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Beyond Greening Environmental Services Pty Ltd

NAME OF APPLICANT: FM CRUSHERS CC

PROPOSED PROJECT: OPENCAST MINE

ENVIRONMENTAL IMPACT ASSESSMENT

AND

ENVIRONMENTAL MANAGEMENT PROGRAMME FOR THE PROPOSED

MINING RIGHT FOR RHYOLITE MINERAL ON

RESERVE 16 OF FARM 15638 IN THE MAGISTERIAL

DISTRICTS OF MHLABUYALINGANA, KWA-ZULU NATAL PROVINCE

SUBMITTED FOR ENVIRONMENTAL AUTHORISATION IN TERMS OF THE

NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT 107 OF 1998) IN

RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY AN

APPLICATION IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES

DEVELOPMENT ACT (ACT 28 OF 2002) (AS AMENDED)

Commodity: Rhyolite

Date: March 2016

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Executive summary

FM Crushers proposed to mine industrial mineral which is known as Rhyolite. The proposed project will be done in terms of the Mineral and Petroleum Resources Development Act, Act 27 of 2004 and National Environmental Management Act, Act 107 of 1998. FM Crushers proposed to undertake opencast mining should the right/authorization is acquired. The proposed project is located at Ngwavuma, Jozini local municipality. FM Crushers must appoint an independent Environmental Assessment Practitioner before the Department of Mineral Resources can consider the application. An Environmental Impact Assessment (EIA) is being done by BeyondGreen, an independent company, to evaluate the potential environmental and social impacts of the proposed project. The EIA is being done in terms of the NEMA EIA 2014 Regulations.

The first phase of an EIA is the Scoping Phase (see Figure 1 below). This is the phase during which public issues and concerns must be identified so that relevant issues can be evaluated by the EIA technical specialists during the current phase (the Impact Assessment Phase) of the EIA. The EIA Regulations make provision for authority consideration based on the EIR Phase of the EIA. Therefore this Draft EIR Report serves the following purpose:

- An introduction to the EIA that is being carried out for the proposed opencast mining
- A description of the regulatory framework for the EIA.
- Description of the proposed project.
- The project alternatives that were considered.
- A description of the way in which the interested and affected parties (I&APs) or stakeholders have been involved.
- To list all issues raised by stakeholders to date.
- To indicate whether all their concerns and suggestions have been considered to date.

Stakeholders could comment on the Draft EIR Report in the following ways:

- Completing the comment sheet enclosed with the report
- Additional written submissions
- Comment by email or telephone
- Attending public meeting to be hold in Ngwavuma (Tribal authority meeting venue), 23/03/2016.

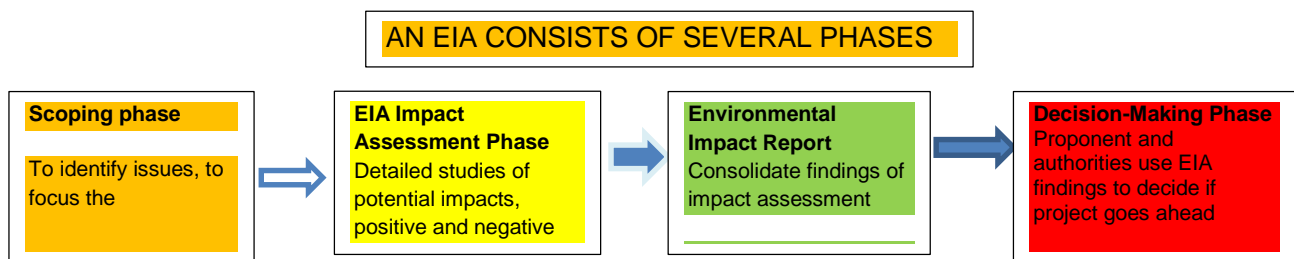


Figure 1. An Environmental Impact Assessment consists of various phases. The EIA for the proposed opencast mining project is currently in the EIR Phase. This is the second phase of the EIA during which issues that were raised on Scoping must be evaluated.

Project Description

Mining (quarrying) will occur as a drill and blast operation with faces of 9-11m high and a blast size of 3000 – 4000 tons/blast, approximately once per month, with such drilling and blasting will be conducted by contractor. The drilling of holes by hydraulic track rig and the computer controlled blast detonation system represents the latest quarrying technology. Ahead of the face blasting, topsoil (where available outside of exposed bedrock) is removed to topsoil stockpile berms for later use in rehabilitation. Shot rock will loaded by excavator into articulated dump trucks for hauling to the processing plant for crushing and screening of sizes to meet market requirements.

The construction phase will compose of the following activities

- Site establishment 6 months: this include
- Strip Topsoil and stockpile
- Remove Softs and stockpile

- Drill & Blast
- Remove Hards and stockpile
- First rhyolite with temporary stockpile

Legal Framework

In terms of the MPRDA, a mining right cannot be granted until an Environmental Authorization has been issued in terms of the National Environmental Management Act, 1998. The EIA Regulations 2014 define the requirements for the submission, processing, consideration and decision of applications for environmental authorisation of listed activities. This scoping report has been compiled to meet the requirements of the EIA Regulations 2014. In accordance with the EIA Regulations 2014, all legislation and guidelines that have been considered in the preparation of the EIR Report are documented.

Need and Desirability

BeyondGreen present the needs and desirability of the mining in terms of various national plans and policies. They make the case that mining would result in long-term benefits for South Africa consisting poverty alleviation, development, housing, major in-country investments in a development project. The extraction of stone is in the best interest of the public at large. Rhyolite Stone is classified as an industrial mineral and is mainly used in the construction industry. Government contracts with construction companies in order to develop infrastructure related to health, transport, residences as well as education sector for the development of a nation.

Process followed to reach the preferred Alternatives

A high-level, comparative assessment of the alternatives is presented in the scoping report. This includes consideration of locality, types of activities, the design/layout, technology, operational aspects and the no-go alternative. Residential and subsistence farming methods were investigated. It is concluded that there is little difference, advantage or disadvantage between the alternatives that are available. Residential area and farming are impossible to have it within the proposed area; the landscape is very much steep and stone seam outcrop.

The project site is determined and delimited by the extent of the aggregate seam and no further site alternatives have been assessed.

Anticipated Issues and Impacts

A number of negative impacts on the bio-physical environment could result from disturbances during mining. Most environmental impacts associated with aggregate mining are benign. Extracting aggregate seldom produces acidic mine drainage. Other environmental health hazards are rare. Most of the impacts that are likely to occur are short-lived, easy to predict and easy to observe. By employing responsible operational practices and using available technology, most impacts can be controlled, mitigated or kept at tolerable levels and can be restricted to the immediate vicinity of the aggregate operation.

The most obvious environmental impact of aggregate mining is the conversion of land use, most likely from undeveloped or agricultural land use, to a (temporary) hole in the ground. This major impact is accompanied by loss of habitat, noise, dust, blasting effects, erosion, sedimentation, and changes to the visual scene. The geologic characteristics of aggregate deposits (geomorphology, geometry, physical and chemical quality) play a major role in the intensity of environmental impacts generated as a result of mining. Mining deposits that are too thin or contain too much unsuitable material results in the generation of excessively large mined areas and large amounts of waste material. FM Crushers employ a very much efficient process with almost 100% recovery. No waste is produced during the processing of rhyolite.

Mining generates a disturbed landscape. The after-mining use of the land is an important aspect of reducing environmental impacts of aggregate extraction. The development of mining provides an economic base and use of a natural resource to improve the quality of human life. Wisely restoring our environment requires a design plan and product that responds to a site's physiography, ecology, function, artistic form, and public perception. With environmental concerns, operating mines and reclaimed mine sites can no longer be considered isolated from their surroundings. Site analysis of mine works needs to go

beyond site-specific information and relate to the regional context of the greater environment. This document provides information from the site to the regional level of the mining area. Understanding design approach can turn features perceived by the public as being undesirable (mines and pits) into something perceived as being desirable.

Mining activity will preclude the current land use for the duration of the mining period.

The area occupied is very small, only one homestead within 500m away from the vicinity of the proposed mining area. Less than 50% of the surface area of the mining right area will be subject to actual disturbance from mining activities over the 25 year period. Any use of land for mining activities will be done through consultation negotiated between the mining right holder and the land owner/occupier. The land owner will have a direct say where the mining activities are taking place on their land. Thus conflicting land uses and activities that disturb key agricultural farming activities can largely be avoided.

Plan of Study for EIA

This chapter describes the nature and extent of further investigations to be conducted by BeyondGreen and the specialists in the Environmental Impact Assessment, and sets out the proposed approach to the EIA process. The EIA process and reporting thereon will comply with Appendices 3 and 4 of the NEMA EIA 2014 Regulations. The project scope to be considered and assessed in the EIA is the 25-year mining work programme as proposed by the applicant. No further alternatives, other than the no-go, are to be considered beyond the scoping report. The identification and assessment of environmental impacts is a multi-faceted process, using a combination of quantitative and qualitative descriptions and evaluations. It involves applying scientific measurements and professional judgment to determine the significance of environmental impacts associated with the proposed project. The process involves consideration of, inter alia: the purpose and need for the project; views and concerns of interested and affected parties; social and political norms, and general public interest. BeyondGreen will identify potential impacts against relevant environmental aspects (i.e. land use, biodiversity, etc.) and describe these in terms of the nature of the impact, compliance with legislation and accepted standards, receptor sensitivity and the significance of the predicted environmental change. BeyondGreen uses an assessment methodology which

considers: the intensity, extent, duration of impacts, the probability of the impact occurring, the reversibility and the degree to which the impacts can be mitigated. The significance of environmental impacts will be rated before and after the implementation of mitigation measures. These measures may be planned or additional measures that may arise from the impact assessment and specialist input.

During the EIA phase a public feedback meeting(s) will be held to present and discuss the findings of the EIA with I&APS. This meeting (series of meetings) will include a presentation by the EAP. The EIA / EMP report will be subjected to public review for a period of 30 days. A summary of the findings of the EIA report will be provided in English. Once the DMR has issued a decision on the application, I&APs on the project database will be informed accordingly of the decision, the reasons therefor and the fact that an appeal may be lodged in terms of the National Appeals Regulations, 2014.

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1. INTRODUCTION

FM Crushers (the applicant) is in a process of acquiring aggregate (Rhyolite) stone mining right and environmental authorization on the following property: portion Reserve no. 16 of farm 15836, in terms of section 22 of the MPRDA (Act of 2002) and section 24 of the NEMA (Act 107 of 1998). Beyond Greening Environmental Services Pty Ltd (referred to BeyondGreen here after) has been appointed by FM Crushers to assist in preparing and submitting environmental reports, EIA process and undertaking a Landowner and Public Consultation Process, in support of a Mining Right and Environmental Authorization application. BeyondGreen has submitted an application for environmental authorization to the Department of Mineral Resources (referred to DMR here after) for the proposed Opencast Mine, Ngwavuma, Kwa-Zulu Natal. DMR has since accepted this application and instructed FM Crushers to precede with the Scoping Report process (this report) in terms of the National Environmental Management Act, Act of 107 of 1998 (NEMA) and its Environmental Impact Assessment Regulations, 2014. The following reference number has been assigned to this project: KZN30/1/2/2/10065MR by DMR.

This EIA report is the environmental document that will be submitted to comply with the required process in terms of the Mineral and Petroleum Resource Development Act, Act 28 of 2002 (MPRDA) as well as NEMA.

The Scoping phase undertaken before the EIA was used as a guide for the compilation of this EIA Report and the Environmental Management Programme (EMPR). All registered Interested and Affected Parties (I&As) will be afforded the opportunity to review this report in due course.

This report details the various mining-related activities, gives a desktop review of the baseline environment, indicates alternative land uses, sites and activities, highlights the way forward with regard to the public participation process and specialists studies required and finally gives a preliminary environmental impact assessment.

1.2. Brief project location and description

This section provides a brief overview of the proposed Mining Right. The proposed application area is located 55 km east of the town of Jozini within the Jozini Local

Municipality of the northern portion of Kwa-Zulu Natal Province. The proposed site will be limited to open cast mining (quarry), which will be located on Reserve 16 of farm no.15836. Mining (quarrying) will occur as a drill and blast operation with faces of 9-11m high and a blast size of 3000 – 4000 tons/blast, approximately once per month or 52 000 per year, with such drilling and blasting will be conducted by contractor. The drilling of holes by hydraulic track rig and the computer controlled blast detonation system represents the latest quarrying technology. Ahead of the face blasting, topsoil (where available outside of exposed bedrock) is removed to topsoil stockpile berms for later use in rehabilitation. Shot rock will be loaded by excavator into articulated dump trucks for hauling to the processing plant for crushing and screening of sizes to meet market requirements.

The proposed phasing of the excavation development is as shown in figures 8-12 below.

Phase 1 is the establishment phase and consists of location of all facilities as well as construction of the plant, preparation of stockpiling area. It also includes excavation establishment as a cut into the hill in the NE corner of the proposed pit. The proper development of haul road access point to the pit (adit) is critical as it will be used for the entire life of mine.

Phase 2 represents the westward expansion of the Phase 1 pit with a floor level still at 75m. Note once again the location of the haul roads in a permanent position. Phase 2's southern advance is limited by the drainage ditch.

Phase 3 is the southward advance of the pit across the drainage ditch and the lowering of the floor by 1 bench to level 65m. A second haul road is developed at this stage.

Phase 4 continues the southward advance until the final southern pit edge is reached as shown in figure 6 with the floor still at level 65m.

Phase 5 is the lowering of the entire floor by a further 6 benches to level 15m.

The volume of material obtained in each phase is included in each phase drawing as well as proposed topsoil handling.

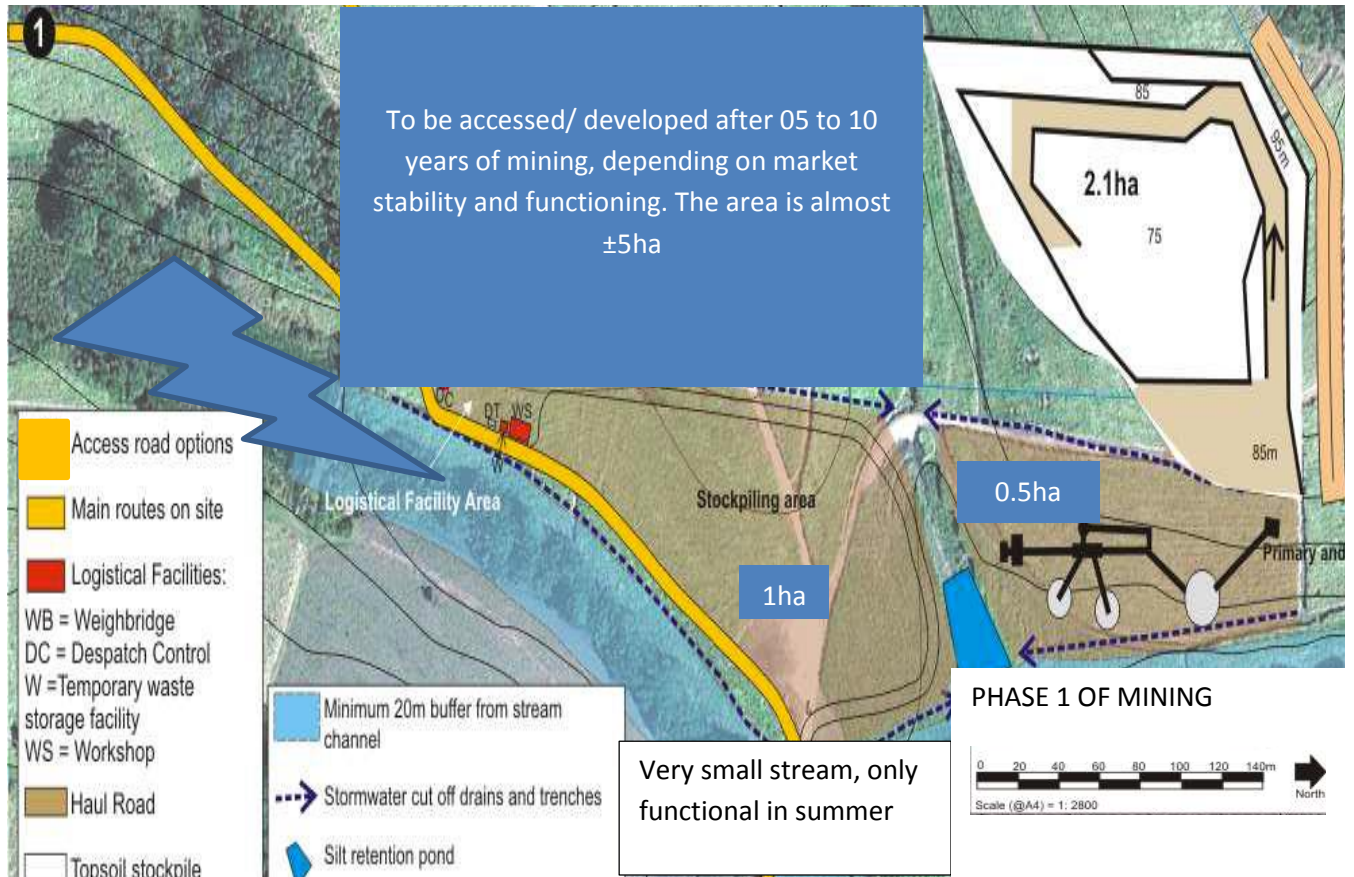


Figure 1: Mine Layout Plan: Phase 1

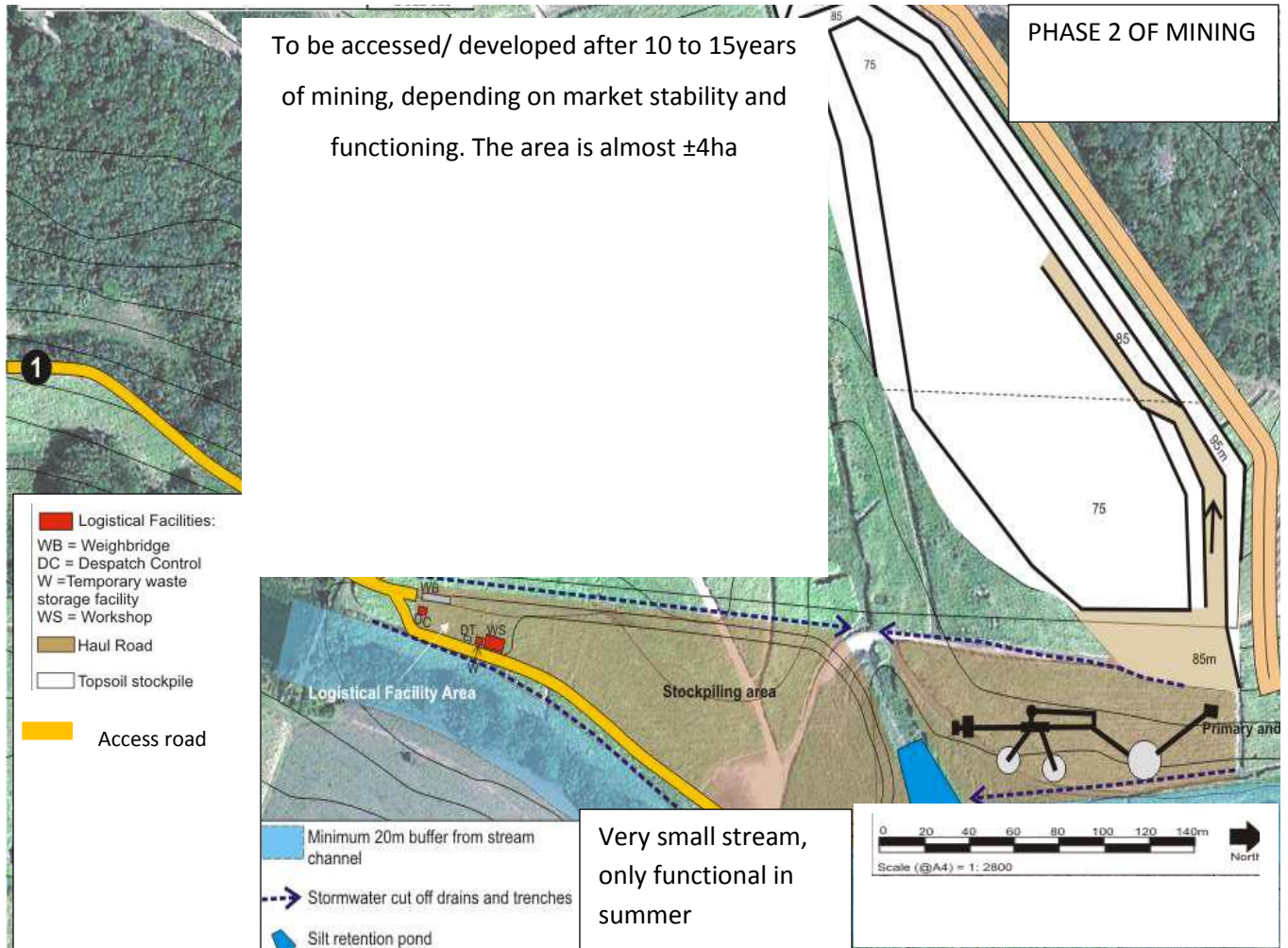


Figure: 2 Mine Layout Plan: Phase 2

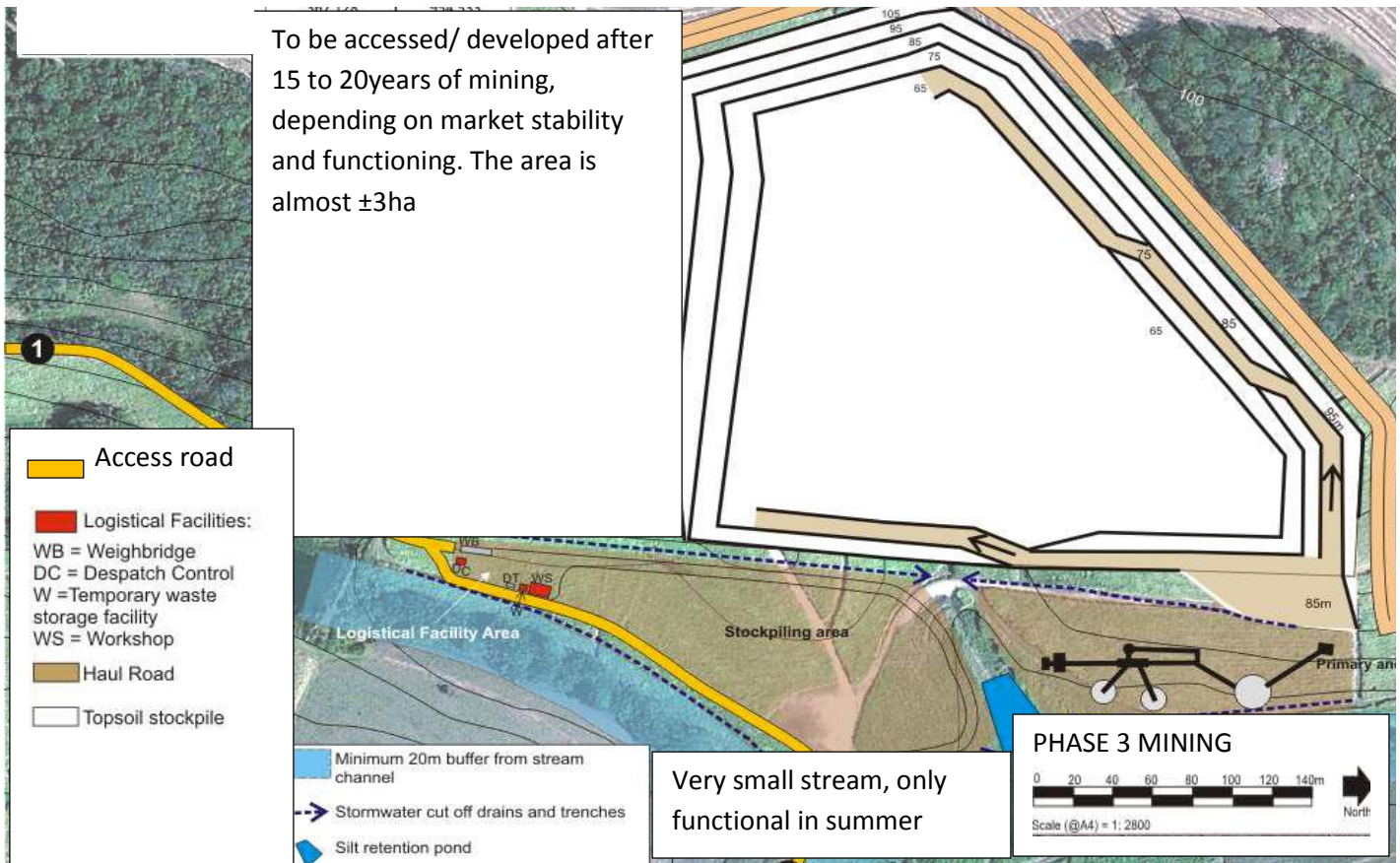


Figure: 3 Mine Layout Plan: Phase 3

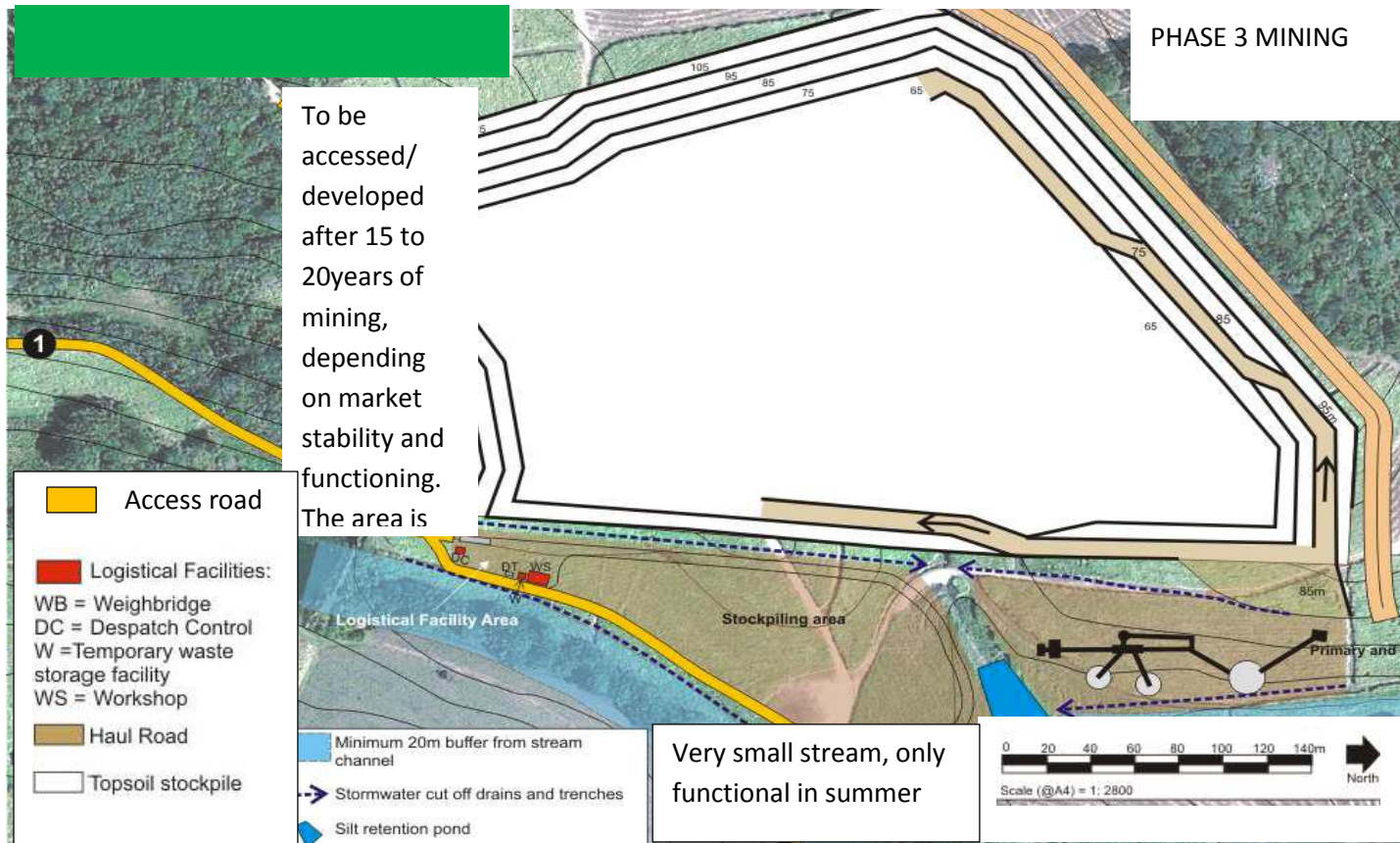


Figure: 4 Mine Layout Plan: Phase 4

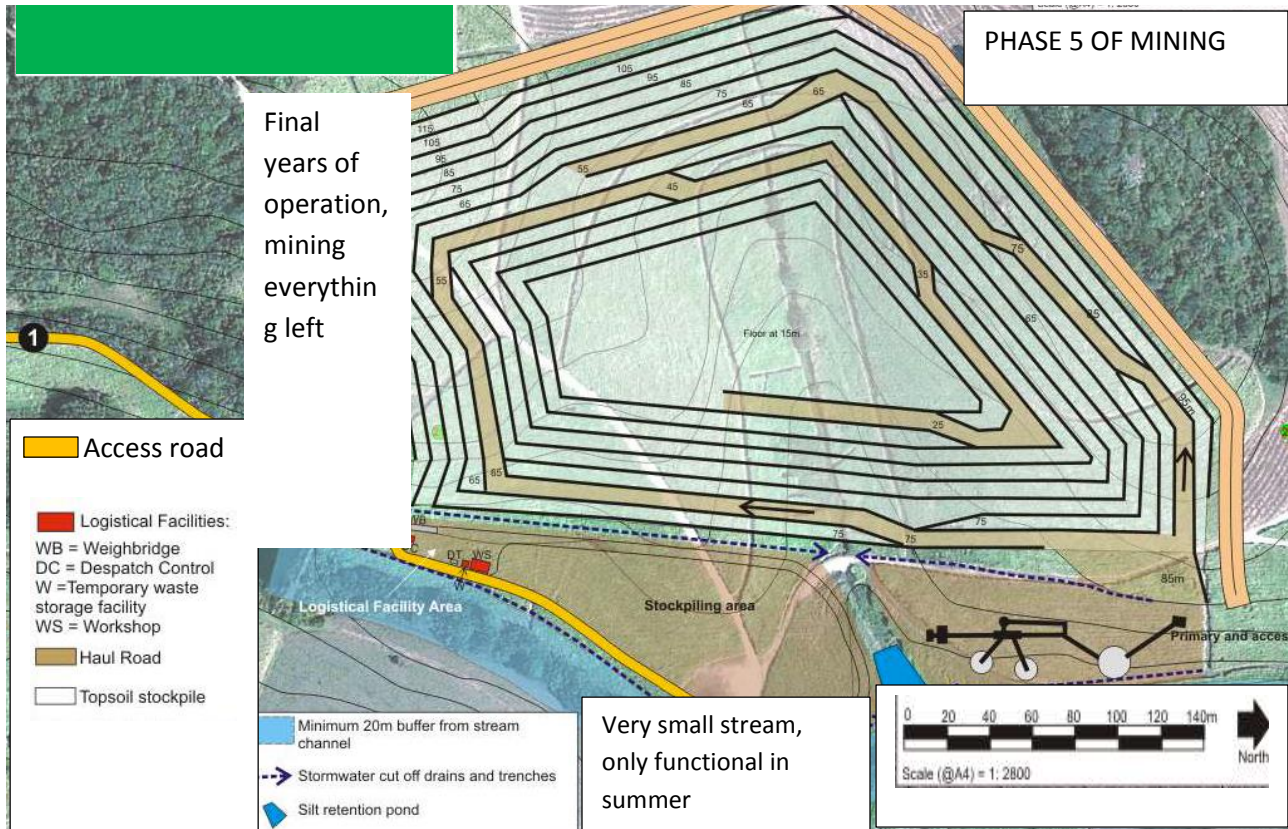


Figure: 5 Mine Layout Plan: Phase 5

LOCATION MAP
Jozini Local Municipality
Ward 11

FM Crushers Mining Right Application

Situated on Farm Portion 10/15836,
SG code N0HV00000001583600010,
Kwazulu Natal

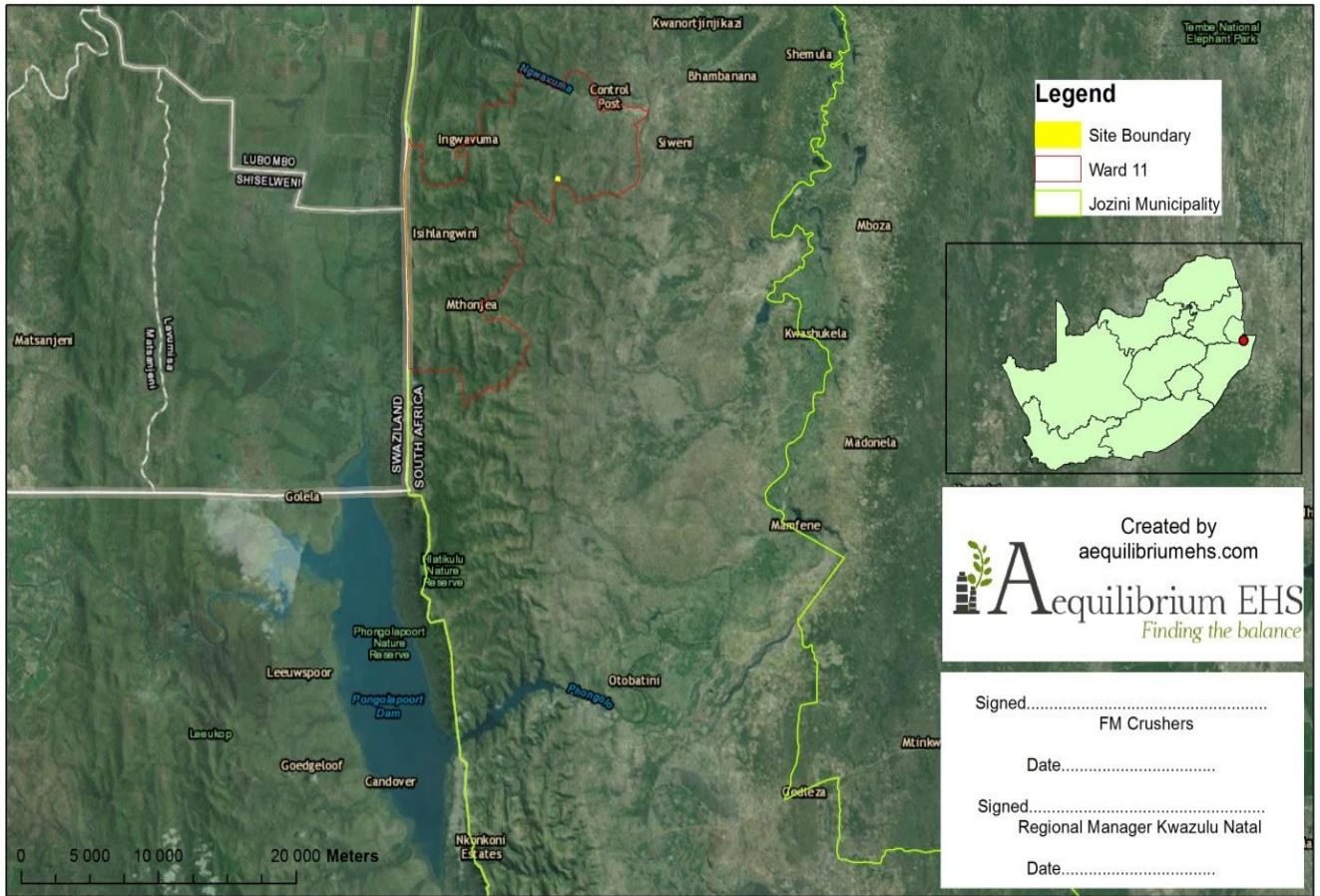


Figure 6: locality map

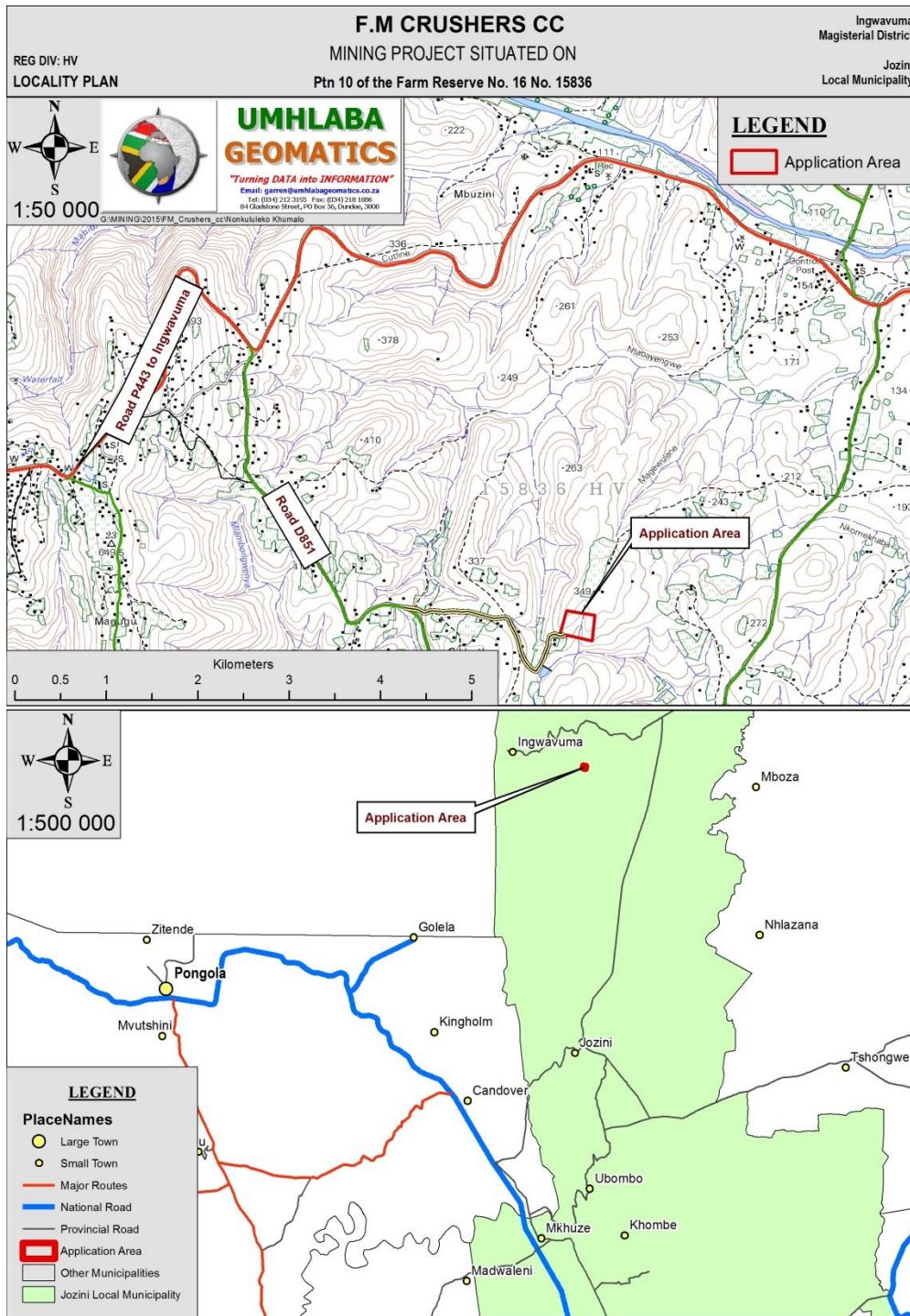


Figure 7: locality map in relation to the proposed mining area



Figure 8: Layout map showing access road, proposed mining site and other structures



Figure 9: Layout google map showing structures around the proposed mining area

1.3 Property and ownership details

The properties described above as the location of the project is owned by Ingonyama Trust. Ingonyama Trust is a board that monitors and regulates traditional affairs of kwaZulu Natal.

Description	Area (HA)	Title deed number	Surface owner	Contact Details
Reserve 16 of farm no.15836	8.00	T144 57/03	INgonyama Trust	033-846 9923 (M)

1.4 Location of Site

1.4.1 Regional setting

The project site is around 55 km east of the town of Jozini within the Jozini Local Municipality of the northern portion of Kwa-Zulu Natal Province. Jozini municipality is located in the northern portion of KwaZulu–Natal, and is bordered by Mozambique to the north, Swaziland to the west, UMhlabuyalingana to the east, Hlabisa to the south and Nongoma and Uphongolo to the west. It consists of four semi formalized towns viz. Jozini, Mkhuze, Ingwavuma and Ubombo. The remaining parts of the municipality are characterized as being rural in nature. Jozini Municipality covers 32% (3057 Square Kilometres) of the total area of 13859 Square Kilometres of uMkhanyakude District Municipality. There is no mining authorization/right within the surrounding of the proposed mining area. The closest mining can be an estimate of 15km away from the proposed mining site that is FM crushers quarrying.

1.4.2 Magisterial district and Municipalities

The project site is situated in the Jozini Local Municipality (ward 11) of uMkhanyakude District Municipality.

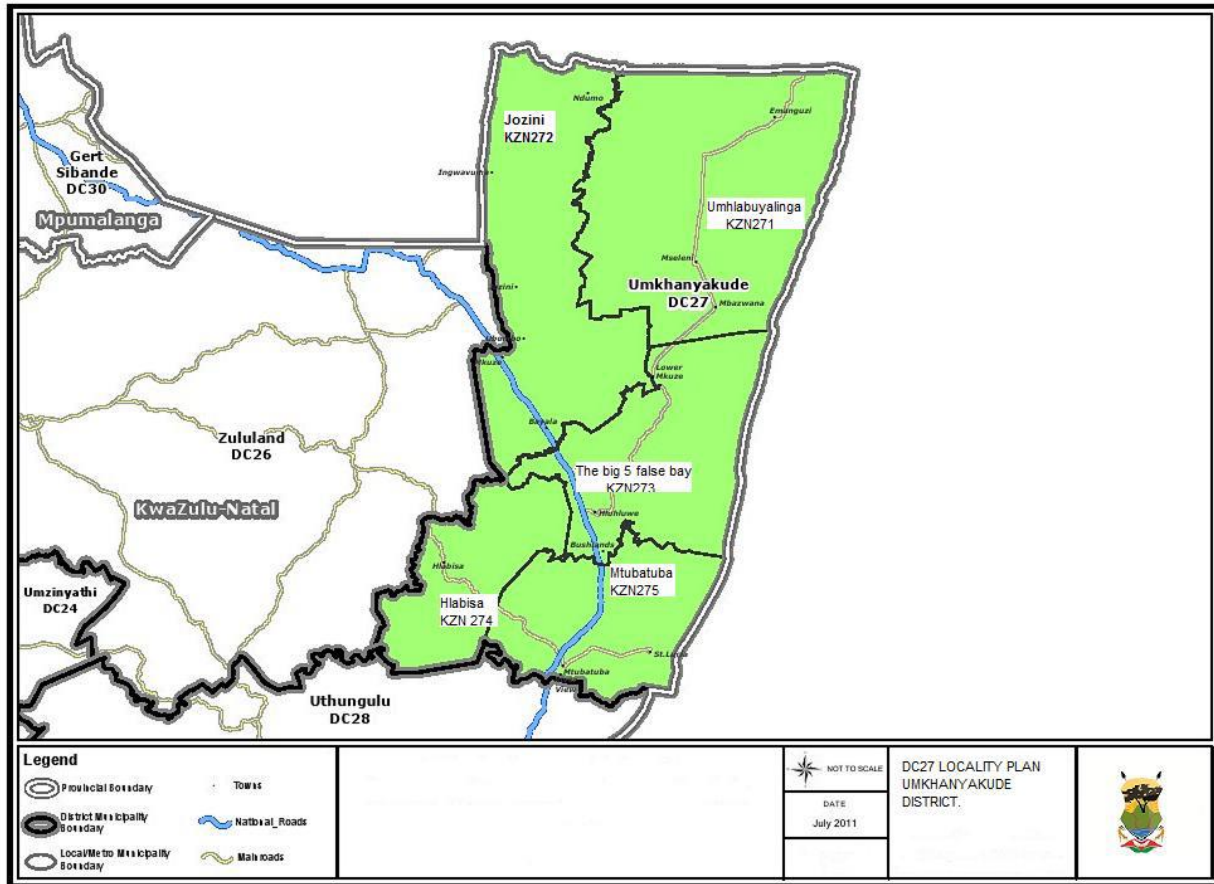


Figure 10: Map showing the municipalities in uMkhanaykude district

1.4.3 Land Tenure and use of immediately adjacent land

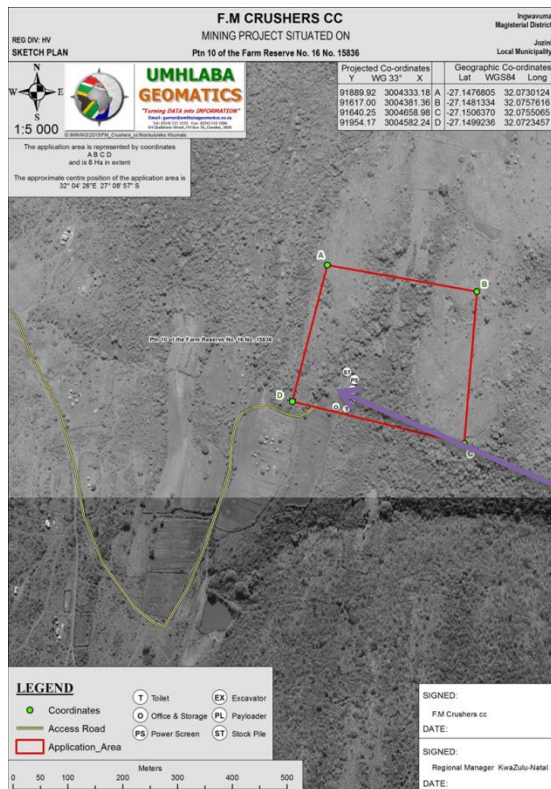
The evident land use pattern and settlement pattern in Jozini LM greatly influenced by topography, environmentally sensitive sites and sites of historical significance. The project site is currently used for grazing, agriculture on natural grasslands with extensive shrubs and thorny vegetation.

1.4.4 Surface infrastructure and servitudes

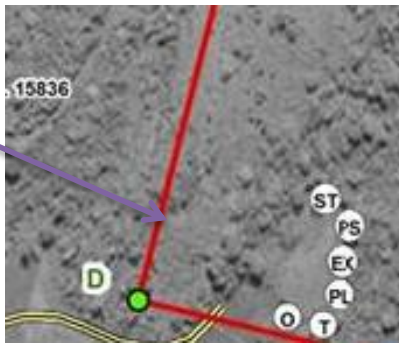
The site has no infrastructure to consider, the area has no National roads, N2 that link Jozini with Mkuze, Richards Bay is more than 100 km away, and the area has regional gravel roads. There are no servitudes or power lines within the mining area.

2. DESCRIPTION OF THE PROPOSED PROJECT

The project description given below entails a full description of operations for the full life of mine. Opencast mining will be conducted starting from the South to West section of the property as indicated in Plan A (extracted area).



Section to commence with the mining activities



Plan A: Sketch diagram depicting portion of the site to commence with mining activities

2.1 Opencast mining

The area directly affected by mining is around 8.0 ha and contains around 1 367 696 tons in situ rhyolite reserves which will be mined over a 25 year period. Around 52 000 tons per year will be mined with a total yield of around 2/3 will be sold as to Department of Transport.

The construction phase will compose of the following activities

- Site establishment 6 months: this include
- Strip Topsoil and stockpile
- Remove Softs and stockpile
- Drill & Blast
- Remove Hards and stockpile
- First rhyolite with temporary stockpile

Due to shallow depth of the resource, at 1 to 20 m below surface, it is ideal for opencast mining. An opencast strip mining method would be employed through method of drilling and blasting of the deposit, with such drilling and blasting will be conducted by contractor. A number of holes will be drilled into the rhyolite deposit and filled with explosives. The explosives break the rock into fragments.

An excavator feed the broken fragments into the crusher for processing. Ahead of the face blasting, topsoil (where available outside of exposed bedrock) is removed to topsoil stockpile berms for later use in rehabilitation. Shot rock is loaded by excavator into articulated dump trucks for hauling to the processing plant for crushing and screening of sizes to meet market requirements.

2.1.1 Discard handling

As rhyolite will be processed onsite discard will be very minimal, the will be almost 100% recovery. Discard will be used for road maintenance.

2.1.2 Haul and access roads

The mine will expand haul and access roads to link the proposed mine with the municipality road. The positions of the roads will be finalized following the assessment studies that will be conducted as part of the EIA.

2.1.3 Sumps and pumps

Dewatering activities will be carried out on site. In all likelihood, the mine will make use of pumps to dewater the opencast pit and dispose of mine affected water into a pollution control dam.

2.1.4 Power supply

No electricity will be required on site. Mining will be done with diesel driven equipment. Mining equipment, including drills, trucks and shovels, front-end loaders and loading trucks for rhyolite haulage will be diesel operated. Diesel will be supplied from 14000L bulk storage facilities which will be constructed onsite.

2.1.5 Weighbridge

A weighbridge will be constructed at the entrance of the mine.

2.1.6 Workshop

A Workshop will be constructed for the servicing of diesel driven equipment on site. Workshops will have properly constructed oil and silt traps.

2.1.7 Ablution facilities

The mine will construct ablution facilities for the contractors and employees on site. Septic tanks will be constructed and the mine will enter in a service level agreement with a service provider to maintain and empty the septic tanks.

2.1.8 Security and access

The site will be fenced off and will be patrolled on a 24hr basis.

2.1.9 Admin Block

Park homes will be used as administration blocks.

2.2 Water Requirements

The main water use on site will be the dewatering of pits to allow for the safe mining of the reserve. Water will be pumped out of the pit and stored in pit sump.

2.2.1 Potable water supply

Potable water supply will be by means of abstraction from groundwater supply in the area. Alternative options for potable water supply will be to truck water to site supplied by the municipal water provider.

2.2.2 Process water supply

Water within the in-pit sumps will be utilized for dust suppression on the haul roads, screening and crushing plant. Any water requirements which may be needed for drilling or other on-site activities will be sourced from the water within in-pit sumps. Any additional water will be sourced from the municipality.

2.2.3 Storm water management

All storm water drainage infrastructures will accommodate 1:50 year storm event as required by legislation. Clean and dirty water will be separated and all dirty water will be channeled into the Pollution Control Dam. Clean water falling outside the footprint will be directed to natural drainage lines via berms and channels upslope of the area of activity.

The process water from the wash bay and workshop area will collect within the sump via an oil separator. The mine will enter in a service level agreement with a service provider to maintain and empty the septic tanks and remove sewage from site.

2.3 Gaseous and Solid Waste& Liquid Effluent

2.3.1 Gaseous Emission

No scheduled gaseous emissions will take place on site.

Vehicles and machinery will emit fumes, but will be serviced and maintained regularly to keep these emissions within the relevant vehicle/machine's specifications.

Dust will be monitored and managed on site to ensure these are within the standards set by NEMQA.

3. PROJECT PHASES

The project can be divided into five phases, namely, the planning and design phase, the construction phase, operational phase, decommissioning phase and the post closure phase. The activities associated with these phases are listed below:

4. METHODOLOGY: NEMA ACTIVITIES

Table 3: Project Phases activities

ACTIVITY (Potential NEMA activities which may be triggered)	SUB ACTIVITY
PLANNING AND DESIGN PHASE	
Site visits	Vehicle and foot traffic on site Demarcate Mining Right area & No-Go areas and danger sign posting
ACTIVITY (Potential NEMA activities which may be triggered)	SUB ACTIVITY
CONSTRUCTION PHASE	
The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometer- (i) where the existing reserve is wider than 13,5 meters; or(ii) where no reserve exists, where the existing road is wider than 8 metres; excluding where widening or lengthening occur inside urban areas. GNR 983 Activity 56	Upgrade selected access road=4km
The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for- (i) the undertaking of a linear activity; or (ii) Maintenance purposes undertaken in accordance with a maintenance management plan GNR 983 Activity 27	Site preparation and vegetation clearance Remove topsoil to berms in Plant and Stockpiling area Construct haul road to excavation
Any activity including the operation of that activity associated with the primary processing of a mineral resource including winning, reduction, extraction, classifying, concentrating, crushing, screening and washing but excluding the smelting, beneficiation, refining, calcining or gasification of the mineral resource in which case activity 6 in this Notice applies. GNR 984 Activity 21	Topsoil removal to perimeter stockpile ahead of face advance Removal and stockpiling of overburden Blasting of rock & Drilling Loading & Hauling of shot rock Crushing and screening of shot rock Stockpiling of product Loading of product for delivery
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 associated infrastructure, structures and earthworks, directly related to the extraction of a mineral resource, including	Construct / Place Container for office and store Construct Workshop with oil trap Construct bunded fuel storage tank Construct wash bay with oil trap Cast concrete footings for crushing plant Erect Crushing plant Construct weighbridge

activities for which an exemption has been issued in terms of section 106 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002). GNR 984, activity 17	Establish storm-water management system Install mist sprays on plant
ACTIVITY (Potential NEMA activities which may be triggered)	SUB ACTIVITY
DECOMMISSIONING PHASE	
The decommissioning of any activity requiring - (i) a closure certificate in terms of section 43 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002); or (ii) a prospecting right, mining right, mining permit, production right or exploration right, where the throughput of the activity has reduced by 90% or more over a period of 5 years excluding where the competent authority has in writing agreed that such reduction in throughput does not constitute closure., GNR 983, Activity 22	Operational Rehabilitation - upper perimeter face splitting (only after phase 4) Dismantling, removal and rehabilitation of unnecessary infrastructure Removal of hydrocarbons from site Sewage removal Removal of final sewage from septic tanks Removal of infrastructure Filling of access voids Mobilization of overburden and subsoil's Final rehabilitation of roads no longer required Final removal of all berms, trenches Ripping/discing of all leveled or compacted areas where required Reprofilling of all disturbed areas Application of topsoil Amelioration of topsoil Construction of contour berms (where necessary)
CLOSURE AND POST CLOSURE PHASES	
Managing and monitoring for all post mining impacts to prevent any further pollution	Monitoring and addressing problem areas

5. SCOPING PROCESS

In terms of environmental permitting and licensing, this EIA and EMPR will also be available for public review from 16 March 2016 to 15 April 2016 after which the report will be finalized based on comments received and submitted to the respective authorizing authorities as well as being released for final review into the public domain. In terms of the NEMA this project required a comprehensive Scoping EIA process to be undertaken.

The investigations that were undertaken during the scoping phase included aspects such as the physical, biological and social environment. A general evaluation of the status of the pre-activity environment was also undertaken. The information in the Scoping Report was compiled from various sources, including information from the proponent or applicant, site visits, interviews and meetings with authorities and I&APs, and literature reviews. A screening level assessment was also undertaken before the Scoping phase.

Both the positive and negative potential impacts that the proposed operations will have on the environment were identified and discussed.

The Public Participation Process (PPP) is central to the investigation of environmental impacts as it is important that stakeholders who are potentially affected by the project are given an opportunity to identify issues relevant to them and to ensure that local knowledge, needs and values are understood and utilised. The views of stakeholders were included in the Scoping Report and were used either to validate the appropriateness of the specialist studies that were commissioned or to indicate where additional specialist studies were required to ensure that relevant issues are addressed.

Issues and impacts identified in the Scoping Report are described in detail and assessed in the EIA and mitigation methods are discussed in the EMP, which also deals with the implementation and monitoring of these mitigation measures.

The objectives of the Scoping Phase were to:

- Initiate investigations into the current receiving environment;
- Develop a project description that is adequate in detail to provide sufficient information;
- Identify and initiate consultation with stakeholders;
- Identify possible impacts that may occur as a result of the proposed project; and
- Formulate a plan of study for the EIA, this included the terms of reference for the identified required specialist investigations.

6. ENVIRONMENTAL IMPACT ASSESSMENT

The EIA uses a rigorous, numerical environmental significance rating process which is based on the accepted impact assessment methodology that uses the probability of an event occurring and the severity of the impact, should an event occur, as factors to determine the significance of a particular environmental risk.

In order to determine the significance of any potential environmental impact, the criteria taken into consideration are the spatial extent of the impact, the duration of the impact and the severity of the impact. The probability of an impact occurring is determined by the frequency at which the activity takes place and by how often the type of impact in question has taken place or takes place in similar circumstances. The values assigned to these factors (weighting) are discussed as part of the EIA. In order to clarify the purpose and limitations of the impact assessment methodology, it is necessary to address the issue of subjectivity in the assessment of the significance of environmental impacts. Even though BeyondGreen, and the majority of environmental impact assessment practitioners, propose a numerical methodology for impact assessment, one has to accept that the process of environmental significance determination is inherently subjective. The weight assigned to each factor of a potential impact, and also the design of the rating process itself, is based on the values and perception of risk of members of the assessment team, as well as that of the I&APs and authorities who ultimately provide input into the process. Whereas the determination of the spatial scale and the duration of impacts are to some extent amenable to scientific enquiry, the severity value assigned to impacts is highly dependent upon the perceptions and values of all involved. It is for this reason that it is crucial that all Environmental Impact Assessments make reference to the environmental and socio-economic context of the proposed activity in order to reach an acceptable rating of the significance of impacts. Similarly, the perception of the probability of an impact occurring is dependent upon perceptions, aversion to risk and availability of information.

It has to be stressed that the purpose of the EIA process is not to provide an incontrovertible rating of the significance of various aspects, but rather to provide a structured, traceable and defensible methodology of rating the relative significance of impacts in a specific context.

The EIA assesses environmental and social impacts according to different stages of the proposed project, namely: the construction, operational, decommissioning and post-closure phases. Impact and benefit significance are assessed before and after the application of any mitigation or enhancement measures and refer to effects on both the ecological and social environment.

Lastly, the cumulative impacts of the proposed operation on the environment, with reference to similar operations and activities in the area are discussed.

The main objectives of the EIA Phase are to:

- Determine the sensitivity and ecological status quo of the receiving environment through specialist investigations;
- Identify the activities involved in all phases of the proposed project that may result in a detrimental or positive impact to the receiving environment;
- Determine the significance of identified impacts; and
- Relay findings of the EIA phase to all stakeholders.

7. ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPR)

The EMPR is aimed at addressing all environmental impacts that have been identified in the EIA phase and providing achievable mitigation measures to reduce or enhance the possible negative or positive impacts on the environment.

As the EIA indicates the relative significance of the various environmental impacts associated with these activities, it serves to focus the allocation of resources on environmental aspects and specific impacts requiring mitigation. The aim of the mitigation measures is to minimize the negative impacts and enhance the positive aspects of the project, as well as to inform and involve the local communities through the process.

The main objective of the EMPR is to:

Provide information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified including cumulative impacts;

- Provide detailed description of the aspects of the activity that is covered by the EMPR;
- Identification of required monitoring programmes;

- Determine associated costs required for rehabilitation and / mitigation.

The EMPR section is divided into the setting of objectives and the planning of management measures. The monitoring and performance assessment section of the EMPR details the monitoring and audits that will be implemented to ensure the effectiveness of mitigation measures. The EMP section will aim to provide all necessary information in terms of Regulation 23 (4) and Appendix 4 of the EIA Regulations, 2014 published in terms of the National Environmental Management Act, 1998.

8. LEGAL AND POLICY FRAMEWORK

8.1 The Minerals and Petroleum Resources Development Act

The Mineral and Petroleum Resources Development Act (Act No 28. Of 2002 -MPRDA) aim is to “*make provision for equitable access to and sustainable development of the nation’s mineral and petroleum resources*”. The MPRDA outlines the procedural requirements that need to be met to acquire mining rights in South Africa. In this regard, BeyondGreen have compiled and simultaneously submitted an application for a Mining Right and Environmental Authorization in terms of Section 22 of the MPRDA and Section 16 of the NEMA EIA 2014 regulations to DMR on 15 September 2015, which was subsequently accepted on 26 November 2015.

The MPRDA also requires adherence with related legislation, chief amongst them is the National Environmental Management Act (Act No. 107 of 1998, NEMA) and the National Water In terms of the MPRDA, a mining right can only be granted once a Scoping, Environmental Impact Assessment (EIA) and Environmental Management Programme (EMP) have been completed for the proposed operation. Furthermore, this process must include a Public Participation Process (PPP).

To date a mining right application for reserve 16 of farm no.15836 has been submitted to the Department of Mineral Resources (DMR), accepted by the DMR on the 26 November 2015. As part of the environmental authorization process a Scoping report was compiled in accordance with NEMA regulations and submitted to the DMR on the 29th February 2016.

8.2 The National Environmental Management Act

In addition to the MPRDA, the NEMA sets out the requirements for the environmental assessment of a range of activities which are associated with mining. The NEMA aim is *“to provide for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for coordinating environmental functions exercised by organs of state; and to provide for matters connected therewith.”* The NEMA outlines the procedural requirements that need to be met to achieve this. The following table identifies the listed activities the proposed project triggers and consequently requires authorization prior to commencement:

TABLE 4: NEMA LISTED ACTIVITIES TO BE AUTHORISED

NEMA Listed activity		
Listing notice	Name of activity	Trigger
GNR 984, activity 17	Any activity including the operation of that activity which requires a mining right as contemplated in section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including associated infrastructure, structures and earthworks, directly related to the extraction of a mineral resource, including activities for which an exemption has been issued in terms of section 106 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).	The application of mining right for extraction of industrial mineral, Rhyolite
GNR 983 Activity 27	The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for- (i) the undertaking of a linear activity; or (ii) Maintenance purposes undertaken in accordance with a maintenance management plan	Clearance of vegetation for the establishment of the mining operations

<p>GNR 983</p> <p>Activity 56</p>	<p>The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometer-</p> <p>(i) where the existing reserve is wider than 13,5 meters; or</p> <p>(ii) where no reserve exists, where the existing road is wider than 8 metres; excluding where widening or lengthening occur inside urban areas.</p>	<p>Upgrades to existing roads for transport to and from the mining area.</p>
<p>GNR 984</p> <p>Activity 21</p>	<p>Any activity including the operation of that activity associated with the primary processing of a mineral resource including winning, reduction, extraction, classifying, concentrating, crushing, screening and washing but excluding the smelting, beneficiation, refining, calcining or gasification of the mineral resource in which case activity 6 in this Notice applies.</p>	<p>The crushing and screening of the rhyolite stone</p>
<p>GNR 983</p> <p>Activity 67</p>	<p>Phased activities for all activities (i)listed in this Notice, which commenced on or after the effective date of this Notice; or (ii)similarly listed in any of the previous NEMA notices, which commenced on or after the effective date of such previous NEMA Notices; where any phase of the activity may be below a threshold but where a combination of the phases, including expansions or extensions, will exceed a specified threshold; excluding the following activities listed in this Notice-17(i)(a-d);17(ii)(a-d);17(iii)(a-d);17(iv)(a-d);17(v)(a-d);20;21;22;24(i);29;30;31;32;34;54(a-d);55;61;62;64and 65.</p>	<p>Pollution control dams, stockpiling area etc.</p>

8.3 National Environmental Management: Air Quality Act

The National Environmental Management: Air Quality Act (NEMAQA) is the main legislative tool for the management of air pollution and related activities. The objective of the Act is: to protect the environment by providing reasonable measures for-

- the protection and enhancement of the quality of air in the Republic;
- the prevention of air pollution and ecological degradation; and
- 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.

Section 21 of the NEMAQA allows that the Minister to publish a list of activities which may result in atmospheric emissions and which may have a significant detrimental effect on the environment. The NEMAQA further states that no person may, without a provisional atmospheric emissions license or an atmospheric emissions license, conduct an activity which is listed in accordance with Section 21 of this Act. The applicability of the listed activities under Section 21 of the NEMAQA will be determined during the EIA phase of the project. Currently the desktop assessment indicate that section 21 does not apply to this project since there will be no atmospheric emissions other than dust pollution from crusher machine; all production stockpiles will remain within the mining boundary and are therefore excluded from the scheduled activities listed under the Air Quality Act.

In addition, Section 9(1) of the NEMAQA makes allowance for the Minister to publish a list of national ambient air quality standards to be implemented throughout South Africa. GN R. 1210 of December 2009 provides these standards for various ambient pollutants.

The dust fall-out studies will be conducted in accordance with the NEMAQA. The ASTM International measurement system to determine monthly average fallout concentrations and the South African National Standards (SANS) 1929: 2005, Edition 1.1 will be utilized during dust sampling and analysis.

8.4 National Environmental Management: Biodiversity Act

The National Environmental Management: Biodiversity Act (Act No. 10 of 2004 -NEMBA) *“provides for the management and conservation of South Africa’s biodiversity within the framework of the NEMA; the protection of species and ecosystems that warrant national protection; the sustainable use of indigenous biological resources; the fair and equitable sharing of benefits arising from bio-prospecting involving indigenous biological resources; the establishment and functions of a South African National Biodiversity Institute; and for matters conducted therewith”*.

In terms of the NEMBA, the applicant has a responsibility for: The conservation of endangered ecosystems and restriction of activities according to the categorization of the area (not just by listed activity as specified in the EIA regulations).

Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area are in line with ecological sustainable development and protection of biodiversity. Limit further loss of biodiversity and conserve endangered ecosystems. Regulations published under NEMBA provides a list of protected species (flora and fauna), according to the Act (GN R. 151 dated 23 February 2007, as amended in GN R. 1187 dated 14 December 2007). Should such species be encountered on site and require relocation, a permit will be required to be submitted to the Competent Authority prior to any disturbance/damage/destruction of any protected flora.

8.5 National Environmental Management: Protected Areas Act

The National Environmental Management Protected Areas Act (ActNo.57 of 2003) is intended to “*provide for the protection and conservation of ecologically viable areas representative of South Africa’s biological diversity and its natural landscapes and seascapes*” and creating a “*national system of protected areas in South Africa as part of a strategy to manage and conserve its biodiversity*”.

The NEMPAA defines various kinds of protected areas, namely: “*special nature reserves, national parks, nature reserves (including wilderness areas) and protected environments; world heritage sites; marine protected areas; specially protected forest areas, forest nature reserves and forest wilderness areas declared in terms of the National Forests Act, 1998 (Act 84 of 1998); and mountain catchment areas declared in terms of the Mountain Catchment Areas Act, 1970 (Act 63 of 1970)*”.

8.6 The National Forest Act

The removal of any indigenous or protected trees or clearing of any woodland, thicket or forest requires a permit, in terms of Section 15 of the National Forest Act (Act No. 84 of 1994 –NFA) and the Nature and Environmental Conservation Ordinance (No. 19 of 1974). Should the project require the removal or any indigenous or protected tree species, a Threatened or Protected Tree Species (TOPS) permit will be required to be submitted to the Competent Authority prior to any disturbance/damage/destruction of any protected flora.

8.7 The National Waste Act

Section 16 of the NEMWA must also be considered which states as follows:

1. *“A holder of waste must, within the holders power, take all reasonable measures to-*
 - a. *avoid the generation of waste and where such generation cannot be avoided, to minimize the toxicity and amounts of waste that are generated;*
 - b. *reduce, re-use, recycle and recover waste;*
 - c. *where waste must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner; manage the waste in such a manner that it does not endanger health or the environment or cause a nuisance through noise, odour, or visual impacts;*
 - e. *prevent any employee or any person under his or her supervision from contravening the Act; and*
 - f. *prevent the waste from being used for unauthorized purposes.”*

These general principles of responsible waste management will be incorporated into the EMPR to be implemented for this project.

8.8 The National Water Act

The National Water Act (Act No.36 of 1998 –NWA) provides the law relating to the water resources of South Africa. The purpose of the NWA is to manage and control the means

by which all water resources are protected, used, developed, conserved and controlled. Sections 21 of the NWA identify certain water uses which require approval from the Department of Water and Sanitation (DWS) in the form of a relevant water use license. No water uses provided for in the Act, are applicable to the project. The mine intends to use water from the rain, which will be harvested from the mine pit. Ngwavuma is an extremely arid area; hence the mine would not even attempt to use water from the water resources or from the municipality. Water will only be used in small volumes, for dust suppression mainly. There is no need for the application of water use license.

8.9 The National Heritage Resources Act

The primary piece of legislation protecting national heritage in South Africa, is the South African National Heritage Resources Act (Act No. 25 of 1999 -NHRA). Section 38 of the NHRA states that:

“38. (1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorized as-

(a) the construction of a road, wall, power-line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;

(b) The construction of a bridge or similar structure exceeding 50m in length;

(c) Any development or other activity which will change the character of a site-

(i) Exceeding 5 000 m² in extent; or

(ii) Involving three or more existing even or subdivisions thereof; or

(iii) Involving three or more even or divisions thereof which have been consolidated within the past five years; or

(iv) The costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;

(d) The re-zoning of a site exceeding 10 000 m² in extent; or

(e) Any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.”

In accordance with Section 38 (Heritage Resources Management) of the NHRA, developers must apply to the relevant authority (KZN Provincial Heritage Resource Agency (AMAFA) and South African Heritage Resources Agency (SAHRA)) for authorization to proceed with their planned activities. This application must be accompanied by documentation detailing the expected impact this will have on national heritage in particular.

Categories of heritage resources recognized as part of the National Estate in Section 3 of the Heritage Resources Act, and which therefore fall under its protection, include among other categories:

- Geological sites of scientific or cultural importance;*
- Objects recovered from the soil or waters of South Africa, including archaeological and paleontological objects and material, meteorites and rare geological specimens;*
- Objects with the potential to yield information that will contribute to an understanding of South Africa’s natural or cultural heritage.*

To address concerns relating to the protection of these particular heritage resources, a Heritage Impact Assessment (HIA) will be undertaken as one of the specialist studies in order to assess any potential impacts to archaeological and paleontological heritage within the footprint of the proposed development and be submitted to the South African Heritage Resources Agency (SAHRA).

9. EIA PROCESS

9.1 Objectives

In accordance with Appendix 3 of GN No. R982, the objectives of the EIA are:

- To identify the relevant policies and legislation relevant to the activity;
- To present the need and desirability of the proposed activity and its preferred location;

- To identify feasible alternatives related to the project proposal;
- To ensure that all potential key environmental issues and impacts that would result from the proposed project are identified;
- To provide a reasonable opportunity for I&APs to be involved in the EIA process;
- To assess potential impacts of the proposed project alternatives during the different phases of project development;
- To present appropriate mitigation or optimisation measures to minimise potential impacts or enhance potential benefits, respectively; and
- Through the above, to ensure informed, transparent and accountable decision-making by the relevant authorities.

The EIA process consists of a series of steps to ensure compliance with these objectives and the EIA

Regulations 2014 as set out in GN No. R982. The process involves an open, participatory approach to ensure to ensure that all impacts are identified and that decision-making takes place in an informed, transparent and accountable manner.

9.2 Need and Desirability

BeyondGreen present the needs and desirability of the mining in terms of various national plans and policies. They make the case that mining would result in long-term benefits for South Africa consisting poverty alleviation, development, housing, and major in country investments in a development project. The extraction of stone is in the best interest of the public at large. Rhyolite Stone is classified as an industrial mineral and is mainly used in the construction industry. Government contracts with construction companies in order to develop infrastructure related to health, transport, residences as well as education sector for the development of a nation.

9.3 Assumptions and limitations

The EIA assumptions and limitations are listed below:

- The EIA assumes that BeyondGreen has been provided with all relevant project information and that it was correct and valid at the time it was provided;
- Specialists were provided with all the relevant project information in order to produce accurate and unbiased assessments;
- There will be no significant changes to the project description or surrounding environment between the completion of the EIR and implementation of the proposed project that could substantially influence findings, recommendations with respect to mitigation and management, etc.; and
- The assessment is based, to a large extent, on a generic description of the proposed mining activities.

These assumptions and limitations, however, are not considered to have any negative implications in terms of the credibility of the results of the EIA process.

9.4 Project Benefits

The major benefits of the project are as follows:

- will provide employment for 25 people over the 26-year operation period.
- the project will further create indirect employment through hiring of contractors and obtaining supplies. This will primarily be sought locally if available.
- The mine will result in continued implementation of social and local economic development plans through its S&LP.
- The proposed project will make a significant contribution to the inland aggregate market as well as the GDP.

The project site is determined and delimited by the extent of the aggregate seam and no further site alternatives have been assessed.

9.5 Project Alternatives

Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives help identify the most appropriate method of developing the project,

taking into account location or site alternatives, activity alternatives, process or technology alternatives, or the no-go alternative. Alternatives also help identify the activity with the least environmental impact.

The EIR report includes a detailed project description, much of which will remain unaltered due to the nature and position of rhyolite stone. Where feasible project alternatives do exist, then these have been elaborated on. Land use alternatives have been assessed under the relevant sections.

9.5.1 Project site and mining method alternatives

The nature of the rhyolite aggregate seams determines the preferred mining method and the location of the feasible stones determines the location of the mining operation. These two factors limit mining alternatives that are available. Some options are open cast roll over mining with truck and shovel or dragline etc. The scale of the operations does not allow for draglines and this would not be feasible. The only other possible alternative available for mining methods will be the no mining option.

9.5.2 Land use alternatives

Consideration of land use alternatives is one of the cornerstones of community planning. Land use decisions must be evaluated in terms of sustainability, broadly defined as balancing environmental, economic and social equity concerns. The primary land use categories that encompass basic functions are residential, commercial, industrial, recreational, institutional, and agricultural uses. Land use is determined by a number of factors. These include climate, resources, population growth, economic activity and topography. When considering a new development for an area, it is required that other land use alternatives are considered to ensure that the development is justified and viable. In the project area, present land use includes agriculture (subsistence livestock farming) and residential.

Alternative 1 implies that no development will take place and that the environment will remain unchanged and unaltered by the proposed project. As much as the no-go option resulting in the protection of the environment in situ and the continued use of the land for

stock farming, it will result in the sterilization of the aggregate resources should no other company mine the area. This would reduce construction material for road construction which is currently a major issue in Jozini, which currently has no viable construction resources. The no-go option would also result in no new employment opportunities. The proposed development footprint of the project will fall within an area comprising of a mixture of natural vegetation. The application area is dominated by shrubs and forest and therefore potential impacts on biodiversity should be considered. If the proposed project should not take place, no additional socio-economic benefits will be created by the mining activities within the area, the mineral resource will be lost, and the additional GDP from the local supply of industrial material will be compromised. Further implications of the No-Go alternative include the loss of economic input into the area and a loss of regional socio-economic benefit. However, the potential impacts on biodiversity and habitat will not occur.

Alternative 2: When considering the allocation of land for development and in deciding applications for planning permission affecting agricultural land, the agricultural implications must be considered together with the environmental, cultural and socio-economic aspects. In particular, prime quality land should normally be protected against permanent development or irreversible damage.

Possible alternative land uses in the case that the project is not implemented include agriculture combined with low-density residential (current land use) and low-cost housing. With regards to agriculture, the soils and land use impact assessment has found that the project site is situated on secondary agricultural land. The area does not really support agricultural activities due to its terrain and climate. The area is stony, dry, and mountainous, very much remote, desert, and terrain of the surrounding area, the viability of using the proposed project site for low-density residential purposes is 0%. Additionally, there is a trend in the local municipal area of individuals moving out of more rural settings into the town of Jozini, in search of employment opportunities and for the sake of better access to services. Mining thus appears to be the most viable and appropriate land use for the project site from a social perspective

Table 5 lists the three alternative land uses which were considered during land use alternative assessment and the impacts associated with these land uses, in comparison with that of mining. The comparative impact assessment indicates that opencast mining will have the greatest environmental impacts followed by residential development and stock agriculture. Livestock subsistence farming will have the least impact to the environment as that is the predominant current land use. Mining and its associated activities will have the greatest impact on the environment and is the least sustainable but upon completion of mining and with proper rehabilitation other land uses can be considered for the area. Most of the mining impacts will also be for a very limited and occurred in a very small area (8ha). Residual impact extent and severity will still need to be assessed, but in general, responsible mining and rehabilitation from the start of the operation can mitigate a lot of the residual impacts associated with mining. Mining will also have a great positive economic impact, and should be considered a viable land use for the area, especially due to the fact that the surrounding area has no sensitive environmental features.

Table 5: Comparative impact assessment for alternative land uses

Aspect	Residential	Agriculture - Stock	Mining
Topography	Status: -ve Duration: Permanent Extent: Site specific Probability: Definite Severity: Slight Significance: Low	Status: -ve Duration: Long term Extent: Site specific Probability: Definite Severity: Slight Significance: Low	Status: -ve Duration: Medium to short term Extent: Site specific Probability: Definite Severity: Slight to moderate Significance: Moderate to low
Soils	Status: -ve Duration: Permanent Extent: Site specific Probability: Definite Severity: Slight to moderate Significance: Moderate to low	Status: Neutral Duration: - Extent: - Probability: - Severity: - Significance: -	Status: -ve Duration: Medium term Extent: Site specific Probability: Definite Severity: Moderate to high Significance: Moderate to high
Land Capability	Status: -ve Duration: Permanent Extent: Site specific Probability: Definite Severity: Moderate Significance: Moderate	Status: Neutral Duration: - Extent: - Probability: - Severity: - Significance: -	Status: -ve Duration: Medium term Extent: Site specific Probability: Definite Severity: Moderate Significance: Moderate

Surface water	Status: -ve Duration: Permanent Extent: Local Probability: Definite Severity: Moderate to high Significance: Moderate to high	Status: -ve Duration: Long term Extent: Site specific Probability: Definite Severity: Slight Significance: Low	Status: -ve Duration: Medium to short term Extent: Local Probability: Definite Severity: Moderate to high Significance: Moderate to high
Groundwater	Status: -ve Duration: Permanent Extent: Local Probability: Definite Severity: Moderate Significance: Moderate	Status: Neutral Duration: - Extent: - Probability: - Severity: - Significance: -	Status: -ve Duration: Long term Extent: Local Probability: Definite Severity: High Significance: High
Air quality	Status: -ve Duration: Permanent Extent: Local Probability: Definite Severity: Slight Significance: Low	Status: Neutral Duration: - Extent: - Probability: - Severity: - Significance: -	Status: -ve Duration: Medium to short term Extent: Local Probability: Definite Severity: Moderate to high Significance: Moderate to high
Noise	Status: -ve Duration: Permanent Extent: Local Probability: Definite Severity: Slight to moderate Significance: Moderate to low	Status: -ve Duration: Long term Extent: Site specific Probability: Definite Severity: Slight Significance: Low	Status: -ve Duration: Short term Extent: Local Probability: Definite Severity: Moderate to high Significance: Moderate to high
Flora and Fauna	Status: -ve Duration: Permanent Extent: Site specific Probability: Definite Severity: Slight to moderate Significance: Moderate	Status: -ve Duration: Long term Extent: Site specific Probability: Definite Severity: Slight Significance: Low	Status: -ve Duration: Long term Extent: Site specific Probability: Definite Severity: Moderate to high Significance: Moderate to high
Archaeology and heritage	Status: -ve Duration: Permanent Extent: Site specific Probability: Definite Severity: Moderate Significance: Moderate	Status: Neutral Duration: - Extent: - Probability: - Severity: - Significance: -	Status: -ve Duration: Long term Extent: Site specific Probability: Definite Severity: Moderate Significance: Moderate
Visual aspect	Status: -ve Duration: Permanent Extent: Local Probability: Definite Severity: Moderate Significance: Moderate	Status: Neutral Duration: - Extent: - Probability: - Severity: - Significance: -	Status: -ve Duration: Short term Extent: Local Probability: Definite Severity: Moderate to high Significance: Moderate to high
Traffic and safety	Status: -ve Duration: Permanent Extent: Local Probability: Definite	Status: Neutral Duration: - Extent: - Probability: - Severity: - Significance: -	Status: -ve Duration: Short term Extent: Local Probability: Definite Severity: Slight to moderate Significance: Moderate to low

	Severity: Moderate to high Significance: Moderate to high		
Regional socio-economics	Status: +ve Duration: Permanent Extent: Site specific Probability: Definite Severity: Slight Significance: Low	Status: +ve Duration: Long term Extent: Local Probability: Definite Severity: Slight Significance: Low	Status: +ve Duration: Long term Extent: Local Probability: Definite Severity: Moderate Significance: Moderate to high
Cumulative assessment	The main cumulative effects of residential development will be around the permanent alteration of the area to residential. This means a permanent alteration of the soils, land capability, land use, floral and faunal biodiversity and a high risk of exotic species through gardening activities. The cumulative impacts are considered of moderate to high significance due to the permanent nature of the impacts.	The main impact is that of water use for livestock watering and the erosion and floral community alteration that may occur through overgrazing. These impacts are considered negligible as are cumulative contributions.	The operation of a mine will contribute most significantly to cumulative impacts. The detailed cumulative assessment is detailed later, but the operations will significantly contribute to drops in groundwater levels, reduced groundwater quality if poorly managed and elevated dust and particulate matter. From a socio-economic perspective it will significantly improve livelihood of the several employees.

10. PUBLIC PARTICIPATION PROCESS (PPP)

The PPP for the proposed project has been undertaken in accordance with the requirements of the MPRDA, and NEMA in line with the principles of Integrated Environmental Management (IEM). IEM implies an open and transparent participatory process, whereby stakeholders and other I&AP’s are afforded an opportunity to comment on the project. A PPP has been implemented to engage with I&AP’s and meet the requirements for Public Participation as stipulated by the relevant legislation. The PPP provides stakeholders with information about the proposed project, and several opportunities to comment throughout the EIA/EMP process. This will ensure public involvement at each key step in the process and allow for comments, concerns, suggestions, and objections to the proposed project to be included in each of the submissions to the relevant Government Authorities.

The first phase of an EIA is the Scoping Phase. In terms of the MPRDA and the NEMA, I&AP’s must be given the opportunity to comment on the proposed project. The Scoping

Report aims to describe the proposed project, the environment in which the project is located, and the potential impacts that may result if the project goes ahead. The Draft Scoping Report was made available for public comment from 07/12/2015 to 13/01/2016 (a period of 35 days). The comments received from I&AP's thus far have been captured in an Issues and Responses Report (IRR) accompanying this Scoping Report (Appendix D) and also recorded on Consultation document submitted at DMR. All comments received before the 13/01/2016, including during the Draft Scoping Report comment period, is included in the Final Scoping Report for submission to the authorities.

A meeting was held on 22/04/2015 with the landowners, whose properties fall within the application area of the proposed project, to discuss the proposed project and allows for questions to be raised. The minutes of this focus group meeting can be found in Appendix D. A public open day was held on the 27 November 2015 to introduce I&AP's to the project and discuss the results of the scoping phase. The Final Scoping report was submitted to DMR, no response was received since then. An EIA Report, including an EMPR, will be presented for public comment on 16 March 2016 to 15 April 2016 as the next step of this EIA process during which time further stakeholder engagement will take place.

10.1 Identifying Regulatory Authorities:

The authorities for this project were identified from similar projects in the past. The authorities contacted with regards to this project include:

- the Department of Mineral Resources (DMR);
- the KwaZulu Natal Department of Economic Development, Environment and Tourism
- The Department of Water Affairs (DWA);
- Land Claims Commissioners Office;
- The South African Heritage Resources Agency (SAHRA);
- The Department of Roads and Transport;
- Jozini Local Municipality
- Mkhanyakude District Municipality (NDM).
- Department of Environmental Affairs

A process of engagement was followed in order to ensure that all I&APs were given the opportunity to raise concerns regarding the proposed activities. Consultation with I&APs took place by the following means: Background Information Document (BID)

10.2 Notices

Further to this, A2 posters written in English and Zulu were erected and displayed on site (Reserve 16 of farm no 15836) as well as the Local Municipality, the Local Library and at a community to the proposed site. These posters informed the public of the proposed activities, invited (I&AP's) to attend the public meeting and requested people to register as I&AP's.

10.3 Adverts

An advertisement, informing people of the proposed activities, the public meeting and requesting readers to register as I&AP's, was placed in a local newspapers. An advertisement was placed in "Isolezwe", on the 22nd November 2015. This was done for Scoping report, it was discovered that the community within this area is too far from the stores or shops where they are selling newspapers. It was clear that the method of advertising does not help, it is not a fair method of consultation since 0% of the area buys a newspaper. The newspaper can only be bought at Jozini, which is like 54km from the proposed area. The community only goes to Jozini probably once a month or thrice at most.

10.4 Introductory Public Meeting

All I&AP's were invited through hail speaker to attend a public meeting that was held on the 30th January 2016 at Traditional leaders home. Minutes of the meeting and a copy of the presentation are attached in Appendix B.

10.5 Document Review

In addition, this NEMA Environmental Impact Report will be made available for public review and comment and all registered I&AP's will be informed of its availability. I&AP's will be given forty (30) days to submit their comments to the EAP. A copy of the report will be made available at the Local Library in Jozini, as well as at the Ngwavuma primary schools.

11 DESCRIPTION OF AFFECTED ENVIRONMENT

Much of the detail provided below is desk-top level studies and generalizations drawn from prior studies conducted by the municipality and other state organs. During the EIA/EMP phase, various studies were completed for the specific proposed area of interest and included in the EIA/EMP report. Site inspection was conducted to ascertain the precise data regarding the affected environment.

11.1 Surrounding land use and capability

The evident land use pattern and settlement pattern in Jozini LM greatly influenced by topography, environmentally sensitive sites and sites of historical significance. The land use pattern has evolved in response to settlement pattern and it relates to places where people live, play and work. The pattern is however different within the close surrounding of the proposed area. The proposed area is mainly used for livestock; the closest homestead is about 5km away. As such the following are the evident broad land uses in Jozini LM (see table 7 below).

Settlements

Towns

Agricultural

Commercial Farmlands

Conservation Areas

Table 6: Surrounding land use and capability

LAND COVER	HACTARES	PERCENTAGE
Airfields	6.5	0.0
Bare rock and sand	506.2	0.1
Bushland and woodland	191521.8	55.6
Forest	7397.9	2.1
Grasslands	62511.5	18.2
Natural water bodies	2112.0	0.6
Plantations	25.3	0.0
Wetlands	5858.3	1.7
Mines and Quarries	31.9	0.0
Dams	1066.7	0.3
Commercial-orchards	19.2	0.0
Commercial- Pineapples	78.2	0.0
Commercial- Sugarcane	7441.8	2.2
Commercial- Agriculture	972.9	0.3
Dense settlements	1191.0	0.3
Low density settlements	12079.8	3.5

Scattered low density settlements	47658.2	13.8
Railways	87.8	0.0
Roads	3612.0	1.0
TOTAL	344179.2	100

The above table illustrates in detail the extent of the various land uses. From the table it is evident that bushland and woodland occupy the majority (55,6%) of the land in Jozini LM and settlements occupy approximately 17,6%.

11.2 Topography

The topography can be described as gently undulating. Topography has a local effect on the climate and influences land use. The Jozini area is bounded in the west by the Lubombo mountain range, which reaches an elevation of approximately 600m. This range has commanding views eastwards over the rest of the sub-region, as well as westwards into Swaziland over the Pongola River. The presence of streams and rivers has created a number of gorges and opened up opportunities for the development of adventure tourism activities.

11.3 Geology and Soils

The underlying geology of Jozini area has controlled the development of the soils and topography, the latter in turn locally affects the climate and overall land use of the area. The Lebombo Range is composed mainly of acid rhyolitic lavas while marine limestones and calcareous mudstones of lower and middle to upper Cretaceous age underlies the Pongola/Mkuze flood-plain zone. Soil types relate to specific physiographic regions each with particular climatic and hydrological conditions. Soil along the Lebombo Range consists mainly of shallow, stony soils of the Mispah and Glenrosa forms. The soils found along the floodplain and in particular along the west bank of the Pongola River, are derived alluvium, river terraces and the Cretaceous sediments. As a result soils are generally fertile to very fertile. The Makhathini Flats irrigation scheme is located in this area. Soils found in the eastern extreme of the region are mainly deep, acidic, well drained sands of Fernwood and Clovelly forms.

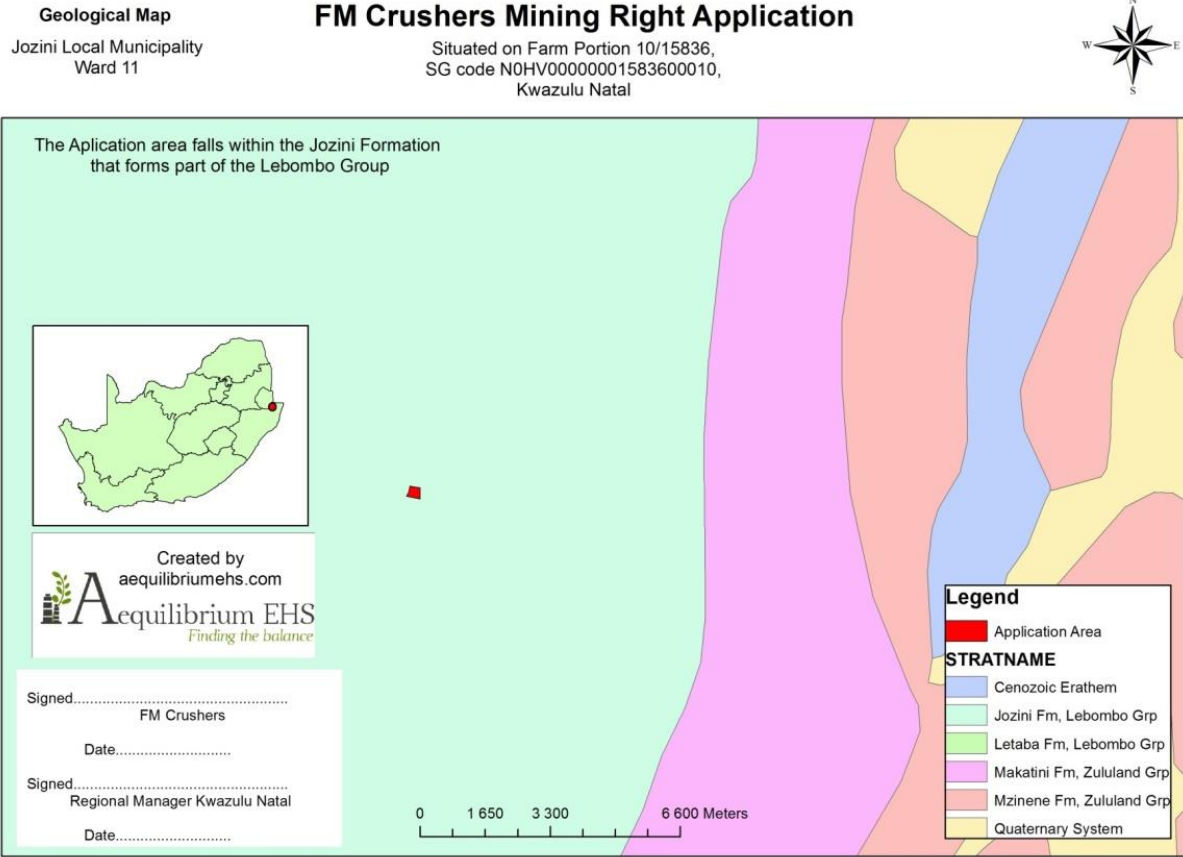


Figure 12: Geological map in relation to soil types

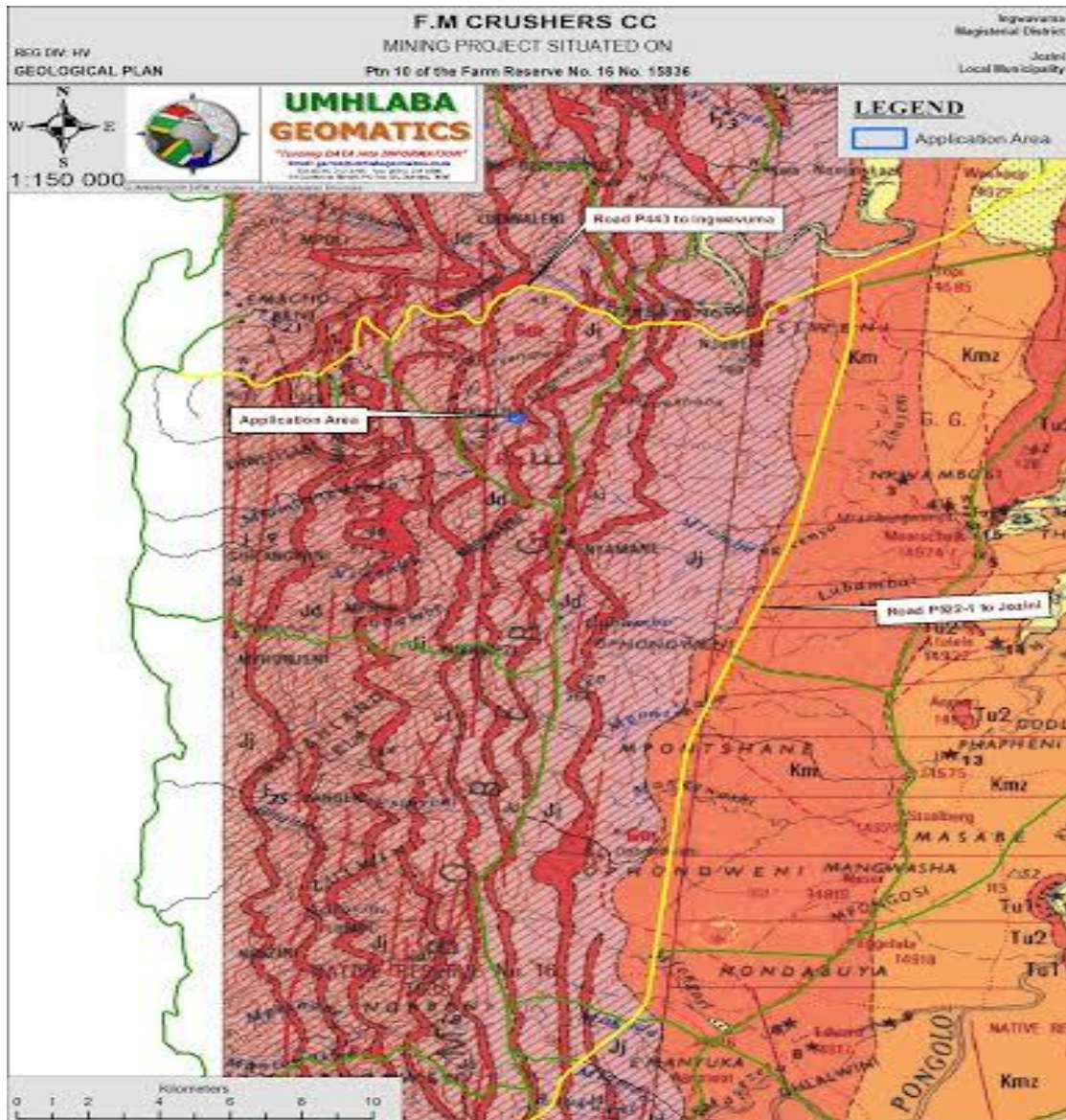


Figure 13: Geological Maps for the proposed project in relation to locality area

11.4 Surface water

Jozini has an abundance of natural water resources. Major rivers include the Pongola River, the Ngwavuma River, the Mkuze River, and the Usuthu River, of these only the Usuthu and Pongola Rivers are perennial. The Pongola is the most important river in Jozini as it traverses the full length of the area. The flooding of the Ngwavuma and the USuthu dam up the waters of the Pongola, resulting in an area of deep flooding during peak floods and the infilling of pans. Local Mountain drainage comprises a number of seasonal streams that drain the dip-slope and scarp-slope faces. Some of these streams

have perennial pools. In spite of this apparent abundance of water, there is some concern about the provision of potable water to rural areas. The rivers are however very far from the proposed area. The closest river, (Ngwavuma River), is more than 15 km away from the proposed activity.

11.5 Sensitive Area

The factors responsible for high levels of biodiversity present in the area are also responsible for the high levels of biodiversity present in the vegetation. The uMkhanyakude District is part of the Indian Ocean phytogeography region, and is a regional transition zone and a regional mosaic. Flora comprises a mixture of several floristic elements and communities and differs substantially from that of surrounding regions. Vegetation is exceptionally diverse and ranges from forest, thickets and woodlands to grassland and swamps depending on topography and edaphic conditions. These can be classified into 15 discrete vegetation types. Of at least 2180 vascular plant species, 225 species are endemic or near endemic to the Jozini area.

Biodiversity in the municipality is under pressure because of land conversion, climate change, unsustainable harvesting of natural resources and the wide spread of alien species. Natural resources provide opportunities for economic empowerment through sustained agriculture, ecotourism, indigenous plant use etc.

11.6 Climate change

Jozini area is characterized by seasonal dry winters and wet summers with periodic flooding. The summer temperature range from 23° to 40°, while winter temperatures range from 16° to 25°. Mean annual rainfall is 600 mm and 800mm along the Lebombo Mountains which fall within a moist belt. The average rainfall at various locations in the area has been recorded and is listed below:

- Othobothini 730 mm
- Ndumo 638 mm
- Ingwavuma 808 mm
- Ubombo 836 mm

The annual average evaporation is approximately 1660mm with evaporation highest during the winter and early spring months.

11.7 Animal life

11.7.1 Fauna Fish

There is a rich estuarine and freshwater fish community. Freshwater fish of rocky waters such as the rock catlet are found in pools along the Lebombo range. The Tiger fish is the most important game fish in the Pongola River.

11.7.2 Reptiles

High levels of species richness are displayed in the herpetofauna including important species such as the Nile crocodile. The area represents either the southernmost or northernmost limit of a large number of species. The highest concentration of endemic reptiles occurs in the North coast region. More specifically, Rupicolous reptiles such as Warrens girdled lizard, Smith's plated rock lizard and Wilhelm's red tailed rock lizard are resident in the Lebombo Mountain Range. Crocodiles are still abundant within Ndumo Game Reserve however they have largely been exterminated outside of the reserve.

11.7.3 Birds

Jozini area is well known with variety of bird species. The very high species diversity is a consequence of the wide variety of terrestrial, wetland and aquatic habitats in the area and the geographical position either as a destination or stopover for migratory species.

The following birds are known to occur within the Jozini Area:

Table 7: Birds species occurring at Jozini

Area	Species
Lebombo Mountain Range	Rock pigeon, rock thrush, red-wing starling and mocking chat
Pongola floodplain	White-winged plover, black coucal, red-winged pratincole and Heuglin's robin.

Floodplain pans	Wattled plover, purple galinule, white-faced duck, red-bill teals, purwing goose and glossy ibis.
Riverine forest	Green coucal, Pel's fishing owl, Heuglin's robin, Natal robin, trumpeter hornbill, green pigeon and wattle-eyed flycatcher.
Riverbank tangles	Peter's finfoot.
Thorn savannah	Grey lourie, yellow-bill hornbill, grey hornbill, Cape glossy starling, long-tailed shrike and rufous-naped lark.
Thorn thickets	White-breasted sunbird, purple-banded sunbird, red-faced mouse-bird, gorgeous bush shrike and pied barbet.
Sand-forest	Bearded robin, black-helmet shrike, Neegard's sunbird, Rudd's apalis, Woodward's batis, pink-throated twinspot and yellow spotted nicator. A variety of birds occur on the savannah.
(Source: Maputaland Ecological and Conservation Potential, Ubombo-Ingwavuma Structure Plan)	

11.7.4 Mammals

The terrestrial mammal fauna of the Jozini area is particularly rich, from the smallest groups such as bats and rodents, to the "big five" within the Game Reserves. The mammal population is a significant component of the biomass of the area, influencing its ecology and forming the basis of much of the tourism in the area. Klipspringer and mountain reedbuck are typical of the Lebombo Range area, with blue duiker occurring in the forests and thickets. Smaller mammals such as red rock rat, Namagua rock rat and the dwarf

shrew are found along the Lebombo Range. Hippo, Elephant, black and white rhino, zebra, giraffe, blue wildebeest, nyala, bushbuck, kudu, waterbuck, reedbuck, impala, warthog and bush pig are known to occur within Mkuze and Ndumo Game Reserves.

11.8 Air quality dust

Due to the rural nature of the municipality; air quality issues in the Jozini are less prevalent. Farming and residential land-uses within the vicinity of the application area have less to none emission sources, the area has few vehicle, few households which can use fuel combustion, biomass burning and various fugitive dust sources. Few homesteads nearby were identified as sensitive receptors within the vicinity of the application area. One nearby homestead occurs within 500m from the proposed mining area.

11.9 Socio economic profile of the area

There is a high rate of poverty and unemployment around the proposed mining area. The proposed mining operation will create employment opportunities for the locals. The area is also a developing area; the locals will have an easy access to the industrial stone at a lower price compared to buying it at the hardware's in town.

The proposed operation will also pay rates and taxes to the appropriate Government institutions. This will help to develop the area and the country at large. According to guide lines prepared by World Bank "Local Economic Development (LED) is the process by which public, business and nongovernmental sector partners work collectively to create better conditions for economic growth and employment generation. The aim is to improve the quality of life for all.

11.9.1 Main Economic Contributors

Agriculture

Tourism

Business: Formal and Informal

11.9.2 Employment and Income Levels

According to the Census 2011 stats, 163 928 of Jozini population have a monthly income of R1600 or less. 79 767 of this population recorded no income at all. There are spatial differences in income – with those living and working in the small towns and in the surrounding game reserves earning little more than grant-dependent - under-capacitated to deal with the developmental challenges it faces. The costs of living keep increasing diminishing the level of disposable income and payment for services

Table 8: Employment and income levels of Jozini population

Income	Number
No Income	79767
R 1 - R 400	63943
R 401 - R 800	6612
R 801 - R 1 600	13606
R 1 601 - R 3 200	3456
R 3 201 - R 6 400	2251
R 6 401 - R 12 800	2605
R 12 801 - R 25 600	1333
R 25 601 - R 51 200	375
R 51 201 - R 102 400	41
R 102 401 - R 204 800	62
R 204 801 or more	

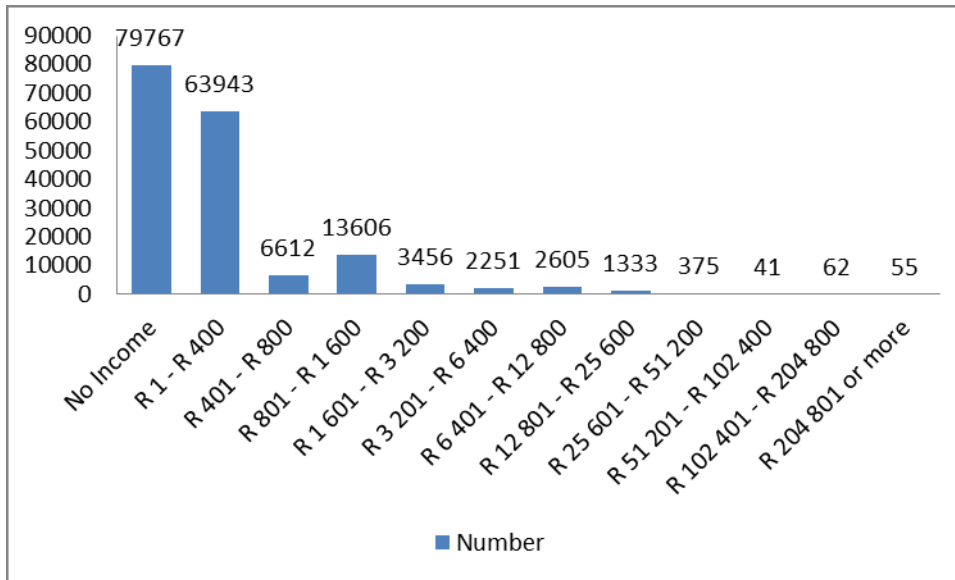


Figure 14 Source: Statistics South Africa (Census 2011)

11.9.3 Community Work Programme

The Community Work Programmes is implemented in 20 wards. The number of Jobs created through the programme is 1080. The reference group as a coordinating body is in place and it sits once a month. Capacity building initiatives to participants are done as to meet some of the objectives for the programme

11.9.4 Agriculture

The climate of the Jozini Local Municipality can generally be described as subtropical, and this varies from moist subtropical along the coast to moderately dry subtropical in the west. The climate (and particularly the rainfall) together with the soils of the area has the greatest influence on agricultural production in the area, and an understanding of the patterns of these parameters is an important predictor of suitable agricultural products for different areas. To respond to the abovementioned conditions the Municipality executed the following programs:

a) Poverty Alleviation projects

In terms of institutional arrangements for all projects that are Agriculture in nature they get coordinated through the Agriculture sector which is comprised of the following stakeholders

Department of Agriculture and Environmental Affairs

LIMA

Department of Social Development (Ingwavuma and Ubombo)

Siyazisiza Trust

Umkhanyakude District

Department of Health

Department of Education

The Municipality has allocated 11 million rands of which portion of it will be used to implement garden and poultry projects as per the needs identified during the IDP processes at ward level. The Sector sits on quarterly basis.

11.9.5 Tourism

Tourism is one the focus areas for economic growth of the area. Jozini is very rich in terms of Natural Resources, Heritage sites, History, Cultural Practices and its location. It became imperative that these attributes are thoroughly looked at to stimulate economic growth. To implement some programs recommended by the tourism sector plan, the following activities were executed:

- Formulation of the Tourism Sector committee comprising of different stakeholders
- Establishment of the Community Tourism Organisation
- Ensuring the effective functioning of the Tourism information Centres (Mkhuze and Jozini)
- The development of the Marketing tools to market Jozini as a tourism destination
- Conducting School awareness programs
- Tourism Ambassador programme
- Tourism Internship programme

11.9.6 Business (Formal and Informal)

- 600 Informal traders were trained on Municipal bi-laws
- Identification of market stalls needed in each town was done
- The programme to support SMME'S and Cooperatives in terms of registration and trainings is in place

- 5 SMME'S and Cooperatives were supported in terms of sourcing finance amounting to 190 000

11.9.7 Local Economic Development: SWOT Analysis

Strengths	Weaknesses	Opportunities	Threats
Subtropical Plenty of land under irrigation and without irrigation Enough water Known as fruit basket Existing LED strategy Existing Tourism strategy Fully functional Unit	Limited resources to support Cooperatives, SMME'S and big projects Shortage of staff(capacity) within the Section Shortage of infrastructure (informal traders)	Heritage sites, Monuments (Idlinza Lenkosi Udingane), Caves etc. Natural Resources (Pans, Animals Birds, Gorges, Mountains etc) Location (Swaziland Mozambique , N2) Other attractions(Jozini Dam, Game Reserves)	No revenue base Red tape Political Instability

11.9.8 Social Development Analysis

Broad Based Community Needs	
Ward	Priorities
1	Water Electricity (phase 2) KwaNgwenya Community Care Centre
2	Water RDP Houses Electricity
3	KwaJobe Youth centre
4	Water Electricity Gujini Community hall
5	Water Electricity
6	Electricity Water Agricultural projects
7	Maphaya road and Bridge Emachibini access road Area 17 access roads
8	Othobothini hall Msiyane Library Housing project
9	Water

	Electricity Roads
10	Water Electricity Housing project
11	Qatha Hall Entuthukweni Access road Ntabayengwe access road
12	Mealie processing

11.9.9 Education

In terms of the Department of Education stats, there are 168 schools under Jozini municipality. According to the public participation meetings that were conducted, many schools need additional classrooms and the upgrading of facilities. Due to their location, some schools do not even have access to basic infrastructure services including access roads. Accommodation for teachers in all areas is also a big problem. Educators are forced to travel far and during the rainy season, many of the schools are inaccessible. Lack of schooling or low levels of education will affect the level of income received in the community and is also a reflection of the standard of living. According to the Business Trust (2207), low education also affects the ability of local residents to actively participate in development programmes. Research indicates that the economic benefits of educating girls are similar to that of educating boys, but the social benefits favour female education over male education. Education of females increases the level of health and nutrition thus increasing overall health and productivity. Income earned by females increase their bargaining power in households and a greater proportion of women's income on child goods compared to that of men. Economic theory suggests that education improves the level and quality of human capital, in turn increasing the productivity of individuals, but increasing the output generated per worker. Education facilitates long term growth and is often described as a tool to escape the poverty trap.

Female education also raises the labour force participation, which significantly raises the productivity and output of the economy.

Key issues

- A need for additional classrooms;

- A need for cottages/ accommodation for teachers;
- A need for the upgrading of school facilities;
- A need for basic infrastructure for schools, including fencing;
- Feeding schemes and
- A shortage of pre-school facilities.

11.10 Site of Archaeological, Cultural and Heritage Significance

Past surveys in the area have indicated no Stone Age or Iron Age sites. Historical sites that have been observed in surrounding areas include homesteads, and farming related structures. According to the National Heritage Resources Act No 25 of 1999, provisions are made to protect national heritage and this forms an integral part of the environmental assessment process. No structures are present on the site.

11.11 Noise

Currently, there are no noise sources on the site. Current ambient noise sources include the road only. Environmental limits for noise will be established to minimize noise impacts. The SANS limits for ambient noise in different types of districts is given in Table 10 below (SANS Code of Practice 10103:2003).

Table 9: Typical rating levels for ambient noise in districts (extracted from the sans cop 10103:2003)

Windows						
	Day-night	Day-time	Night-time	Day-night	Day-time	Night-time
Residential Districts Rural Districts	45	45	35	35	35	25
Suburban districts with little road traffic	50	50	40	40	40	30
Urban districts	50	55	45	45	45	35
Non Residential Districts Urban districts with some workshops, with business premises and with main roads	60	60	50	50	50	40
Central business districts	65	65	55	55	55	45
Industrial districts	70	70	60	60	60	50
<input type="checkbox"/> Daytime – 06:00 to 22:00 <input type="checkbox"/> Night-time – 22:00 to 06:00						

12 ENVIRONMENTAL IMPACT ASSESSMENT

The EIA process is being carried out in accordance with the NEMA 2014 EIA regulations. The main objectives of the Environmental Impact Assessment process, as set out in Appendix 3 to the EIA Regulations.

12.1 Methodology

In order to clarify the purpose and limitations of the impact assessment methodology, it is necessary to address the issue of subjectivity in the assessment of the significance of environmental impacts. Even though BeyondGreen, and the majority of environmental impact assessment practitioners, propose a numerical methodology for impact assessment, one has to accept that the process of environmental significance determination is inherently subjective. The weight assigned to the each factor of a potential impact, and also the design of the rating process itself, is based on the values and perception of risk of members of the assessment team, as well as that of the I&AP's and authorities who provide input into the process. Whereas the determination of the spatial scale and the duration of impacts are to some extent amenable to scientific enquiry, the severity value assigned to impacts is highly dependent on the perceptions and values of all involved.

It is for this reason that it is crucial that all EIA's make reference to the environmental and socio-economic context of the proposed activity in order to reach an acceptable rating of the significance of impacts. Similarly, the perception of the probability of an impact occurring is dependent on perceptions, aversion to risk and availability of information.

It has to be stressed that the purpose of the EIA process is not to provide an incontrovertible rating of the significance of various aspects, but rather to provide a structured, traceable and defensible methodology of rating the relative significance of impacts in a specific context. The methodology employed for environmental impact assessment is divided into two distinct phases, namely, impact identification and impact assessment.

Social, Economic and Heritage aspects have been discussed in separate sections.

Table 9 below lists each of the activities which may generate impacts. The shaded blocks represent a potential impact which could conceivably occur, but this is before any attenuation and is not ranked. Red blocks indicate negative impact whilst green blocks indicate positive impact.

Activity	Geology	Topography	Soil/topsoil	Visual	Land capability	Vegetation	Surface water	Groundwater	Animal life	Noise	Air quality	Blast vibration	Fly rock	Social/Econo	Archeologica	Hydrocarbon	Traffic/Access
Pre-establishment phase																	
Approvals (Pre-establishment)																	
Site Survey to place Facilities																	
Demarcate Mining Right area & No-Go areas and danger sign posting																	
Establishment phase																	
Upgrade selected access Road																	
Provide chemical toilets for site establishment staff																	
Supply header tanks																	
Connect to water supply from header tank to logistical facilities																	
Remove topsoil to berms in logistics and stockpiling Area																	

Activity	Geology	Topography	Soil/topsoil	Visual	Land capability	Vegetation	Surface water	Groundwater	Animal life	Noise	Air quality	Blast vibration	Fly rock	Social/Economic	Archaeological/Culture	Hydrocarbon	Traffic/Access
Remove topsoil to berms in Plant area																	
Construct Primary Ramp																	
Construct haul road to Excavation																	
Construct / Place Container for office and store																	
Place personnel amenities container																	
Construct domestic waste collection point																	
Cast concrete footings for crushing plant																	
Erect Crushing plant																	
Construct weighbridge																	
Establish stormwater management system																	
Initiate induction environmental training of staff																	
Install mist sprays on plant																	
Conduct post establishment EPA																	

Operational phase																		
Activity	Geology	Topography	Soil/topsoil	Visual	Land capability	Vegetation	Surface water	Groundwater	Animal life	Noise	Air quality	Blast vibration	Fly rock	Social/Econo	Archaeologica	Culture	Hydrocarbon	Traffic/Access
Topsoil removal to perimeter stockpile ahead of face advance																		
Drilling																		
Blasting / Quarry Advance																		
Loading of shot rock																		
Hauling of shot rock																		
Crushing and screening of shot rock																		
Use of mist sprays on plant																		
Stockpiling of product																		
Loading of product for delivery																		
Use of access/delivery road to the site (and other unsurfaced roads)																		
Operational phase Monitoring and Rehabilitation activities																		
Monitor fly rock during and after blasting																		
Record blast ground & air vibration																		
Monitor dust blowing in direction of residents/communities																		

Activity	Geology	Topography	Soil/topsoil	Visual	Land capability	Vegetation	Surface water	Groundwater	Animal life	Noise	Air quality	Blast vibration	Fly rock	Social/Economic	Archaeological/Cultural	Hydrocarbon	Traffic/Access
Conduct EPA (biannually)																	
Monitor and Maintain stormwater system																	
Monitor and Maintain dust control sprinklers on plant																	
Monitor and Maintain access/delivery road																	
Collection of waste bins																	
Enforce no-go area access																	
Operational Rehabilitation – upper perimeter face splitting (only after phase 4)																	
Decommissioning phase																	
Complete rehabilitation of the excavation through:																	
Complete upper bench splitting of hard face																	
Retain safety fence and berm around top of excavation rim																	
Allow excavation floor to flood as reedbed																	
Retain haul road access																	
Complete rehabilitation of the logistical facility, plant and stockpiling area through:																	

Demolish all unrequired Structures																		
Remove process plant and steel structures																		
Remove protruding foundations and footings																		
Remove all pipelines and Cables																		
Remove ramp to bottom of pit																		
Remove weighbridge concrete structures																		
Rip / scarify all hardened Areas																		
Replace Topsoil ex berms in the logistics and stockpiling area and revegetate																		
Replace Topsoil ex berms in Plant area and revegetate																		
Retain stormwater management system																		
Retain access roads for future use																		
Post rehabilitation and Maintenance phase																		
Maintain stormwater management system																		

Remove alien vegetation (if applicable)																	
Conduct supplementary seeding if necessary																	
Conduct final performance assessment																	
Lodge closure Application																	

13 LIST OF ALL POTENTIAL CUMULATIVE ENVIRONMENTAL IMPACTS

The assessment of cumulative impacts on a site specific basis is often a complex operation. The aim of this impact analysis is ultimately to determine at which point the combined impacts from several operations (similar or dissimilar) in the area will affect the environment or part thereof to such a negative degree that the project should not be allowed to proceed.

Always remember that mining is a place-bound operation (as opposed to say a housing development which is less dependent on geology or other factors).

13.1 Types of cumulative impacts

Additive impact: Impacts of the same nature from different operations (e.g. excessive groundwater abstraction from several operations in the same area result in a severe drawdown effect).

Interactive impact: where a cumulative impact is the result of a combination of different impacts to cause a new kind of impact. This kind of impact can be:

- Countervailing – the net adverse effect is less than the sum of the individual impacts (e.g. pumping clear water into a polluted water resource).
- Synergistic – when the impacts work together to develop a sum of different impacts results in an impact which is greater than the individual impacts.

13.2 Methodology used in assessing cumulative impact/s

Determine extent of cumulative impacts:

- Identify potentially significant cumulative impacts associated with the proposed activity
- Establish the geographic scope of the assessment
- Establish the timeframe of the analysis
- Identify other activities affecting the environmental resources of the area

Describe the affected environment:

- Characterize the resources identified above in terms of their response to change and ability to withstand stress
- Define a baseline condition that provides a measuring point for the environmental resources that will be acted upon

Assess the cumulative impacts:

- Determine the magnitude or significance of cumulative impacts

Recommend mitigation measures.

So, using the aforementioned procedure as headings, herewith an assessment of the cumulative impacts arising from this operation:

13.3 Determining the extent of the cumulative impacts

Identification of potentially significant impacts:

Vegetation: All vegetation communities, identified during field that are present within the proposed area of development and will be impacted on. Of concern is the natural areas as the existing vegetation (Grassland, rocky ridges and riparian areas) will be removed to facilitate the construction of mine and related infrastructure. This will include the continuous and complete removal of vegetation on the footprint of the actual pit. This activity is considered to be short term and will occur during the construction phase at a

very much small scale ±3ha. The impact will be local in extent with impacts likely to occur on site. The presence of sensitive habitats does however mean that destruction will be a regional loss of the habitat type. The severity of the impact was determined to be high.

The destruction of the areas with undisturbed natural grassland will result in the permanent reduction of natural habitat of reptiles, birds, frogs, insects and mammals present within the areas. The destruction of the rocky ridges habitat type will be of special concern as these are sensitive habitats. The grassland, rocky areas and riparian vegetation found offers habitat to certain birds, reptiles, frogs, insects and mammals that could be present. The impact will be site specific in extent with impacts likely to occur on site. The severity of the impact was determined to be high.

Noise: It is expected that, during the life of mine of the proposed project, the noise levels generated by the mining activities will have a minor significant impact on the ambient noise level at noise sensitive receivers. It is expected that the impact will be of a minor significance because of the relative short duration of the construction phase. During the operational phase the noise levels are expected to impact even less because of the pit walls, soil berms and overburden dumps that will mitigate the noise propagation by acting as natural noise barriers. In any event, the FM Crushers site is located beyond a ridgeline to the community and such topographical barriers are extremely effective in reducing noise impact. It is likely that the only noise impact of any significance will be the noise generated by blasting. It is expected that FM Crushers quarry will blast once per month.

Dust: The construction phase will increase the current dust levels due to increased activity of vehicles and heavy machinery, the construction of a haul road, the stripping of vegetation and exposure of soil layers. Preparation of areas for opencast mining by stripping soil and blasting rock will increase dust levels. Therefore the construction phase will have negative impacts on air quality in the area.

Water quality: The clearing of naturally occurring vegetation, levelling of land, creation of hard surfaces and the creation of compacted surfaces to make way for development generates changes to the environment which allows for the alteration of normal drainage

patterns. Altered drainage patterns serve to alter the aquatic ecosystems in the following manners:

- Increased runoff due to presence of hard surfaces and removal of vegetation;
- Decreased seepage due to increased runoff;
- Increased erosion due to increased runoff; and
- Increased sediment load of nearby aquatic systems.

Activities associated with the vehicular movements/maintenance creates the potential for substances such as oils and lubricants to leak into the surrounding environment. Once in the environment these substances can be carried into the aquatic ecosystem via water runoff. These substances are known to contain Poly Aromatic Hydrocarbons (PAH's) which have been shown to be persistent in nature. These substances have shown to decrease ecological integrity. The incidence of increased runoff may produce sedimentation in the local river systems thereby altering habitats in water chemistry thereby lowering the ecological status of the associated river systems.

If these impacts were to occur the following would be observed in the aquatic ecosystem:

- Decreased water quality;
- Altered flow dynamics; and
- Negative impacts on biodiversity.

Socio-economic impacts: Possibly the most significant impact is the impact on socio-economics. The positive impacts of the quarry as a standalone quarry in a remote area are clear.

Agriculture (livestock): Impact will arise through the permanent loss of ±8ha of livestock lands as a result of the excavation and removal of shrubs and grass. No impact has experienced in the area except the grazing of livestock by the community within the surrounding area.

Geographic Scope of assessment:

Impact aspect	Geographic scope
Dust	Local area
Noise	Local area
Surface water quality	Seasonal stream below the proposed mining area.
Socio-economic	Local Municipal area and surrounding commercial quarries
Agriculture (livestock)	8ha (but must be considered against other losses)

Assessment and evaluation of potential impacts

List of each potential impact identified in above.

Table 10 merely lists the proposed activities and a list of aspects of the environment which may be impacted upon by such activity. The table does not (and is not meant to) quantify or describe the nature of impact.

Activity
1. PRE- ESTABLISHMENT ACTIVITIES
1.1. Approvals (Pre-establishment)
1.2. Site Survey to place facilities
1.2.1. Land Capability
1.3. Demarcate Mining Right area & No-Go areas and danger
1.3.1. Land Capability
2. ESTABLISHMENT ACTIVITIES
2.1. Upgrade selected access road
2.1.1. Topsoil
2.1.2. Visual

2.1.3. Land Capability
2.1.4. Animal Life
2.1.5. Noise
2.1.6. Air Quality
2.1.7. Hydrocarbons
2.2. Provide chemical toilets for site establishment staff
2.2.1. Surface Water
2.2.2. Groundwater
2.3. Supply header tanks
2.4. Connect to water supply from header tank to logistical Facilities
2.5. Remove topsoil to berms in Logistics and stockpiling Area
2.5.1. Topsoil
2.5.2. Land Capability
2.5.3. Vegetation
2.5.4. Animal Life
2.5.5. Noise
2.5.6. Air Quality
2.5.7. Archaeology
2.5.8. Hydrocarbons
2.6. Remove topsoil to berms
2.6.1. Topsoil
2.6.2. Land Capability
2.6.3. Vegetation
2.6.4. Animal Life
2.6.5. Noise
2.6.6. Air Quality
2.6.7. Archaeology
2.6.8. Hydrocarbons
2.7. Construct Primary Ramp
2.7.1. Topography
2.7.2. Visual
2.7.3. Noise
2.7.4. Dust
2.8. Construct haul road to excavation
2.8.1. Noise
2.8.2. Dust
2.8.3. Hydrocarbons
2.9. Construct / Place Container for office and store
2.10. Place personnel amenities container
2.11. Construct domestic and industrial waste collection point
2.11.1. Noise
2.11.2. Dust
2.11.3. Hydrocarbons

2.12 Cast concrete footings for crushing plant
2.12.1. Noise
2.12.2. Dust
2.12.3. Hydrocarbons
2.13 Cast concrete footings for crushing plant
2.13.1 Noise
2.13.2. Dust
2.13.3. Hydrocarbons
2.14 Construct weighbridge
2.14.1 Noise
2.14.2. Dust
2.14.3. Hydrocarbons
2.15 Establish stormwater management system
2.15.1. Surface Water
2.15.2. Noise
2.15.3. Dust
2.15.4. Hydrocarbons
2.16. Initiate induction environmental training of staff
2.17. Install mist sprays on plant
2.18. Conduct post establishment Environmental Performance Assessment (EPA)
3. OPERATIONAL PHASE ACTIVITIES
3.1. Topsoil removal to perimeter stockpile ahead of face advance
Activity
3.1.1. Topsoil
3.1.2. Visual
3.1.3. Land Capability
3.1.4. Vegetation
3.1.5. Animal Life
3.1.6. Noise
3.1.7. Dust
3.1.8. Archaeology
3.1.9. Hydrocarbons
3.2. Drilling
3.2.1. Noise
3.2.2. Dust
3.2.3. Hydrocarbons
3.3. Blasting / Quarry advance
3.3.1. Geology
3.3.2. Topography
3.3.3. Visual
3.3.4. Land Capability
3.3.5. Surface Water
3.3.6. Surface Water
3.3.7. Groundwater: Quantity
3.3.8. Noise
3.3.9. Dust

3.3.10. Blast Vibration
3.3.11. Fly rock
3.4. Loading of shot rock
3.4.1. Noise
3.4.2. Dust
3.4.3. Hydrocarbons
3.5. Hauling of shot rock
3.5.1. Noise
3.5.2. Dust
3.5.3. Hydrocarbons
3.6. Crushing and screening of shot rock
3.6.1. Visual
3.6.2. Noise
3.6.3. Dust
3.6.4. Hydrocarbons
3.7. Use of mist sprays on plant
3.7.1. Water Use
3.7.2. Air Quality
3.8. Stockpiling of product
3.8.1. Noise
3.8.2. Dust
3.8.3. Hydrocarbons
3.9. Loading of product for delivery
3.9.1. Noise
3.9.2. Dust
3.9.3. Hydrocarbons
3.10 Use of access/delivery road to the site (and other unsurfaced roads)
3.10.1. Noise
3.10.2. Dust
3.10.3. Hydrocarbons
3.10.4. Traffic / Access
4. OPERATIONAL PHASE MONITORING AND REHABILITATION ACTIVITIES
4.1. Monitor fly rock during and after blasting
4.2. Record blast ground and air vibration
4.3. Monitor dust blowing in direction of surrounding residents/ communities
4.4. Conduct EPA (bi-annually)
4.5. Monitor and Maintain stormwater system
4.6. Monitor and Maintain dust control sprinklers on plant
4.7. Monitor and Maintain access/delivery road
4.8. Collection of waste bins
4.9. Enforce no-go area access
4.10. Operational Rehabilitation - upper perimeter face splitting (only after phase 4)
4.10.1. Topography
4.10.2. Topsoil
4.10.3. Visual

4.10.4. Land Capability
5. DECOMMISSIONING PHASE ACTIVITIES
Complete rehabilitation of the excavation through:
5.1. Complete upper bench splitting of hard face
5.1.1. Topography
5.1.2. Topsoil
5.1.3. Visual
5.1.4. Land Capability
5.2. Retain safety fence and berm around top of excavation rim
5.3. Allow excavation floor to flood as reedbed
5.4. Retain haul road access
<i>Complete rehabilitation of the logistical facility, plant and stockpiling area through</i>
5.5. Demolish all unrequired structures
5.5.1. Noise
5.5.2. Air Quality
5.5.3. Hydrocarbons
5.6. Remove all process plant and steel structures
5.6.1. Noise
5.6.2. Air Quality
5.6.3. Hydrocarbons
5.7. Remove all protruding foundations and footings
5.7.1. Noise
5.7.2. Air Quality
5.7.3. Hydrocarbons
5.8. Remove all pipelines and cables
5.9. Remove ramp to bottom of pit
5.9.1. Topography
5.9.2. Noise
5.9.3. Air Quality
5.9.4. Hydrocarbons
5.10. Remove weighbridge concrete structures
5.11. Rip / scarify all hardened areas
5.11.1. Noise
5.11.2. Air Quality
5.11.3. Hydrocarbons
5.12. Replace Topsoil ex berms in the logistics and stockpiling area and revegetate
5.12.1. Topsoil
5.12.2. Land Capability
5.12.3. Vegetation
5.12.4. Animal Life
5.12.5. Noise
5.12.6. Air Quality
5.12.7. Hydrocarbons
5.13. Replace Topsoil ex berms in Plant area and revegetate
5.13.1. Topsoil

5.13.2. Land Capability
5.13.3. Vegetation
5.13.4. Animal Life
5.13.5. Noise
5.13.6. Air Quality
5.13.7. Hydrocarbons
5.14. Retain stormwater management system
5.14.1. Land Capability
5.14.2. Surface Water
5.15. Retain access roads for future use
6. POST REHABILITATION AND MAINTENANCE PHASE
6.1. Maintain stormwater management system
6.1.1. Land Capability
6.1.2. Surface Water
6.2. Remove alien vegetation (if applicable)
6.3. Conduct supplementary seeding if necessary
6.4. Conduct final performance assessment
6.5. Lodge closure Application

Table 11: List of potential impacts per activity

13.4 Concomitant impact rating for each potential impact listed in paragraph above

This section describes the impact of the proposed mining programme. The impacts are rated according to nature, extent, duration, probability of occurring and significance.

a) The significance level is based on the following criteria:

Significance		Criteria
Negative	Significant (S)	Recommended level always exceeded with associated widespread community action Disturbance to areas that are pristine, have conservation value, are important resource to humans and will be lost forever Complete loss of land capability <input type="checkbox"/> Destruction of rare or endangered specimens

		<input type="checkbox"/> May affect the viability of the project
	Moderate (M)	Moderate measurable deterioration and discomfort Recommended level occasionally violated – still widespread complaints Partial loss of land capability Complete change in species variety or prevalence May be managed Is insignificant if managed according to EMP provisions
	Minor/ (l) Insignificant	Minor deterioration. Change not measurable Recommended level will rarely if ever be violated Sporadic community complaints Minor deterioration in land capability Minor changes in species variety or prevalence
	Negligible	An impact will occur but it is barely discernible and not worthy of further investigation
Positive	Minor	Improvements in local socio-economics
	Significant	Major improvements in local socio-economics with some regional benefits

b) The **duration** is classified as:

- Permanent (post-closure)
- Life of Mine (LOM)
- Temporary

c) The **probability** is ranked as:

- Definite/Certain
- Possible
- Unlikely

Table 12: Impact rating table

Activity	Nature of impact	Extent	Duration	Probability	Significance
1. PREESTABLISHMENT ACTIVITIES					
1.1. Approvals (Prestablishment)					
1.2. Site Survey to place					
1.2.1. Land Capability	Placing of facilities as	Mining Right area	Life of Mine	Definite	Positive (Insignificant)
1.3. Demarcate Mining Right area & No-Go areas and danger sign posting					
1.3.1. Land Capability	Placing of beacons to demarcate activity areas	Mining Right area	Life of Mine	Definite	Positive (Insignificant)
2. ESTABLISHMENT ACTIVITIES					
Upgrade selected access road	May require widening of sections of existing road				
Activity	Nature of impact	Extent	Duration	Probability	Significance
2.1.1. Topsoil	Limited topsoil removal; will be required should road widening/ construction be required	Unknown but will be minor in currently cultivated lands	Life of Mine	Probable	Insignificant
2.1.2. Visual	Sections of access road may be visible from other public roads	Minor	Life of Mine	Possible	Insignificant

2.1.3. Land Capability	Sections of currently Cultivated areas will be Disturbed	No cultivated land will be disturbed	8ha	N/A	N/A
2.1.4. Animal Life	Disturbance of habitat (in grazing land)	Minor	On execution	Unlikely	Insignificant
2.1.5. Noise	Earthmoving Equipment	Local	On execution	Definite	Insignificant
2.1.6. Air Quality	Dust generated by earthmoving equipment	Local	On execution	Definite	Insignificant
Activity	Nature of impact	Extent	Duration	Probability	Significance
2.1.7. Hydrocarbons	Possible oil/ fuel; leak from earthmoving Equipment	Local	On execution until cleaned	Possible	Insignificant
2.2. Provide chemical toilets for site establishment staff					
2.2.1. Surface Water	Possible leakage	Local	On execution until cleaned	Possible	Insignificant
2.2.2. Groundwater	Possible leakage	Local	On execution until cleaned	Unlikely	Insignificant
2.3. Supply header tanks					
2.4. Connect to water supply from header tank to logistical facilities					
2.5 Remove topsoil to berms in Logistics and stockpiling area					

2.5.1 Topsoil	1.ha area topsoil to be removed to berms	1.ha @ 15cm deep = 2850m ³	Life of Mine	Definite	Moderate
2.5.2. Land Capability	1.ha cultivated area lost to activities	1.ha	N/A	N/A	None
2.5.3. Vegetation	natural vegetation will be disturbed/lost to activities	1ha	Life of Mine Definite	Definite	Insignificant
2.5.4. Animal Life	Disturbance of habitat	Minor	On execution	unlikely	Insignificant
Activity	Nature of impact	Extent	Duration	Probability	Significance
2.5.5 Noise	Earthmoving Equipment	Local	On execution	Definite	Insignificant
2.5.6. Air Quality	Dust generated by earthmoving equipment	Local	On execution	Definite	Insignificant
2.5.7. Archaeology	Possible disturbance of Artefacts	1ha	Permanent	Highly unlikely given type of terrain	Insignificant
2.5.8. Hydrocarbons	Possible oil/ fuel; leak from earthmoving equipment	Local	On execution until cleaned up	Possible	Insignificant
2.6. Remove topsoil to berms in Plant area					
2.6.1 Topsoil	1.ha area topsoil to be removed to berms	1.ha @ 15cm deep = 1950m ³	Life of Mine	Definite	Moderate

2.6.2. Land Capability	1.ha cultivated area lost to activities	1.ha	N/A	N/A	None
2.6.3. Vegetation	natural vegetation will be disturbed/lost to activities	1ha	Life of Mine Definite	Definite	Insignificant
2.6.4. Animal Life	Disturbance of habitat	Minor	On execution	unlikely	Insignificant
2.6.5 Noise	Earthmoving Equipment	Local	On execution	Definite	Insignificant
2.6.6. Air Quality	Dust generated by Earthmoving Equipment	Local	On execution	Definite	Insignificant
Activity	Nature of impact	Extent	Duration	Probability	Significance
2.6.7. Archaeology	Possible disturbance of Artefacts	1ha	Permanent	Highly unlikely given type of terrain and location	Insignificant
2.6.8. Hydrocarbons	Possible oil/ fuel; leak from earthmoving equipment	Local	On execution until cleaned up	Possible	Insignificant
2.7. Construct Primary					
2.7.1. Topography	Typical ramps up to 5m ⁶ high with retaining wall to intake hopper	From surface to 5m high over an area of ±250m ²	Will remain for life of mine	Definite	Insignificant
2.7.2 Visual	May be visible from R102	From distance of 2km and	Life of mine	Possible	Negligent

		more if at all			
2.7.3 Noise	Earthmoving Equipment	Local	During construction	Definite	Insignificant
2.7.4. Dust	Dust generated by earthmoving equipment	Local	During construction	Definite	Insignificant
2.8. Construct haul road to excavation					
2.8.1 Noise	Earthmoving Equipment	Local	During construction	Definite	Insignificant
2.8.2. Dust	Dust generated by earthmoving equipment	Local	During construction	Definite	Insignificant
Activity	Nature of impact	Extent	Duration	Probability	Significance
2.8.3 Hydrocarbons	Possible oil/fuel; leak from earthmoving equipment	Local	On execution until cleaned up	Possible	Insignificant
2.9. Construct / Place					
2.10 Container for office and store					
2.11 Construct domestic and industrial waste collection point					
2.11.1 Noise	Earthmoving Equipment	Local	During construction	Definite	Insignificant
2.11.2. Dust	Dust generated by earthmoving equipment	Local	During construction	Definite	Insignificant
2.11.3 Hydrocarbons	Possible oil/fuel; leak from earthmoving equipment	Local	On execution until cleaned up	Possible	Insignificant

2.12 Cast concrete footings for crushing plant					
2.12.1 Noise	Earthmoving Equipment	Local	During construction	Definite	Insignificant
2.12.2. Dust	Dust generated by earthmoving equipment	Local	During construction	Definite	Insignificant
2.12.3 Hydrocarbons	Possible oil/fuel; leak from earthmoving equipment	Local	On execution until cleaned up	Possible	Insignificant
2.13. Erect Crushing plant					
Activity	Nature of impact	Extent	Duration	Probability	Significance
2.13.1 Noise	Earthmoving Equipment	Local	During construction	Definite	Insignificant
2.13.2. Dust	Dust generated by earthmoving equipment	Local	During construction	Definite	Insignificant
2.13.3 Hydrocarbons	Possible oil/fuel; leak from earthmoving equipment	Local	On execution until cleaned up	Possible	Insignificant
2.14. Construct weighbridge					
2.14.1 Noise	Earthmoving Equipment	Local	During construction	Definite	Insignificant
2.14.2. Dust	Dust generated by earthmoving equipment	Local	During construction	Definite	Insignificant

2.14.3 Hydrocarbons	Possible oil/fuel; leak from earthmoving equipment	Local	On execution until cleaned up	Possible	Insignificant
2.15 Establish stormwater management system					
2.15.1. Surface Water	Will prevent siltation of natural water resources	Local and Downstream	Life of mine	Definite	Insignificant to moderate (Positive)
2.15.2 Noise	Earthmoving Equipment	Local	During construction	Definite	Insignificant
2.15.3. Dust	Dust generated by earthmoving equipment	Local	During construction	Definite	Insignificant
Activity	Nature of impact	Extent	Duration	Probability	Significance
2.15.4 Hydrocarbons	Possible oil/fuel; leak from earthmoving equipment	Local	On execution until cleaned up	Possible	Insignificant
2.16 Initiate induction environmental training of staff	Positive attenuation Measure				
2.17 Install mist sprays on plant	Positive attenuation Measure				
2.18 Conduct post establishment Environmental Performance Assessment (EP	Positive attenuation Measure				
3. OPERATIONAL PHASE ACTIVITIES					
3.1. Topsoil removal to	Until end phase 4 after				

perimeter stockpile ahead of face advance	which topsoil can be replaced on upper benches				
3.1.1. Topsoil	Topsoil removed to average 15cm deep ahead of face of advance	In 40mstrips ahead of mining advance	Until at least end Phase 4	Definite	Moderate
3.1.2 Visuals	Landscape alteration	Local	Until end of Phase 4	Probable	Insignificant
Activity	Nature of impact	Extent	Duration	Probability	Significance
3.1.3. Land Capability	Cleared area will not be available for livestock grazing	Eventually 8ha (at end Phase 4)	Permanent	Definite	Insignificant (small scale)
3.1.4. Vegetation	natural vegetation will be disturbed	8ha	Until end of Phase 4	Definite	Insignificant (small scale)
3.1.5. Animal Life	Disturbance of habitat	Minor	On execution	Unlikely	Insignificant
3.1.6 Noise	Earthmoving Equipment	Local	On execution	Definite	Insignificant
3.1.7. Air Quality	Dust generated by Earthmoving Equipment	Local	On execution	Definite	Insignificant
3.1.8 Archaeology	Possible disturbance of Artefacts	4ha	Permanent	Highly unlikely given type of terrain & location	Insignificant

3.1.9 Hydrocarbons	Possible oil/fuel; leak from earthmoving	Local	On execution until cleaned up	Possible	Insignificant
3.2 Drilling					
3.2.1 Noise	Drilling noise	Local	On execution	Definite	Insignificant
3.2.2. Air Quality	Dust generated by Drilling	Local	On execution	Definite	Insignificant
Activity	Nature of impact	Extent	Duration	Probability	Significance
3.2.3 Hydrocarbons	Possible oil/fuel; equipment	Local	On execution until cleaned up	Definite	Insignificant
3.3. Blasting / Quarry advance					
3.3.1. Geology	Removal of 1200000 tons of rhyolite material	8ha	Permanent	Definite	Negligible
3.3.2. Topography	Excavation development in hard rock	8ha surface area to depth of btm 60m in east & 110m in SW	Permanent	Definite	Moderate to significant
3.3.3. Visual	Landscape alteration	Local	Until end of Phase 4	Probable	Insignificant
3.3.4. Land Capability	Natural area will not be available for livestock grazing	Eventually 8ha (at end Phase 4)	Permanent	Definite	Insignificant (small scale)
3.3.5 Surface Water	Loss of surface run-off Contribution to the stream below mining area	8ha	Permanent	Definite	Insignificant

3.3.6. Groundwater	Possible exposure of Groundwater. Could lead to drawdown	Over excavation surface area of 2ha (or even less)	Permanent	Possible	Insignificant
3.3.7 Noise	Blast noise	Mine area and beyond	At blasting time	Definite	insignificant (given houses 2km away from closest blast)
Activity	Nature of impact	Extent	Duration	Probability	Significance
3.3.8 Dust	Blast dust	Mine area and beyond	At blasting time	Definite	Insignificant given wind vectors
3.3.9 Blast vibration	Blast vibration as sub surface waves can cause damage to structures if excessive	Mine area and beyond	Damage at time of blasting	unlikely	insignificant (given houses 2km away from closest blast)
3.3.10 Fly rock	Damage to structures and potential loss of life	Community to the surrounding & structures nearby	Damage related to blasting	unlikely	insignificant (given houses 2km away from closest blast)
3.4. Loading of shot rock					
3.4.1 Noise	Earthmoving Equipment	Local	During construction	Definite	Insignificant

3.4.2. Dust	Dust generated by earthmoving equipment	Local	During construction	Definite	Insignificant
3.4.3 Hydrocarbons	Possible oil/fuel; leak from earthmoving equipment	Local	On execution until cleaned up	Possible	Insignificant
3.5. Hauling of shot rock					
Activity	Nature of impact	Extent	Duration	Probability	Significance
3.5.1 Noise	Earthmoving Equipment	Local	During construction	Definite	Insignificant
3.5.2. Dust	Dust generated by earthmoving equipment	Local	During construction	Definite	Insignificant
3.5.3 Hydrocarbons	Possible oil/fuel; leak from earthmoving equipment	Local	On execution until cleaned up	Possible	Insignificant
3.6 Crushing and screening of shot rock					
3.6.1 Visual	Dust also causes visual Impact	Local	Whilst crusher and screens operational under dry conditions	Probable	Insignificant
3.6.2 Noise	Earthmoving Equipment	Local	During construction	Definite	Insignificant
3.6.3. Dust	Dust generated by earthmoving equipment	Local	During construction	Definite	Insignificant

3.6.4 Hydrocarbons	Possible oil/fuel; leak from earthmoving equipment	Local	On execution until cleaned up	Possible	Insignificant
3.7. Use of mist sprays on plant					
3.7.1. Water Use	Ground or surface water (quarry sump) Use	Minor volumes	Whilst crusher and screens operational under dry conditions	Definite	Insignificant
Activity	Nature of impact	Extent	Duration	Probability	Significance
3.7.2 Air quality	Reduction in dust levels	Local (and reduction in visual outside of Mining Right area	Whilst crusher and screens operational under dry conditions	Definite	Insignificant
3.8. Stockpiling of product					
3.8.1 Noise	Earthmoving Equipment	Local	During construction	Definite	Insignificant
3.8.2. Dust	Dust generated by earthmoving equipment	Local	During construction	Definite	Insignificant
3.8.3 Hydrocarbons	Possible oil/ fuel; leak from earthmoving Equipment	Local	On execution until cleaned up	Possible	Insignificant
3.9 Loading of product for delivery					
3.9.1 Noise	Earthmoving Equipment	Local	During construction	Definite	Insignificant
3.9.2. Dust	Dust generated by earthmoving	Local	During construction	Definite	Insignificant

	equipment				
3.9.3 Hydrocarbons	Possible oil/ fuel; leak from earthmoving Equipment	Local	On execution until cleaned up	Possible	Insignificant
3.12. Use of access/delivery road to the site (and other unsurfaced roads)					
3.9.1 Noise	Earthmoving Equipment	Local	During construction	Definite	Insignificant
3.9.2. Dust	Dust generated by earthmoving equipment	Local	During construction	Definite	Insignificant
Activity	Nature of impact	Extent	Duration	Probability	Significance
3.9.3 Hydrocarbons	Possible oil/fuel; leak from earthmoving equipment	Local	On execution until cleaned up	Possible	Insignificant
3.9.4 Traffic / access	Increased heavy vehicle traffic	20 trucks per day	Life of Mine During working hours	Most likely	Moderate
4. OPERATIONAL PHASE MONITORING AND REHABILITATION ACTIVITIES					
4.1 Monitor fly rock during and after Blasting		Monitoring is an impact reduction measure. As such it has a positive impact.			
4.2 Record blast ground and air vibration		Monitoring is an impact reduction measure. As such it has a positive impact.			
4.3. Monitor dust blowing in direction of surrounding residents/ Communities		Monitoring is an impact reduction measure. As such it has a positive impact.			
4.4 Conduct EPA (biannually)		Monitoring is an impact reduction measure. As such it has a positive impact.			
4.5 Monitor and Maintain stormwater system		Monitoring is an impact reduction measure. As such it has a positive impact.			
4.6 Monitor and Maintain dust control sprinklers on plant		Monitoring is an impact reduction measure. As such it has a positive impact.			

4.7 Monitor and Maintain access/delivery road		Monitoring is an impact reduction measure. As such it has a positive impact.			
4.8 Collection of waste bins		Is an impact reduction measure			
4.9 Enforce no-go area access		Is an impact reduction measure			
Activity	Nature of impact	Extent	Duration	Probability	Significance
4.10 Operational Rehabilitation - upper perimeter face splitting (only after phase 4)					
4.10.1 Topography	Shaping of upper faces to maximise revegetation potential and safety	Upper 10m bench	Permanent	Definitely	Insignificant (Positive)
4.10.2. Topsoil	Topsoil replaced over split benches	All benches	Permanent	Definitely	Insignificant
4.10.3 Visuals	Vegetation will grow on replaced topsoil hiding faces behind them	All benches	Permanent	Definitely	Moderate to Insignificant
4.10.4 Land capability	Allows for wilderness rating to be applied	Entire excavation (eventually)	Permanent	Definite	Insignificant
5. DECOMMISSIONING PHASE ACTIVITIES					
<i>Complete rehabilitation of the excavation through:</i>					
5.1 Complete upper bench splitting of hard face	Shaping of upper faces to maximise revegetation potential	Upper 10m Bench	Permanent	Definite	Insignificant (Positive)

	and safety				
5.1.1 Topography	Shaping of upper faces to maximise revegetation potential and safety	Upper 10m bench	Permanent	Definitely	Insignificant (Positive)
5.1.2 Topsoil	Topsoil replaced over split benches	All benches	Permanent	Definite	Insignificant
5.1.3 Visuals	Vegetation will grow on replaced topsoil hiding faces behind them	All benches	Permanent	Definitely	Moderate to Insignificant
5.1.4 Land capability	Allows for wilderness rating to be applied	Entire excavation (eventually)	Permanent	Definite	Insignificant
5.2 RETAIN SAFETY FENCE AND BERM AROUND TOP OF EXCAVATION RIM					
5.3 ALLOW EXCAVATION FLOOR TO FLOOD AS REEDBED					
5.4 RETAIN HAUL ROAD ACCESS					
Activity	Nature of impact	Extent	Duration	Probability	Significance
<i>Complete rehabilitation of the logistical facility, plant and stockpiling area through:</i>					
5.5 Demolish all unrequired structures					
5.5.1 Noise	Earthmoving Equipment	Local	During construction	Definite	Insignificant

5.5.2. Dust	Dust generated by earthmoving equipment	Local	During construction	Definite	Insignificant
5.5.3 Hydrocarbons	Possible oil/ fuel; leak from earthmoving Equipment	Local	On execution until cleaned up	Possible	Insignificant
5.6 Remove all process plant and steel structures					
5.6.1 Noise	Earthmoving Equipment	Local	During construction	Definite	Insignificant
5.6.2. Air quality	Dust generated by earthmoving Equipment	Local	During construction	Definite	Insignificant
5.6.3 Hydrocarbons	Possible oil/ fuel; leak from earthmoving Equipment	Local	On execution until cleaned up	Possible	Insignificant
5.7 Remove all protruding foundations and footings					
5.7.1 Noise	Earthmoving Equipment	Local	During construction	Definite	Insignificant
5.7.2. Air quality	Dust generated by earthmoving Equipment	Local	During construction	Definite	Insignificant
5.7.3 Hydrocarbons	Possible oil/ fuel; leak from earthmoving Equipment	Local	On execution until cleaned up	Possible	Insignificant
5.8 REMOVE ALL PIPELINES AND CABLES					
5.9 REMOVE RAMP TO BOTTOM OF PIT					
5.9.1 Topography	Ramp removed	±250m ²	Permanent	Definite	Insignificant

5.9.2 Noise	Earthmoving Equipment	Local	During construction	Definite	Insignificant
5.9.3. Air quality	Dust generated by earthmoving Equipment	Local	During construction	Definite	Insignificant
5.9.4 Hydrocarbons	Possible oil/ fuel; leak from earthmoving Equipment	Local	On execution until cleaned up	Possible	Insignificant
5.10 Remove weighbridge concrete structures					
5.11 Rip / scarify all hardened areas					
5.11.1 Noise	Earthmoving Equipment	Local	During construction	Definite	Insignificant
5.11.2. Air quality	Dust generated by earthmoving Equipment	Local	During construction	Definite	Insignificant
5.11.3 Hydrocarbons	Possible oil/ fuel; leak from earthmoving Equipment	Local	On execution until cleaned up	Possible	Insignificant
5.12 Replace Topsoil ex berms in the logistics and stockpiling area and revegetate					
5.12.1 Topsoil	1.ha area topsoil to be replaced to berms	1.ha @ 15cm deep = 2850m ³	Permanent	Definite	Moderate
5.12.2. Land Capability	1.ha available as Wilderness or for grazing	1.ha	Permanent	Definite	Insignificant
5.12.3. Vegetation	Will be seeded with vegetation	1ha	Permanent	Definite	Insignificant
5.12.4. Animal Life	Habitat returned	Minor	Permanent	Definite	Insignificant
5.12.5 Noise	Earthmoving Equipment	Local	During construction	Definite	Insignificant

5.12.6. Air quality	Dust generated by earthmoving Equipment	Local	During construction	Definite	Insignificant
5.12.7 Hydrocarbons	Possible oil/ fuel; leak from earthmoving Equipment	Local	On execution until cleaned up	Possible	Insignificant
5.13. Replace Topsoil ex berms in Plant area and revegetate					
5.13.1 Topsoil	1.ha area topsoil to be removed to berms	1.ha @ 15cm deep = 1950m ³	Permanent	Definite	Moderate
5.13.2. Land Capability	1.ha available as Wilderness or for grazing	1.ha	Permanent	Definite	Insignificant
5.13.3. Vegetation	Will be seeded with vegetation	1ha	Permanent	Definite	Insignificant
5.13.4. Animal Life	Habitat returned	Minor	Permanent	Definite	Insignificant
5.13.5 Noise	Earthmoving Equipment	Local	During construction	Definite	Insignificant
5.13.6. Air Quality	Dust generated by Earthmoving Equipment	Local	During construction	Definite	Insignificant
5.13.7 Hydrocarbons	Possible oil/ fuel; leak from earthmoving Equipment	Local	On execution until cleaned up	Possible	Insignificant
5.14 Retain stormwater management system					
5.14.1 Land Capability	Enables more effective revegetation through prevention of erosion	Mining right area	Until revegetated	Definite	Insignificant

5.14.2 Surface water	Elimination of potential siltation of stream below site	Mining right area	Until revegetated	Definite	Insignificant
5.15 Retain access roads for future use					
6. AFTERCARE PERIOD					
6.1 Maintain stormwater management system					
6.1.1 Land Capability	Enables more effective revegetation through prevention of erosion	Mining right area	Until revegetated	Definite	Insignificant
6.1.2 Surface water	Elimination of potential siltation of stream below site	Mining right area	Until revegetated	Definite	Insignificant
6.2 Remove alien vegetation (if applicable)					
6.3 Conduct supplementary seeding if necessary					
6.4 Conduct final performance Assessment					
6.5 Lodge closure Application					

14 ENVIRONMENTAL MANAGEMENT PLAN

14.1 Mitigatory measures for each significant impact of the proposed mining operation

When assessing the criteria which describe the levels of impact in the table above

The largest impacts will be generated by:

- Impact on topography as a result of the excavation advance.
- Impact on topsoil through disturbance ahead of mining
- Possible dust impact on surrounding community and cultivation

The mitigation measures to be introduced in each of these aspects is described in the table below

Table: 13 Mitigatory measures for each significant impact of the proposed mining operation

Activity	Nature of impact	Management option chosen
1. PRE- ESTABLISHMENT ACTIVITIES		
1.1 Approvals (Pre-establishment)		
1.2 Site Survey to place Facilities		
1.2.1 Land Capability	Placing of facilities as per plan	Demarcation Plan
1.3 Demarcate Mining Right area & No-Go areas and danger sign posting		
1.3.1 Land Capability	Placing of beacons to demarcate activity areas	Demarcation Plan
2. ESTABLISHMENT ACTIVITIES		
2.1 Upgrade selected access road	May require widening of sections of existing road	
2.1.1 Topsoil	Limited topsoil removal; will be required should road widening/ construction be required	Topsoil Handling Method
2.2.2. Land Capability	Sections of access road may be visible from other public roads	Vegetation Management Options

2.2.3. Vegetation	Sections of currently grazing/vegetated areas will be disturbed	Vegetation Management Options
2.2.4. Animal Life	Disturbance of habitat	Vegetation Management Options
2.2.5 Noise	Earthmoving equipment	Noise Reduction Measures
2.2.6. Air Quality	Dust generated by earthmoving equipment	Dust Reduction Measures
2.2.7 Hydrocarbons	Possible oil/fuel; leak from earthmoving equipment	Hydrocarbon Management Protocol & Industrial & Domestic Waste Control
2.2 Provide chemical toilets for site establishment staff		
2.2.1. Surface Water	Possible leakage	Monitoring programme
2.2.2. Groundwater	Possible leakage	Monitoring programme
2.3. Supply header tanks		
2.4. Connect to water supply from header tank to logistical facilities		
2.5 Remove topsoil to berms in Logistics and stockpiling area		
2.5.1 Topsoil	1.ha area topsoil to be removed to berms	Topsoil Handling Method
2.5.2. Land Capability	1.ha cultivated area lost to activities	Vegetation Management Options
2.5.3. Vegetation	natural vegetation will be disturbed/lost to activities	Vegetation Management Options
2.5.4. Animal Life	Disturbance of habitat	Vegetation Management Options
Activity	Nature of impact	Management option chosen
2.5.5 Noise	Earthmoving equipment	Noise Reduction Measures
2.5.6. Air Quality	Dust generated by earthmoving equipment	Dust Reduction Measures

2.5.7. Archaeology	Possible disturbance of artefacts	Archaeological occurrence procedure
2.5.8. Hydrocarbons	Possible oil/ fuel; leak from earthmoving equipment	Hydrocarbon Management Protocol & Industrial & Domestic Waste Control
2.6. Remove topsoil to berms in Plant area		
2.6.1 Topsoil	1.ha area topsoil to be removed to berms	Topsoil Handling Method
2.6.2. Land Capability	1.ha cultivated area lost to activities	Vegetation Management Options
2.6.3. Vegetation	natural vegetation will be disturbed/lost to activities	Vegetation Management Options
2.6.4. Animal Life	Disturbance of habitat	Vegetation Management Options
2.6.5 Noise	Earthmoving equipment	Noise Reduction Measures
2.6.6. Air Quality	Dust generated by Earthmoving equipment	Dust Reduction Measures
2.6.7. Archaeology	Possible disturbance of artefacts	Archaeological occurrence procedure
2.6.8. Hydrocarbons	Possible oil/ fuel; leak from earthmoving equipment	Hydrocarbon Management Protocol & Industrial & Domestic Waste Control
2.7. Construct Primary		
2.7.1. Topography	Typical ramps up to 5m ⁶ high with retaining wall to intake hopper	None required
2.7.2 Visual	May be visible from Locals hunting	Grass seed exposed slope if relevant
2.7.3 Noise	Earthmoving Equipment	Noise Reduction Measures
2.7.4. Dust	Dust generated by earthmoving	Dust Reduction Measures

	equipment	
2.8. Construct haul road to excavation		
2.8.1 Noise	Earthmoving Equipment	Noise Reduction Measures
2.8.2. Dust	Dust generated by earthmoving equipment	Dust Reduction Measures
2.8.3 Hydrocarbons	Possible oil/fuel; leak from earthmoving equipment	Hydrocarbon Management Protocol & Industrial & Domestic Waste Control
2.9. Construct / Place		
2.10 Container for office and store		
2.11 Construct domestic and industrial waste collection point		
2.11.1 Noise	Earthmoving equipment	Noise Reduction Measures
2.11.2. Dust	Dust generated by earthmoving equipment	Dust Reduction Measures
2.11.3 Hydrocarbons	Possible oil/fuel; leak from earthmoving equipment	Hydrocarbon Management Protocol & Industrial & Domestic Waste Control
2.12 Cast concrete footings for crushing plant		
2.12.1 Noise	Earthmoving equipment	Noise Reduction Measures
2.12.2. Dust	Dust generated by Earthmoving equipment	Dust Reduction Measures
2.12.3 Hydrocarbons	Possible oil/fuel; leak from earthmoving equipment	Hydrocarbon Management Protocol & Industrial & Domestic Waste Control
2.13. Erect Crushing plant		
2.13.1 Noise	Earthmoving	Noise Reduction Measures

	equipment	
2.13.2. Dust	Dust generated by earthmoving equipment	Dust Reduction Measures
2.13.3 Hydrocarbons	Possible oil/fuel; leak from earthmoving equipment	Hydrocarbon Management Protocol & Industrial & Domestic Waste Control
2.14. Construct weighbridge		
2.14.1 Noise	Earthmoving equipment	Noise Reduction Measures
2.14.2. Dust	Dust generated by earthmoving equipment	Dust Reduction Measures
2.14.3 Hydrocarbons	Possible oil/fuel; leak from earthmoving equipment	Hydrocarbon Management Protocol & Industrial & Domestic Waste Control
2.15 Establish stormwater management system		
2.15.1. Surface Water	Will prevent siltation of natural water resources	Stormwater Management System
2.15.2 Noise	Earthmoving equipment	Noise Reduction Measures
2.15.3. Dust	Dust generated by earthmoving equipment	Dust Reduction Measures
2.15.4 Hydrocarbons	Possible oil/fuel; leak from earthmoving equipment	Hydrocarbon Management Protocol & Industrial & Domestic Waste Control
2.16 Initiate induction environmental training of staff	Positive attenuation Measure	
2.17 Install mist sprays on plant	Positive attenuation Measure	
2.18 Conduct post establishment Environmental	Positive attenuation Measure	

Performance Assessment (EP		
1. OPERATIONAL PHASE ACTIVITIES		
3.1. Topsoil removal to perimeter stockpile ahead of face advance	Until end phase 4 after which topsoil can be replaced on upper benches	
3.1.1. Topsoil	Topsoil removed to average 15cm deep ahead of face of advance	Topsoil Handling Method
3.1.2 Visuals	Landscape alteration	Initiate upper face trimming and revegetation of benches as soon as feasible
3.1.3. Land Capability	Cleared area will not be available for livestock grazing	Vegetation Management Options
3.1.4. Vegetation	natural vegetation will be disturbed	Vegetation Management Options
3.1.5. Animal Life	Disturbance of habitat	Vegetation Management Options
3.1.6 Noise	Earthmoving Equipment	Noise Reduction Measures
3.1.7. Air Quality	Dust generated by Earthmoving Equipment	Dust Reduction Measures
3.1.8 Archaeology	Possible disturbance of Artefacts	Archaeological occurrence Procedure
3.1.9 Hydrocarbons	Possible oil/fuel; leak from earthmoving	Hydrocarbon Management Protocol & Industrial & Domestic Waste Control
3.2 Drilling		
3.2.1 Noise	Drilling noise	Noise Reduction Measures
3.2.2. Air Quality	Dust generated by	Dust Reduction Measures

	Drilling	
3.2.3 Hydrocarbons	Possible oil/fuel; equipment	Hydrocarbon Management Protocol & Industrial & Domestic Waste Control
3.3. Blasting / Quarry advance		
3.3.1. Geology	Removal of 1200000 tons of rhyolite material	None required
3.3.2. Topography	Excavation development in hard rock	Upper face shaping
3.3.3. Visual	Landscape alteration	Upper face shaping
3.3.4. Land Capability	Natural area will not be available for livestock grazing	Vegetation Management Options
3.3.5 Surface Water	Loss of surface run-off Contribution to the stream below mining area	None required
3.3.6. Groundwater	Possible exposure of Groundwater. Could lead to drawdown	None required
3.3.7 Noise	Blast noise	Noise Reduction Measures
3.3.8 Dust	Blast dust	Dust Reduction Measures
3.3.9 Blast vibration	Blast vibration as sub surface waves can cause damage to structures if excessive	Blasting considerations
3.3.10 Fly rock	Damage to structures and potential loss of life	Blasting considerations
3.4. Loading of shot rock		
3.4.1 Noise	Earthmoving Equipment	Noise Reduction Measures
3.4.2. Dust	Dust generated by earthmoving equipment	Dust Reduction Measures
3.4.3 Hydrocarbons	Possible oil/fuel; leak	Hydrocarbon Management

	from earthmoving equipment	Protocol & Industrial & Domestic Waste Control
3.5. Hauling of shot rock		
3.5.1 Noise	Earthmoving Equipment	Noise Reduction Measures
3.5.2. Dust	Dust generated by earthmoving equipment	Dust Reduction Measures
3.5.3 Hydrocarbons	Possible oil/fuel; leak from earthmoving equipment	Hydrocarbon Management Protocol & Industrial & Domestic Waste Control
3.6 Crushing and screening of shot rock		
3.6.1 Visual	Dust also causes visual impact	Dust Reduction Measures
3.6.2 Noise	Earthmoving Equipment	Noise Reduction Measures
3.6.3. Dust	Dust generated by earthmoving equipment	Dust Reduction Measures
3.6.4 Hydrocarbons	Possible oil/fuel; leak from earthmoving equipment	Hydrocarbon Management Protocol & Industrial & Domestic Waste Control
3.7. Use of mist sprays on plant		
3.7.1. Water Use	Ground or surface water (quarry sump) Use	None required
Activity	Nature of impact	Extent
3.7.2 Air quality	Reduction in dust levels	Dust Reduction Measures
3.8. Stockpiling of product		
3.8.1 Noise	Earthmoving Equipment	Noise Reduction Measures
3.8.2. Dust	Dust generated by earthmoving equipment	Dust Reduction Measures

3.8.3 Hydrocarbons	Possible oil/ fuel; leak from earthmoving equipment	Hydrocarbon Management Protocol & Industrial & Domestic Waste Control
3.9 Loading of product for delivery		
3.9.1 Noise	Earthmoving Equipment	Noise Reduction Measures
3.9.2. Dust	Dust generated by earthmoving equipment	Dust Reduction Measures
3.9.3 Hydrocarbons	Possible oil/ fuel; leak from earthmoving equipment	Hydrocarbon Management Protocol & Industrial & Domestic Waste Control
3.12. Use of access/delivery road to the site (and other unsurfaced roads)		
3.9.1 Noise	Earthmoving Equipment	Noise Reduction Measures
3.9.2. Dust	Dust generated by earthmoving equipment	Dust Reduction Measures
3.9.3 Hydrocarbons	Possible oil/fuel; leak from earthmoving equipment	Hydrocarbon Management Protocol & Industrial & Domestic Waste Control
3.9.4 Traffic / access	Increased heavy vehicle traffic	Fine road use offenders & Obey traffic regulations
3. OPERATIONAL PHASE MONITORING AND REHABILITATION ACTIVITIES		
4.1 Monitor fly rock during and after Blasting		
4.2 Record blast ground and air vibration		
4.3. Monitor dust blowing in direction of surrounding residents/ Communities		

4.4 Conduct EPA (biannually)		
4.5 Monitor and Maintain stormwater system		
4.6 Monitor and Maintain dust control sprinklers on plant		
4.7 Monitor and Maintain access/delivery road		
4.8 Collection of waste bins		
4.9 Enforce no-go area access		
4.10 Operational Rehabilitation - upper perimeter face splitting (only after phase 4)		
4.10.1 Topography	Shaping of upper faces to maximise revegetation potential and safety	Upper Face Shaping
4.10.2. Topsoil	Topsoil replaced over split benches	Topsoil Handling Method
4.10.3 Visuals	Vegetation will grow on replaced topsoil hiding faces behind them	Upper Face Shaping
4.10.4 Land capability	Allows for wilderness rating to be applied	Upper Face Shaping
4. Decommissioning phase activities		
<i>Complete rehabilitation of the excavation through:</i>		
5.1 Complete upper bench splitting of hard face	Shaping of upper faces to maximise revegetation potential and safety	
5.1.1 Topography	Shaping of upper faces to maximize revegetation potential and safety	Upper face shaping

5.1.2 Topsoil	Topsoil replaced over split benches	Topsoil Handling Method
5.1.3 Visuals	Vegetation will grow on replaced topsoil hiding faces behind them	Upper Face Shaping
5.1.4 Land capability	Allows for wilderness rating to be applied	Upper Face Shaping
5.2 RETAIN SAFETY FENCE AND BERM AROUND TOP OF EXCAVATION RIM		
5.3 ALLOW EXCAVATION FLOOR TO FLOOD AS REEDBED		
5.4 RETAIN HAUL ROAD ACCESS		
<i>Complete rehabilitation of the logistical facility, plant and stockpiling area through:</i>		
5.5 Demolish all Unrequired Structures		
5.5.1 Noise	Earthmoving Equipment	Noise Reduction Measures
5.5.2. Dust	Dust generated by Earthmoving equipment	Dust Reduction Measures
5.5.3 Hydrocarbons	Possible oil/ fuel; leak from earthmoving Equipment	Hydrocarbon Management Protocol & Industrial & Domestic Waste Control
5.6 Remove all process plant and steel structures		
5.6.1 Noise	Earthmoving Equipment	Noise Reduction Measures
5.6.2. Air quality	Dust generated by Earthmoving equipment	Dust Reduction Measures

5.6.3 Hydrocarbons	Possible oil/ fuel; leak from earthmoving Equipment	Hydrocarbon Management Protocol & Industrial & Domestic Waste Control
5.7 Remove all protruding foundations and footings		
5.7.1 Noise	Earthmoving Equipment	Noise Reduction Measures
5.7.2. Air quality	Dust generated by earthmoving equipment	Dust Reduction Measures
5.7.3 Hydrocarbons	Possible oil/ fuel; leak from earthmoving Equipment	Hydrocarbon Management Protocol & Industrial & Domestic Waste Control
5.8 REMOVE ALL PIPELINES AND CABLES		
5.9 REMOVE RAMP TO BOTTOM OF PIT		
5.9.1 Topography	Ramp removed	None required
5.9.2 Noise	Earthmoving Equipment	Noise Reduction Measures
5.9.3. Air quality	Dust generated by earthmoving equipment	Dust Reduction Measures
5.9.4 Hydrocarbons	Possible oil/ fuel; leak from earthmoving Equipment	Hydrocarbon Management Protocol & Industrial & Domestic Waste Control
5.10 Remove weighbridge concrete structures		
5.11 Rip / scarify all hardened areas		
5.11.1 Noise	Earthmoving Equipment	Noise Reduction Measures
5.11.2. Air quality	Dust generated by earthmoving equipment	Dust Reduction Measures
5.11.3 Hydrocarbons	Possible oil/ fuel; leak from earthmoving Equipment	Hydrocarbon Management Protocol & Industrial & Domestic Waste Control
5.12 Replace Topsoil ex berms in the logistics and		

stockpiling area and revegetate		
5.12.1 Topsoil	1.ha area topsoil to be replaced to berms	Topsoil Handling Method
5.12.2. Land Capability	1.ha available as Wilderness or for grazing	Vegetation Management Options
5.12.3. Vegetation	Will be seeded with vegetation	Vegetation Management Options
5.12.4. Animal Life	Habitat returned	Vegetation Management Options
5.12.5 Noise	Earthmoving Equipment	Noise Reduction Measures
5.12.6. Air quality	Dust generated by earthmoving equipment	Dust Reduction Measures
5.12.7 Hydrocarbons	Possible oil/ fuel; leak from earthmoving Equipment	Hydrocarbon Management Protocol & Industrial & Domestic Waste Control
5.13. Replace Topsoil ex berms in Plant area and revegetate		
5.13.1 Topsoil	1.ha area topsoil to be removed to berms	Topsoil Handling Method
5.13.2. Land Capability	1.ha available as Wilderness or for grazing	Vegetation Management Options
5.13.3. Vegetation	Will be seeded with vegetation	Vegetation Management Options
5.13.4. Animal Life	Habitat returned	Vegetation Management Options
5.13.5 Noise	Earthmoving Equipment	Noise Reduction Measures
5.13.6. Air Quality	Dust generated by Earthmoving Equipment	Dust Reduction Measures
5.13.7 Hydrocarbons	Possible oil/ fuel; leak from earthmoving Equipment	Management Protocol & Industrial & Domestic Waste Control
5.14 Retain stormwater management system		

5.14.1 Land Capability	Enables more effective revegetation through prevention of erosion	Stormwater Management System
5.14.2 Surface water	Elimination of potential siltation of stream below site	Stormwater Management System
5.15 Retain access roads for future use		
1. AFTERCARE PERIOD		
6.1 Maintain stormwater management system		
6.1.1 Land Capability	Enables more effective revegetation through prevention of erosion	Stormwater Management System
6.1.2 Surface water	Elimination of potential siltation of stream below site	Stormwater Management System
6.2 Remove alien vegetation (if applicable)		
6.3 Conduct supplementary seeding if necessary		
6.4 Conduct final performance assessment		
6.5 Lodge closure Application		

14.2 Description of the mitigation measures

14.2.1 Demarcation Plan

The applicant is required to demarcate no go areas as follows:

- The mining right area must be demarcated by means of posts in each of the corner positions of the mining right area. In addition posts must be placed so that two side by

side posts are always visible from any position for a person to easily determine whether they are inside of the mining right area

- A second set of posts (colour coded) must be placed to demarcate the final extent of excavation. Employees /operators must be informed of this maximum extent and absolutely no access is permitted beyond these beacons (except in the case of topsoil stockpiles)

- And finally, the 20m buffer zone from the stream bank must be demarcated by posts and absolutely no encroachment is permitted into this 20m buffer (and that includes toe creep of any fill platform or stockpile)

The no go areas must form part of the Environmental Induction Training (which forms part of the Environmental Awareness Programme)

14.2.2 Topsoil Handling Procedure

The management of topsoil is of utmost importance. Without topsoil management, the disturbed area is subject to several other potential long term impacts such as lack of revegetation, dust generated off denuded areas and potential visual scarring. Given the locality of this operation within an area earmarked as Endangered in terms of the KZN

Conservation status mapping, it is of utmost importance that all topsoil is stripped for use in rehabilitation to maximise the eventual wilderness land use of all areas.

Topsoil stripping

Successful rehabilitation is dependent on careful management of topsoil. Generally some 70-80% of all plant species found on site can return if topsoil is conserved and replaced following mining.

Based on (limited) core drilling near the site and site visit the average topsoil thickness across the site is set at 15cm even though there is evidence of hard rock outcropping on the site.

Bulldozing can be used to collect and stockpile a mixture of topsoil and surface rock to retrieve as much of the available soil as possible.

Topsoil storage:

The topsoil should be stored in berms on the perimeter of the site/activity areas. Topsoil berms are to be restricted to 2m height and may be as wide as required. The reason for the 2m height restriction is to preserve as much of the natural seed bank as viable. Side slopes of the berms must be sloped to minimum 1:2 to prevent wind and water erosion of the slopes.

Returning topsoil

Topsoil to be replaced over prepared areas to a minimum of 15cm depth. The preparation of such areas entails the following:

- Decommissioned plant, stockpiling and logistical facility areas (and any other areas on natural surface): Area to be ripped to about 30cm deep and levelled to approximate natural contours. Topsoil to be spread over such area
- Excavation benches: Topsoiling of excavation benches can begin as soon as benches have reached their final positions and will not require access at some point in the future. Such topsoil can merely be spread on surface of bench to 15-20cm deep
- Excavation floor: The excavation floor will flood as a result of summer rains.

As a result there is no point in topsoiling the excavation floor.

14.2.4 Vegetation Management

Devegetation

All vegetation communities, identified during field that are present within the proposed area of development and will be impacted on. Of concern is the natural areas as the existing vegetation (Grassland, rocky ridges and riparian areas) will be removed to facilitate the construction of mine and related infrastructure. This will include the

continuous and complete removal of vegetation on the footprint of the actual pit. This activity is considered to be short term and will occur during the construction phase. The impact will be regional in extent with impacts likely to occur on site. The presence of sensitive habitats does however mean that destruction will be a regional loss of the habitat type. The severity of the impact was determined to be moderate due to the fact that the area of disturbance will be very small considering that the area is dominated by hard rock outcropping on the site.

The destruction of the areas with undisturbed natural grassland will result in the permanent reduction of natural habitat of reptiles, birds, frogs, insects and mammals present within the areas. The destruction of the rocky ridges habitat type will be of special concern as these are sensitive habitats. The grassland, rocky areas and riparian vegetation found offers habitat to certain birds, reptiles, frogs, insects and mammals that could be present. The impact will be site specific in extent with impacts likely to occur on site. The severity of the impact was determined to be insignificant.

Revegetation

Once the topsoil has been replaced, then seeding with summer rain grass seed mix can commence using the species to be advised by the ecologist/botanist during the rehabilitation/closure phase.

14.2.5 Noise reduction measures

It is not expected that noise of the plant or any other operational activity (besides blasting) result in any impact on surrounding land users given the topographical features, remote and predominant wind regime. However, the following measures must be put in place to limit this impact:

Table 14: Noise reduction measures

Activity	Extent	Attenuation measures
Earthmoving equipment	Local area	Ensure silencers are operational

Access road use by delivery vehicles	Local area	Maintain low speeds specifically whilst passing any residences
Drilling	Local area	None feasible but will not generate any impact on surrounding land users
Blasting	Local / outside mining right area	<ol style="list-style-type: none"> 1. Never blast under temperature inversion 2. Avoid blasting under low cloud conditions 3. Always try to blast at the same time of day so that it becomes expected 4. Warn, by way of telephone / SMS, those who are most affected (i.e. those persons who register complaints (if any)). 5. Apply best blasting practice to limit noise by correct stemming, electric detonation and bottom hole initiation
Loading and hauling of ore	Local area	Ensure silencers are operational and maintain low speeds
Crushing and screening	Local area	<ol style="list-style-type: none"> 1. Enclose screens and crushers 2. Avoid crushing after hours

In addition, mining and crushing will be restricted to take place between hours of 07h00 to 19h00.

14.2.6 Blasting Considerations

- Blast noise

In case of blast noise, the following attenuation measures must be put in place should such impact arise / result in complaints. Chances of impacting the surrounding community are zero since the community is like 5km away from the proposed mining area. Nonetheless such impact must be monitored through:

1. Generate a database of surrounding land users with contact details and inform them timeously when blast is expected to take place
2. Always blast at same time of day
3. Avoid high wind conditions, low cloud cover and temperature inversions (afternoons are usually best)

Blast Vibration:

The following information is quoted directly from a report on Vibration measurement and control (Mohamed, 2010).

The ground vibration can be affected by certain blast design parameters:-

- (i) The maximum instantaneous charge or MIC is the amount of explosives fired at the same moment in time.
- (ii) The number and frequency of delays. The introduction of a delay sequence can reduce the size of the maximum wave produced.
- (iii) The height of the working bench and therefore the length of borehole.
- (iv) The number of "decks" or layers of explosives and detonators in each hole.
- (v) The spacing, burden and number of holes, in the blast ratio.
- (vi) The diameter of the shot hole, which will affect the amount of explosives used.

There are several steps an operator can take to reduce ground vibrations:***Blast design***

Use a blast design that produces the maximum relief practical in the given situation.

Explosions in blast holes which have good relief – i.e. those having nearby free faces produce less ground vibration. The use of delay blasting techniques establishes internal free faces from which compressional waves produced later in the blast can delay patterns, maximum relief can be retained.

In general, when blasting multiple row patterns, greater relief can be obtained by using a longer delay between rows than between the holes within a single row. A delay of at least 2–3 ms/m of burden between the holes within a row is recommended for the necessary relief and best fragmentation.

Use a spacing/burden ratio greater than one. The presence of weak seams or irregular back break may dictate the local use of a spacing/burden ratio close to one.

Hole straightness

Control drilling of blast holes as closely as possible. Establish bench marks for use in setting out the hole locations for the next blast before each blast in order to help avoid possible errors due to irregular back break.

Subdrilling

Restrict the amount of sub drilling to the level required to maintain good floor conditions. Typical sub drilling for holes inclined 3:1 is 30% of the burden at floor level.

Tape each drill hole and match it to the face height. If hole depth is greater than intended, backfill with drill cuttings or crushed stone. Excessive sub drilling can increase vibration because of the lack of a nearby free face to create reflection waves.

Charge per delay

Use the following techniques to reduce charge weight per delay and, therefore, peak particle velocity.

- reduce hole depths with lower bench heights and increase specific drilling,
- use smaller diameter holes, subdivide explosive charges in holes by using inert decks and fire each explosive deck with initiators using different delays,
- Use electronic or mechanical timers to increase the available number of periods of delay electric blasting caps and to increase timing flexibility. Non electric delays coupled with surface delay connectors can provide similar flexibility.

Explosives

Eliminate or reduce hole-to-hole propagation between charges intended to detonate at different delay periods. Use explosive, such as water gels, which are much less sensitive than dynamite to hole -to-hole propagation. Hole-to-hole propagation occurs when the

explosive charges or blastholes are only a few feet apart, as in trenching, decked holes, or underwater excavations, or at greater distances when blasting interbedded soft and hard layer rock, such as coral or mud-seamed rock, that is saturated with water.

Using NONEL blasting system

Use NONEL blasting system can reduce the wave superposition by increasing delay time among shots. In addition to reduce the air vibration by using NONEL shock tube instead of detonating cord.

Air overpressure

There are five principal sources of air overpressure from blasting at surface mineral workings:

- (i) The use of detonating cord which can produce high frequency and hence
- (i) The use of detonating cord which can produce high frequency and hence audible energy within the air overpressure spectrum.
- (ii) Stemming release, seen as a spout of material from the boreholes, gives rise to high frequency air overpressure.
- (iii) Gas venting through an excess of explosives leading to the escape of high velocity gases, give rise to high frequency air overpressure.
- (iv) Reflection of stress waves at a free face without breakage or movement of the rock mass. In this case the vertical component of the ground-vibration wave gives rise to a high-frequency source.
- (v) Physical movement of the rock mass, both around the boreholes and at any other free faces, which gives rise to both low and high-frequency air overpressure.

The steps to reduce air vibrations:

Detonating cord should be used as sparingly as possible, and any exposed lengths covered with as much material as possible. Just a few feet of exposed cord can lead to significant amounts of audible energy and, hence, high air overpressure levels.

Stemming release can be controlled by detonation technique, together with an adequate amount of good stemming material. Drill fines, while readily available, do not make good stemming material. The use of angular chippings is better. It should be noted however that detonation cord and stemming release have been virtually eliminated with the use of in hole initiation techniques.

Gas venting results from overcharging with respect to burden and spacing or, perhaps, a local weakness within the rock, and is also typified by the occurrence of fly rock. Its control is essential for economic and safe blasting, and is considerably aided by accurate drilling and placement of charges, together with regular face surveys. The controllable parameters such as geology, Topography, and Meteorological Conditions can be controlled to some extent by adjustment of blast pattern and blaster in charge judgment for blasting operation.”

Flyrock:

Flyrock has the potential to result in significant impact including fatal accidents. Modern blasting practice however allows for blast design planning to accurately determine the charge per hole and delays required for a specific exclusion zone. This blast design description does not fall within the ambit of this documentation but must be conducted by the blasting professional and in the case where facilities / communities are located within 500m, then such blast design is presented to the DMR for their approval.

The following factors are generally regarded as the cause of (excessive) flyrock:

1. Holes loaded with excessive explosives
2. Inadequate burden
3. Incomplete or poorly conducted hazard assessment prior to blasting
4. Incomplete checking of hole placement and geological changes of the rock mass
5. No clear supervision for the whole blasting activity

So, to reduce the chance of uncontrolled flyrock, the following should be undertaken (ZHOU Zilong, 2011):

1. Ensure that all blast holes are loaded with the proper amount of explosives
2. Ensure effective blast design.
3. Perform a complete hazard assessment prior to blasting.
4. Check all hole placements and look into geological changes of the rock mass.
5. Ensure that profile methods are applied where there is a potential for drill wander due to cracked ground.
6. Establish clear lines of responsibility, supervision and communication for the whole blasting activity. The blaster should talk to the driller to determine the condition of the boreholes before loading them with explosives.
7. Establish, review and enforce written safe work procedures for all blasting operations
8. Ensure that all persons associated with the blasting activity are properly trained.
9. Give careful consideration to the blast orientation (i.e. quarry face) to ensure the blast occurs in a safe direction.
10. Where unexpected events occur, determine the causes and take appropriate action.
11. As well, to guard against unexpected flyrock, blasters should:
 - a. Predetermine the danger area and clear everyone from the danger area.
 - b. Protect themselves and others from the threat of possible flyrock with adequate blasting shelters.

14.2.7 Dust Reduction Processes

Climate's role in dust generation

The Ngwavuma area has an average annual rainfall of over 700mm per annum (WB40) and evaporation rate of 1660mm per annum (WB28, A-Type Pan).

Dust impact is typically dependant on:

- Dust generation at source
- Rainfall
- Wind speed, direction and frequency (percentage blowing in a specific direction)
- Topographical controls (funnelling of wind and associated dust along valleys, and other topographical features)

Attenuation by retained surrounding trees lines. These trees reduce wind speed resulting in reduced dust generation off denuded surfaces and reduced dispersion.

Dust Dispersion and Expected Dust Levels Based on Other Monitored Sites

(a) Point of Departure in the matter

Both observation and dust monitoring statistics of fall-out dust at especially Palmiet Quarry in Grabouw (a site in Western Cape, where a specialist study was conducted) and Bridgetown Quarry at Moorreesburg show that:

- (i) The main source of dust is the crushing plant and its immediate manoeuvring area.
- (ii) Water (mist sprays and sprinkler systems) is the most effective dust control mechanism.
- (iii) Without effective dust control at source dust generation levels are so excessive that extremely high impacts would result even on distant land uses (i.e. but less than 1km) and in any event such levels of dust would not be allowed within the working environment at the quarry. (Mine Health and Safety Act).

(iv) After implementation of dust control measures, plant/stockpile loading generation of dust seldom exceeds the residential area **limit** of 600mg/m²/day at the short distance of 250m downwind of the plant and will therefore not exceed acceptable limits.

Dust generation impact table

Dust generation as a result of the proposed project will be through the following:

Table 15: Dust generation impact

Activity	Extent	Significance	Probability	Timing	Duration / Status
Traffic generated dust along portions of access /delivery road	Along unsurfaced sections of access road	Insignificant	Likely	On occurrence	Until tarring of access road / negative
Topsoil removal (occurs rarely)	Local / site only	Insignificant	Definitely	On occurrence	Intervals for short periods / Negative
Drilling operation	Local / site only	Insignificant (with dust extraction equipment)	Definitely	On occurrence (Often)	Two weekly intervals for up to 4 days / Negative
Blasting (1 x per	Local / Farm and	Moderate	Definite	On occurrence	Life of mine / episodic/

month)	Surrounds				
Loading and hauling of shot rock	Local / Excavation Only	Insignificant	Definite	On occurrence	Life of mine / periodic/ negative
Crushing and screening	Local / Farm and surrounds	Moderate	None with dust suppression		Life of mine / Negative
Dust off denuded areas	Local / Farm and surrounds	Insignificant	Likely	Under high winds	Life of mine / Negative

Attenuation measures to be implemented

Note further that in addition to the measures described below, **dust must be continually monitored and analysed**. This allows for an assessment of import / export fall-out dust quantification (in other words, the dust generated by the quarry can be quantified as well dust generated by other sources in the area) and standard services include the regular sample collection, filtration and data analysis as well as data reporting of the findings (Monthly Fallout & Trends Analysis).

The following is a list of measures that must be implemented at the quarry to prevent any impact of dust on surrounding land uses or users.

Activity	Attenuation Measure (Internal)
Traffic along portions of access roads	<input type="checkbox"/> Water cart wetting of the road must occur during dry and / or windy conditions. Use of unsurfaced roadways <input type="checkbox"/> Water cart wetting of roads during dry and / or windy conditions <input type="checkbox"/> Install permanent sprinkler system on long term routes such as haul roads
Topsoil removal	<input type="checkbox"/> Pre-wet topsoil <input type="checkbox"/> Avoid high wind conditions <input type="checkbox"/> Schedule in the wet season
Drilling	<input type="checkbox"/> Supply masks where applicable. <input type="checkbox"/> Fit dust extraction equipment to drill rigs
Blasting (Excavation Advance)	<input type="checkbox"/> Avoid blasting under extreme winds. <input type="checkbox"/> Apply best available blasting practice
Hauling	<input type="checkbox"/> Wet haul road with water cart but preferably permanent sprinkler system
Primary Tipping and Crushing	<input type="checkbox"/> Semi-enclosure of hopper. <input type="checkbox"/> Install mist spray system at primary intake hopper. <input type="checkbox"/> Install dust extraction plant to bag filters on all crushers as a last option

	<ul style="list-style-type: none"> <input type="checkbox"/> Supply masks where applicable for employee health protection
Screening	<ul style="list-style-type: none"> <input type="checkbox"/> Supply masks where applicable for employee health protection <input type="checkbox"/> Screens and crushers to be housed. <input type="checkbox"/> Mist sprays at transfer points and on stockpile product walls. <input type="checkbox"/> Dust extraction equipment to be fitted to plant as last option
Transfer points	<ul style="list-style-type: none"> <input type="checkbox"/> Apply mist sprays at all belt transfers and screens. <input type="checkbox"/> Enclose transfer points.
Stockpiling	<ul style="list-style-type: none"> <input type="checkbox"/> Wall stockpiles where ever possible <input type="checkbox"/> Provide sprinkler systems on walled or other stockpiles where wetting of product can take place
Loading and despatch	<ul style="list-style-type: none"> <input type="checkbox"/> Sprinkler wet stockpile to maintain moisture content <input type="checkbox"/> Cover delivery trucks carrying dust generating loads
Monitoring of dust	<p>Continuous monitoring of dust levels in the expected impact vector must take place.</p>

14.2.8 Hydrocarbon and Domestic and Industrial Waste Management Protocol

Industrial and Domestic Waste handling

All domestic waste will be collected in bins located strategically around the site (i.e. at the office, the crushing plant and at the workshops). The domestic waste is to be collected on a daily basis and placed in the designated temporary storage area. waste bins will be labelled according to waste hierarchy.

Emergency repairs on site:

Note: no workshop will be constructed onsite. Repairs and maintenance will be done in Ngwavuma. In the event of a breakdown with repair being required in the field, the staff should be trained in use of drip trays and suitable funnels (not to drain oil into the sand) for filling and draining of lubricants and the staff shall be provided with such equipment to prevent oil contamination.

In addition:

- Used/replaced filters, hoses, belts, cloths, etc. are to be placed in a bin for return to the used oil and lubricant storage area/ waste bin. Used filters are not to be buried at the site of repair (nor discarded in the excavation to be backfilled).
- In the event of soil contamination, the soils are to be treated with a suitable decontaminant such as the OT8 or Spillsorb range of products. Such product to be available on site at all times.

All staff involved in mobile plant operation and maintenance are to be made aware of these oil and lubricant procedures. Staff will require instruction in the:

- Deleterious effects of oil / fuel on the environment
- Neutralization of oil leaks on the concrete apron
- The operation of the oil trap (including the temporary storage of recovered oil); and
- Use of OT8 / Spillsorb products.

General Provisions

- All operators are to check their equipment for leaks and report such leaks on a daily basis.
- No used oils are to be used as dust suppressants on maneuvering areas.
- All staff to be instructed to report oil spills immediately and be trained in firefighting and the use of biodegradable solvents such as OT8 or Spillsorb or similar products in the clean-up operation.

14.2.9 Archaeological Occurrence Procedure

In the unlikely event that a grave site or artefact of archaeological interest is uncovered then the following procedure must be adhered to:

1. Before any work is conducted on the site, all staff are to undergo induction training. Such induction training must include a section in respect of heritage issues. Staff must be trained what to look out for and what to do if they find such occurrence.
2. The important aspect is that work must cease at the site of the finding and mine manager must be called in.
3. The mine manager must immediately inform the relevant heritage authority of Natal in the case of grave site, or in the case of archaeological artefact, take a GPS reading of the site and if reasonably possible work elsewhere and contact the heritage authority.

14.2.10 Stormwater Management System

The stormwater management system must be put into place to prevent silt laden water entering the natural surface water system. While the mist sprays on the plant and dust suppression sprinklers on the roadways and stockpiles do not generate free-flow from these areas, it is the periodic rainfall and associated stormwater run-off which occurs in the dust-laden areas which poses the risk of silt-load into the natural drainage system.

Storm water will result in silt laden runoff from the logistical facility, plant and stockpiling areas. The stormwater system consequently consists of the following elements:

1. Stormwater is prevented from entering any denuded areas by way of **stormwater cut-off trench above the affected site**.
2. Any stormwater which does flow from denuded areas is potentially silt laden and must be prevented from entering the natural water system. Such prevention is through the provision of **silt cut off drains below the affected area** to lead water away.

It is imperative that silt laden water is fed into silt retention ponds which facilitate silt settlement before (clear) water is allowed to enter the natural surface water system.

The silt retention pond also serves to facilitate seepage into the rock/soil as recharge and to reduce run-off and allow the re-use of the clear water. There must be access to front end loader to remove collected silt from the silt traps. Such collected silt will be mixed into sub base product

Mitre drains must be provided along the access road and long term internal roads

The dimensions of each of the abovementioned elements is as follows:

1. All drains and trenches need only be shallow channels, 30-50cm deep by 60cm wide.
2. The silt retention pond: The small intermediate ponds must be at least 5m x 5m and 1.5m deep with 500mm freeboard above their discharge pipe.

The stormwater management system must be periodically checked (especially after rains) and all silt retention ponds must be regularly cleared of silt and the silt mixed into the sub-base product. Monitoring of runoff by sampling during high run-off spates and testing to ensure that TSS (Total Suspended Solids) does not exceed the DWAF standard of 25mg/ℓ above ambient is imperative.

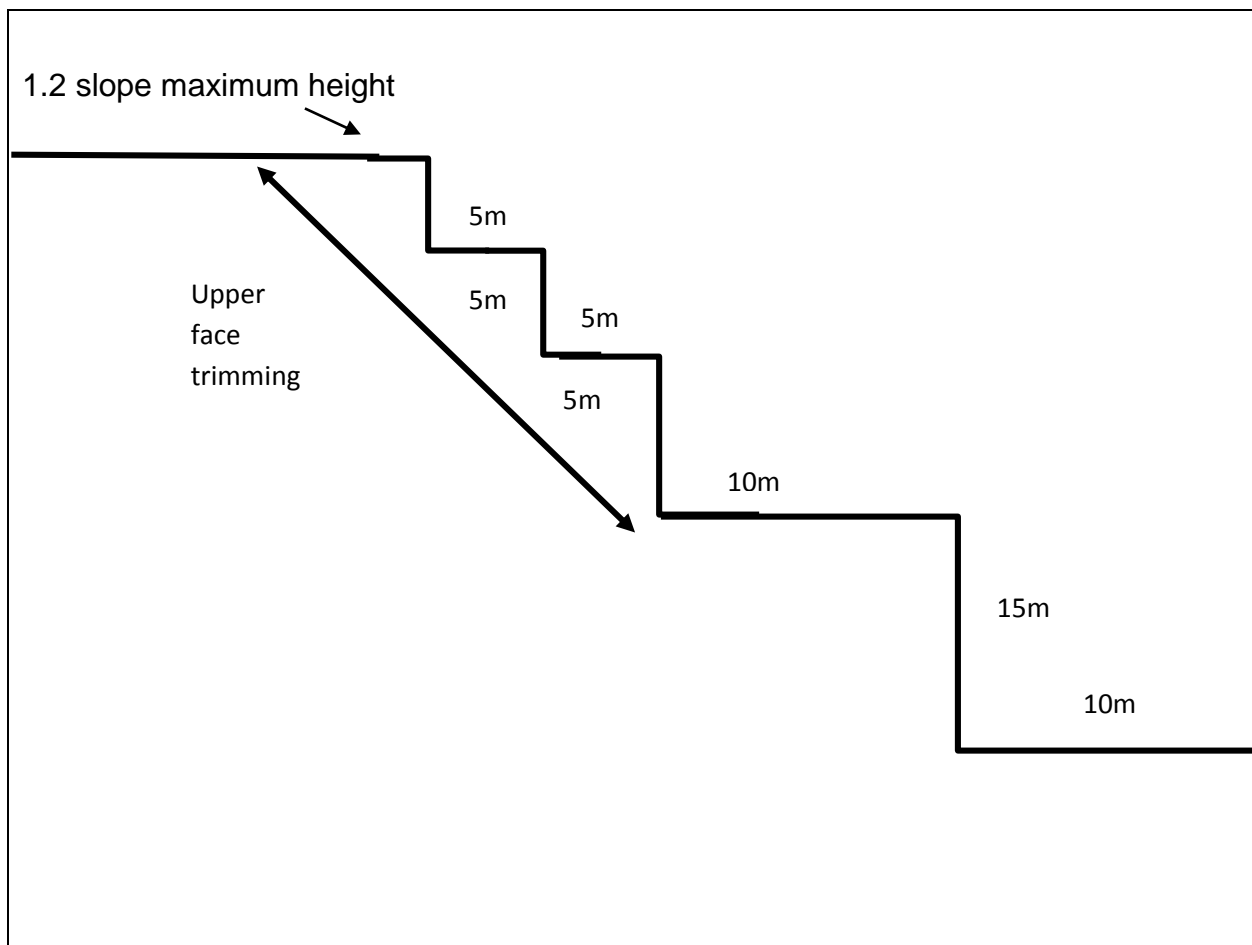
14.2.11 Excavation rehabilitation method: Shaping

In this case, the rehabilitation of the pit side slopes is relatively straightforward. The aim of such rehabilitation is to:

1. Ensure safety to humans and animals
2. Ensure that final rehabilitation of the site blends into surrounding natural vegetation and topography as much as possible.

It consists of upper trimming as per diagram below where the upper 15m is trimmed into smaller faces on benches. Each of these benches and slopes is topsoiled and revegetated.

The benches below that (i.e. the “normal” benches) are 10m wide (Minimum) under 15m high faces (max). **Figure 15** type of benches to be developed



14.3 Emergency Response Plan

An environmental management programme and associated management options are intended to minimise environmental risk as far as possible. Should, however, circumstances lead to unacceptable risks, emergency systems and procedures need to be designed and implemented in the case of an emergency to prevent or minimise the consequential environmental damage. The environmental emergency contingency plan must address any reasonably anticipated failure (most probable risk) for the entire mining area as well as the additional infrastructure such as transport routes and focuses on incidents that could cause environmental emergencies.

14.3.1 Content

The most crucial aspect of the emergency system is the identification and communication of the emergency to the appropriate persons. Consequently, the names of the appropriate contact person together with their contact numbers would be prominently displayed around the facility. The contact details will be updated on a regular basis. First-party employees (such as security, safety superintendents, mine overseers, environmental officers) will be trained to respond to the responsible personnel in the event of an emergency.

Each person's responsibility would be cleared with him/her beforehand and a copy of the emergency contingency plan would be distributed to each person, including the responsible and/or affected persons not associated with FM Crushers:

Disaster management and firefighting agencies;

- downstream water supply authorities;
- downstream users that could be affected in the case of an emergency such as neighbouring mines, farmers and local communities;
- Relevant government authorities such as DWA and DMR; and
- Approved professional person (engineer).

It must be ensured that operating and supervisory staff are familiar with the emergency plan, and that the content thereof is understood and familiar to them.

The emergency response plan will be updated as circumstances change or operating procedures are amended, and as a minimum in the event of:

- Any additional recommendations made by a professional engineer (annual safety inspections) or environmental auditors;
- Any change in operational procedures and/or management of the mining activity;
- The identification of any issues of concern or additional risks as a result of regular inspections and/or monitoring results; and
- Any unplanned or unforeseen emergency situation.

14.3.2 Objectives

Emergencies and risks that should be listed here, as a minimum, include: accidents, fires, spillages (hydrocarbon or loss of rhyolite during transportation) and flooding.

If the emergency has the potential to affect surrounding communities, they will be alerted via alarm signals or contacted in person. The surrounding community will be informed of the potential dangers that exist and the actions to be taken in the event of any emergency.

Communication is vital in an emergency and thus communication devices, such as mobile phones, radios, pagers or telephones, must be available around the site. A checklist of emergency response participants must be consulted and the relevant units notified. In this case, many of the emergency services will be sourced from Jozini or even Pongola/Richards Bay. The checklist includes:

- fire department;
- police;
- emergency health services such as ambulances, paramedic teams, poisons centres;
- hospitals, both local and for evacuation for specialist care;

- public health authorities;
- environmental agencies, especially those responsible for air, water and waste issues;
- other industrial facilities in the locality with emergency response facilities;
- public works and highway departments, port and airport authorities; and
- public information authorities and media organisations.

It will be of paramount importance that the plan be reviewed after an incident or accident to ensure that the necessary measures are in place to protect the environment and protect the operators against liability claims that could result. In addition, a yearly review of the emergency response plan will be carried out, irrespective of whether an incident occurred during that year.

14.4 Environmental Monitoring Programmes

14.4.1 Objectives of Monitoring Programme

The objective of the monitoring plan would be to monitor the impact of the aggregate mining, rhyolite waste and its subsequent infrastructure through the continuous analyses of water quality and quantity (where possible).

14.4.2 Monitoring Frequency

Phase	Variables	Frequency
Construction	All	Weekly/2 weeks
Operational	All	Monthly; Where negative impacts are detected (spillage) frequency to be increased to weekly
Decommissioning	All	weekly

14.4.3 Soil

The opencast mine rehabilitation operation requires a high level of monitoring, as many elements are changing on a regular basis. Both during rehabilitation and once they are completed, routine maintenance of structures such as down drains, collection dams and fences is required. In addition the actual re-vegetation operation needs to be monitored as especially performance and completion criteria need to be met. The following should also be undertaken:

- Measurement of soil depth on rehabilitated areas and discard dumps on a regular basis (Chamber of Mines of South Africa, 1981);

Most practical to measure when the vegetation monitoring is carried is done. This can be carried out using a soil auger and will establish that the placing of topsoil has been done to the correct depth.

- Soil analyses to ensure that the fertility of the soil is correct for the vegetation being grown. This is also required to calculate the fertiliser required for the next season;

- The basal cover of the vegetation should be measured together with a species composition assessment as well as the biomass of representative sample plots;

- Monitor movement and stability of the topsoil stockpile; and

- Monitor topsoil balance annually for volumes of soil.

Vegetation cover assessments, soil depth and soil fertility testing should be carried out as a combined operation annually, during the growing season and at least one month after rain has fallen.

Erosion assessments should be carried out in the rehabilitated areas to visually check for erosion channels. This should be done twice a year, during the summer growing season, and again after rain events.

Where fresh erosion channels are found, indicating that active erosion is occurring, remediation work will need to be programmed to improve the vegetation cover or divert rain water runoff.

During the vegetation cover monitoring, the presence of **invasive weeds** should be detected. An active program of weed management, to control the presence and spread of invasive weeds, will need to be instituted, so that any weeds encroaching because of the disturbed conditions are controlled

14.4.4 Hydrological

A monitoring programme is essential as a management tool to detect negative impacts as they arise and to ensure that the necessary mitigation measures are implemented.

14.4.5 Surface water quantity

Where possible the water quantity and channels geometry will be monitored in extreme flood events to determine any impact of the mining on river channels and water quantity in general, in the catchment.

14.4.6 Noise monitoring

It is recommended that the monitoring plan be implemented to determine potential sources of noise, increases and decreases in noise levels, and determine level of mitigation required. Components to be included in the proposed monitoring plan are discussed below.

Noise monitoring is to be conducted on a quarterly basis throughout the construction phase to determine the impact of the noise levels on the relevant noise sensitive receivers as determine the level of mitigation. Once it is established that the mitigation measures have decreased the specific noise levels from the mining activities, the noise monitoring should be carried out on a bi-annual basis thereafter throughout the life of mine. The noise measurements should be taken as per the baseline noise measurement locations of this report. A report must be compiled quarterly/ bi-annual, depending on the intervals of the monitoring programme then submitted to management to ascertain compliance with the required standards. Mine management should be advised of any significant increase in the ambient sound level as operations continue. At each measurement point the ambient noise level will be sampled in terms of the following parameters:

- The A-weighted equivalent sound pressure level (LAeq) for duration not less than 30 minutes per monitoring point.
- Measurements to be taken only during daytime since the operation will only be during the day (06:00 to 06:00).

14.4.7 Dust Suppression monitoring

The main areas where dust suppression should be implemented is where material handing takes place.

Table 16 below: Dust control measures which can be implemented during the operational phase (U.S. EPA, 1995).

Activity	Recommended Control Measure(s)
Material handling (soil, waste rock, ore)	Mass transfer reduction
	Drop height reduction
	Wind speed reduction through sheltering
	Wet suppression
	Enclosures
Vehicle entrainment from unpaved roads	Wet suppression or chemical stabilisation of unpaved roads
	Reduction of unnecessary traffic
	Strict speed control
	Avoid track-on onto neighbouring paved roads
	Design haul roads as far from fence line as possible
Open areas – wind erosion	Reduction of extent of open areas through careful planning and progressive vegetation
	Reduction of frequency of disturbance
	Compaction and stabilisation (chemical or vegetative) of disturbed soil
	Introduction of wind-breaks

14.5 Rehabilitation Plan

NOTE: It is incumbent on the applicant to provide a rehabilitation fund guarantee to cover the costs of decommissioning rehabilitation. Such guarantee must be lodged prior to the Mining Right being issued. The fund has to be calculated:

1. At application stage and annually during the life of mine.
2. As if the quarry were to shut down immediately at the time of highest impact.
3. As if all work had to be conducted by outside contractors.

It is therefore advantageous to the applicant to continuously conduct operational rehabilitation during the life of mine to reduce the size of the “immediate closure fund” and the decommissioning rehabilitation costs. Most operational rehabilitation is geared toward reducing the amount and value of decommissioning rehabilitation of the site but some is geared toward maintaining a neat and effective quarry site. In this case, the decommissioning rehabilitation of the upper faces of the excavation cannot be fully implemented until such faces are not required to access the advancing faces (so operational rehabilitation of the pit is limited).

As such, operational rehabilitation will consist of at least the following elements:

General housekeeping of the site must be of high order and the site must be kept neat at all times. Vegetation of certain areas and banks, demarcation of movement areas etc. all contribute to a pleasing aesthetic.

Whenever faces have reached their final configuration, work must begin on the rehabilitation of such faces. Such rehabilitation will consist of sloping/trimming, topsoiling and vegetation of the affected benches.

- Continual monitoring of the site by management and staff.
- Conducting of Environmental Performance Assessments every two years during full production (more often during construction phase).

14.5.1 Decommissioning rehabilitation

The closure objective requires that:

1. All structures, buildings, foundations and footing are removed from site.
2. All resultant hardened areas are ripped to 30-50cm depth, covered in topsoil and seeded with grass seed mix.
3. The excavation is to be shaped to meet safety requirements and provide suitable profile to facilitate revegetation of benches (remember that the floor will flood).
4. To topsoil benches and revegetate through a grass seeding
5. The excavation floor will flood with rain water and act as a breeding pond for water fowl. The excavation will thus also form a conservation feature although with varied habitat type from present. The access road to the water level will be retained and the water reservoir can prove useful (if required post mining).
6. All structures and roads not required by the landowner be removed.
7. All hardened areas outside of the excavation will be ripped/scarified, topsoiled and

General

- Retain stormwater management system for duration of aftercare period.
- Allow floor to flood from rain catchment to form reedbed and water fowl habitat.

15 FINANCIAL PROVISION

In terms of Section 24P of NEMA, an applicant for Environmental Authorisation relating to mining must, before the Minister of Mineral Resources issues the Environmental Authorisation, comply with the prescribed financial provision for the rehabilitation, closure and ongoing post decommissioning management of negative environmental impacts.

FM Crushers would ensure appropriate financial cover is in place prior to any work being undertaken in the mining area. FM Crushers would discuss and conclude the nature and quantum of the financial provision required for the management and remediation of environmental damage with DMR prior to any mining activities being undertaken. The

proposed nature and quantum of the financial provision is presented below as per the requirements of section 24p of NEMA.

The total amount is as follows:

Table 17: Quantum of FM Crushers Financial Provision

	Final closure	Unit	Quantity	Master Rate	Multi-factor	Cost
1	Dismantling of processing plant	m ³	100	R10.87	1.0	R1087.00
2a	Demolition of steel buildings and structures	m ²	50	R151.47	1.0	R7573.50
2b	Demolition of reinforced concrete structures	m ²	12	R223.14	1.0	R2677.68
3	Rehabilitation of access roads	m	0	R27.10	1	00
4a	Demolition and rehabilitation of electrified railway lines	m ²	12	R223.14	1.0	00
4b	Demolition and rehabilitation of noelectrified rail lines	m ²	0	R143.44	1.0	00
5	Demolition of houses and facilities	m ²	50	R75.83	1.0	R3791.50
6	Opencast rehabilitation including final voids and ramps	Ha	2	R9921,97	0.52	R10318.84
7	Sealing of shafts and adits	m ³	0	R81.29	1.0	00
8a	Rehab of overburden and spoils	ha	0	R105830.37	1.0	00

8b	Processing waste deposits and evaporation ponds (salt)	Ha	0	R131 809.81	1.0	00
8c	Processing waste deposits and evaporation ponds (salt)	Ha	0	R131 809.81	1.0	00
9	Rehabilitation of subsided areas	Ha	0	R88 617.00	1.0	00
10	General surface rehab and grassing	Ha	2	R41917.75	1.0	R83 835.50
11	River diversions	ha	0	R83 835.50	1.0	00
12	Fencing	m	0	R95.63	1.0	00
13	Water Management	m	2	R996	0.25	R498.07
14	2-3 years of maintenance and after care	ha	3	R1 115.68	1.0	R3347.04
Sums of the items above						R113129.13 88
Sub Total 1: Multiply by Weighting factor 2					1.0	R113129.13 88
1	Preliminary and General (6% of cost)					R67877.48
2	Contingencies (10% of cost)					R11312.913 88
Sub-Total 2 (Subtotal 1 plus management and contingencies)						R192319,53 268
Vat ((14% of subtotal 2)						R2692.735
Grand Total						R219244.26 72

FM Crushers has opted to supply the financials of rehabilitation through a financial guarantee.

16 OTHER MATTERS REQUIRED IN TERMS OF SECTIONS 24(4)(A) AND (B) OF THE ACT

None.

17 UNDERTAKING

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

- ✓ The information provided herein is correct;
- ✓ the comments and inputs from stakeholders and I&APs has been correctly recorded;
- ✓ information and responses provided to stakeholders and I&APs by the EAP is correct; and
- ✓ the I&APs and stakeholders have reviewed and commented on the Plan of Study for EIA and the level of agreement therewith has been correctly documented.



Signature of the EAP

Date: 15 March 2016