) November 2017)

20.2 Confirm that this amount can be provided for from operating expenditure

Canyon Coal (Pty) Ltd will fund the operation and hereby confirms that the amount is anticipated to be an operating cost and is provided for as such in the Mining Works Programme (MWP). Financial provision will be provided to the DMRE in the form of a bank guarantee.

21 Deviations from the approved scoping report and plan of study

An Economic Cost Benefit Analysis (ECBA) was conducted which did not form part of the Plan of Study of the approved Scoping Report. The ECBA measured the net benefits (including economic, social and environmental) to the broader community resulting from the proposed operations of the project over the long run of say 50 years. These net benefits were compared to the no-go option of the project, i.e., the continuation of current land – use without the project.

22 Other Information required by the competent Authority

22.1 Compliance with the provisions of sections 24(4) (a) and (b) read with section 24 (3) (a) and (7) of the National Environmental Management Act (Act 107 of 1998).

The potential socio-economic impacts are discussed in detail in Section 13.2.14. Agricultural land around the STLM area is increasingly under threat, due to the need for urban expansion, mining development and electricity generation. This competing land use amongst sectors that cause a strain on local economic development is particularly relevant between the mining sector and agriculture, which poses a huge food security challenge. The largest part of the proposed mining area is cultivated and is classed as high potential arable land. The development of the mine will result in the loss of a large area of high potential arable land. From a socio-economic perspective support for the project can only be provided on condition that the socio-economic specialist's recommendations (included in Section 13.4) are implemented.

22.2 Impact on any national estate referred to in section 3(2) of the National Heritage Resources Act

The HIA identified various heritage resources within the study area of which only the burial grounds and graves could be rated as having a high heritage significance and may require further mitigation work before the project can continue. In addition, a preliminary investigation based on the SAHRIS palaeosensitivity map identified the presence of geological deposits of Very High palaeontological sensitivity underlying the location of the study area.

No historical structures were identified so there is no impact to be assessed.

The heritage specialist concluded that the impacts as identified and rated on the identified and projected heritage resources can be sufficiently mitigated to allow the project to continue.

Refer to Section 13.2.11 for a discussion of the potential impacts above.

22.3 Other matters required in terms of sections 24(4) (a) and (b) of the Act

This section requires proof of compliance with section 24(4)(b)(i) of the National Environmental Management Act, which section reads as follows:
"24. Environmental authorisations
(4) *Procedures for the investigation, assessment and communication of the potential consequences or impacts of activities on the environment -*
(b) must include, with respect to every application for an environmental authorisation and where applicable-
(i) investigation of the potential consequences or impacts of the alternatives to the activity on the environment and assessment of the significance of those potential consequences or impacts, including the option of not implementing the activity;"

This EIAR has been compiled in support of the Environmental Authorisation application for the development of the proposed Driefontein Mine. No other Environmental Authorisation exist as part of the proposed project. This report was compiled using the information generated by the site-specific specialist studies conducted according to the approved Plan of Study which was submitted in the Final Scoping Report. Alternatives have been identified in Section 8 of this report. For this specific application, the site, activity (coal mining) and technology to be used has already been selected. Therefor the alternatives in terms of the following aspects were assessed during the EIA Phase:

- Design or layout.
- Operational aspects.
- No go Option.