76 Valley View Road, Morningside, Durban, 4001
PO Box 37069, Overport, Durban. 4067

Tel: +27 (0)31 3032835
Fax: +27 (0)86 692 2547

SCREENING REPORT FOR THE PROPOSED MINING PERMIT

TO MINE AGGREGATE ON PORTION 16 OF THE FARM HERMANUS KRAAL NO. 1186, SITUATED IN THE MAGISTERIAL DISTRICT OF LADYSMITH, KWA-ZULU-NATAL

Prepared by:
Mr Andrew Batho
Afzelia Environmental Consultants cc
Physical Address: 76 Vally View Road, Morningside, Durban, 4001
Postal Address: PO Box 37069, Overport, 4067
Tel: 031 303 2835
Fax: 086 692 2547
Email: andrew@afzelia.co.za

Prepared For:
Ladysmith Crushed Stone Products cc
PO Box 925, Ladysmith, 3370

INDEMNITY AND CONDITIONS PERTAINING TO THIS REPORT

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information cited. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and Afzelia Environmental Consultants and its staff reserve the right to modify aspects of the report including the recommendations if and when new information may become available from on-going research or further work in this field, or pertaining to this investigation.

Although Afzelia Environmental Consultants exercises due care and diligence in rendering services and preparing documents, Afzelia Environmental Consultants accepts no liability, and the client, by receiving this document, indemnifies Afzelia Environmental Consultants and its directors, managers, agents and employees against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by Afzelia Environmental Consultants and by the use of the information contained in this document.

Executive Summary:

1. Afzelia Environmental Consultants was appointed to conduct a basic ecological and biodiversity screening assessment of an existing but abandoned quarry located on Portion 16 of the Farm Hermanus Kraal No 1186, Ezakheni District of Ladysmith. The mining operations were assessed for its possible impact on the biodiversity as well as ecosystem stability. The assessment focused on factors which could affect the existing habitat of the site concurrently with any Red Data, endemic or protected species predicted to occur in the area. Visual evidence suggests past disturbance of the area surrounding the quarry. However, it appears that since mining operations ceased in 1954, the area has been able to revert back to its natural state bar the existing quarry itself that still remains relatively barren and sparsely vegetated.

2. The technical aspect of the proposed aggregate mining operations describes the completion of a quarry face profiling survey prior to the drilling of a number of holes for the insertion of detonator cord and high explosives. The detonators are connected to the electric trigger wire and the circuit is checked. A final safety check is carried out and only when the final all clear is given does the shot firer set off the explosives generating a shotpile of rock material. The shotpile is then tidied up by onsite excavators, bulldozers and TLBs and loaded into a mechanical crusher located on the site. It is here that primary crushing will take place, and this crushed material will be loaded onto trucks to be transported to the proceeding plant located a few kilometres away from the site.

3. According to the Ezemvelo KZN Wildlife Minset database, the proposed quarry site is situated in an area that is un-shaded. Therefore, the planning unit in which it falls is currently “available” to meet conservation targets if any planning units classified as Biodiversity Priority Area 2 or 3 in the surrounding area are lost or transformed.

4. The vegetation types modelled to occur on the property were identified as KwaZulu-Natal Highland Thornveld and Tugela Thornveld. The vegetation unit in which the site falls was identified as KwaZulu-Natal Highland Thornveld which is listed as vulnerable (Mucina and Rutherford, 2006), because none is conserved within statutory conservation areas and a significant portion has already been lost to agriculture and urban development.

5. Minimal alien vegetation was encountered on the site. In order to prevent the establishment and spread of alien vegetation as a result of mining activities, mitigation measures have been provided and should be implemented throughout the mining process.

6. All red listed and protected flora species of conservation significance identified on the site will be impacted by the proposed aggregate mining operations. A survey of the area by a botanist to identify further species and develop a rehabilitation plan has been recommended. The recommended translocation of the abovementioned plant species shall be undertaken before any mining activities commence once the necessary permits have been obtained. Relocation of these plants will be undertaken by a qualified plant specialist. Rescued plant material shall either be planted nearby within suitable habitats in areas that will not be disturbed in the foreseeable future.

7. Red Data bird species predicted to occur in the area would be minimally affected by the aggregate mining operations due to the small size of the mining footprint, the unsuitability of the habitat that occurs on the site for some species and the absence of suitable breeding and foraging sites. Furthermore, good habitat will remain in the surrounding areas, including the Tugela Private Game Reserve and Tugela Drift Nature Reserve.

8. The Ezemvelo KZN Wildlife Minset Database predicted the occurrence of fauna of conservation importance within the planning unit the site is located. Based on the analysis of other databases, literature and the subsequent site inspections the following conclusions were made:

i. Fauna would be minimally affected by the aggregate mining operations due to the small size of the mining footprint on a landscape scale;
ii. The unsuitability of the habitat that occurs on the site for a number of fauna species because of the .absence of suitable foraging, sheltering and breeding areas.
iii. The presence of humans, livestock and their dogs in close proximity to the site on a regular basis.
iv. Good habitat will remain in the surrounding areas, including the Tugela Private Game Reserve and Tugela Drift Nature Reserve.

9. The Hermanspruit Stream is located to the north of the proposed aggregate quarry site. This watercourse runs down the Hermanspruit Valley from the west, into the Klip River to the east and falls outside of the boundaries of the proposed site. Impacts on water resources in the form of wetlands and watercourses are considered to be minimal provided the recommendations contained within this report and the EMP are adhered to. The establishment of a 30 m buffer zone around the Hermanspruit Stream and its designation as a no-go area would prevent the degradation of the watercourse during mining operations.

10. The Heritage Impact Assessment undertaken by *Umlando: Archaeological Tourism and Resource Management* located several small features that could relate to the 2nd Anglo-Boer War within the mining footprint and scattered throughout the surrounding area. However, none of the sites located within the mining footprint were deemed to be of high significance that would compromise the establishment of the quarry site. Furthermore, no detrimental impacts on heritage sites or artefacts of significance, identified in the surrounding area are likely to occur if the recommendations contained within this report are adhered to prior to the commencement of mining operations.

TABLE OF CONTENTS

List of Figures:

LIST OF TABLES:

1. INTRODUCTION

Afzelia Environmental Consultants was appointed to conduct a basic ecological and biodiversity screening assessment and the mining permit application for an existing but abandoned quarry located on Portion 16 of the Farm Hermanus Kraal No 1186, Ezakheni District of Ladysmith. This assessment investigates the sensitivity of the proposed quarry site and identifies potential environmental impacts associated with the establishment and operation of the proposed quarry. The study includes a desktop assessment of the potential occurrence of red data (endemic or protected) floral and faunal species on the site as obtained from various sources, as well as a general field appraisal of the site.

In addition to the abovementioned assessment of the site, Umlando: Archaeological Tourism and Resource Management were appointed to undertake a heritage and cultural impact assessment of the site (Annexure F).

2. LEGISLATIVE BACKGROUND

In terms of biodiversity, South Africa has signed and ratified a large number of international treaties, protocols and agreements, including *inter alia the* following:

- Lusaka Agreement on Co-operative Enforcement Operations Directed at Illegal Trade in Wild Fauna and Flora (1974)
- Convention on International Trade in Endangered Species (CITES) (1975)
- Convention on Wetlands of International Importance, especially as Waterfowl Habitat (Ramsar) (1975)
- Convention on Conservation of Migratory Species of Wild Animals (Bonn Convention) (1991)
- Convention on Biological Diversity (CBD) (1995)
- Cartagena Protocol on Biosafety, 2003

Biodiversity conservation is protected and implemented *inter alia* by the following national and provincial policy and legislation:

- South Africa's Constitution (Act 108 of 1996), including the Bill of Rights (Chapter 2, Section 24)
- Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983)
- Environment Conservation Act (Act 73 of 1989)
- Marine Living Resources Act, 1998 (Act 18 0f 1998)
- National Water Act, 1998 (Act 36 of 1998)
- National Forests Act, 1998 (Act 84 of 1998)
- National Environmental Management Act (Act No. 107 of 1998)
- National Environmental Management: Protected Areas Act, 2003 (Act 57 of 2003)
- National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)
- National Environmental Waste Management Act (Act 59 of 2008)
- KwaZulu-Natal Nature Conservation Management Act (Act No. 5 of 1999)
- KwaZulu-Natal Nature Conservation Ordinance (No. 15 of 1974)

Other relevant legislation concerned with the well fare of the natural environment, surrounding communities and mining employees:

- Mine Health and Safety Act (Act No. 29 of 1996)
- Minerals and Petroleum Resources Development Act (No 28 of 2002)

The national policy on biodiversity was published in 1997, the White Paper on the Conservation and Sustainable Use of South Africa's Biological Diversity. The Department of Environmental Affairs and Tourism prepared the National Biodiversity Strategy and Action Plan (NBSAP) (DEAT, Country Study 2005) to establish a clear framework and a plan of action for the conservation and sustainable use of South Africa's biodiversity and the equitable sharing of benefits derived from its use.

Of importance are also all provincial and municipal by-laws and regulations that are relevant but not listed here. Some of the acts may have changed or are in the process of change. However, once implementation of the project commences, new legislation and all amendments that are current at that time will apply.

3. TERMS OF REFERENCE

The following terms of reference are applicable to this assessment:

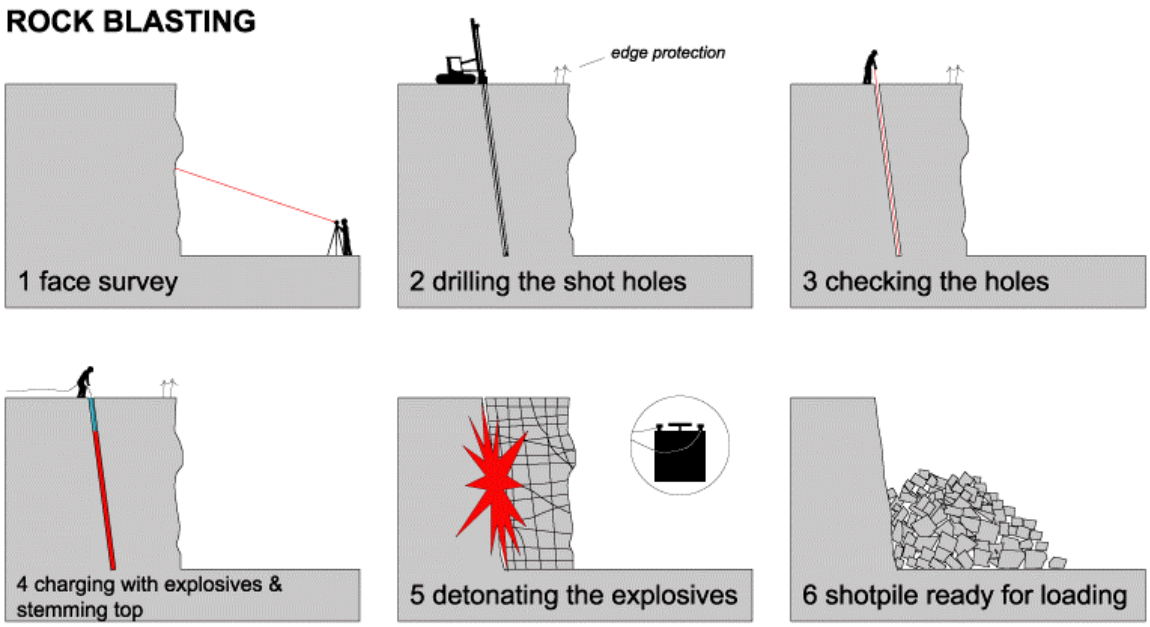
(i) Conduct a survey of the habitat(s) and other natural and man-made features that will be directly affected by the proposed aggregate quarry operation:

- To assess the current state and conservation significance of the habitat(s) in these areas.
- To compile a faunal and floral inventory of the natural communities known or predicted to occur on the site as per desktop study and site visit, and advise whether species of high conservation significance are likely to occur/breed on the site.
- A ground-truthing exercise to verify the presence of important species and ecological communities on or near the proposed quarry site.
- Determine and report on the degree to which the impacts associated with the establishment and operation of the proposed quarry will affect species of high conservation significance at the local and regional level, including an evaluation of significance.
- Determine whether the proposed development will impact on corridor processes, on the proposed site and adjacent areas.
- Identify important habitats on the proposed site and adjacent areas (wetlands, river systems and indigenous forest)
- Identify obvious sites and artefacts of heritage, archaeological, paleontological and cultural significance on the proposed site and adjacent areas, and co-ordinate any required heritage impact assessments (with integration of any resultant specialist recommendations into the screening report).
- Evaluate the importance of the site for biodiversity, including ecosystem processes, and the conservation importance of the site in terms of conservation planning; and
- Consider invasive alien plant status and rehabilitation potential of natural areas.
- Provide recommendations for the mitigation of potential impacts stemming from the proposed mining activities.
- The development of a comprehensive rehabilitation plan to ensure the land returns to a condition similar to the condition that existed before the commencement of mining operations on the property.
- Development of a cost breakdown for closure and rehabilitation of the aggregate quarry.

4. AGGREGATE QUARRY – OPERATION OVERVIEW

The extraction of stone from a quarry is a multistage process by which rock is extracted from the ground and crushed to produce aggregate, which is then screened into the sizes required for immediate use, or for further processing, such as coating with bitumen to make bituminous macadam (bitmac) or asphalt.

1) The process begins with a detailed three-dimensional survey of the quarry rock face. This allows the explosives engineer to design the blast and to plot where the shot holes should be drilled so that the blast can be carried out safely and efficiently. The survey will show if there are any bulges or hollows in the face. A bulge will need more explosive than normal to ensure that it is completely fragmented and not left in place in the face. Hollow areas require less explosive than normal. The placement of explosives is professionally planned to ensure that the required fragmentation of the rock is achieved with the minimum environmental impact.



2) After the face profiling survey, the drilling contractor arrives. Using an air operated drilling rig, he drills the number of shot holes required, at the marked spots corresponding to the position of the holes on the blast design, at the angles and depths required. After the shot holes have been drilled, they are surveyed to check that all of them correspond to the blast design and the two surveys are combined to allow the blast engineer to work out how each shot hole is filled with explosives.

3) A detonator cord and high explosives are inserted into each hole to within a few metres of the top. The remaining depth is "stemmed" with quarry dust or fine aggregate. The site is then cleared. Sirens are sounded to make sure that everyone nearby is warned. The detonators are connected to the electric trigger wire and the circuit is checked. A final safety check is carried out and only when the final all clear is given does the shot firer set off the explosives. A single blast can fragment up to 20,000 tonnes of rock.

4) After the blast, the face and shotpile (sometimes called the muck-heap) are inspected to determine whether all the shot holes have fired correctly and no additional blasting is required. Excavators, bulldozers and TLBs then tidy up the shotpile and load the material onto haul trucks for transportation to the processing plant via the dirt access road that runs parrallel to the Hermanspruit Stream. This acess

road connects onto a gravel track that leads to the industrail area of Ezakheni. This is were the main processing plan is located.

5) The remaining material not removed from the site will be retained within the tidied up shotpile until it is loaded onto transport for movement to the procesisng plant.

No permanent structures will be established on the proposed quarry site or in adjacent areas. selected loading and transporting vehicles, portable chemical toilets, water stoarge tanks, appropriate waste receptacles and a storage area will be positioned within a site camp. A mobile prefab-office or shipping container will be brought onto site to act as a site office, this still however had to be confirmed at the time of writing. The site camp would be established on a piece of cultivated land located on a neighbouring property owned by a member of the local community. The Applicant/Site Manager has managed secure the right to use this piece of land for the purposes of the erection of the site camp prior to the commencement of mining activites.

5. BACKGROUND AND LOCALITY OF PROPOSED QUARRY SITE

Locality & Current Land Use

The proposed quarry site is located on Portion 16 of the Farm Hermanus Kraal No 1186 situated 18 km south of the town of Ladysmith, 20 km north east of the town of Colenso and 2 km North West of the industrial area of Ezakheni within the Emnambithi Ladysmith Local Municipality, KwaZulu-Natal. The coordinates of the site are 28° 36' 39.39 S, 29° 50' 03.2" E. The proposed site is 1.5 hectares in extent and is in part positioned within an old quarry that was abandoned over thirty years ago. This quarry site is bordered to the north by the Hermanspruit River and the Spoornet railway line in the east. The surrounding land uses are predominantly focused on subsistence crop and livestock production. Scattered small holdings and homesteads were identified in the vicinity of the proposed quarry site.

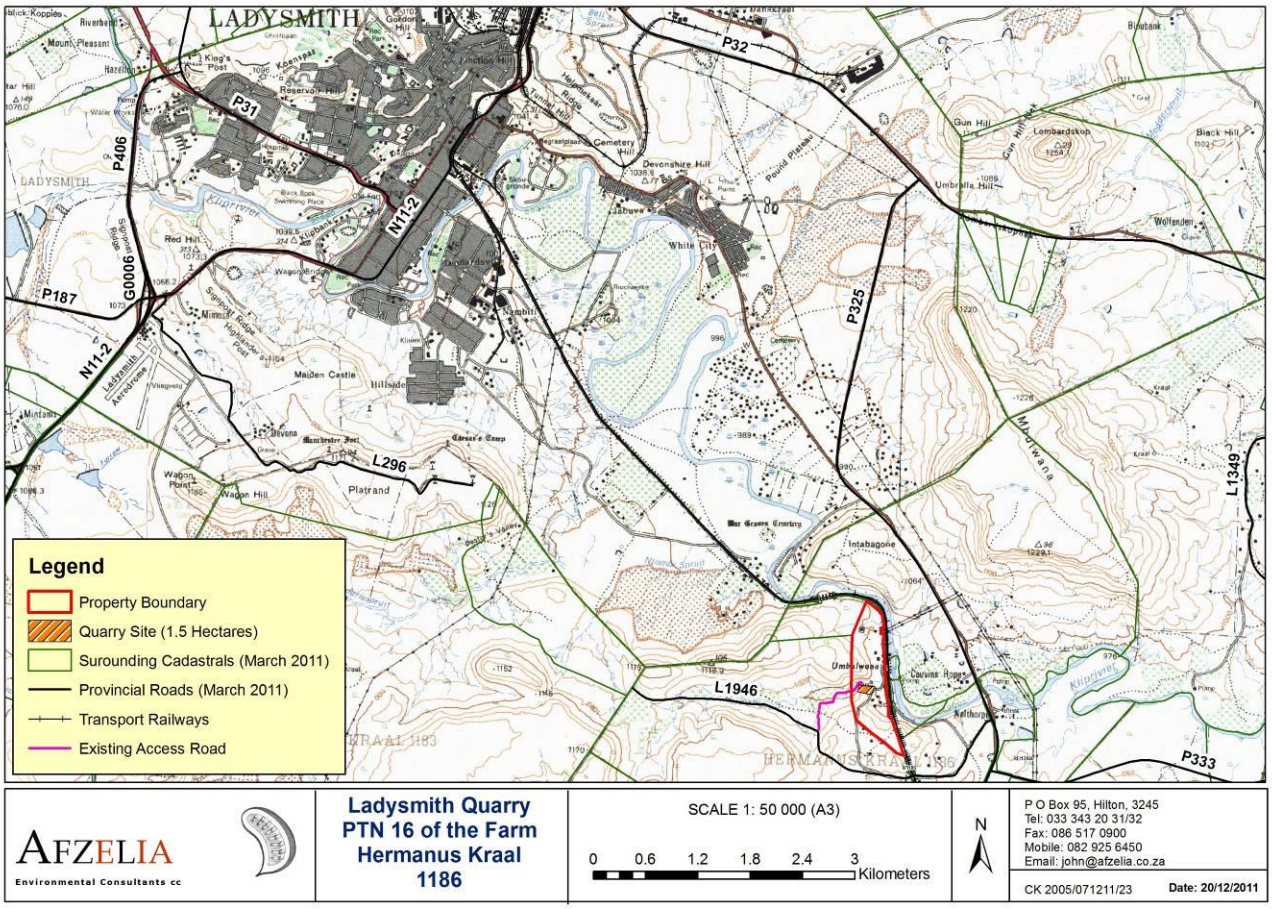


Figure 1: Location of proposed quarry site on Portion 16 of the Farm Hermanus Kraal 1186

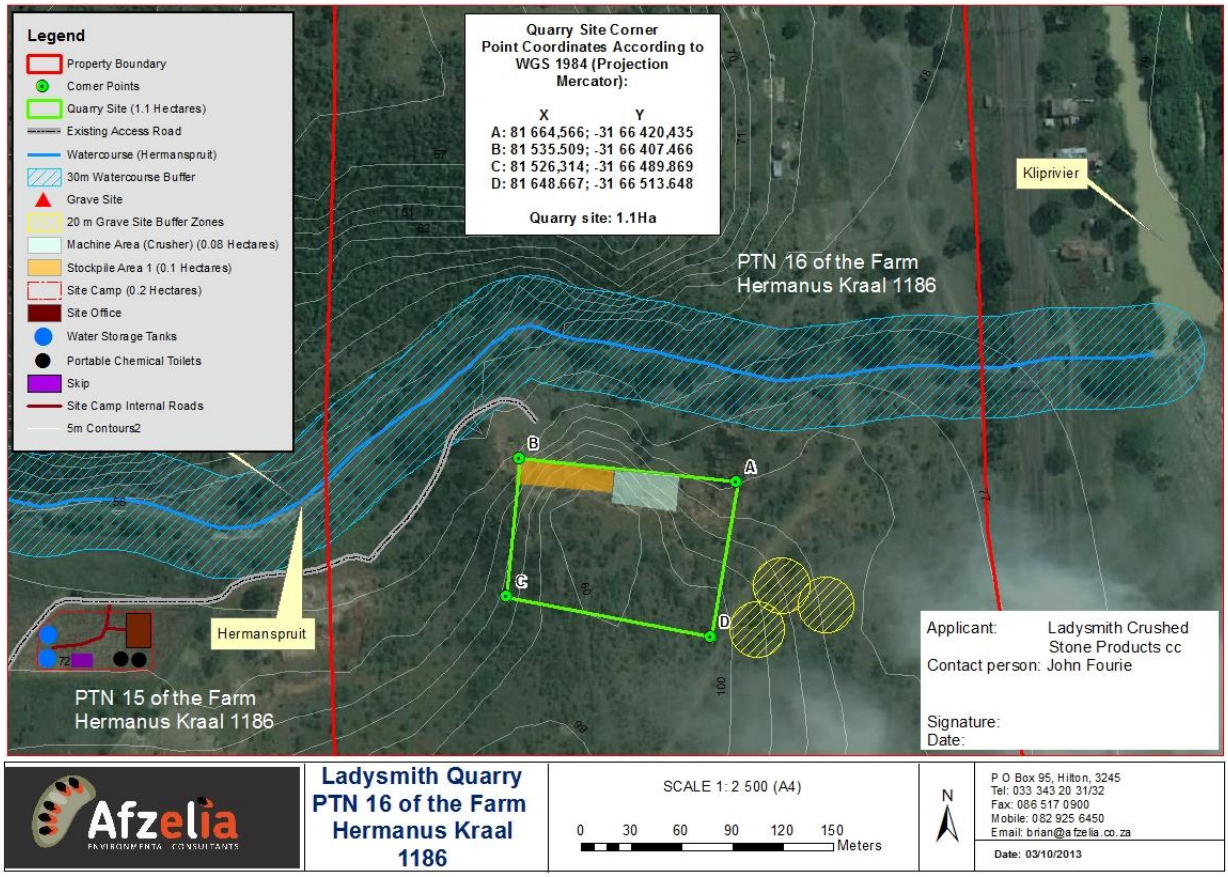


Figure 2: Proposed quarry site located on Portion 16 of the Farm Hermanus Kraal 1186

Topography and Vegetation Cover

The topography of the Emnambithi Ladysmith Local Municipality is diverse and is characterised by hilly, undulating landscapes, broad valleys, moderate and steeply slopes, rolling hills and flat plains. The dominant landscape features are valley slopes and undulating hills. West of Ladysmith small dolerite koppies and steeper slopes and ridges occur.

Portion 16 of the Farm Hermanus Kraal No 1186 and surrounding areas are characterised by a hilly, undulating landscape and broad valleys. The northern portion of the property is characterised by Acacia-dominated bushveld of variable densities (ranging from wooded grassland patches to dense tickets) with dense grassy undergrowth. This is representative of areas characterised by the savannah biome -Thukela Thornveld vegetation unit.

Southern portions of the property where the proposed quarry site is located support tall tussock grasslands that are dominated in places by *Hyparrhenia hirta*, with the intrusion of savannoid woodlands with scattered *Acacia sieberiana var. Woodii* and patches of *A.karoo* and *A.nilotica.* This is a characteristic of the grassland biome and specifically the KwaZulu-Natal Hinderland Thornveld vegetation unit. The denseness and maturity of the vegetation cover seen in the vicinity of the proposed quarry site suggests a reduced incidence of fires that would normally have controlled bush encroachment. For further information on the relevant vegetation units and their floral composition, please see the relevant sub-sections below.

The proposed site camp falls on a piece of cultivated land within the KwaZulu-Natal Hinderland Thornveld vegetation unit. However, the area had been cleared and ploughed at the time of inspection and no indigenous vegetation was note in the area.

Figure 3: Dirt path leading to the edge of the existing quarry rock face. Please note dense vegetation either side of the path

Figure 4: Stone walls found on site. Noted grassed clearing friged by dense woodland that is a common occurrence on the site and the remainder of the property. Please note specimens of the Acacia speces *Acacia nilotica* and the small tree species *Dichrostachys cinerea* in the background

Figure 5: Remnants of the foundations and walls of a structure on the site. Note mature specimen of *Acacia sieberiana* in the background.

Figure 6: Undulating, hilly terrain found on Portion 16 of the Farm Hermanus Kraal 1186 (Directly adjacent to the proposed 1.5ha quarry site). Please note scattered specimens of *Aloe Marlothii* in the image

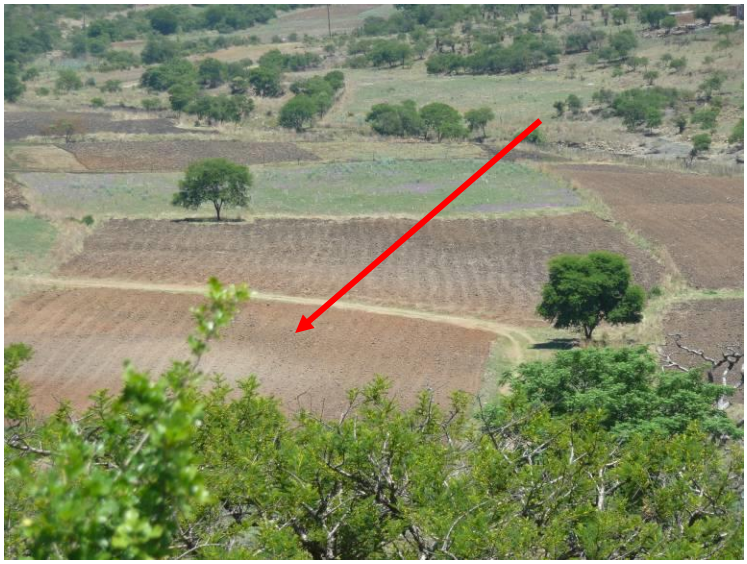


Figure 7: Piece of cultivated land where the mining site camp will be located. Please note the dirt access road leading to the mining site in the image

Geology and Soil

The northern section of Portion 16 of the Farm Hermanus Kraal No 1186 are dominated by a broad variety of soils ranging from vertisols and solodised solonetzic soils to transitional fersiallitic soils that develop over Karoo Supergroup sediments of the Ecca and Beaufort Groups. Heavy soils are developed over Jurassic Dolerite intrusions forming koppies and sills. The land types that are known to occur include Fb, Db, Ea, Fc and Dc.

The southern portion of the property where the propose quarry site is located, and the location of the proposed mining site camp, are characterised by a variety of Karoo Supergroup rocks, including the Dwyka, Ecca and Beaufort Groups and marginally also Jurassic dolerite intrusions. Yellow-brown soils over plinthic sub soils and shallow duplex soils are common. Red and black heavy soils are derived from dolerites and show high resistance to erosion. The units fall within various land types including Ca, Fb, Fa, Db and Bb.

GeoZone GeoServices were appointed to carry out an assessment of the proposed quarry site. The investigation has determined that the region is indeed underlain by Jurassic dolerite which has intruded the older mudstones and sandstones of the Adelaide Subgroup. However, the actual quarry is located within the dolerites as per the 1:250 000 Geological; Series 2828 Harrismith, as published by the Council for Geosciences, 1998. This was confirmed by a brief walkover through the abandoned quarry and along the crest of the hill south of and above the blasted face by the specialist.

Please see the Paleontological Assessment component of the Heritage Impact Assessment located in Annexure F for further information about the geology of the region.

CLIMATE

The town of Colenso and industrial area of Ezakheni receive an average annual rainfall of approximately 646mm, with most rainfall occurring during mid-summer. Figure 8 below shows the average monthly rainfall values for Colenso and the surrounding area. It receives the lowest average rainfall (1mm) in June and the highest (124mm) in January. The monthly distribution of average daily maximum temperatures (Figure 9 below) shows that the average midday temperatures for Colenso and the surrounding area range from 20.2°C in June to 28.3°C in January. The region is the coldest during July when the temperature drops to 3°C on average during the night. Please refer to Figure 10 below for an indication of the monthly variation of average minimum daily temperatures.

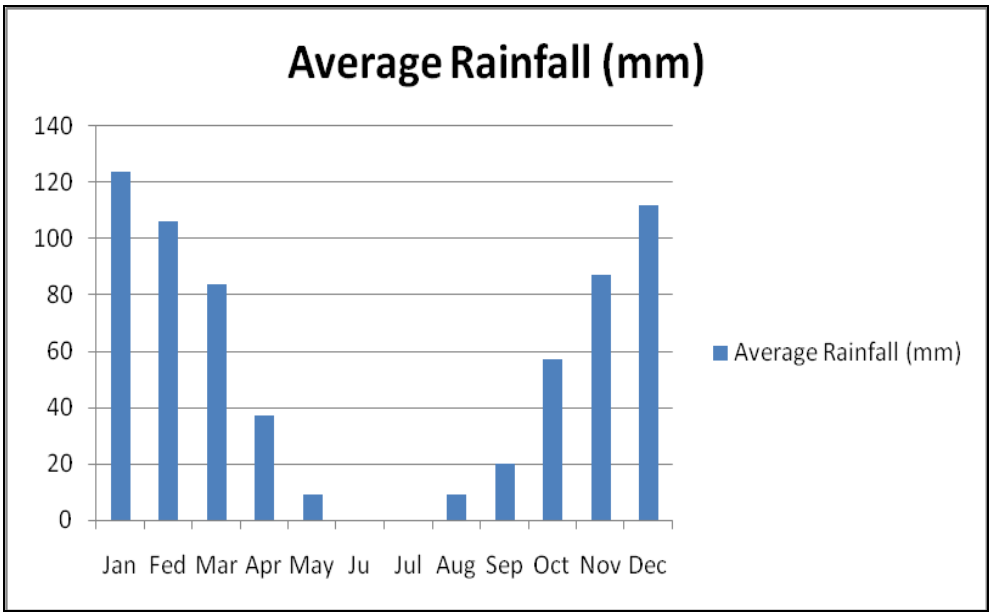


Figure 8: Average rainfall for Colenso and surrounding area

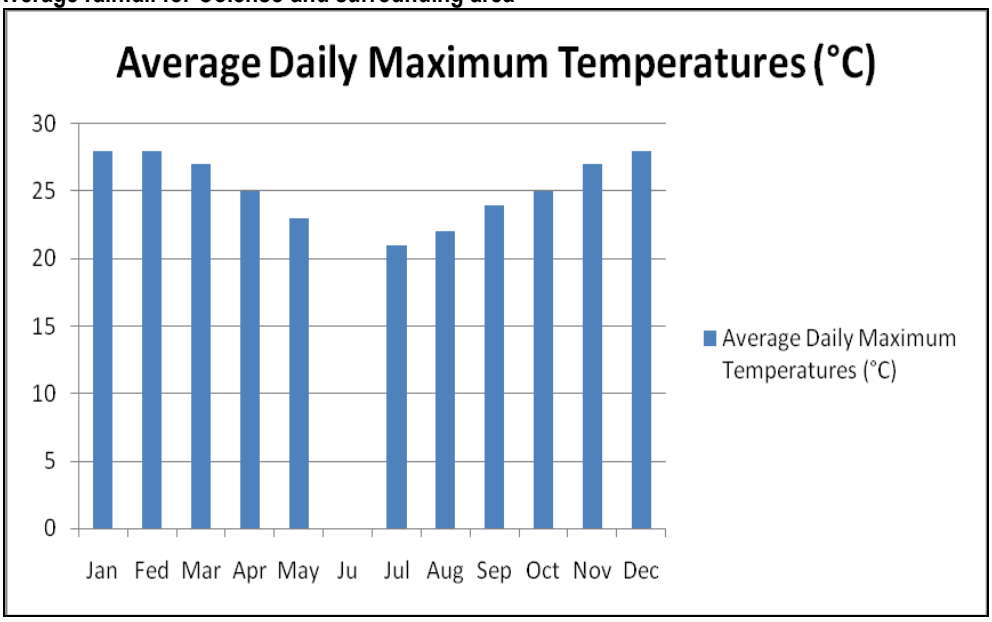


Figure 9: Average daily maximum temperature for Colenso and surrounding area

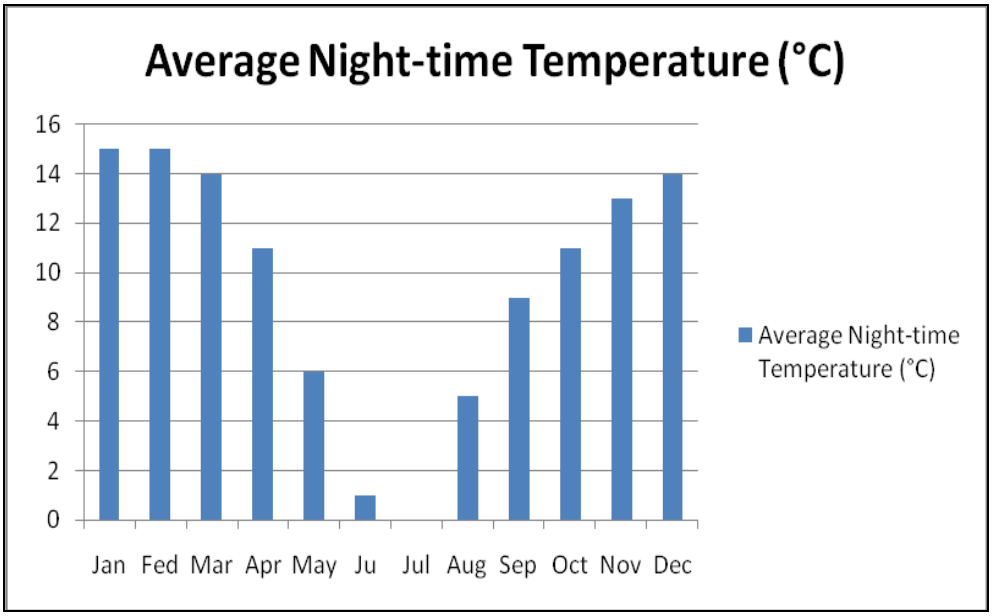


Figure 10: Average night-time temperature for Colenso and surrounding area

6. SITE SPECIFIC EVALUATION

General Overview

The desktop biodiversity assessment conducted by Afzelia included a review of several conservation databases, documents and historical aerial imagery from various sources. Of particular importance to this assessment were the Emnambithi Ladysmith Local Municipality: Strategic Environmental Planning Tool (SEPT), Ezemvelo KwaZulu-Natal Wildlife MINSET, Ezemvelo KwaZulu-Natal Wildlife Vegetation and SEA Databases. Site inspections by the EAP were undertaken on the 13th October 2011 and 3rd November 2011. The site was inspected visually for the presence of endangered or threatened flora, bird, mammal, reptile, amphibian and invertebrate species. The EAP also assessed the topography of the area, and the presence or absence of transformed land in the vicinity of the site.

The paragraphs below provide context to the two main databases which were utilised for the desktop component of the assessment.

Ezemvelo KZN Wildlife Minset Database 2010

In order to achieve defined conservation targets in KwaZulu-Natal, Ezemvelo KZN Wildlife (EKZNW) has developed a planning tool, known as the Minset. The Minset identifies the minimum number of planning units contained within KwaZulu-Natal which are required to meet biodiversity conservation targets, and the outputs are updated as new information becomes available. The database spatially classifies planning units into the following categories:

- **Existing Protected area network** – Planning units that comprise areas which are formally protected under the National Environmental Management: Protected Areas Act (No 57 of 2003) as amended.
- **100 % Transformed** – Planning units that are 100% transformed in terms of natural asset according to the 2005 EKZNW land cover dataset.
- **Outside Province**– Planning units which fall outside of the KZN provincial boundary.

- **Biodiversity Priority Area 1** - Planning units which contain features that, if lost, EKZNW conservation targets cannot be met in any other planning unit within the Province.

- **Biodiversity Priority Area 2** – Planning units which contain features that, if lost, EKZNW conservation targets can only be met in a very limited number of alternative planning units within the Province.

- **Biodiversity Priority Area 3** - Planning units which contain features that, if lost, EKZNW conservation targets can only be met in a limited number of alternative planning units within the Province.

Un-shaded planning units are "available" to meet conservation targets if any planning units classified as Biodiversity Priority Area 2 or 3 are lost or transformed.

According to the Ezemvelo KZN Wildlife Minset database, the proposed quarry site and site camp are situated in an area that is un-shaded. Therefore, the planning unit in which it falls is currently "available" to meet conservation targets if any planning units classified as Biodiversity Priority Area 2 or 3 in the surrounding area are lost or transformed. For confirmation of the above please see Figure 11 below.

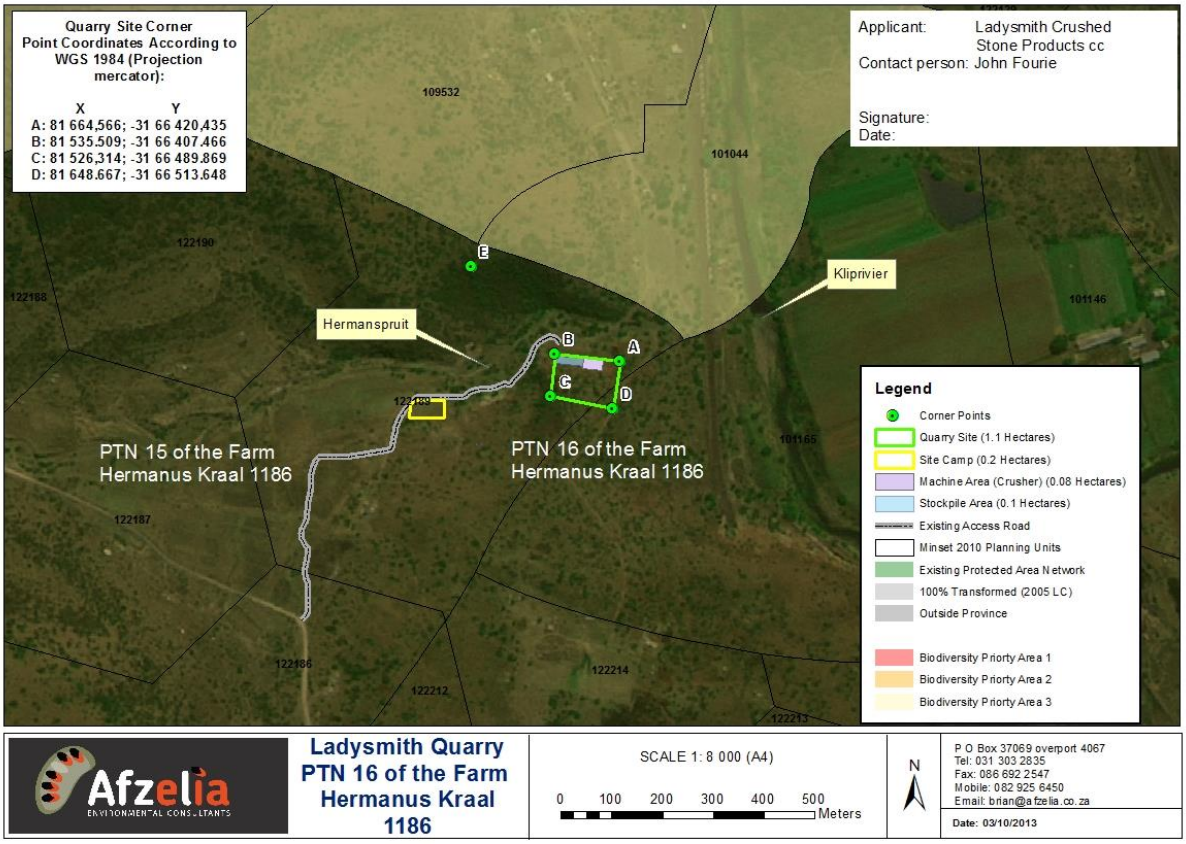


Figure 11: Ezemvelo KwaZulu-Natal Wildlife Minset Database 2010 for the proposed quarry site

A number of floral and faunal species of conservation significance are modelled to occur on the site. The features of conservation significance / priority within these abovementioned planning units are provided in Table 1 below.

TABLE 1: FEATURES OF CONSERVATION SIGNIFICANCE MODELLED TO OCCUR ON THE SITE

SCIENTIFIC NAME	COMMON NAME / VEGETATION TYPE	GROUP
Not Applicable	Drakensberg Foothill Moist Grassland	Vegetation Group / Unit
Kniphofia albomontana	Unknown	Plant
Ourebia ourebi	Oribi	Mammal - Antelope
Gypaetus barbatus	Bearded Vulture	Bird – Raptor Species
Chrysoritis oreas	Drakensburg Daisy Copper Butterfly	Insect (Butterfly)
Eremidium erectus	Species of Grasshopper	Grasshopper (Insect)
Transvaaliana draconis	Not Applicable	Grasshopper (Insect)
Doratogonus montanus	Not Applicable	Millipede (Insect)
Centrobolus tricolor	Three-coloured Red Millipede	Millipede (Insect)
Spinotarsus triangulosus	Not Applicable	Millipede (Insect)

This implies that one or more of the abovementioned species have been recorded within this planning unit, or that the planning unit contains habitat suitable their existence.

Emnambithi Ladysmith Local Municipality: Strategic Environmental Planning Tool (September 2010)

The Strategic Environmental Planning Tool (SEPT) serves to incorporate environmental considerations into spatial planning processes. This is crucial from a prudent environmental management perspective, as in many circumstances environmental considerations are ignored during spatial planning due to limited or lack of information and / or knowledge regarding extant environmental features and their attributes, as well as environmental issues and opportunities in an area under consideration.

The SEPT attempts to facilitate decision making to ultimately ensure sustainable management of natural resources in the municipality. The intention is for the SEPT to be used as an input to the municipal Spatial Development Framework (SDF) and Integrated Development Plan (IDP) and it will provide the basis for co-ordinated decision making between the local and district municipalities to manage sustainable environmental development.

The SEPT functions in the same realm as other environmental planning tools, such as a Strategic Environmental Assessment (SEA) and Environmental Management Framework (EMF). It also holds similarities with both of these tools.

The Emnambithi Ladysmith Local Municipality: Strategic Environmental Planning Tool compiled by compiled by NEMAI Consulting, assisted in the identification of Red Data flora and fauna species that occur within the municipality, the vegetation units found within the municipality and the geological, climate and topographical background of the area in which the proposed quarry site falls.

A number of faunal species of conservation significance are modelled to occur within the municipality. These species have been listed in Table 2 below

TABLE 2: FAUNA SPECIES THAT COULD POTENTIALLY OCCUR WITHIN THE REGION

FAMILY	SPECIES	CONSERVATION STATUS
Fish	*Barbus pallidus*	Least Concern
Amphibian	*Leptopelis xenodactylus*	Endangered
Amphibian	*Afrixalus spinifrons*	Vulnerable
Annelid	*Proandricus babanango*	No entries found
Annelid	*Proandricus bourquini*	No entries found
Arachnid	*Hadogenes trichiurus pallidus*	No entries found
Bird	*Bugeranus carunculatus*	Critically Endangered
Bird	*Hirundo atrocaerulea*	Critically Endangered
Bird	*Anthropoides Paradisea*	Vulnerable
Bird	*Balearica regulorum*	Vulnerable
Bird	*Bucorvus leadbeateri*	Endangered
Bird	*Gyps africanus*	Vulnerable
Bird	*Hemimacronyx chloris*	Vulnerable
Bird	*Neotis denhami*	Vulnerable
Bird	*Lioptilus nigricapillus*	Near Threatened
Bird	*Zoothera gurneyi*	Near Threatened
Gastropod	*Archachatina burnupi*	No entries found
Gastropod	*Archachatina simplex*	No entries found
Gastropod	*Natalina reenenensis*	No entries found
Insect	*Chrysoritis aureus*	Rare
Insect	*Iolaus diametra natalica*	Rare
Insect	*Durbania amakosa flavida*	Indeterminate
Insect	*Bittacus bicornis*	No entries found
Insect	*Bittacus sobrinis*	No entries found
Insect	*Bittacus zulu*	No entries found
Insect	*Charaxes xiphares penningtoni*	No entries found
Insect	*Damalis femoralis*	No entries found
Insect	*Dasophrys androclea*	No entries found
Insect	*Dasophrys dorattina*	No entries found
Insect	*Dasophrys umbripennis*	No entries found
Insect	*Durbania amakosa natalensis*	No entries found
Insect	*Neolophonotus argyphus*	No entries found
Insect	*Neolophonotus hirsutus*	No entries found
Insect	*Neolophonotus io*	No entries found
Insect	*Neolophonotus leucodiadema*	No entries found
Insect	*Stagira dracomontanoides*	No entries found
Mammal	*Chrysospalyx villosus*	Critically Endangered
Reptile	*Bradypodion thamnobates*	Near threatened
Reptile	*Bradypodion melanocephalum*	No entries found
Reptile	*Scelotes bourquini*	No entries found

Source: Emnambithi Ladysmith Local Municipality: Strategic Environmental Planning Tool complied by NEMAI Consulting

6.2. FLORAL ASSESSMENT

Vegetation Units

The Emnambithi Ladysmith Local Municipality: Strategic Environmental Planning Tool (compiled by NEMAI Consulting) divides vegetation into biomes and their associated vegetation units according to Mucina & Rutheford (2006). A biome is defined as a *"broad ecological spatial unit...defined mainly by vegetation structure,*

climate as well as major large-scale disturbance factors". These vegetation units are described as units of plant groups that have similar ecological requirements and conservation requirements.

Based on the content of the above document, the following dominant vegetation types are found within the municipality: Northern KwaZulu-Natal Shrubland, Thukela Thornveld, KwaZulu-Natal Highland Thornveld, and Thukela Valley Bushveld. Smaller pockets of other vegetation types include: Northern KwaZulu-Natal Shrubland, Northern Afrotemperate Forest, Income Sandy Grassland, Eastern Temperate Freshwater Wetlands, Eastern Free State Clay Grassland, and Basotho Montane Shrubland (Mucina & Rutheford, 2006).

According to Rutherford & Westfall (1994), the municipality is characterised by two biomes, specifically the Grassland and the Savannah Biomes. The Grassland Biome within the municipality comprises of the Sub-Escarpment Grassland Bioregion and the Savannoid Biome comprises of the Central Bushveld Bioregion. The dominant vegetation group that appears within the region is KwaZulu–Natal Highland Thornveld, followed by Thukela Thornveld and Northern KwaZulu-Natal Shrubland (Mucina & Rutheford, 2006).

Based on the content of strategic environmental management tool and subsequent verification against the EKZNW vegetation database, the Environmental Assessment Practitioner confirmed that Portion 16 of the Farm Hermanus Kraal No 1186 is divided into two different vegetation units. Part of the property falls within the Grassland Biome in the KwaZulu–Natal Highland Thornveld vegetation unit, and part within the Savannoid Biome known in the Thukela Thornveld Vegetation Unit. The proposed quarry site itself falls within KwaZulu–Natal Highland Thornveld vegetation unit. Please see Annexure D for further information pertaining to the above vegetation units.

The EKZNW MINSET database notes Drakensberg Foothill Moist Grassland present in the vicinity of the site (See Table 3 below). However, this vegetation unit was not found on the site during the site inspection. Please see Mucina and Rutherford (2006) vegetation units that have been illustrated in Annexure D.

TABLE 3: VEGETATION UNITS IDENTIFIED IN THE VICINITY OF THE SITE

SCIENTIFIC NAME	VEGETATION TYPE	GROUP
Not Applicable	KwaZulu-Natal Highland Thornveld	Vegetation Unit
Not Applicable	Tugela Thornveld	Vegetation Unit
Not Applicable	Drakensberg Foothill Moist Grassland	Vegetation Unit

The plants characteristic of each vegetation type are described below (as per Mucina and Rutherford, 2006):

Kwazulu–Natal Highland Thornveld

KwaZulu–Natal Highland Thornveld is characterised by tall tussock grassland mainly comprising of *Hyparrhenia hirta* and some savannoid woodlands comprising of *Acacia sieberiana* and limited occurrences of *Acacia karoo* and *Acacia nilotica*. Other small trees include *Acacia natalitia*, and *Dichrostachys cinerea*.

Low shrubs found in these areas include *Barleria obtusa, Antospermum rigidum, Chaetechantus setiger, Gymnosporia heterophylla*. A *semiparasitic* shrub is *Thesium costatum. Graminoids include Abildgaardia ovata, Andropogon eucomus, Aristida bipartita, Aristida Congesta, Chloris virgata, Cynodon dactylon, Elionurus muticus, Eragrostis capensis, Eragrostis chloromelas, Eragrostis plana, Eragrostis racemosa, Eragrostis superba, Heteropogon contortus, Hyparrhenia hirta, Setaria sphacelata, Themeda triandra, Tristachya leucothrix, Andropogon appendiculatus, Brachiaria serrata, Cymbopogon caesius, Cymbopogon marginatus, Cymbopogon pospischilii, Cyperus obtusiflorus, Digitaria monodactyla, Digitaria tricholaenoides, Diheteropogon amplectens, Eragrostis curvula, Eragrostis gummiflua, Eragrostis patentissima, Harpochloa falx, Microchloa caffra, Panicum natalense, Setaria nigriorostris, Sporobolus africanus and Sporobolus pyramidalis*.

Herbs include *Hermania depressa, Becium filamentosum, Chamaecrista mimosoides, Euryops transvaalensis, Haplocarpha scaposa and Helichysum rugulosum*. Herbaceous climbers include *Rhynchosia totta. Geophytic* herbs include *Haemanthus montanus*. Succulent herbs include *Aloe dominella*, *Aloe greenii* and *Orbea woodii*

Endemic vegetation include low shrub such as *Barleria greenii*; succulent shrub such as *Aloe gerstneri* and succulent herb such as *Aloe inconspicua*.

Thukela Thornveld

The Thukela Thornveld vegetation unit is characterised by small trees such as *Acacia natalitia, Acacia nilotica, Acacia Siberiana, Acacia tortilis, Allohylus melanocarpus, Boscia albitrunca, Clausena anisata, Cussonia spicata, Dais cotinifolia* and *Ziziphus mucronata*.

Tall shrubs include *Coddia rudis, Buddleja saligna, Clerodendrum glabrum, Euclea crispa, Heteromorpha arborescens, Hibiscus calyphyllus, Lippia javanica, Pachystigma macrocalyx, Rhus pentheri* and *Rhus rehmanniana*. Low shrubs include *Barleria obtusa* and *Justicia flava*. Amongst soft shrubs is the *Peristrophe cernua*.

Woody succulent climbers include *Senecio brachypodus*. Graminoids include, amongst others, *Eragrostis curvula, Hyparrhenia hirta*, *Melinis repens, Panicum maximum, Themeda triandra, Tristachya leucothrix, Aristida congesta, Digitaria eriantha, Elionurus muticus, Eragrostis chloromelas, Eragrostis superba, Heteropogon contortus, Setaria sphacelata,* and *Sporobolus pyramidalis*.

Herbs include *Osteospermum muricatum*. Geophytic herbs include *Sansevieria hyacinthoides*. Succulent herbs include *Aloe mudenensis*.

KwaZulu-Natal Highland Thornveld is classified as Vulnerable by Ezemvelo KZN Wildlife; 66.87% is untransformed). Thukela Thornveld has a conservation status of Least Threatened according to the National Spatial Biodiversity Assessment (NSBA). As such the unit as a whole is not a high conservation priority in terms of habitat preservation. The transformation of 1.5 hectares of vegetation, some of which is degraded and bush encroached, would not significantly impact on conservation targets.

Please note that the site camp falls on a piece of cleared and ploughed agricultural land devoid of any indigenous vegetation, therefore the transformation of 0.4 hectares of disturbed ground would not impact on conservation targets.

A number of floral species of conservation importance occur within the municipality according to the Emnambithi Ladysmith Local Municipality: Strategic Environmental Planning Tool. The species modelled to occur on or near the proposed quarry site are listed in Table 4.

TABLE 4: FLORA SPECIES OF CONSERVATION IMPORTANCE PREDICTED TO OCCUR ON THE SITE

FORM/USES	SPECIES	CONSERVATION STATUS
Medicinal plant	*Alepidea amatymbica*	Vulnerable
Plant	*Barleria greenii*	Critically Endangered
Plant	*Bowiea volubilis*	Vulnerable
Medicinal plant	*Curtisia dentata*	Near Threatened
Plant	*Encephalartos cerinus*	Critically Endangered
Plant	*Encephalartos msinganus*	Unknown
Medicinal plant	*Eucomis autumnalis*	Declining
Plant	*Kniphofia flammula*	Endangered
Plant	*Ocotea bullata*	Lower Risk
Plant	*Stachys rivularis*	Data Deficient

Source: Emnambithi Ladysmith Local Municipality: Strategic Environmental Planning Tool complied by NEMAI Consulting

None of the above listed floral species were identified during the inspections of the proposed quarry site and the surrounding area.

Floral Species Identified During Site Inspections

The following plant species were identified by the EAP during the assessment of the site. Please note that the EAP's knowledge of indigenous plant species is limited and a vegetation survey of the site and plant rescue by a qualified botanist will be necessary to confirm plant species prior to the commencement of mining operations.

Red List and Protected Species

The proposed quarry site was found to contain a number of threatened, rare and protected plant species, listed in Table 5. The Red List species deserve special attention due to their recognition as being under threat of eventual extinction in the wild. The red listed species do not comprise highly significant threat ratings. With regard to the Schedule 12 provincially protected species, these are protected under KwaZulu-Natal Ordinance 15 of 1974 and permits would be required from Ezemvelo KZN Wildlife (EKZNW) prior to any potential damage or disturbance of the site.

TABLE 5: RED LIST AND PROTECTED FLORA SPECIES IDENTIFIED DURING SITE INSPECTIONS

BOTANICAL NAME	COMMON NAME	STATUS
A. marlothii	Mountain Aloe	Least Concern - EKZNW Schedule 12
A. dominella	Grass Aloe	Near Threatened - EKZNW Schedule 12
A. gerstneri	-	Vulnerable -EKZNW Schedule 12

TABLE 6: FLORA SPECIES IDENTIFIED DURING SITE INSPECTIONS

Botanical Name	Common Name	Status
A. karroo	Sweet Thorn	Least Concern
A. nilotica	Prickly Acacia or Egyptian Thorn	Least Concern
A. sieberiana	Paperbark Thorn	Least Concern
A. congesta	Aristida	Least Concern
A. junciformis	Bristle grass	Least Concern
B. inscuplta	Creeping Bluegrass	Least Concern
C. dactylon	Bermuda Grass	Least Concern
C. anisata	Horsewood	Least Concern
C. excavatus	Common turpentine grass	Least Concern
C. rudis	Small Bone-Apple	Least Concern
D. amplectens	Broad-leaved Bluestem	Least Concern
D. cinerea	Sickle Bush	Least Concern
D. lycioides	Transvaal Bluebush	Least Concern
D. tricholaenoides	Purple Finger Grass	Least Concern
D. eriantha	Finger Grass	Least Concern
E. crispa	Blue Guarri	Least Concern
E. curvula	Weeping Love Grass	Least Concern
E.s capensis	Heart Seed Love Grass	Least Concern
E. racemosa	Grass Species	Least Concern
G. heterophylla	Common Spike-thorn	Least Concern
H. rugulosum	Pink Everlasting	Least Concern
H. contortus	Tussock Grass	Least Concern
H. hirta	Common Thatching Grass	Least Concern
L. javanica	Fever Tea	Least Concern
M. repens	Natal Redtop Grass	Least Concern
P. maximum	Guinea grass	Least Concern
P. cernua	False Buchwheat	Least Concern
P. pentheri	Common Crowberry	Least Concern
S. africanus	African Bonebract	Least Concern
S. pyramidalis	Giant Rat's Tail Grass	Least Concern
T. triandra	Red Oat Grass	Least Concern
Z. mucronata	Buffalo Thorn	Least Concern

The site visit was not intended as an exercise to identify all species on the site, but was rather carried out to obtain an overall appreciation of the habitat on the site and to identify any important species.

The activities associated with the extraction of aggregate material would result in the almost complete removal of plants from the mining footprint. However, these impacts would be limited by the size of the operational footprint on a landscape scale, and the current state of the surrounding area in terms of the quality of vegetation cover. Also, the area would have to be rehabilitated once mining is completed. Furthermore, if the recommendations provided below, and the contents of the EMPR submitted to the Department of Mineral Resources are adhered to, it is highly unlikely that mining activities would have a detrimental impact on the floral species of conservation importance that occur on the site.

The impacts on floral species and vegetation types are unlikely to be significant.

Floral Management Recommendations

The following recommendations have been provided based on the findings of this assessment:

Vegetation Rehabilitation Plan

The Applicant, Site Manager or Land Owner shall appoint a suitably experienced botanist / horticulturist to survey the site prior to mining and compile a vegetation rehabilitation plan that shall detail plant translocation requirements, seed collection, seed mixing, seeding methods, planting and vegetation rehabilitation in all areas of the mining footprint. The Applicant, Site Manager or Land Owner and/or vegetation specialist shall submit the vegetation rehabilitation plan to the Environmental Control Officer (ECO*)* for approval.

The botanist / horticulturist shall be familiar with KwaZulu-Natal Highland Thornveld and Tugela Thornveld vegetation units and the vegetation composition of these areas. The vegetation rehabilitation plan shall include, but not be limited to the following:

- Seed requirements, harvesting methods and locations, seed storage methods;
- Plant translocation requirements;
- Handling and management of plant material rescued (translocation areas, propagation, etc.);
- Establishment and maintenance of a project-specific nursery, if required;
- Topsoil, mulch, fertiliser and soil stabiliser requirements and application during rehabilitation;
- Landscaping and re-vegetation methods for each area, i.e. hydroseeding / hydromulching, planting, including locations and timing;
- Procurement requirements and a list of species of plants to be procured, if any;
- Vegetation establishment and maintenance requirements (irrigation, etc.) for all re-vegetated areas; and
- The use of any herbicides and pesticides, if required.

General

- Ongoing identification of protected plants and trees. Any protected plants or trees in proximity to the construction servitude that will remain, should be marked clearly and must not be disturbed, defaced, destroyed or removed, unless otherwise specified by ECO. Acquire the necessary permits under the National Forests Act (No. 84 of 1998) if avoidance of protected trees of forested areas is not possible.
- All areas disturbed by mining activities, including access roads, storage and stockpiling areas, etc. shall be rehabilitated to the satisfaction of the EAP and landscaping contractor / horticulturist
- Certain areas may be identified where specific plants / trees could be planted successfully. All plants / trees used in re-vegetation shall be locally indigenous species only.
- Re-vegetation of mining footprint shall take place as soon as possible after completion of mining activities works. The timing of re-vegetation shall take cognisance of maintenance requirements and provision shall be made for any irrigation requirements
- No mining equipment, vehicles or unauthorised personnel shall be allowed onto areas that have been re-vegetated.

- All plant material for rehabilitation purposes shall be obtained from reputable nurseries and shall comprise locally occurring indigenous species only.

Plant Translocation

- All red listed and protected flora species of conservation significance must be avoided wherever possible. In the case of protected species permit authorization is imperative prior to such disturbance on the site.
- Any indigenous trees which constitute "forest" (i.e. three or more indigenous trees with connected canopies) will require a permit application to the Department of Agriculture, Forestry and Fisheries (DAFF) prior to their removal.
- Translocation of all rare or localised plant species within the site shall be undertaken before any mining activities commence. Translocation shall include the collection of plants, cuttings and, where applicable, seed.
- Propagation of seed and cuttings for propagation purposes may be undertaken within no go areas under the supervision of the ECO.
- Rescued plant material shall either be planted nearby within suitable habitats in areas that will not be disturbed in the foreseeable future.
- Relocation of plants of conservation importance should be implemented by a qualified plant specialist.

Fertiliser

- The use, storage and handling of fertiliser shall be strictly controlled.
- Fertilisers shall be suitably stored in sealed containers in areas approved by the ECO.
- Care shall be taken when using fertilisers near no-go areas, watercourses and wetland areas and other sensitive natural areas.
- Soil shall be well watered and moist before any fertiliser is applied.

Plants / Trees

- The botanist / horticulturist must count the number of indigenous tree that will be lost to mining activities. Based on these findings, the applicant must obtain the exact number of indigenous trees for re-planting during the rehabilitation process.
- The handling, maintenance and planting of plants / trees shall be undertaken under supervision of the appointed botanist/ horticulturist.
- The Applicant or Site Manager shall ensure that each plant / tree is handled and packed in the approved manner for that species or variety, and that all necessary precautions are taken to ensure that the plants arrive on site in a proper condition for successful growth.
- Plants shall be protected from wind during transportation. No plants with exposed roots shall be subjected to prolonged exposure to drying winds and sun, or subjected to water logging or force-feeding at any time after purchase.
- The Applicant or Site Manager shall ensure that the plants are in a good condition and free from plant diseases and pests. If they are uncertain of the condition of the plants, the botanist / horticulturist must be asked to assist in the assessment and removal of any plants infected with disease and/or pests from the site.
- All plants supplied by the Applicant or Site Manager shall be healthy, well formed, and well rooted. Roots shall not show any evidence of having been restricted or deformed at any time. The potting materials used shall be weed free.
- There shall be sufficient topsoil around each plant to prevent desiccation of the root system.

Alien Vegetation Control

- Although invasive alien plants are not very prevalent at the site, eradication and control is strongly recommended to prevent proliferation and spread of these species at the site and into adjoining habitats. Alien infestations arising from neighbouring properties will need to be managed on a continual basis.

- Control of alien invasive species and noxious weeds in line with the requirements o the Conservation of Agricultural Resources Act will be undertaken. Strict control to prevent the establishment and spread of Sickle Bush should be implemented.
- It is also essential that regular monitoring of the project site be undertaken to ensure that alien vegetation does not become established in disturbed areas. Initiate control measures immediately upon evidence of alien vegetation species introduction or spread.
- If any alien vegetation clearing is required within no-go areas on the property (watercourse, heritage sites and buffer zones), this shall not take place without the written approval of the ECO. All alien vegetation removal within no-go areas shall be supervised by the ECO.
- Spraying of herbicides / pesticides should not take place under windy conditions and must comply with OHSA specs and other chemical handling laws.
- Avoid applying herbicides if heavy rain or windy conditions are forecasted.
- Application of herbicides and pesticides must be according to the manufactures instructions.
- To minimize the impacts on the watercourse and the buffer zone, employees tasked with removing alien vegetation must cut/slash/break individual plants and paint the herbicide on the exposed stems.

Other Recommendations

- No vegetation disturbance must be allowed outside of the demarcated mining footprint.
- Removal of medicinal plants by construction workers must not be allowed.
- No trees to be felled for fuel purposes.

Further recommendations in addition to those mentioned above have been captured in the Environmental Management Programme (EMPR) that will be submitted to the Department of Mineral Resources for consideration.

6.3 FAUNAL ASSESSMENT

The following faunal species have been modelled to occur in the vicinity of the proposed quarry site, based on various documentation and databases.

Birds

The site inspections revealed the following:

- A large unoccupied Hamerkop (*Scopus umbretta*) nest was observed within the abandoned quarry close to location of the proposed quarry site. It appears that the nest has not been used for a prolonged period of time because of its dilapidated appearance. If the nest was occupied, the occupants would bring in fresh nesting material (reeds, leaves and mud) to maintain the nests structural integrity on a regular basis. It is the opinion of the Environmental Assessment Practitioner, that should mining activities commence on the proposed site, the pair of Hamerkops responsible for the construction of the abovementioned nest would be driven away by the blasting and the constant presence of humans and vehicles. There are sufficient roosting, foraging and breeding opportunities for this species in the area around Colenso and the surrounds.
- Hamerkop nest platforms provide breeding, roosting and foraging opportunities for other bird species. Hamerkop nests are often used by Spotted Eagle Owl (*Bubo africanus*), Cape Eage Owl (*Bubo capenis*), Giant Eagle Owl (*Bubo lacteus*) and other birds of prey for the establishment of their nests. Southern Ground Hornbills (*Bucorvus leadbeateri*) have also been observed occupying large nesting platforms in the Kruger National Park. However, the accessibility and exposed nature of the location of the nest within the abandoned quarry would discourage occupation for breeding purposes.
- Several ledges and boulders towards the top of the rock face showed signs of regular use as roosting sites for bird species. The build up of guano on the rock face below these sites was evidence of regular occupation. The Environmental Assessment Practitioner observed a bird of prey leaving a rock ledge and flying away from the quarry face in a north east direction during the course of the first site visit. The bird was likely to be a falcon or kestrel. The fast flight away from the rock face further confirmed this theory. These roosting sites will be lost the proposed aggregate mining operations, and the bird species frequenting the abandoned quarry rock face would be forced to relocate to other suitable rock faces in the area around Colenso and the surrounds.
- The abovementioned rock ledges, cracks and cavities within the quarry rock face may provide foraging opportunities for several bird species. Gymnogenes (*Polyboroides typus*) are known to forage in such areas. Other birds of prey would use the ledges as vantage points from which to hunt. Smaller insect eating bird species such as shrikes, starlings, chats, robins and thrushes would forage amongst the dislodged rock and boulder material at the base of the rock face, and cavities and cracks further up the rock face for their insect prey. Bronze Manikins (*Spermestes cuullatus*) and Redwing Starlings (*Onychognathus morio*) were seen foraging on the site. All the foraging sites within the boundaries of the proposed quarry site would be lost, Bird species that frequent the abandoned quarry rock face and surrounding area for foraging purposes would be forced to relocate to other suitable habitats in the area around Colenso and the surrounds.

The list of important bird species potentially present or affected by activities on the site, listed in Table 7, was obtained from the Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Barnes, 2000), Roberts Online- Birds of Southern Africa (http://www.robertsonline.co.za) as well as the SANBI Bird in Reserves Project website (http://www.birds.sandi.org).

TABLE 7: BIRD SPECIES PREDICTED TO OCCUR N THE SITE

SCIENTIFIC NAME	COMMON NAME	STATUS
Bugeranus carunculatus	Wattled Crane */**/***	Critically Endangered
Hirundo atrocaerulea	Blue Swallow ***	Critically Endangered
Bucorvus leadbeateri	Southern Ground Hornbill **	Endangered
Gypaetus barbatus	Bearded Vulture */**/***	Endangered
Lioptilus nigricapillus	Bush Blackcap **	Near Threatened
Zoothera gurneyi	Orange Ground Thrust **	Near Threatened
Stephanoaetus coronatus	Crowned Eagle *	Near Threatened
Anthropoides Paradisea	Blue Crane */**/***	Vulnerable
Balearica regulorum	Grey Crowned Crane */**/***	Vulnerable
Gyps africanus	African White-Backed Vulture *	Vulnerable
Gyps coprotheres	Cape Vulture *	Vulnerable
Hemimacronyx chloris	Yellow Breasted Pipit **	Vulnerable
Neotis denhami	Denham's Bustard **/***.	Vulnerable
Typo capensis	Grass Owl ***	Vulnerable
Eupodotis cafra	Whitebellied Korhaan **/ ***.	Vulnerable
Neotis denhami	Stanley's Bustard **/ ***.	Vulnerable
Falco Naumanni	Lesser Kestrel *	Vulnerable
Circus ranivorus	African Marsh Harrier **	Vulnerable
Polemaetus bellicosus	Martial Eagle *	Vulnerable

Source: Emnambithi Ladysmith Local Municipality: Strategic Environmental Planning Tool and Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Barnes, 2000)

The proposed aggregate mining operations are unlikely to significantly impact on the above listed Red Data birds due to the following:

- The significance of the impact expected on an individual species is related to its spatial requirements versus the size of the proposed quarry site. Wide-ranging bird species that require more than 100 km² of territory, like the abovementioned crane and raptor species (*) are least likely to be impacted.
- The loss of foraging and breeding habitat for the species covering smaller home ranges (**) will be minimal due to the small size of the proposed quarry site and absence of suitable breeding and foraging

sites. Good habitat will remain in the surrounding areas, including the Tugela Private Game Reserve and Tugela Drift Nature Reserve.

- The woodland habitat on the site is not ideal natural habitat for specific avian species mentioned above .i.e. grassland, wetland or riparian habitats (***).

Impacts on conservation important bird species are unlikely to be significant.

Mammals

The site inspections revealed the following:

- The spoor and faecal material of a mongoose was noted near the watercourse crossing point to the north west of the proposed quarry site.
- The spoor of several domestic dogs was seen on the site. Regular occurrence of domestic dogs in the general vicinity of the proposed quarry site would deter larger mammals from utilising the proposed quarry site.
- The cattle, horses and goats utilise the site. Several points along the watercourse in the vicinity of the proposed site had been heavy trampled by livestock. The regular movement of livestock through the area would deter indigenous disturbance sensitive mammals from utilising the proposed quarry site.
- There is a high level of human disturbance on the site, with poaching likely on the property.

Data on mammal species listed in Table 8 was obtained from the Red Data Book of Mammals of South Africa, the Emnambithi Ladysmith Local Municipality: Strategic Environmental Planning Tool, and various local publications on indigenous wildlife such as *Wild Ways (1997)* and *Smither's Mammals of Southern Africa* (2000) written and edited by Mr P. Apps. The *Oribi Antelope: Population and Habitat Viability Assessment Report* (2006) complied by EKZNW, Endangered Wildlife Trust, Oribi Working Group and the Conservation Breeding Specialist Group – Southern Africa, was reviewed in order to establish whether the site and the remainder of the property was suitable for Oribi. These findings were verified against the EKZN Minset Database for the area.

TABLE 8: RED DATA MAMMALIAN SPECIES PREDICTED TO OCCUR ON THE SITE

SCIENTIFIC NAME	COMMON NAME	STATUS
Chrysospalyx villosus	Rough-haired Golden Mole	Critically Endangered
Myosorex varius	Forest Shrew	Endangered
Crocidura flavescens	Greater Red Musk Shrew	Endangered
Poecilogale albinucha	Striped Weasel	Rare
Ourebia ourebi	Oribi Antelope	Vulnerable
Orycteropus afer	Aardvark	Vulnerable
Mystromys albicaudatus	White- Tailed Mouse	Vulnerable
Amblysomus hottentotus	Hottentot Golden Mole	Data Deficient

Source: Smither's Mammals of Southern Africa (2000) & Emnambithi Ladysmith Local Municipality: Strategic Environmental Planning Tool (2010)

The proposed aggregate mining operations are unlikely to significantly impact on the above Red Data mammals due to the following:

- Local populations of the abovementioned mouse and shrew species will be negligibly impacted by the mining activities due to the small size of the site in context of the available similar habitat in the surrounding areas.
- The Minset Database has predicted the occurrence of the Rough-haired Golden Mole (*Chrysospalyx villosus)* in the vicinity of the site. This species is classified as critically endangered according to the IUCN List of Threatened Species. Please note that only three specimens have been collected in Southern Africa since 1980, and none of these were collected in the vicinity of the site. Furthermore, this species favours

sandy soils in grasslands, meadows and along the edges of marshes in savannah and grassland biomes. As already indicated, the site is covered by woodland and the area is characterised by shallow soils and rocky terrain. Therefore, it is unlikely that this mole species will be encountered on the proposed quarry site.

- The Red Data Book of Mammals and Smithers' Mammals of Southern Africa both indicate that the Hottentot Golden Mole (*Amblysomus hottentotus)* could potentially occur in the area. However, other documentation and databases refer to Pietermaritzburg being the southernmost distribution point of the species. This species tends to favour coastal forest, temperate grassland, montane vleis and tree savannah with sandy soils. However, the site is characterised by shallow soils and rocky terrain making it unsuitable habitat for this species. It is unlikely that this mole species will be encountered on the proposed quarry site.
- Smither's Mammals of Southern Africa indicates that Aardvark (*Orycteropus afer*) occur in the southern region of the Emnambithi Ladysmith Local Municipality. This species is unlikely to be affected due to the scale of its habitat, absence of termite mounds in the area, and no evidence (spoor, faecal material and evidence of foraging) was found.
- The Striped Weasel (*Poecilogale albinucha*) suffers from predation and competition with domestic dogs. Furthermore, it is heavily exploited for traditional medicine and magic by local communities. The area in the vicinity of the proposed quarry site is easily assessable to the local people and domestic dogs from nearby homesteads. It is unlikely that this species would be found foraging, sheltering or breeding on the site or its surrounds
- Oribi favour moist grassland on flat to gently undulating terrain. Research has found that 90% of the Oribi within the Highmoor Nature Reserve occur on slopes less than 15°. Within the Giants Castle Nature Reserve, Oribi favour gentle slopes (5° or less) and gentle undulating plateaus and ridge tops with a slope of less than 10°. Within the Transvaal, Viljoen (1982), found Oribi to prefer plateaus and spurs of between 1° and 20°. Furthermore, Oribi tend to favour the north and east facing slopes and show a negative selection towards the south and south-eastern facing slopes. The site is characterised by steep hilly, undulating terrain with broad relatively flat valleys in some areas. The proposed quarry site is located on the crest of a dolerite sill, with the exposed rock face of the existing quarry presenting a vertical drop of 90° to the valley floor below. The remainder of the areas is largely undisturbed and characterised by rising and falling terrain with slopes exceeding 20° in some places; the site is exceedingly rocky. The majority of the site falls away at roughly 15° towards the south away from the existing quarry rock face. Furthermore, the untouched portion of the proposed quarry site is south facing. The remainder of the site that was disturbed in the past by mining operations is facing north i.e. the existing quarry rock face. Oribi show a preference for open natural grassland dominated by *Themeda triandra*, veld hayfields and planted hayfields – the vegetation covering the site is characterised by tall tussock grassland mainly comprising of *Hyparrhenia hirta* with areas of *Acacia* woodland. The presence of domesticated and feral dogs in the area poses a serious threat to local fauna populations

  It is therefore unlikely that Oribi would be utilising the site or its surrounds.

Therefore, based on the findings of this assessment impacts on conservation important mammal species are unlikely.

Reptiles

Data on reptile species of conservation importance was based on information obtained from the Emnambithi Ladysmith Local Municipality: Strategic Environmental Management Tool, the EKZNW Strategic Environmental Assessment Report, and the EKZNW Minset Database for the area. The species predicted to occur on the site are included in Table 9.

TABLE 9: REPTILE SPECIES OF CONSERVATION IMPORTANCE PREDICTED TO OCCUR ON THE SITE

SCIENTIFIC NAME	COMMON NAME	STATUS
Bradypodion thamnobates	Natal Midlands Dwarf Chameleon	Near threatened
Bradypodion melanocephalum	Black-Headed Dwarf Chameleon	No entries found
Scelotes bourquini	Bourquin's Dwarf Burrowing Skink	No entries found

Source: Emnambithi Ladysmith Local Municipality: Strategic Environmental Planning Tool

The chameleon and skink species are unlikely to be significantly impacted on by the proposed activity, primarily due to the small scale of the activity and the suitability of surrounding habitat to sustain the local population. A chameleon sweep prior to mining commencing is recommended at the first point of activity. Thereafter, these species are likely to avoid the active mining areas due to the disturbance that the mining activities will create.

Therefore, based on the findings of this assessment impacts on conservation important reptiles species are unlikely.

Amphibians

The Strategic Environmental Management Tool for the municipality indicates that Long-Toed Tree Frog (*Leptopelis xenodactylus)* and Natal Spiny Reed Frog (*Afrixalus spinifrons)* may occur in the area. Please refer to Table 10 below:

TABLE 10: RED DATA AMPHIBIAN SPECIES PREDICTED TO OCCUR WITHIN THE EMNAMBITHI LADYSMITH LOCAL MUNICIPALITY

SCIENTIFIC NAME	COMMON NAME	STATUS
Leptopelis xenodactylus	Long-Toed Tree Frog	Endangered
Afrixalus spinifrons	Natal Spiny Reed Frog	Vulnerable

Source: Emnambithi Ladysmith Local Municipality: Strategic Environmental Planning Tool

- *Afrixalus spinifrons intermedius* (Red Listed as Vulnerable), the Natal Spiny Reed Frog, is predicted to occur in the area. This species is endemic to South Africa. It inhabits Coastal Bushveld-Grassland and Moist Upland Grassland. At higher altitudes it inhabits marshes, dams, floodplains and riverbanks. This species is therefore likely to be present on the natural grassland and wetland areas associated with water resources.
- *Leptopelis xenodactylis* (Red Listed as Endangered), the Long-toed Tree Frog, is also predicted to occur in the area. This species is endemic to south-eastern South Africa in the southern KwaZulu-Natal province highlands, and marginally in Eastern Cape Province. It is not found on the steep slopes of the escarpment, and is usually found between 1,000 and 1,830m a.s.l. It occurs in grassland, keeping to areas away from trees, and breeds in upland bogs, grassy wetlands and marshes, generally using semi-permanent water. Eggs are presumably laid in a nest on the ground near water. It has a small range, and lives in a habitat that is threatened by afforestation, fire, and the spread of alien plants that lower the water table (leading to drying out of breeding sites).

These species are unlikely to be impacted on due to unsuitable habitat in the area proposed to be mined. Impacts on conservation important amphibian species are therefore unlikely.

Insects

The EKZNW Minset and SEA Databases have predicted the occurrence of a number of invertebrate species of conservation importance on the site (Table 11).

TABLE 11: INSECT SPECIES OF CONSERVATION IMPORTANCE PREDICTED TO OCCUR ON THE SITE

SCIENTIFIC NAME	COMMON NAME	GROUP
Chrysoritis oreas	Drakensburg Daisy Copper Butterfly	Butterfly (Insect)
Eremidium erectus	Species of Grasshopper	Grasshopper (Insect)
Transvaaliana draconis	-	Grasshopper (Insect)
Doratogonus montanus	-	Millipede (Insect)
Centrobolus tricolor	Three-coloured Red Millipede	Millipede (Insect)
Spinotarsus triangulosus	-	Millipede (Insect)

The following applies:

- The three millipede species that have been predicted to occur in the vicinity of the proposed site are *Spinotarsus triangulosus, Centroblus tricolor* and *Doratogonus montanus.* All three of the species are recognised as being of 'Least Concern' according to the IUCN Red Listed criteria. These species have been recorded inhabiting indigenous grasslands, woodlands and forested areas in the past and there is a possibility that these species may be present on the site. If present, adjacent areas would provide sufficient habitat for the persistence of any populations present.
- Two species of grasshoppers have been predicted to occur in the area. *Eremidium erectus* and *Transvaaliana draconis* inhabit grassland areas. If present, adjacent areas would provide sufficient habitat for the persistence of any populations present.
- The Drakensburg Daisy Copper Butterfly *(Chrysoritis oreas*) is classified as lower risk/near threatened according to the ICUN Red List of Threatened Species. It is highly unlikely that this species would be found on the site. The species is known from specimens collected in the area around the Town of Bulwer within the Drakensberg Mountain Range. A hot spot for the species is located on the slopes of Bulwer Mountain. No specimens of this species of butterfly have been recorded in the vicinity of the proposed quarry site. In addition, the adult butterflies feed on flowers of protea species (*Thesium sp*) - the EAP did not identify any individual specimens belonging to genus *Thesium* in the vicinity of the site.

Therefore, based on the findings of this assessment impacts on conservation important insect species are unlikely.

Fauna Management Recommendations:

The following recommendations have been provided based on the findings of this assessment:

- Construction staff will be educated in relation to the risks of fauna deaths and how to manage animals which are injured or displaced.
- Under no circumstances shall any fauna be handled, removed, killed or interfered with by the Applicant, Site Manager, Land Owner, his employees, his subcontractors or his subcontractors' employees. However, if mining activities are likely to injure, kill or interfere with any fauna encountered on the site, appropriate action must be taken to ensure their preservation.
- Non-venomous fauna encountered during clearing activities will not be unduly stressed and will be provided with opportunities to disperse into surrounding indigenous vegetation. Fauna unable to disperse or noted to be in distress will be safely caught, removed and transported to an undisturbed area a suitable distance away from the mining activities is advisable.

- Venomous fauna encountered on the site must be removed and released by a professional/ expert e.g. herpetologists are responsible for removal of venomous snake species. If this is not possible, the venomous must be left undisturbed and allowed to move off the site itself without any interference, disturbance or irritation caused by the Applicant, Site Manager, Land Owner, his employees, his subcontractors or his subcontractors' employees.
- Where safety allows, prior to the felling of large trees, check tree hollows for fauna and allow them to move away from the clearing area.
- No fauna may be fed by the Applicant, Site Manager, Land Owner, his employees, his subcontractors or his subcontractors' employees on or near the mining site.
- No deliberate lighting of fires for heating, cooking or burning of waste will be permitted.
- Poaching of fauna is prohibited and anyone caught will be subjected to appropriate disciplinary action and eventual dismissal.
- Please note all mining activities must cease if fauna is encountered on the site. Mining activities can only restart once the fauna has been caught and removed from the area.
- Disturbance to fauna and their habitats in the vicinity of the mining site must be minimised wherever possible. Temporary fencing or barriers will be erected in areas likely to be used as fauna corridors, to cordon off "No-Go" areas like watercourses and their buffer zones etc.
- Recommended measures include that mining infrastructure should be screened wherever possible from ecologically sensitive areas to reduce the human disturbance factor.
- During mining operations, use should be made of the existing access route to the mining site. Construct approved vehicle turning areas, avoiding selected ecological sensitive areas or species, and have turning area routes approved by the ECO.
- Applicant and/or Site Manager must ensure that all mining personnel, labourers and equipment remain within the demarcated mining site at all times. Where mining personnel and/or equipment wish to move outside the boundaries of the site, the Applicant and/or Site Manager and their employees must obtain permission in writing from the ECO.
- All workers will be informed of sensitive fauna on the site and the appropriate speed limit set at 30 km/hr within the mining envelope to minimise chance strikes of fauna.
- Vehicular movement (construction vehicles) will be limited to operational hours so as to minimise disturbance to fauna.
- The Applicant and/or Site Manager and their employees shall not bring any domesticated animals onto the site.
- The Applicant and/or Site Manager shall ensure that the work site be kept clean, tidy and free of rubbish that would attract animals.
- Gates will be left as found to prevent unauthorised livestock movements. Any unintentional livestock movements, e.g. through fences or gates, will be reported immediately to the ECO who will seek landowner assistance in removing them from the site.

Further recommendations in addition to those mentioned above have been captured in the Environmental Management Programme (EMPR) that will be submitted to the Department of Mineral Resources for consideration.

7. WATER RESOURCES

In terms of the provisions of the National Water Act 36 of 1998, water resources must be suitably protected against contamination and destruction by development related activities. In accordance with the contents of the Act, it was necessary to appoint a wetland and riparian specialist to assess and delineate the Hermanspruit Stream located to the north of the proposed quarry site. This watercourse runs down the Hermanspruit Valley from the west, into the Klip River to the east and falls outside of the boundaries of the proposed site. Please see Annexure A, B and F for visual confirmation of the locality of the watercourses and the buffer zone. The Riparian Delineation Report has been included in Annexure J of this report and the environmental component of the appendix section of the mining application submitted to Department of Mineral Resources.

Figure 12: The watercourse that runs from west to east, across the front of the site.

Figure 13: Looking back towards the railway line and the location of the deteriorating structures fro the previous mining operations on the property

Mining related activities can have a severe detrimental impact on watercourses and every precaution must be taken to ensure it is appropriately protected at all times. Based on this, the Wetland and Riparian Specialist in consultation with the EAP has made the following recommendations:

- A 30 m "Mining Exclusion Zone" must be established around the watercourse in which no mining activities may take place. This would protect the watercourse and riparian vegetation from impacts stemming from mining activities.
- The mining activities must be separated from the stream by a cut-off drain routed into a dry pond, which allows for settling out of sediment prior to release into the stream.
- Any areas identified by the EAP as being ecologically sensitive adjacent to any quarry work area will be suitably demarcated to prevent damage by alien vegetation encroachment and mining activities. The use of marked wooden stakes at suitably close intervals to indicate the perimeter of the "No – Go" areas is advisable.
- The movement of vehicles and employees within the watercourse and the buffer zone is prohibited, unless this occurs on existing access roads.
- The erection of structures and infrastructure of any kind associated with mining activities within the watercourse and the buffer zone is prohibited.
- The establishment of stockpile areas and refuse dumps within the watercourse buffer zone is prohibited. The stockpiling of soil or any other materials must not be allowed near watercourses to prevent pollution or impediment to surface runoff. Controls must be put in place to mitigation measures to prevent the erosion of stockpiles.
- The Applicant / Employees shall not be permitted to use any watercourse or natural water source adjacent to or within the designated mining site for any operational / processing purposes including of bathing, washing of clothing of for any construction related activities. Municipal water (or another suitable domestic source approved by the Applicant, Site Manager or Land Owner) must instead be used for all activities undertaken on the site.
- Every effort should be made to ensure that any chemicals or hazardous substances do not contaminate any water resource in the vicinity of the mining site. Washing of vehicles and equipment on site is prohibited.
- Storage of potentially hazardous materials must be above the 100-year flood line, or as agreed with the EAP/ECO. These materials include fuel, oil and herbicides.
- All hazardous materials and waste must be stored within an impermeable bunded area.
- Any soil contaminated during spillage of hazardous waste must be collected in impermeable containers or drums and stored within the bunded area. Please note that a registered hazardous waste removal company would need to be appointed to transport this hazardous waste to a registered landfill site.
- Special care must be taken at all times to protect indigenous vegetation in "No – Go" areas from trampling, herbicide drift, etc.

Further recommendations in addition to those mentioned above have been captured in the Environmental Management Programme (EMPR) that will be submitted to the Department of Mineral Resources for consideration.

8. ARCHAEOLOGICAL, HISTORICAL AND PALEONTOLOGICAL ASSESSMENTS

In terms of the KwaZulu-Natal Heritage Act No. 4 of 2008, any transformation on land of area greater than 2500 m² for development purposes requires a Heritage Impact Assessment.

Afzelia initially assessed the proposed quarry site and surrounding area to establish whether sites and artefacts of Heritage and cultural significance occurred in the area. The purpose of the abovementioned assessment was to determine whether the altered landscape and dilapidated remnants of the abovementioned structures were of Heritage and Cultural Significance.

The following was noted during the second inspection of the site:

- A man-made platform of rocks near the edge of the quarry.
- Stone walling located in the centre of the proposed quarry site. Site consisted of stonewalled circular of around 2 metre radius.
- Several stone walls and foundations observed from the top of the koppie in the valley below.

Figures 14 to 17 below are of the suspected heritage sites found on the prospered quarry site during the second site inspection.

Figure 14: Stone wall found near the edge of the quarry rock face on the proposed quarry site

Figure 15: Stone structure covered in vegetation on the proposed quarry site

Figure 16 & 17: Stone structures observed from the top of the koppie in the valley below

Based on the findings of the site inspections, *Umlando: Archaeological Tourism and Resource Management* was contracted by *Afzelia Environmental Consultants cc* to undertake archaeological, historical and paleontological assessments in terms of the abovementioned Act. For further details about the findings of these assessments please see the attached Heritage Impact Assessment in Annexure G.

The following recommendations must be implemented to ensure legal compliance and limit the impact on Heritage resources in the vicinity of the proposed quarry site:

Artefacts

- All artefacts identified by the Heritage Practitioner must be removed from the area prior to the commencement of mining operations.
- An application for a permit from AMAFA must be obtained as this is a specific requirement of the Act, against which severe penalties for non-compliance with the Act will be implemented.
- Only an accredited Heritage Practitioner or accredited official from AMAFA may remove, handle or transport artefacts. No employee of the Applicant may remove, damage or destroy any artefact.
- All employees must be required to attend a heritage compliance training session held by the Environmental Control Officer and/or Heritage Practitioner. An isiZulu translator may be required.
- Removed artefacts must be securely stored at an appropriate institution. In this case, it would be AMAFA KZN.
- Prior to the commencement of mining operations, a permit must be applied for and granted by AMAFA for the use of a metal detector to examine the Heritage sites located on and near the proposed quarry site in an attempt to identify other artefacts.
- The Heritage specialist and the ECO recommend the removal of all vegetation cover obscuring some of the areas identified in the Heritage assessment report by hand i.e. hand pulling, chopping down or poisoning. No bulldozers, excavators, trucks or other heavy vehicles will be permitted to undertake any part of the above vegetation removal.

Structures

- In terms of the Act, no structure which is, or which may reasonably be expected to be older than 60 years, may be demolished, altered or added to without the prior written approval of the Council having been obtained on written application to the Council.

- Approval for the demolition of the heritage sites located within the proposed quarry site must be obtained from AMAFA prior to the commencement of mining operations in writing. No verbal approvals will be accepted.

Grave Sites

- In terms of the Act, all grave sites identified in the vicinity of the proposed site must be clearly demarcated before the commencement of mining operations.
- A 20 m buffer zone has been established around known grave site in which no mining activity may take place. The true extent of the grave site must be established before commencement of mining to allow the true extent of the site to be buffered and effectively fenced.
- All grave sites within 100 metres (m) of the quarry must securely fence off and an access gate provided.
- Appropriate signs indicating heritage status of the site must be erected.
- A distance of 10-20 m must be left undisturbed between the graves and the fence around the grave site.
- All grave sites must be respected and regarded as "no-go" areas.
- All access/ haulage roads and site infrastructure must be planned and positioned to avoid grave sites.
- Any employee caught damaging, destroying or moving any contents or part of graves must be subjected to appropriate disciplinary action.
- If grave sites are discovered during the mining process, the following procedures must be followed:
    - Mining activities must cease in the vicinity of the discovery.
    - The finding must be reported to the nearest South African Police Station.
    - The ECO must be notified immediately.
    - Report the finding to AMAFA and await the findings of their investigation.

Based on the findings of AMAFA, the grave site will either be relocated or the mining operations moved to leave the grave site/s in an undisturbed state.

Grave Relocations

The process of grave removals is a complex one that requires community consultation, advertisements, several permits, and finally reburial. Moreover, those graves older than 60 years require qualified archaeologists to undertake the entire process. This process is summarised as follows:

In terms of the National Heritage Resources Act (No. 25 of 1999), and KZN Heritage Act of 1997 and 2008, graves older than 60 years (not in a municipal graveyard) are protected. Human remains younger than 60 years should be handled only by a registered undertaker or an institution declared under the Human Tissues Act. Anyone who wishes to develop an area where there are graves older than 60 years is required to follow the process described in the legislation (section 36 and associated regulations). The specialist will require a permit from the Heritage resources authority:

- Determine/ confirm the presence of the graves on the property. Normally the quickest way to proceed is to obtain the service of a professional archaeologist accredited to undertake burial relocations. The archaeologist will provide an estimate of the age of the graves. There may be a need for archival research and possibly test excavations (permit required).
- The preferred decision is to move the development so that the graves may remain undisturbed. If this is done, the developer must satisfy SAHRA/KZN Heritage that adequate arrangements have been made to protect the graves on site from the impact of the development. This usually involves fencing the grave (yard) and setting up a small site management plan indicating who will be responsible for maintaining the graves and how this is legally tied into the development/mining operation. It is recommended that a distance of 10-20 m is left undisturbed between the grave and the fence around the graves.

If the developer wishes to relocate or disturb the graves:

- A 60-day public participation (social consultation) process as required by section 36 (and regulations - see attachment), must be undertaken to identify any direct descendants of those buried on the

property. This allows for a period of consultation with any family members or community to ascertain what their wishes are for the burials. It involves notices to the public on site and through representative media. This may be done by the archaeologist, who can explain the process, but for large or sensitive sites a social consultant should be employed. Archaeologists often work with undertakers, who rebury the human remains.

- If as a result of the public participation, the family (where descendants are identified) or the community agree to the relocation process then the graves may be relocated.
- The archaeologist must submit a permit application to SAHRA/KZN Heritage for the disinterment of the burials. This must include written approval of the descendants or, if there has not been success in identifying direct descendants, written documentation of the social consultation process, which must indicate to SAHRA's satisfaction, the efforts that have been made to locate them. It must also include details of the exhumation process and the place to which the burials are to be relocated. (There are regulations regarding creating new cemeteries and so this usually means that relocation must be to an established communal rural or formal municipal cemetery.)

Permission must be obtained before exhumation takes place from the landowner where the graves are located, and from the owners/managers of the graveyard to which the remains will be relocated. Other relevant legislation must be complied with, including the Human Tissues Act (National Department of Health) and any ordinances of the Provincial Department of Health). The archaeologist can usually advise about this.

Amafa Contact Details

AMAFA Head Office in Ulundi (AMAFA has a satellite office in Pietermaritzburg)

Tel: 033 394 6543
Fax: 033 342 6097
Postal Address: PO Box 523, Ulundi, 3838

Please note the recommendations and directives contained within the Heritage Impact Assessment Report and EMP not alluded to here, must be adhered to at all times.

9. SIGNIFICANT RATING OF IMPACTS

Please see Annexure H for details related to the significance rating of all potential impacts stemming from the aggregate mining operations on the property before and after implementation of mitigation measures recommended in this Ecological and Biodiversity Screening, Heritage Impact and Riparian Delineation Reports and submitted EMP.

10. GENERAL AGGREGATE MINING RECOMMENDATIONS

The following recommendations are in addition to those in the body of the document, and would assist in mitigating the potential negative impacts associated with mining activities:

Haulage and Access Roads

- Access to site must be via existing or planned roads only. They must not be created on an ad-hoc basis.
- The Applicant, Land Owner or Site Manager will have to ascertain the existing condition of access roads and repair accordingly should damage occur due to mining activities.
- All routes must be clearly defined with white stakes/painted rocks and disturbance outside these areas will not be permitted.
- Roads should not increase runoff or erosion.
- Road width and total length should be minimised to reduce extent of impact on surrounding area.
- Turning points will be marked out on the site / corridor for easy identification by employees. No turning manoeuvres other than at designated places shall be permitted.
- To increase the longevity, reduce dust and erosion should be well surfaced with durable materials of suitable size, and surface cross slopes should facilitate good drainage.
- The location of all underground services and servitudes must be identified and confirmed. Even after consultation with the utility companies/organisations, it is possible that additional service runs may be uncovered and damaged during the construction process. Should such damage occur, the contractor shall immediately inform the relevant utility company/organisation and shall facilitate/ undertake a prompt and speedy repair to ensure that nuisance/ waste of resources/ pollution are all minimised.
- The watercourse and the 30 m buffer zone must be accurately delineated on the ground, pegged and cordoned off prior to the commencement of mining activities to avoid vehicles entering these areas.
- Heritage sites (grave sites and structures) must be appropriately fenced off and signage installed prior to the commencement of mining operations indicating the presence of a heritage site to avoid vehicles driving through these areas.
- The Applicant, Land Owner or Site Manager must take into account any limitations identified, and adhere stringently to the recommendations and directives captured in the environmental screening report and specialist studies when deciding on an access route to the mining site. For example:
- The Applicant/Land Owner/Site Manager must familiarize themselves with the recommendations and directives captured in the environmental screening report, EMPR and specialist studies prior to the commencement of mining operations. Please note that ignorance is not an excuse for failing to comply with the directives contained within any of the abovementioned reports and the responsible parties will be subjected to appropriate penalties.

Flora and Fauna

- Prior to clearance of vegetation each specific plot site should be inspected for the presence of the Red Data Book / Specially Protected plant species predicted to occur on the property. If any are found then the specimen should be buffered 4m diameter (preferred) or translocated to a suitable area.
- No vegetation may be cleared without prior permission from the ECO.
- Disturbance to birds, animals and reptiles and their habitats should be minimised wherever possible. Development infrastructure should be screened wherever possible from ecologically sensitive areas to reduce the human disturbance factor.
- All employees will be informed of sensitive fauna on the site and a speed limit set within the development envelope to minimise chance strikes of fauna.
- Vehicular movement will be limited to operational hours so as to minimise disturbance to fauna.
- The removal of indigenous flora and fauna from the area for bush meat, traditional medical purposes or fire wood is prohibited and severe penalties will be imposed on any employee caught contravening this directive.
- A chameleon sweep prior to mining commencing is recommended at the first point of activity

Stockpiling

- Stockpiles must be located within identified stockpiling areas
- Stockpile areas must be carefully planned to avoid unnecessary disturbance of the natural environment and modification of drainage patterns.
- Location of stockpile sites must not cause damming of water or runoff, nor expose stockpiles to erosion.
- Stockpiles must be located on disturbed portions of the property. If this is not possible, an area must be identified and designated for the life of the quarry and all stockpiling should take place within this area. This area should only be rehabilitated once the quarry has been exhausted or the quarry is closed down for other reasons.
- Topsoil stockpile sites must be clearly distinguishable from overburden and material stockpile sites.
- Stockpile sites must not exceed 2 m (metres) in high unless otherwise indicated by the ECO.

Ablutions

- Chemical toilets should be provided for employees, and all acts of excretion and urination should occur within these facilities. These facilities should be no closer than 50m from any watercourse or other water bodies. Such facilities, which shall comply with local authority regulations, shall be maintained in a clean and hygienic condition. Their use shall be strictly enforced. They shall be positioned in an appropriate place.
- Under no circumstances may open areas or the surrounding bush or degraded and built up areas be used as a toilet facility. A penalty of R100.00 must be imposed on any site worker caught not utilizing the provided toilet facilities. The construction of a "long-drop" is forbidden.
- There shall be a minimum of 1 toilet for every 20 workers and these should be situated no further than 100m from the work front.

Noise and Visual Impacts

- Blasting and other noisy activities - schedule noisy activity to less sensitive times of the day. There are sensitive times of the day for different people, for example, schools during the day, times of religious services, and residences during evenings and night. Where severally noisy pieces of equipment are used or blasting is necessary, these activities must be scheduled to minimize impacts.
- Operational hours should be limited to between 07h00 and 17h00 to avoid sleep/rest disruption and general disturbance of adjacent land users.
- Operational hours on Saturdays should be limited to between 09h00 and 15h00. No mining activities should be allowed on Sundays and Public Holidays.
- Educating employees and contractors about noise and quiet work practices. This could include signage, for example, some construction and mining sites have signs reminding employees to consider neighbours and be quiet, and to not start noisy work too early (e.g. before 7.00 am).
- Ensuring that equipment has an efficient muffler system or suitable noise insulation (e.g. compressors or jackhammers with insulation, or trucks that have efficient muffler systems).

Dust

- Vehicles travelling to and from the mining site must adhere to the speed limits so as to avoid producing excessive dust. A speed limit of 30 km/h must be adhered to on all roads.
- Access points and other cleared surfaces must be dampened whenever necessary and especially in dry and windy conditions to avoid excessive dust.
- Vehicles and machinery are to be kept in good working order and to meet the manufacturer's specifications for safety, fuel consumption etc. Should excessive emissions be observed, the Applicant, Land Owner or Site Manager is to have the equipment seen to as soon as possible.
- Should excessive emissions be observed, the Contractor is to have the equipment seen to as soon as possible.
- Stockpiles not used in three (3) months after stripping must be seeded to prevent dust and erosion.

- Keep soil and other material moist while loading into dump trucks.
- Keep soil and other material loads below the freeboard of the truck to avoid excess dust during transportation of excavated soil, rubble and other material.
- Minimize drop heights when loaders/bulldozers dump soil into trucks to minimize dust.
- Cover dump trucks before travelling on public roads.
- When feasible, shut down idling vehicles and equipment.
- Enclose the noise source to reduce noise levels, if feasible.

Waste Management

- Management of solid waste must be strictly controlled and monitored by the Applicant, Land Owner or Site Manager. The quantities generated should be minimized and littering should be avoided.
- Precautions must be taken to prevent any waste from spreading on, or from, the site. The bins and/or skips should be covered to prevent wind-blown rubbish and scavenging by people and animals.
- No onsite burying, burning, dumping will be permitted.
- Bins and / or skips shall be provided at convenient intervals for the disposal of waste.
- Bins should have liner bags for efficient and safe disposal of waste.
- Recycling and the provision of separate waste receptacles for different types of waste should be encouraged. Where possible, plastics, paper, glass and cans should be separated from other domestic waste for recycling. If waste is to be recycled, appropriately labelled waste receptacles must be made available

Appointment of Environmental Control and Occupational Health and Safety Officers

- The Applicant must appoint an Environmental Control Officer (ECO) for the purpose of ensuring that the environmental conditions as outlined in this EMPR are implemented by the Applicant prior to the commencement of preparation phase of mining operations. The ECO is to have access to the site at all times, for the purpose of inspections to ensure that the environmental conditions of the EMPR are being implemented and adhered to. The ECO must report on the environmental aspects of the mining project to the Applicant/Site Manager and the Department of Mineral Resources at agreed intervals.
- The Applicant must appoint an Occupational Health and Safety Officer to promote health and safety within the mining enterprise prior to the commencement of preparation phase of mining operations. The Officer will inspect and test machinery, vehicles and equipment to ensure they reach safety regulation standards; check workplaces to ensure protective gear is available for all situations; use test instruments to ascertain air quality; ensure all relevant legislation is complied with and assist with the supervision of accident investigation. The Officer must report on health and safety issues of the mining project to the Applicant/Site Manager and the Department of Mineral Resources at agreed intervals.
- These Officers must be employed for the duration of the mining operation. Therefore, continued appointment from preparation, operation, closure and rehabilitation is a requirement for this mining project.

Environmental Management Programme (EMP)

- A standard Department of Minerals Resources EMP should be used in conjunction with and incorporate the issues dealt with in this report to mitigate against impacts stemming from the mining process.

11. REHABILITATION PLAN FOR PROPOSED QUARRY SITE

Time of Rehabilitation

- The timing of rehabilitation is critical, and rehabilitation of disturbed areas should be ideally programmed to occur as soon as practically possible following the cessation of mining activities on the site. The period between the cessation of activities associated with the mining of aggregate material and the onset of rehabilitation for the area should ideal not exceed 1 month (28 days). The purpose of rehabilitation is to:

    - Reduce the visual impacts of the quarry site
    - Facilitate adequate conservation and utilisation of topsoil
    - Simplifies the management of runoff and attendant erosion
    - Reduces health and safety risks
    - Minimises the effects of operations on nearby communities and flora/fauna populations.

Securing the Perimeter

- The fence must be patrolled and monitored by security guards if the quarry poses a safety risk in terms of instability, steepness of slopes or poor drainage. Damage or weakness in the fence must be addressed immediately.
- If the existing fence is unsuitable, it must be replaced with a new one.
- Stock-proof fencing in concert with appropriate signage should be maintained in a satisfactory condition.
- Gates should be maintained to provide permit access to the site for the ongoing monitoring and management of the site.
- If new gates are required, they must be installed immediately.
- Care should be taken not to damage any existing gates and fences.
- Security guards should be stationed that the entrance and patrol the perimeter to deter intruders and monitor the fence line for signs of entry.
- The fence should be topped with razor or barbed wire.

General Site Cleanup and Removal of Material

- The area that previously housed the site camp is to be checked for spills of substances such as oil, grease and fuels, etc. and these should be cleaned up.
- All hazardous waste material must be collected by a registered hazardous waste removal company for appropriate transportation and disposal at a hazardous landfill site. No material may be transported by the Applicant, Site Manager or employees.
- Soil that is contaminated with, e.g. fuel, oil, grease and other hazardous substances must be disposed of at an appropriate registered landfill site.
- All hardened surfaces on site must be ripped, all imported materials removed, and the area shall be top-soiled and re-grassed using the guidelines set out in the re-vegetation specification that is attached to this document.
- All infrastructure and structures that have been erected must be demolished and the material removed.
- All equipment, portable toilets, water storage tanks, concrete footing and the site office must be removed from the mining site unless otherwise proof can be provided that their presence on the site is essential to rehabilitation activities.
- The portable toilets must be cleaned registered chemical waste company prior to the removal of these facilities to avoid leakages and spillages on the site.
- Water storage tanks and portable chemical toilets should be removed from the mining site unless the Applicant or Site Manager requires this source of water to irrigate rehabilitated areas, or the ablution facilities for employees. Water can be brought onto the site by means of water tankers if the Applicant or Site Manager would like to clear everything off the site. No water from the watercourse may be used for the purposes of irrigation, washing and drinking by employees.

- All foreign materials must be removed from the site. Non-hazardous waste must be deposited of at the nearest landfill site.
- The burning, burning or dumping of waste on the mining site is prohibited.
- Recycling of non-hazardous waste collected from the site camp is recommended.
- Left over, undamaged building material like concrete, bricks and wood should be donated to the local community or reused on other sites instead of dumping it at the landfill site.
- The Applicant or Site Manager must arrange the cancellation of all temporary services.

Trimming and Shaping

- The quarry should be finished off in such a way that:
    - It blends in with the surrounding area and appears as a natural extension to the adjacent, undisturbed ground profiles;
    - Sharp edges and corners must be avoided;
    - Smooth and flowing curves are created to blend into the surround landscape;
    - Even contours must be created; and
    - No slopes steeper than 1:3 must be created.

- All material in and around the quarry left over from the mining operations (stockpiled material, over sized material remaining in the quarry and material resulting from clearing operations must be used in shaping the quarry or appropriately disposed off. Material not capable of support vegetation shall be buried in the quarry and covered with a thick layer of top soil approximately 500 mm deep.

Compaction of Disturbed Areas

- The level of compaction of areas disturbed by mining vehicles should be addressed, preferably prior to the spreading of topsoil, by scarified the ground surface by hand, plough or a mechanical ripper to a depth of approximately 150 mm (and a maximum spacing of 1000 mm) to break down soil clods.
- Compacted soil that has become too hard to scarify, should be ripped with a mechanical ripper or other pieces of appropriate equipment to a depth of 250 mm. No section of the ground should remain undisturbed after the ripping has taken place.

Access and Haulage Roads

- All roads and pathways not required by the Applicant/Site Manager must be closed off and rehabilitated once the remainder of the mining side has been successfully rehabilitated.
- The surface of roads and pathways must be ripped to ensure growth of vegetation.
- The requisite permanent drainage works and erosion protection structures must be established in areas at risk of erosion and sedimentation.

Topsoiling

- Approximately 50 to 100 mm of previously stripped material and stockpiled overburden materials should be applied to the newly shaped and scarified/ ripped portions of the quarry.
- Before topsoil is place on the ground, all weeds must be removed from the area and from the topsoil itself. The previously stripped and stockpiled topsoil material should generally be spread evenly over the prepared surface to a depth of 75 to 150 mm on flat ground and to a minimum of 75 mm on slopes of 1:3 or steeper.
- Topsoil placement should be undertaken in a phased manner. Top soil should be placed in the same area from which it was striped.
- Where amounts of topsoil are inadequate, slopes should take priority.

Stormwater Management

- High runoff and erosion rates and a poorly developed surface cover can jeopardise the success of the rehabilitation and re-vegetation process, due to the fact that topsoil and seeds are washed away. Measures to prevent soil erosion should be established in all rehabilitated areas, mining areas, access roads, areas used for infrastructure and stockpiles, and any other areas disturbed during mining operations that have natural drainage routes running through them or which are not level. Measures included:
    - Appropriate shaping of the quarry area
    - Ensuring slopes are no steeper than 1:3
    - Stabilisation by vegetation
    - Logging
    - Live staking
    - The application of chemical stabilisers
    - Straw stabilisation
        - Mulching
        - And permanent drainage works such as bunds and cut-off drains.

- Bunds: This consists of a ridge of compacted material intended to divert overland sheet flow to a stabilised outlet or channel. This should be made up of a earth bund of at least 0.5 m in height (top width 0.4 m and base 1.4 m) constructed upslope of the quarry site or area being rehabilitated. If the bund is retained for the lifetime of the quarry, it should be re-vegetated.
- Cut-off Drains: This constitutes a formal drainage structure to collect storm water flow and channel it into an appropriate discharge point. This should be constructed on the uphill side of the bund and side drains should be constructed to convey the flows to flat ground or into an appropriate watercourse.
- Drainage should be designed to avoid pooling of water on site.
- Drainage systems should be designed to minimise erosion caused by runoff and major rainfall events

Visual Screening

- The most effective means of mitigation against the visual impacts of the quarry site is via effective implementation of the rehabilitation process, and the attainment of stable slopes and acceptable re-vegetation of the area.
- Visual screening of the quarry site is advisable. Screening could involve the establishment of an earth bund 1 m high on the boundary/ periphery of the quarry
- Planting a screen of indigenous trees, shrubs or other vegetation along the boundary/periphery of the quarry site.

Vegetation Rehabilitation Plan

The Applicant, Site Manager or Land Owner shall appoint a suitably experienced botanist / horticulturist to survey the site prior to mining and compile a vegetation rehabilitation plan that shall detail plant translocation requirements, seed collection, seed mixing, seeding methods, planting and vegetation rehabilitation in all areas of the mining footprint. The Applicant, Site Manager or Land Owner and/or vegetation specialist shall submit the vegetation rehabilitation plan to the EAP/ECO for approval.

The botanist / horticulturist shall be familiar with KwaZulu-Natal Highland Thornveld and Tugela Thornveld vegetation units and the vegetation composition of these areas. The vegetation rehabilitation plan shall include, but not be limited to the following:

- Seed requirements, harvesting methods and locations, seed storage methods;
- Plant translocation requirements;
- Handling and management of plant material rescued (translocation areas, propagation, etc.);
- Establishment and maintenance of a project-specific nursery, if required;
- Topsoil, mulch, fertiliser and soil stabiliser requirements and application during rehabilitation;

- Landscaping and re-vegetation methods for each area, i.e. hydroseeding / hydromulching, planting, including locations and timing;
- Procurement requirements and a list of species of plants to be procured, if any;
- Vegetation establishment and maintenance requirements (irrigation, etc.) for all re-vegetated areas; and
- The use of any herbicides and pesticides, if required.

General

- Ongoing identification of protected plants and trees. Any protected plants or trees in proximity to the construction servitude that will remain, should be marked clearly and must not be disturbed, defaced, destroyed or removed, unless otherwise specified by ECO. Acquire the necessary permits under the National Forests Act (No. 84 of 1998) if avoidance of protected trees of forested areas is not possible.
- All areas disturbed by mining activities, including access roads, storage and stockpiling areas, etc. shall be rehabilitated to the satisfaction of the ECO and landscaping contractor / horticulturist
- Certain areas may be identified where specific plants / trees could be planted successfully. All plants / trees used in re-vegetation shall be locally indigenous species only.
- Re-vegetation of mining footprint shall take place as soon as possible after completion of mining activities works. The timing of re-vegetation shall take cognisance of maintenance requirements and provision shall be made for any irrigation requirements
- No mining equipment, vehicles or unauthorised personnel shall be allowed onto areas that have been re-vegetated.
- All plant material for rehabilitation purposes shall be obtained from reputable nurseries and shall comprise locally occurring indigenous species only.

Plant Translocation

- All red listed and protected flora species of conservation significance must be avoided wherever possible. In the case of protected species permit authorization is imperative prior to such disturbance on the site.
- Any indigenous trees which constitute “forest” (i.e. three or more indigenous trees with connected canopies) will require a permit application to the Department of Agriculture, Forestry and Fisheries (DAFF) prior to their removal.
- Translocation of all rare or localised plant species within the site shall be undertaken before any mining activities commence. Translocation shall include the collection of plants, cuttings and, where applicable, seed.
- Propagation of seed and cuttings for propagation purposes may be undertaken within no go areas under the supervision of the ECO.
- Rescued plant material shall either be planted nearby within suitable habitats in areas that will not be disturbed in the foreseeable future.
- Relocation of plants of conservation importance should be implemented by a qualified plant specialist.

Landscaping and Ground Surface Preparation

- All slopes shall be shaped and trimmed to approximate the natural condition and contours as closely as possible.
- All slopes shall be left as rough as possible and shall be shaped to contain ridge that would facilitate the accumulation of topsoil
- Prior to re-vegetation, the Applicant or Site Manager shall ensure that the area is clear of any building materials and other foreign debris.
- All visible weeds shall be removed from the area before replacing topsoil
- Compacted soil shall be ripped along the contour and hand-trimmed. Topsoil shall then be spread evenly over the surface.
- The final prepared ground surface shall be furrowed to follow the natural contours of the land and not smooth.

Fertiliser

- Only fertiliser approved by the botanist/ horticulturalist and ECO shall be used on the site.
- The use, storage and handling of fertiliser shall be strictly controlled.
- Fertilisers shall be suitably stored in sealed containers in areas approved by the ECO.
- Care shall be taken when using fertilisers near no-go areas, watercourses and wetland areas and other sensitive natural areas.
- Soil shall be well watered and moist before any fertiliser is applied.

Hydroseeding / Hydromulching

- The hydroseeder shall be capable of pumping the specified seed mix, fertiliser, soil stabiliser, etc. at the specified rates over the areas to be seeded, according to the approved method statement.
- The hydroseeder shall have an agitation system, which shall be sufficient to agitate, suspend and homogeneously mix the specified slurry.

- The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with hydraulic spray nozzles suitable for the even distribution of the slurry on the various slopes to be seeded.

Plants / Trees

- The botanist / horticulturist must count the number of indigenous tree that will be lost to mining activities. Based on these findings, the applicant must obtain the exact number of indigenous trees for re-planting during the rehabilitation process.
- The handling, maintenance and planting of plants / trees shall be undertaken under supervision of the appointed botanist/ horticulturist.
- The Applicant or Site Manager shall ensure that each plant / tree is handled and packed in the approved manner for that species or variety, and that all necessary precautions are taken to ensure that the plants arrive on site in a proper condition for successful growth.
- Plants shall be protected from wind during transportation. No plants with exposed roots shall be subjected to prolonged exposure to drying winds and sun, or subjected to water logging or force-feeding at any time after purchase.
- The Applicant or Site Manager shall ensure that the plants are in a good condition and free from plant diseases and pests. If they are uncertain of the condition of the plants, the botanist / horticulturist must be asked to assist in the assessment and removal of any plants infected with disease and/or pests from the site.
- All plants supplied by the Applicant or Site Manager shall be healthy, well formed, and well rooted. Roots shall not show any evidence of having been restricted or deformed at any time. The potting materials used shall be weed free.
- There shall be sufficient topsoil around each plant to prevent desiccation of the root system.

Establishment of Vegetation

Irrigation

- The Applicant or Site Manager shall be responsible for maintaining the desired level of irrigation necessary to maintain vigorous and healthy growth, as advised by the appointed botanist / horticulturist.
- Water used for the irrigation of re-vegetated areas shall be free of chlorine and other pollutants that will have a detrimental effect on the plants.
- Where hydroseeding was undertaken, the commencement of watering may be postponed until seeds have germinated and growth begins.
- Where an irrigation system is required, the Applicant or Site Manager shall be responsible for its installation prior to seeding or planting. The Applicant or Site Manager shall supply all required water as well as all equipment as required by the approved method statement.

- Every effort shall be made to avoid irrigation overspray into no-go areas and other areas with natural vegetation.

Weed, Disease and Pest Control

- The Applicant or Site Manager shall be responsible for ensuring that all re-vegetated areas remains free of all alien and indigenous weed species during the contract and establishment period.
- Weeding, removal methods and storage of this material shall be undertaken in such a manner that prevents the re-infestation of the cleaned areas.
- All dead plant material shall be removed immediately as it may become a fire hazard.
- The Applicant or Site Manager shall ensure that all plants are disease and pest free. Any methods used to control any diseases and/or pests, including the use of herbicides and pesticides, must be approved by the ECO.

Tree Establishment

- Any trees planted as part of the re-vegetation shall be watered three times weekly in summer, once weekly in winter, or otherwise as specified by the appointed botanist /horticulturist.
- Trees that die or become diseased so that they appear to be in a badly impaired condition shall be promptly removed and replaced as soon as possible.
- Trees shall be kept free from dead wood, broken branches, etc.

Other Recommendations

- The Contractor shall ensure that no hunting, trapping, shooting, poisoning or otherwise disturbance of any fauna takes place.
- The feeding of any wild animals is prohibited.
- The use of pesticides is prohibited unless approved by Botanist/ ECO.
- No domestic pets or livestock are permitted on site.
- No vegetation disturbance must be allowed outside of the demarcated mining footprint.
- Removal of medicinal plants by construction workers must not be allowed.
- No trees to be felled for fuel purposes.

Alien Vegetation Control

- Although invasive alien plants are not very prevalent at the site, eradication and control is strongly recommended to prevent proliferation and spread of these species at the site and into adjoining habitats. Alien infestations arising from neighbouring properties will need to be managed on a continual basis.
- Control of alien invasive species and noxious weeds in line with the requirements o the Conservation of Agricultural Resources Act will be undertaken. Strict control to prevent the establishment and spread of Sickle Bush should be implemented.
- It is also essential that regular monitoring of the project site be undertaken to ensure that alien vegetation does not become established in disturbed areas. Initiate control measures immediately upon evidence of alien vegetation species introduction or spread.
- If any alien vegetation clearing is required within no-go areas on the property (watercourse, heritage sites and buffer zones), this shall not take place without the written approval of the ECO. All alien vegetation removal within no-go areas shall be supervised by the ECO.
- Spraying of herbicides / pesticides should not take place under windy conditions and must comply with OHSA specs and other chemical handling laws.
- Avoid applying herbicides if heavy rain or windy conditions are forecasted.
- Application of herbicides and pesticides must be according to the manufactures instructions.
- To minimize the impacts on the watercourse and the buffer zone, employees tasked with removing alien vegetation must cut/slash/break individual plants and paint the herbicide on the exposed stems.
- The Applicant, Site Manager and employees must comply with the following directives at all times -

- If any alien vegetation clearing is required within sensitive/no-go areas (watercourse, indigenous forests and other sensitive areas), this shall not take place without the written approval of the ECO. All alien vegetation removal within no-go areas shall be supervised by the ECO.
- All alien vegetation within sensitive areas shall be cleared. Removal of woody vegetation will be undertaken as follows:

    - Foliar application of herbicides within sensitive areas and their buffer zones is prohibited.
    - Application of herbicides near watercourse or within their buffer zones is prohibited. All alien vegetation shall be removed by manual/mechanical methods.
    - Seedlings of woody vegetation will be removed by hand pulling, cutting or slashing. No herbicides will be applied to woody vegetation seedlings during alien vegetation removal activities.
    - All dense thickets of mature woody vegetation within sensitive areas will be ring barked. If the plants have not died within 4-5 months of ring barking, the Contractor will cut down the plant as close to the ground as possible. Only tools that would give a clean cut on the size of the stem should be used. For example, loppers for diameters up to 50 mm and a saw for diameters of greater than 50 mm. A mixture of herbicide and diesel must be applied to the stump as soon as possible, within 30 minutes of felling.
    - All mature alien woody vegetation found singly or small patches within or near sensitive areas will be cut down as close to the ground as possible and the chemical mixture mentioned above applied to the stump.
    - Alien vegetation clearing within sensitive areas shall be undertaken on foot.
    - No heavy machinery (motor vehicles, trucks, bulldozers or bobcats) shall be permitted to enter the sensitive areas on or near the development. Please note examples of machinery not allowed in sensitive areas below.
    - Heavy vehicles and equipment may be used outside of the watercourses and wetland areas for stacking, removal and transportation of alien vegetation material. The Applicant or Site Manager shall be informed (verbally and in writing) of any further constraints on equipment utilisation during implementation of the alien vegetation control prior to commencement of those activities by the ECO.
    - Special care must be taken at all times to protect indigenous vegetation in sensitive areas from trampling, accidental removal or damage during alien vegetation removal activities.

- All alien vegetation within the sensitive areas and their buffer zones must be cleared. Alien vegetation clearance on private land shall exclude homestead gardens and shall be negotiated with the relevant landowners. The principle is that all alien vegetation shall be removed, unless a specific request is received from the relevant landowner/s.
- Regular follow up checks should be put in place to ascertain whether the site is permanently clear of Alien Invasive plants, so that extensive and expensive measures can be avoided in the future and a maintenance plan can be set up.
- All alien vegetation outside of sensitive areas and their buffer zones must be removed. The Applicant and Site Manager should always favour manual/ mechanical removal methods over application of herbicides during the undertaking of the alien vegetation control measures. However, if application of herbicides is necessary, the following directives must be adhered to at all times:

    - The use of herbicides is encouraged in preference to vehicle-driven brush cutting and grading outside of sensitive areas and buffer zones. Cutting of vegetation without the application of herbicides would stimulate re-growth.
    - If any alien vegetation clearing is required outside of sensitive areas, this shall not take place without an inspection of the identified area by the EAP and written approval being submitted to the Applicant or Site Manager.

- All trees and saplings need to be cut down at ankle height where possible and herbicides applied immediately after cutting.
- Eradication must start in the least infected areas and from the highest lying areas.
- Herbicides must be applied according to the manufacturer's recommends at all times.
- Mix the herbicides in a coloured dye so that you can accurately see which areas have been sprayed, and whether areas have been missed.
- Ensure adequate follow-up treatment of alien vegetation treatment.
- Where possible, wipe or inject alien vegetation with herbicides instead of spraying which might cause spray drift onto surrounding indigenous vegetation and open water bodies.
- Do not apply herbicides to vegetation that is under stress, such as on very hot days or during very dry or dusty conditions, as the uptake of the chemicals through the plants eaves will be minimal.
- Avoid spraying chemicals during strong winds where there is the chance of blow-back or loss of chemicals into the environment.
- Wet or damp leaves should not be sprayed and chemical control methods should not be applied during the rain, due to the risk of it being washed into watercourses and wetlands. No herbicides should be applied when rain is forecast within two days.
- Avoid using surfactants, as many of these products may be more toxic to the environment than the actual herbicides.
- While in the field, employees keep all dangerous chemicals on a plastic drip sheet and in a safe, marked-out area, whilst spraying takes place – out of reach of the public and out of direct sun.
- Wear Personal Protective Equipment (PPE) at all times, to prevent inhalation, skin burns, eye irritation, or accidental ingestion.
- Do not spray when it is extremely hot to avoid the risk of fire.
- Do not spray leaves over 1m tall to avoid the risk of chemicals rubbing off onto people and wildlife.
- Do not allow children or pregnant women to be near or involved in chemical operations, and do not spray near children or pregnant women.
- If private contractors or other organisations are used for the alien vegetation removal, the Applicant or Site Manager and appointed ECO must ensure they are familiar with the above principles and additional ones included within this report.
- Unused herbicides and empty herbicide containers shall not be disposed of on site. Please refer to the directives for disposal and management of hazardous materials contained within the EMPR before disposing of unused herbicides and empty containers.

- It is extremely important that the safety of the operator that all the proper precautions are followed when using herbicides and other chemicals, including the use of correct clothing and disposal procedures. These instructions are provided on the packaging and containers the herbicides are provided in.

Disposal of Alien Plant Material

- Plant material should be used beneficially wherever possible, as opposed to disposing of it at a landfill site where it takes up valuable airspace, or let it further propagate on unchecked, vacant land.
- Woody and dry material, provided no seeds are present, can be chipped and used as mulch or made available to the local community for firewood.
- Wet material and aquatic weeds should be combined with other organic matter and composed. Alternatively, it may be possible to use it for basket making, animal feed or other uses.
- Burning of alien vegetation waste material is prohibited.
- Burying of alien vegetation waste material in or near sensitive areas is prohibited.
- Any vegetation which is not viable for use must be disposed of at a registered disposal unit.

Monitoring of Alien Vegetation Onsite

- Follow up inspections are necessary to establish whether follow-up operations are necessary. It is preferable to follow up on an area and remove all seedlings or treat re-sprouting plants, rather than threat a new area.
- Inspections of the site must be carried out every two months. Follow-up operations must be carried out if inspections establish that initial removal efforts have failed.

General Information

- Negotiate right of access with landowners where private land must be crossed for maintenance purposes or clearer vegetation adjacent the site.
- Accurate records of maintenance actions and associated costs should be compiled to assist with the future plans for the site.

Emergency Procedures

- All alien vegetation clearing teams must be aware of the correct emergency contact numbers for the areas they are working in.
- Draw up detailed emergency procedures for spillages of hazardous materials during alien vegetation control operations.
- All teams must be aware of the emergency procedures. These include how to isolate the source of the leakage or spillage, how to cordon off the affected area, locating and utilisation of absorbent materials and the numbers of relevant local authorities that should be notified of such spills and leakages.

Employee Conduct on Site

All employees involved in the rehabilitation of the mining site must adhere to the following directives already mention the sections discussing preparation and operation:

- A general regard for the social and ecological well being of the site and adjacent areas is expected of the site employees. Workers need to be made aware of the following rules:
- No alcohol / drugs to be present on site; no vehicles or machinery are to be operated whilst under the influence of alcohol.
- Prevent excessive noise
- No firearms allowed on site or in vehicles transporting employees to / from the site (unless used by security personnel).
- No unsocial behaviour.
- Bringing pets onto site is forbidden.
- All employees are to make use of facilities provided for them, as opposed to ad-hoc alternatives (e.g. fires for cooking, the use of surrounding bush as a toilet facility is forbidden).
- Any construction worker found to be poaching on the property will be subjected to a disciplinary hearing.
- No fires to be permitted on site. Encourage the use of gas operated cookers for preparation of food on site.
- Trespassing on private / commercial properties adjoining the site is forbidden.
- Only *pre-approved* security employees and workers shall be permitted to live on the construction site.
- No worker may be forced to do work that is potentially dangerous or for what he / she is not trained to do.

Protection of Rehabilitated Areas

- Re-vegetation should not occur in any area until operations have ceased.

- Once re-vegetated, areas should be protected to prevent trampling and erosion – erection of screening, demarcations or danger tap around such areas is advisable.
- No mining equipment, vehicles or employees should be allowed to gain access or move across areas that have been rehabilitated. Signage should be erected indicating these areas are out of bounds during rehabilitation operations.
- Only equipment and employees required for the preparation of areas, application of fertiliser and spreading of topsoil, fertiliser and the planting of plants should be allowed in areas that are being rehabilitated or have been rehabilitated.
- Where rehabilitation sites are located within actively grazed areas, they should be fenced off and monitored closely.
- All fencing should be removed once sound vegetation cover has been achieved.
- All runnels, erosion channels and wash away developing after re-vegetation should be backfilled and consolidated and areas restored to a proper stable condition. The erosion should not be allowed to develop on a large scale before affecting repairs and all erosion damage should be repaired as soon as possible.

12. CONCLUSION

It is the opinion of the EAP that based on the findings of this assessment that, although an aggregate mining operation on the proposed site has the potential to negatively impact on various aspects of the local ecology, heritage and cultural sites and artefacts, impacts would be limited by the size of the operational footprint in the surrounding landscape and implementation of the proposed mitigation and management requirements described in this report. Correct rehabilitation and management of the mining footprint post development has the potential for the re-establishment of ecological processes in the future and potentially a net gain in the biodiversity of the general area.

Impacts on water resources in the form of wetlands and watercourses are considered to be minimal provided the recommendations contained within this report and the EMPR are adhered to. It is the opinion of the EAP that the establishment of a 30 m buffer zone around the Hermanspruit Stream and adhering to the directive provided instructing all parties to recognise this part of the property as a no-go area, would prevent degradation of the watercourse during mining operations.

The heritage impact assessment undertaken by *Umlando: Archaeological Tourism and Resource Management* located several small features that could relate to the 2nd Anglo-Boer War within the mining footprint and scattered throughout the surrounding area. However, none of the sites located within the mining footprint were deemed to be of high significance that would compromise the establishment of the quarry site. Furthermore, no detrimental impacts on heritage sites or artefacts of significance, identified in the surrounding area are likely to occur if the recommendations contained within this report are adhered to prior to the commencement of mining operations.

11. REFERENCES

- Apps, P. 2000. Smither's Mammals of Southern Africa, A Field Guide. Struik Publisher, Cape Town.
- Apps, P. 1997. Wild Ways, A Field Guide to the Behaviour of Southern African Mammals. Struik Publisher, Cape Town.
- Barnes, K.N. (ed.) 2000. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. BirdLife South Africa, Johannesburg.
- Gibbon, G. 2006. Robert's Multimedia Birds of Southern Africa: version 3, published by Southern Africa Birding cc, Durban.
- Henning, G.A., Terblanche , R.F and Ball, J.B. (Editors). 2009. South African Red Data Book: Butterflies, Department of Conservation Ecology and Entomology and Centre for Agricultural Biodiversity, Faculty of AgriSciences, University of Stellenbosch, Cape Town.
- B, Daly, B Friedmann Y, Lemmer, F, Marchant, A, McCann, K, Rushworth, I. and Wakelin, J. (editors). 2006. Oribi Antelope (*Ourebia ourebi*) Population and Habitat Viability Assessment Workshop Report. Conservation Breeding Specialist Group (SSC / IUCN) / CBSG Southern Africa. Endangered Wildlife Trust, Johannesburg.
- Branch, W.R. 1988. South African Red Data Book—Reptiles and Amphibians. South African National Scientific Programmes Report No. 151.
- Friedman Y & Daly B. 2004. Red Data Book of the Mammals of South Africa: A Conservation Assessment: CBSG Southern Africa, Conservation Breeding Specialist Group (SSC/IUCN), Endangered Wildlife Trust. South Africa
- Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., TreeE, A.J., Parker, V & Brown, C.J. (eds). 1997. The atlas of southern African birds. Vol. 1&2. Bird Life South Africa, Johannesburg.
- Low, A.B. & Rebelo, A.G. (eds). 1996. *Vegetation of South Africa, Lesotho and Swaziland*. Pretoria: Department of Environmental Affairs and Tourism.
- Minter, L.R., Burger, M., Harrison, J.A., Braak, H.H., Bishop, P.J., and Kloepfer, D. (eds). 2004. Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland. Smithsonian Institute and Avian Demography Unit.
- Mucina, L. & Rutherford, M.C. (eds). 2006. *The Vegetation of South Africa, Lesotho and Swaziland.* Strelitzia 19. South African National Biodiversity Institute, Pretoria.
- NEMAI Enviromental and Social Consultants. (2010). Emnambithi Ladysmith Local Municipality: Strategic Environmental Management Tool, (Accessed online 2011/2011 at www.ladysmith.co.za/docs/reps/2010/ELLM.pdf
- Pooley, E 1997. *The Complete Field Guide to Trees of Natal, Zululand and Transkei*. Natal Flora Publications Trust, Durban.

- P.S. Goodman. 2010. Determining the conservation value of land in KwaZulu-Natal: Biodiversity Division KwaZulu-Natal Nature Conservation Services, Ezemvelo KwaZulu-Natal Wildlife, Pietermaritzburg (Accessed online 10/12/2011 at devplan.kzntl.gov.za/idp...2009.../KZNW%20SEA%20Report.pdf)

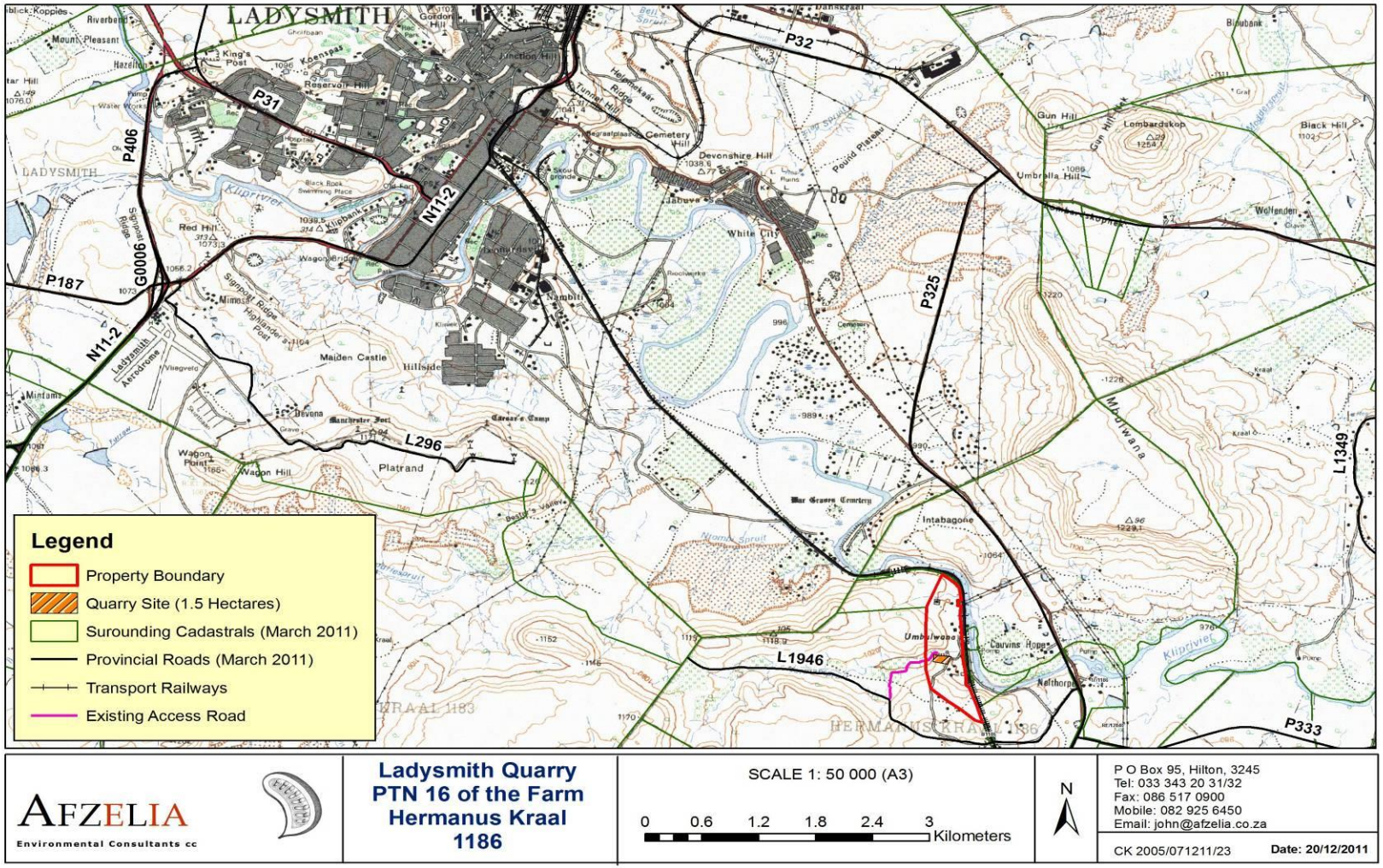
- Stuart, C., Stuart, T. 2007. Field Guide to the Mammals of Southern Africa: Revised Edition. Struik Publishers, Johannesburg.

- Van Oudtshoorn, F 1999. *Guide to Grasses of South Africa*. BRIZA Publications CC. Cape Town.

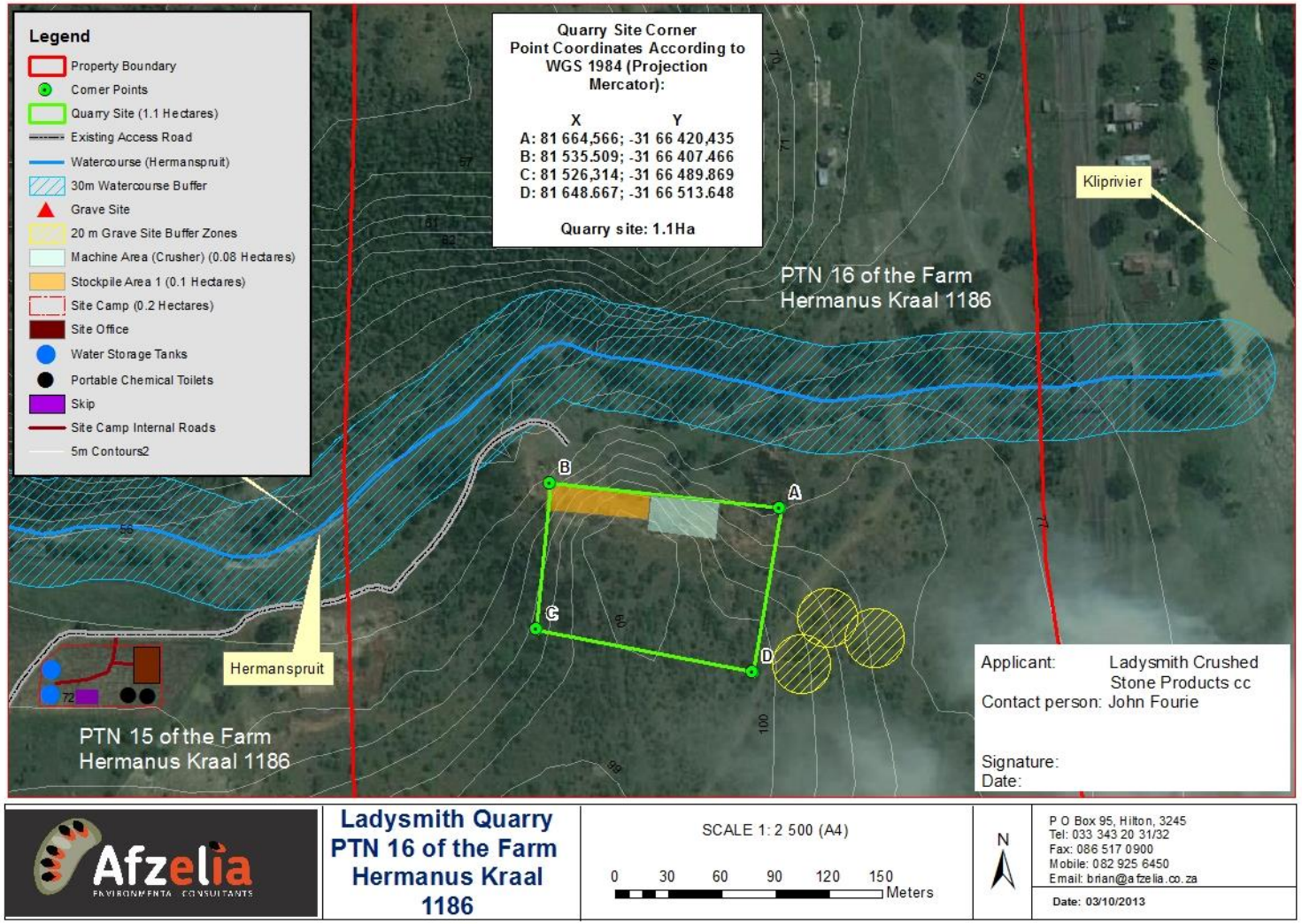
- Wilson, D.E., Reeder, D.M. 2005. Mammal Species of the World. A Taxonomic and Geographic Reference, 3rd Ed. John Hopkins University Press, Baltimore, U.S.A. (Accessed online 10/4/08 at www.bucknell.edu.msw3

ANNEXURES:

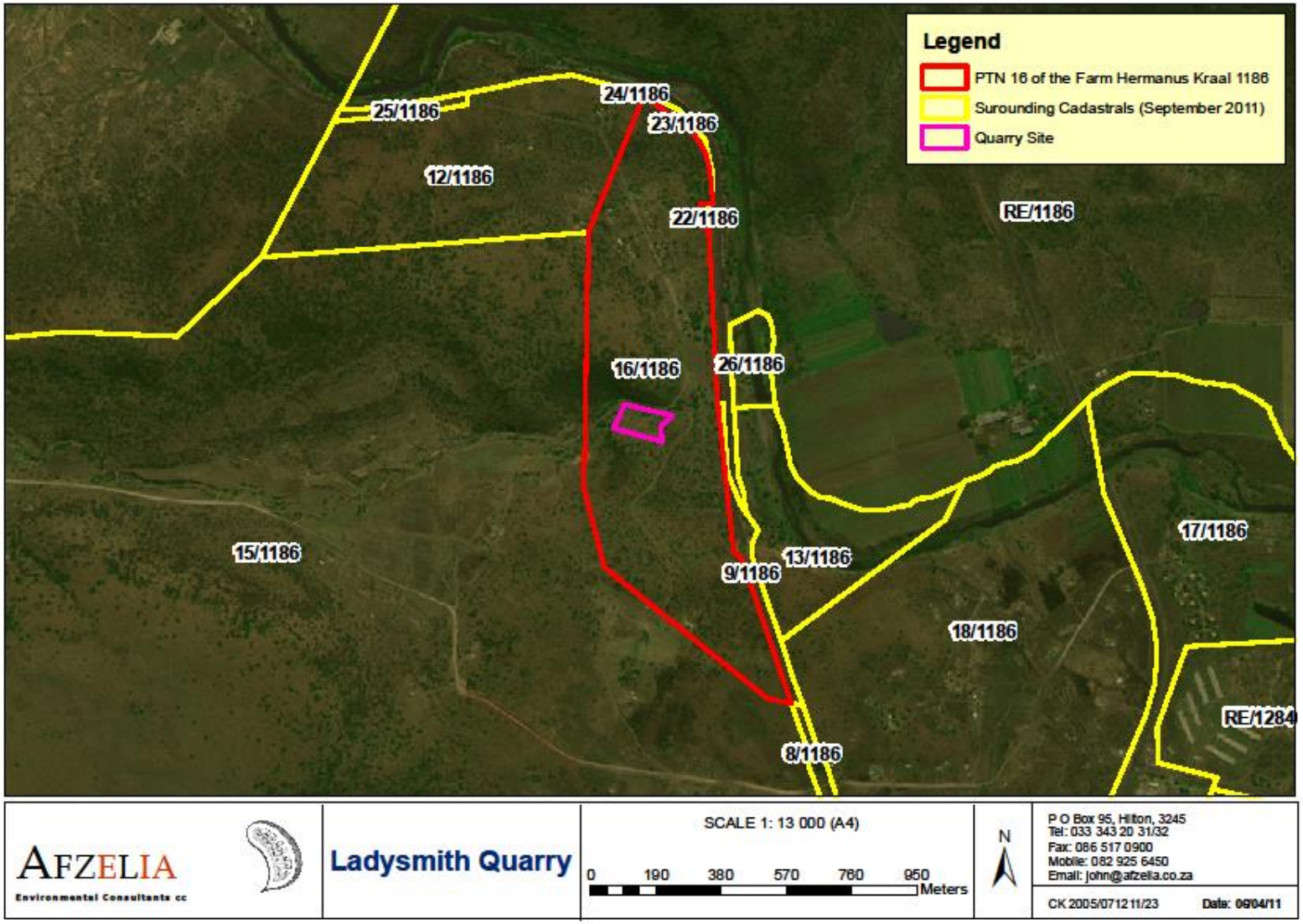
Annexure A: Locality Map



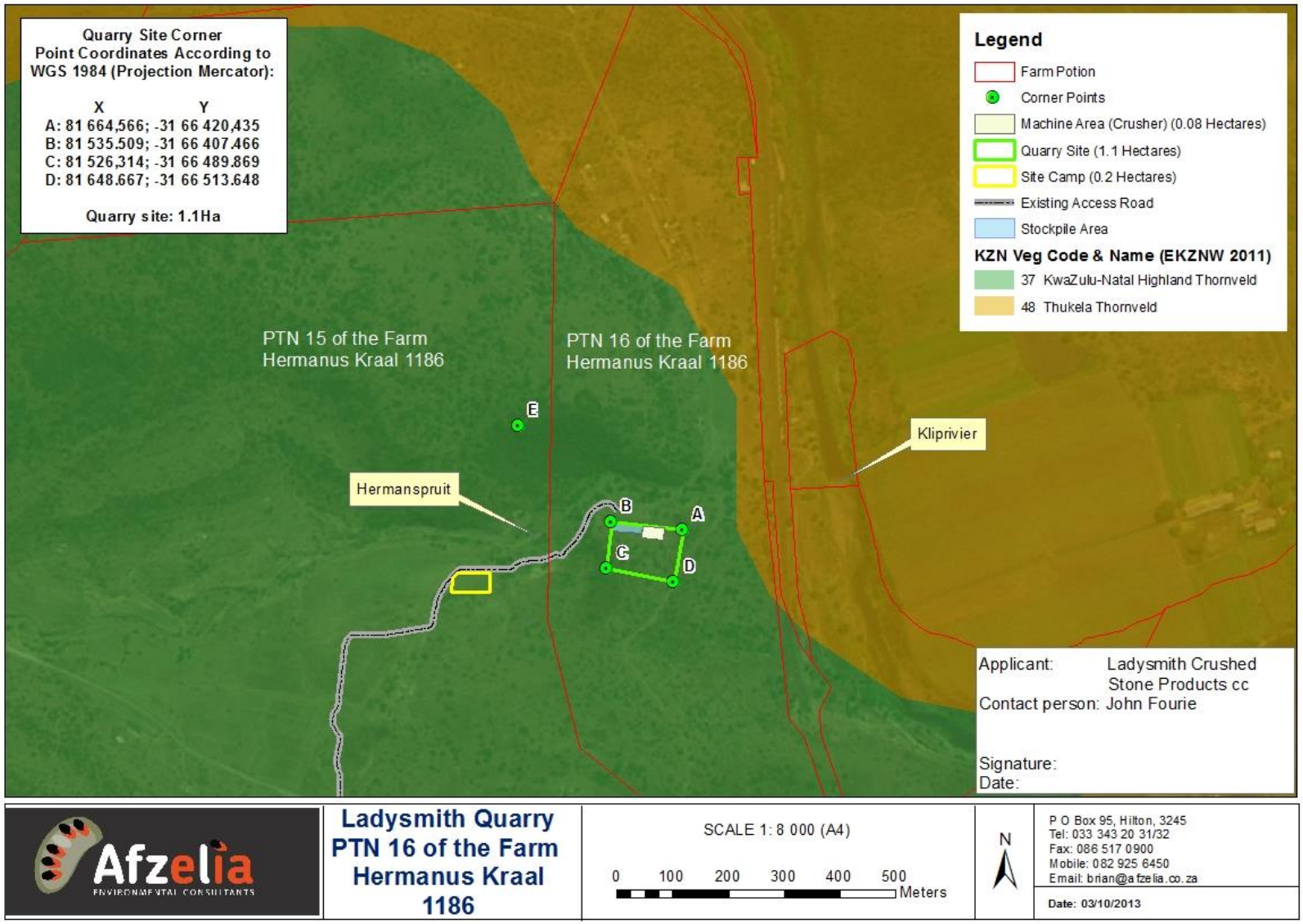
Annexure B: Aerial Imagery with Coordinates



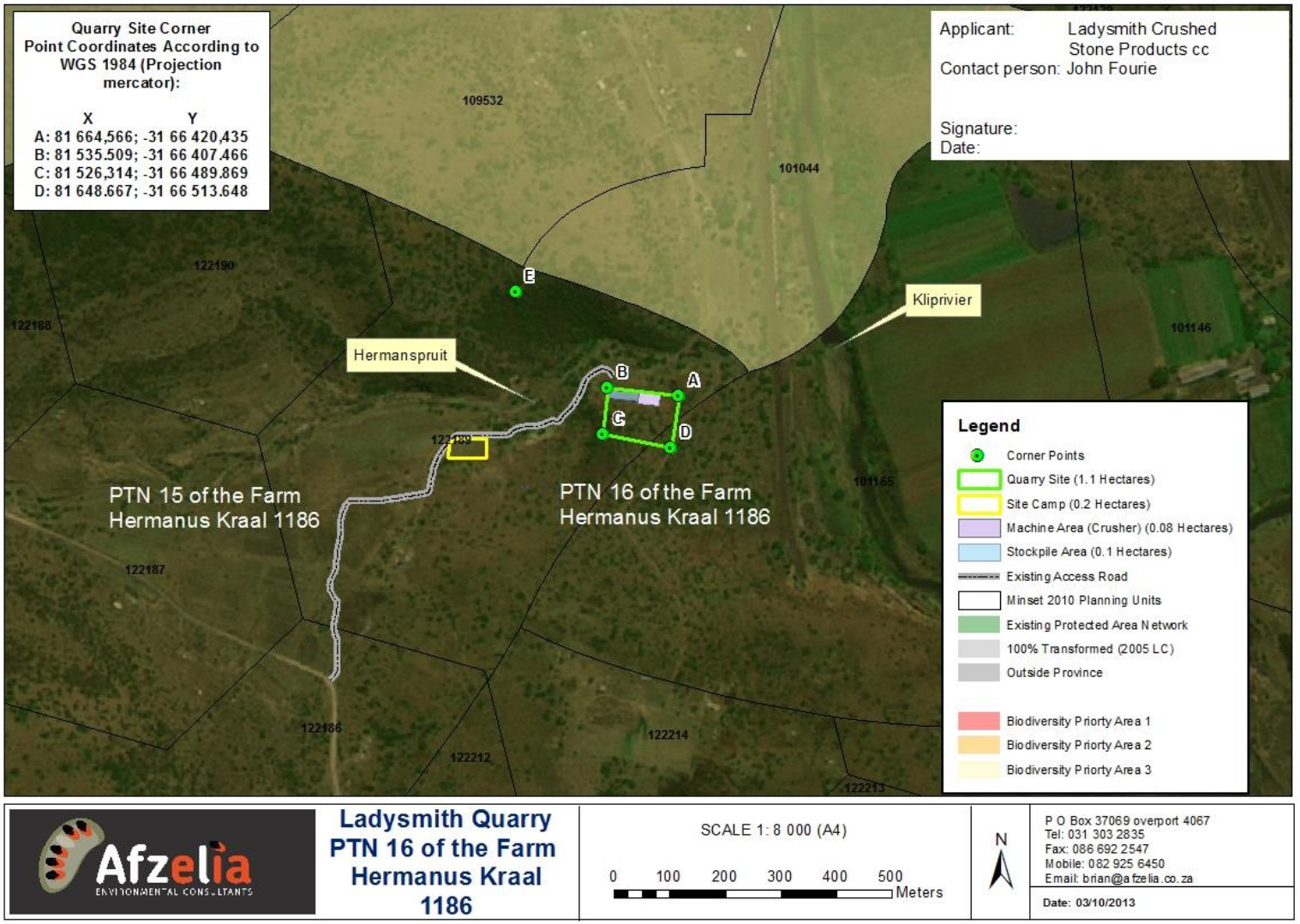
Annexure C: Cadastral Imagery



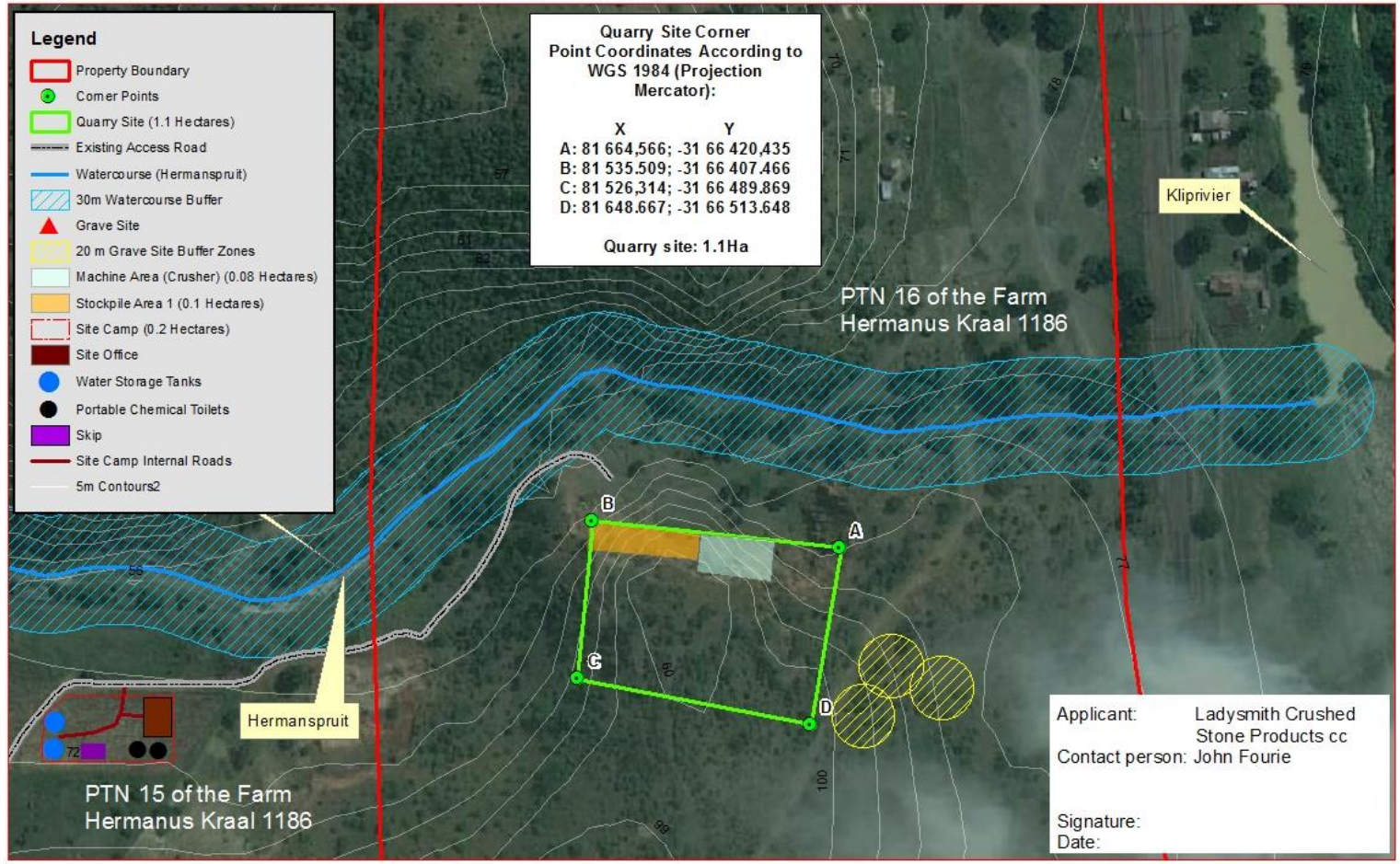
Annexure D: EKZNW Vegetation Imagery



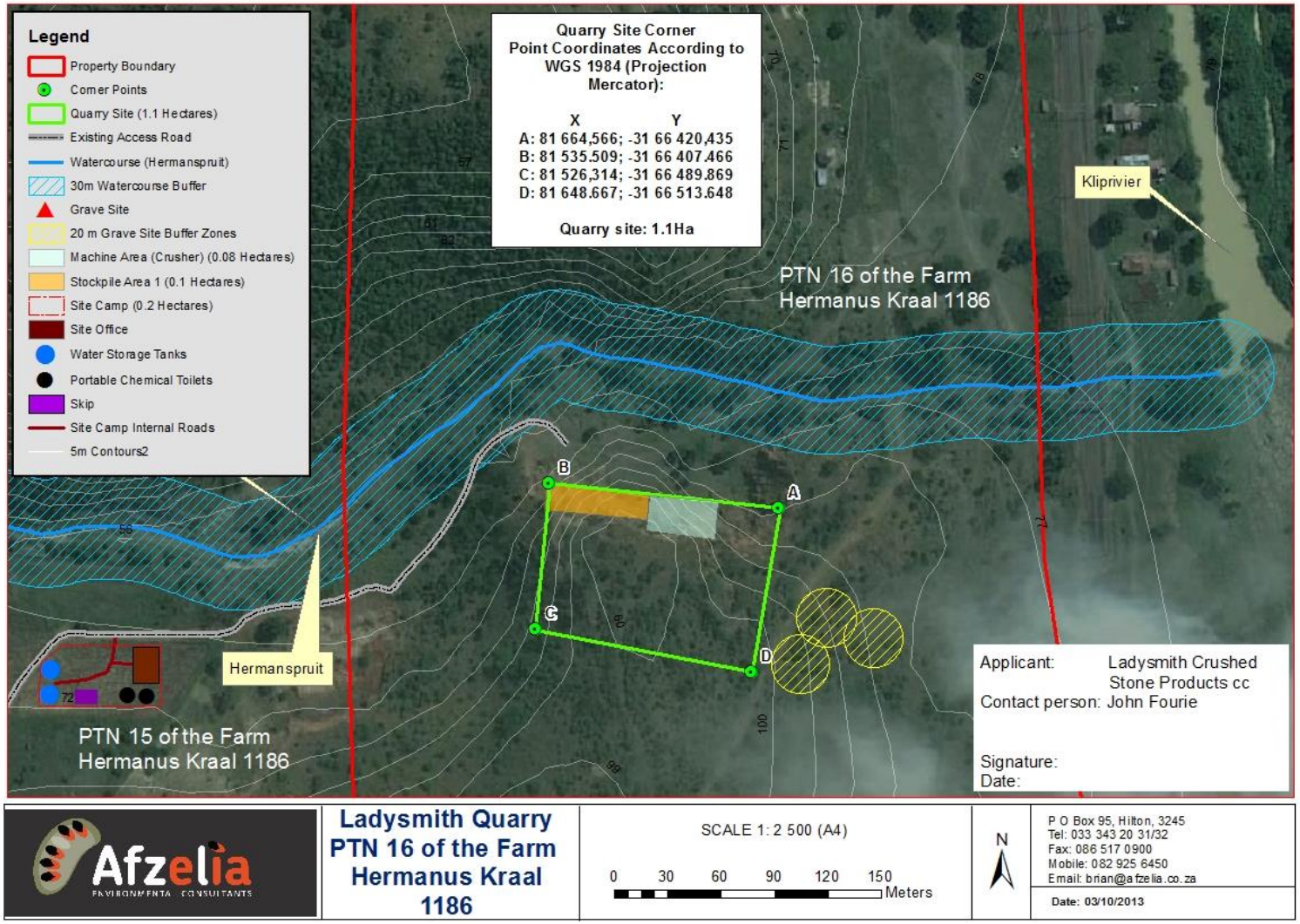
Annexure E: EKZNW Minset Database 2010 Imagery



Annexure F: 20 m Grave Site Buffer Zones



Annexure G: Watercourse and Buffer Zone



Annexure H: Heritage Impact Assessment Report

Annexure I: Significance Rating for Environment Impacts

Significance Rating of Potential Impacts Stemming from Aggregate Mining Operations

a. CRITERIA USED FOR THE SIGNIFICANCE RATING – NO IMPLEMENTATION OF MITIGATION MEASURES

- All surface disturbances area rated high.
- Dust is rated low if only minimal dust expected to accumulate over the permit period, medium if it is expected to require dust suppression such as watering, and high if there is a risk that it will migrate beyond the permit area.
- Noise is rated low if no machinery is to be used, medium if machinery is to be used, and high if there is a potential for complaints from the public and neighbours.
- Heritage and cultural sites and artefacts are rated high.
- Fire stemming from activities associated with preparation, operation and decommissioning phases is rated high.
- All drainage is rated high
- All blasting is rated high in terms of noise, dust, and surface disturbance, disturbance, modification or destruction of habitat and flora and fauna species.
- All dust and noise associated with loading, hauling and transport is rated high.
- Drainage from ablution facilities are rated high.

1. SIGNIFICANCE RATING: NO IMPLEMENTATION OF MITIGATION MEASURES DURING PREPARATION, OPERATION AND DECOMMISSIONING PHASES OF MINING OPERATION

SIGNIFICANCE RATING: NO MITIGATION OF POTENTIAL IMPACTS PROVIDED						
PHASE OF MINING OPERATION	**ACTIVITY** Mark with X which activities are applicable		**POTENTIAL IMPACT**	**SIGNIFICANCE RATING**		
				Low	**Medium**	**High**
CONSTRUCTION/ PREPARATION PHASE	Establishment of site camp – erection of fence, gate, portable toilets and water storage tanks, storage areas and site office.	X	Contamination of soil, ground and surface water resources (hazardous substances and materials)		x	
			Contamination of natural environment (non-hazardous waste materials)		x	
			Dust		x	
			Noise		x	
			Surface Disturbance			x
			Disturbance, injury or death of fauna		x	
			Disturbance, removal or damage of flora		x	
			Alien Vegetation		x	
			Destruction, damage or removal of heritage and cultural sites and artefacts			x
			Drainage			x
			Fire			x
			Health and Safety		x	
	Access Control Measures – fences security lighting, gates and security guards.	X	Noise		x	
			Dust		x	
			Light		x	
			Surface Disturbance			x
			Disturbance, injury or death of fauna		x	
			Disturbance, removal or damage of flora		x	
			Alien Vegetation		x	
			Destruction, damage or removal of heritage and cultural sites and artefacts			x

			Fire			x
			Health and Safety		x	
	Upgrading access road to mining site.	X	Contamination of soil, ground and surface water resources		x	
			Dust		x	
			Noise		x	
			Light		x	
			Surface Disturbance			x
			Disturbance, injury or death of fauna		x	
			Disturbance, removal or damage of flora		x	
			Alien Vegetation		x	
			Destruction, damage or removal of heritage and cultural sites and artefacts			x
			Drainage			x
	Increase in vehicle and human traffic	x	Contamination of soil, ground and surface water resources (hazardous substances and materials)		x	
			Contamination of natural environment (non-hazardous waste materials)		x	
			Dust		x	
			Noise		x	
			Light		x	
			Surface Disturbance			x
			Disturbance, injury or death of fauna		x	
			Disturbance, removal or damage of flora		x	
			Alien Vegetation		x	
			Destruction, damage or removal of heritage and cultural sites and artefacts			x
			Fire			x
			Health and Safety		x	
OPERATIONAL PHASE	Excavations – surveying and drilling	x	Contamination of soil, ground and surface water resources (hazardous substances and materials)	x		
			Contamination of natural environment (non-	x		

			hazardous waste materials)			
			Dust		x	
			Noise		x	
			Surface Disturbance			x
			Disturbance, injury or death of fauna		x	
			Disturbance, removal or damage of flora		x	
			Health and Safety		x	
			Destruction, damage or removal of heritage and cultural sites and artefacts			x
	Excavations - Blasting	x	Contamination of soil, ground and surface water resources (hazardous substances and materials)		x	
			Contamination of natural environment (non-hazardous waste materials)		x	
			Dust			x
			Noise			x
			Surface Disturbance			x
			Disturbance, injury or death of fauna			x
			Disturbance, removal or damage of flora			x
			Fire			x
			Health and Safety - flying rock material.			x
			Destruction, damage or removal of heritage and cultural sites and artefacts			x
	Stockpiling	x	Dust		x	
			Noise		x	
			Surface Disturbance			x
			Drainage			x
			Destruction, damage or removal of heritage and cultural sites and artefacts			x
	Loading, haulage and transportation.	X	Contamination of soil, ground and surface water resources (hazardous substances and materials)		x	
			Contamination of natural environment (non-hazardous waste materials)		x	

			Dust			x
			Noise			x
			Light		x	
			Surface Disturbance			x
			Disturbance, injury or death of fauna		x	
			Disturbance, removal or damage of flora		x	
			Alien Vegetation		x	
			Destruction, damage or removal of heritage and cultural sites and artefacts			x
			Health and Safety		x	
DECOMMISSIONING AND REHABILITATION PHASE	Clearing the site camp and remainder of the mining site of structures, equipment and other facilities. Also includes clearance of hazardous and non-hazardous waste.	x	Contamination of soil, ground and surface water resources (hazardous substances and materials)		x	
			Contamination of natural environment (non-hazardous waste materials)		x	
			Dust		x	
			Noise		x	
			Surface Disturbance			x
			Disturbance, injury or death of fauna		x	
			Disturbance, removal or damage of flora		x	
			Alien Vegetation		x	
			Destruction, damage or removal of heritage and cultural sites and artefacts			x
			Fire			x
			Health and Safety		x	
			Drainage			x
	Access Control Measures – fences security lighting, gates and security guards.	x	Noise		x	
			Dust	x		
			Light		x	
			Surface Disturbance			x
			Disturbance, injury or death of fauna		x	
			Disturbance, removal or damage of flora		x	

			Alien Vegetation		x	
			Destruction, damage or removal of heritage and cultural sites and artefacts			x
			Health and Safety		x	
	Rehabilitating site camp and mining site – infilling, trimming and shaping	x	Contamination of soil, ground and surface water resources (hazardous substances and materials)		x	
			Contamination of natural environment (non-hazardous waste materials)		x	
			Dust		x	
			Noise		x	
			Surface Disturbance			x
			Disturbance, injury or death of fauna		x	
			Disturbance, removal or damage of flora		x	
			Alien Vegetation		x	
			Destruction, damage or removal of heritage and cultural sites and artefacts		x	
			Health and Safety		x	
			Drainage			x
	Rehabilitating site camp and mining site – ripping and top soiling	x	Contamination of soil, ground and surface water resources (hazardous substances and materials)		x	
			Contamination of natural environment (non-hazardous waste materials)		x	
			Dust		x	
			Noise		x	
			Surface Disturbance			x
			Disturbance, injury or death of fauna		x	
			Disturbance, removal or damage of flora		x	
			Alien Vegetation		x	
			Destruction, damage or removal of heritage and cultural sites and artefacts		x	
			Health and Safety		x	

			Drainage			x
	Rehabilitating site camp and mining site – re-vegetation.	x	Contamination of soil, ground and surface water resources (hazardous substances and materials)		x	
			Contamination of natural environment (non-hazardous waste materials)		x	
			Dust		x	
			Noise		x	
			Surface Disturbance			x
			Disturbance, injury or death of fauna		x	
			Disturbance, removal or damage of flora		x	
			Destruction, damage or removal of heritage and cultural sites and artefacts		x	
			Health and Safety		x	
			Drainage			x
	Protection and maintenance of rehabilitated areas of the site camp and mining site.	x	Contamination of soil, ground and surface water resources (hazardous substances and materials)		x	
			Contamination of natural environment (non-hazardous waste materials)		x	
			Dust		x	
			Noise		x	
			Surface Disturbance			x
			Disturbance, injury or death of fauna		x	
			Disturbance, removal or damage of flora		x	
			Destruction, damage or removal of heritage and cultural sites and artefacts			x
			Health and Safety		x	
			Drainage			x

2. SIGNIFICANCE RATING: IMPLEMENTATION OF MITIGATION MEASURES DURING PREPARATION, OPERATION AND DECOMMISSIONING PHASES OF MINING OPERATION

SIGNIFICANCE RATING: AFTER IMPLEMENTATION OF MITIGATION MEASURES						
PHASE OF MINING OPERATION	**ACTIVITY** Mark with X which activities are applicable		**POTENTIAL IMPACT**	**SIGNIFICANCE RATING**		
				Low	**Medium**	**High**
CONSTRUCTION/ PREPARATION PHASE	Establishment of site camp – erection of fence, gate, portable toilets and water storage tanks, storage areas and site office.	X	Contamination of soil, ground and surface water resources (hazardous substances and materials)	x		
			Contamination of natural environment (non-hazardous waste materials)	x		
			Dust	x		
			Noise	x		
			Surface Disturbance	x		
			Disturbance, injury or death of fauna	x		
			Disturbance, removal or damage of flora	x		
			Alien Vegetation	x		
			Destruction, damage or removal of heritage and cultural sites and artefacts		x	
			Drainage		x	
			Fire	x		
			Health and Safety	x		
	Access Control Measures – fences security lighting, gates and security guards.	X	Noise	x		
			Dust	x		
			Light	x		
			Surface Disturbance		x	
			Disturbance, injury or death of fauna	x		
			Disturbance, removal or damage of flora	x		
			Alien Vegetation	x		
			Destruction, damage or removal of heritage		x	

			and cultural sites and artefacts			
			Fire	x		
			Health and Safety	x		
	Upgrading access road to mining site.	X	Contamination of soil, ground and surface water resources	x		
			Dust	x		
			Noise	x		
			Light	x		
			Surface Disturbance		x	
			Disturbance, injury or death of fauna	x		
			Disturbance, removal or damage of flora	x		
			Alien Vegetation	x		
			Destruction, damage or removal of heritage and cultural sites and artefacts		x	
			Drainage		x	
	Increase in vehicle and human traffic	x	Contamination of soil, ground and surface water resources (hazardous substances and materials)	x	x	
			Contamination of natural environment (non-hazardous waste materials)	x		
			Dust	x		
			Noise	x		
			Light	x		
			Surface Disturbance		x	
			Disturbance, injury or death of fauna	x		
			Disturbance, removal or damage of flora	x		
			Alien Vegetation	x		
			Destruction, damage or removal of heritage and cultural sites and artefacts		x	
			Fire	x		
			Health and Safety	x		
OPERATIONAL PHASE	Excavations – surveying and drilling	x	Contamination of soil, ground and surface water resources (hazardous substances and materials)	x		

			Contamination of natural environment (non-hazardous waste materials)	x		
			Dust		x	
			Noise		x	
			Surface Disturbance		x	
			Disturbance, injury or death of fauna	x		
			Disturbance, removal or damage of flora	x		
			Health and Safety		x	
			Destruction, damage or removal of heritage and cultural sites and artefacts		x	
	Excavations - Blasting	x	Contamination of soil, ground and surface water resources (hazardous substances and materials)	x		
			Contamination of natural environment (non-hazardous waste materials)	x		
			Dust		x	
			Noise		x	
			Surface Disturbance			x
			Disturbance, injury or death of fauna		x	
			Disturbance, removal or damage of flora		x	
			Fire	x		
			Health and Safety - flying rock material.	x		
			Destruction, damage or removal of heritage and cultural sites and artefacts		x	
	Stockpiling	x	Dust	x		
			Noise	x		
			Surface Disturbance		x	
			Drainage		x	
			Destruction, damage or removal of heritage and cultural sites and artefacts		x	
	Loading, haulage and transportation.	X	Contamination of soil, ground and surface water resources (hazardous substances and materials)	x	x	
			Contamination of natural environment (non-	x		

			hazardous waste materials)			
			Dust		x	
			Noise		x	
			Light	x		
			Surface Disturbance	x		
			Disturbance, injury or death of fauna	x		
			Disturbance, removal or damage of flora	x		
			Alien Vegetation	x		
			Destruction, damage or removal of heritage and cultural sites and artefacts	x		
			Health and Safety	x		
DECOMMISSIONING AND REHABILITATION PHASE	Clearing the site camp and remainder of the mining site of structures, equipment and other facilities. Also includes clearance of hazardous and non-hazardous waste.	x	Contamination of soil, ground and surface water resources (hazardous substances and materials)	x		
			Contamination of natural environment (non-hazardous waste materials)	x		
			Dust	x		
			Noise	x		
			Surface Disturbance		x	
			Disturbance, injury or death of fauna	x		
			Disturbance, removal or damage of flora	x		
			Alien Vegetation	x		
			Destruction, damage or removal of heritage and cultural sites and artefacts		x	
			Fire	x		
			Health and Safety	x		
			Drainage		x	
	Access Control Measures – fences security lighting, gates and security guards.	x	Noise	x		
			Dust	x		
			Light	x		
			Surface Disturbance	x		
			Disturbance, injury or death of fauna	x		

			Disturbance, removal or damage of flora	x		
			Alien Vegetation	x		
			Destruction, damage or removal of heritage and cultural sites and artefacts	x		
			Health and Safety	x		
	Rehabilitating site camp and mining site – infilling, trimming and shaping	x	Contamination of soil, ground and surface water resources (hazardous substances and materials)	x		
			Contamination of natural environment (non-hazardous waste materials)	x		
			Dust	x		
			Noise	x		
			Surface Disturbance		x	
			Disturbance, injury or death of fauna	x		
			Disturbance, removal or damage of flora	x		
			Alien Vegetation	x		
			Destruction, damage or removal of heritage and cultural sites and artefacts	x		
			Health and Safety	x		
			Drainage		x	
	Rehabilitating site camp and mining site – ripping and top soiling	x	Contamination of soil, ground and surface water resources (hazardous substances and materials)	x		
			Contamination of natural environment (non-hazardous waste materials)	x		
			Dust	x		
			Noise	x		
			Surface Disturbance		x	
			Disturbance, injury or death of fauna	x		
			Disturbance, removal or damage of flora	x		
			Alien Vegetation	x		
			Destruction, damage or removal of heritage and cultural sites and artefacts	x		

			Health and Safety	x		
			Drainage		x	
	Rehabilitating site camp and mining site – re-vegetation.	x	Contamination of soil, ground and surface water resources (hazardous substances and materials)	x		
			Contamination of natural environment (non-hazardous waste materials)	x		
			Dust	x		
			Noise	x		
			Surface Disturbance		x	
			Disturbance, injury or death of fauna	x		
			Disturbance, removal or damage of flora	x		
			Destruction, damage or removal of heritage and cultural sites and artefacts	x		
			Health and Safety	x		
			Drainage		x	
	Protection and maintenance of rehabilitated areas of the site camp and mining site.	x	Contamination of soil, ground and surface water resources (hazardous substances and materials)	x		
			Contamination of natural environment (non-hazardous waste materials)	x		
			Dust	x		
			Noise	x		
			Surface Disturbance		x	
			Disturbance, injury or death of fauna	x		
			Disturbance, removal or damage of flora	x		
			Alien Vegetation	x		
			Destruction, damage or removal of heritage and cultural sites and artefacts	x		
			Health and Safety	x		
			Drainage		x	

Annexure J: Cost Breakdown of Closure and Rehabilitation

TEMPLATE FOR ASSESSING QUANTUM

COST BREAKDOWN FOR CLOSURE AND REHABILITATION OF AGGREGATE QUARRY

NB: PLEASE NOTE THAT THE FIGURES PROVIDED HAVE BEEN ESTABLISHED THROUGH CONSULTATION WITH REPUTABLE CIVIL ENGINEERING AND ARCHITECTURAL FIRMS AND THE GUIDANCE OF A RECOGNIZED DEMOLITION COMPANY.

1 TEMPLATE FOR ASSESSING THE QUANTUM

1.1 Step 1: Mine type and saleable mineral by-product

Use Tables B.12, B.13 and B.14.

Mine type	Aggregate
Saleable mineral by-product	None

1.2 Step 2: Risk ranking

Use Tables B.12, B.13 and B.14

- Class A (High risk),
- Class B (Medium risk), or
- Class C (Low risk).

Primary risk ranking (either Table B.12 or B.13)	Class B (Medium Risk)
Revised risk ranking (B.14)	Class B (Medium Risk)

1.3 Step 3: Environmental sensitivity of the mine area

Use Table B.3

- High sensitivity,
- Medium sensitivity, or
- Low sensitivity.

Environmental sensitivity of the mine area	Medium Sensitivity

1.4 Step 4: For Class A or B mines and preferred route for Class c mines

1.4.1 Step 4.1: Level of information

See Section 4.3.1:

- Extensive information, or
- Limited information.

Level of information available	Extensive Information

1.4.2 Step 4.2: Identify closure components

See Table B.4 and site-specific conditions

Component No.	Main description	Applicability of closure components (Circle Yes of No)	
1	Dismantling of processing plant and related structures (including overland conveyors and powerlines)	Yes	(No)
2(A)	Demolition of steel buildings and structures	Yes	(No)
2(B)	Demolition of reinforced concrete buildings and structures	Yes	(No)
3	Rehabilitation of access roads	(Yes)	No
4(A)	Demolition and rehabilitation of electrified railway lines	Yes	(No)
4(B)	Demolition and rehabilitation of non-electrified railway lines	Yes	(No)
5	Demolition of housing and facilities	(Yes)	No
6	Opencast rehabilitation including final voids and ramps	(Yes)	No
7	Sealing of shafts, adits and inclines	(Yes)	No
8(A)	Rehabilitation of overburden and spoils	(Yes)	Yes
8(B)	Rehabilitation of processing waste deposits and evaporation ponds (basic, salt-producing)	Yes	(No)
8(C)	Rehabilitation of processing waste deposits and evaporation ponds (acidic, metal-rich)	Yes	(No)
9	Rehabilitation of subsided areas	Yes	(No)
10	General surface rehabilitation, including grassing of all denuded areas	(Yes)	No
11	River diversions	Yes	(No)
12	Fencing	(Yes)	No
13	Water management (Separating clean and dirty water, managing polluted water and managing the impact on groundwater)	(Yes)	No
14	2 to 3 years of maintenance and aftercare	(Yes)	No

1.4.3 Step 4.3: Identify unit rates for closure components

Risk ranking	Class B (Medium Risk)
Environmental sensitivity of mine area	Medium Sensitivity

Use Table B.5 to determine Master rates and multiplication factors for applicable closure components.

Component No.	Main description	Master rate	Multiplication factor
1	Dismantling of **processing plant and related structures** (including overland conveyors and powerlines)	N/A	N/A
2(A)	Demolition of **steel buildings and structures**	N/A	N/A
2(B)	Demolition of **reinforced concrete buildings and structures**	N/A	N/A
3	Rehabilitation of **access roads**	25.00	1.0
4(A)	Demolition and rehabilitation **electrified railway lines**	N/A	N/A
4(B)	Demolition and rehabilitation of **non-electrified railway lines**	N/A	N/A
5	Demolition of **housing and facilities**	276.00	1.0
6	**Opencast rehabilitation** including final voids and ramps	144,420.00	0.92
7	Sealing of **shafts, adits and inclines**	74	1.0
8(A)	Rehabilitation of **overburden and** spoils	96,280.00	1.0
8(B)	Rehabilitation of **processing waste deposits and evaporation** ponds (basic, salt-producing)	N/A	N/A
8(C)	Rehabilitation of **processing waste deposits and evaporation** ponds (acidic, metal-rich)	N/A	N/A
9	Rehabilitation of **subsided areas**	N/A	N/A
10	**General surface rehabilitation**, including grassing of all denuded areas	76,270.00	1.0
11	**River diversions**	N/A	N/A
12	**Fencing**	87	1.0
13	**Water management** (Rate applicable to post-closure of a portion of the mine)	29,000.00	0.60
14	2 to 3 years of **maintenance and aftercare**	10,150.00	1.0

1.4.4 Step 4.4: Determine weighting factors

Use Tables B.6 and B.7

Weighting factor 1: Nature of terrain/accessibility	1.6
Weighting factor 2: Proximity to urban area where goods and services are to be supplied	1.0

1.4.5 Step 4.5: Identify areas of disturbance

Use suitably scaled topographical maps and/or site visits to the mining operations.

1.4.6 Step 4.6: Identify closure costs from specialist studies

Calculate the total of all closure costs from specialist studies that have been submitted by the permit holder.

1.4.7 Step 4.7: Calculate closure costs

CALCULATION OF THE QUANTUM

Mine:		Location:	
Evaluators:		Date:	

No	Description	Unit	A Quantity	B Master rate	C Multiplication factor	D Weighting factor 1	E=A*B*C*D Amount (rands)
			Step 4.5	Step 4.3	Step 4.3	Step 4.4	
1	Dismantling of processing plant and related structures (including overland conveyors and power lines)	m²	0	0	1.0	1.0	0.00
2(A)	Demolition of steel buildings and structures	m²	0	0	1.0	1.0	0.00
2(B)	Demolition of reinforced concrete buildings and structures	m²	0	0	1.0	1.0	0.00
3	Rehabilitation of access roads	m²	10,000.00	25.00	1.0	1.0	500,000.00
4(A)	Demolition and rehabilitation of electrified railway lines	m	0	0	1.0	1.0	0.00
4(B)	Demolition and rehabilitation of non-electrified railway lines	m	0	0	1.0	1.0	0.00
5	Demolition of housing and/or administration facilities	m²	2,640.00	276.00	1.0	1.0	728,640.00
6	Opencast rehabilitation including final voids and ramps	ha	1.5	144,420.00	0.52	1.0	112,647.60
7	Sealing of shafts, adits and inclines	m²	200,000.00	16.00	1.0	1.0	3,200,000.00
8(A)	Rehabilitation of overburden and spoils	ha	0.1	96,280.00	1.0	1.0	9,628.00
8(B)	Rehabilitation of processing waste deposits and evaporation ponds (basic, salt-producing waste)	ha	0	0	1.0	1.0	0.00
8(C)	Rehabilitation of processing waste deposits and evaporation ponds (acidic, metal-rich waste)	ha	0	0	1.0	1.0	0.00
9	Rehabilitation of subsided areas	ha	0	0	1.0	1.0	0.00
10	General surface rehabilitation	ha	2.5	76,270.00	1.0	1.0	190,675.00
11	River diversions	ha	0	0	1.0	1.0	0.00
12	Fencing	ha	488	87	1.0	1.0	42,456.00
13	Water management	ha	0.3	29,000.00	0.60	1.0	
14	2 to 3 years of maintenance and aftercare	ha	62.5	101,380.00	1.0	1.0	6,336,250.00
15 (A)	Specialist study – Botanist	Sum	42	400.00	1.0	1.0	16,800.00
15 (B)	Specialist study – Civil Engineer	Sum	80	320.00	1.0	1.0	25,600.00
						Sub Total 1 (Sum of items 1 to 15 above)	44,131,224.68

1	Preliminary and General	12.5% of Subtotal 1	Weighting factor 2 (Step 4.4) 1.0	5,141,403.00
2	Administration and supervision costs	6.0% of Subtotal 1		2,467,873.44
3	Engineering drawings and specifications	2.0% of Subtotal 1		822,624.48
4	Engineering and procurement of specialist work	2.5% of Subtotal 1		1,028,280.60
5	Development of a closure plan	2.5% of Subtotal 1		1,028,280.60
6	Final groundwater modelling			
			Sub Total 2 (Subtotal 1 plus sum of management and administrative items, 1 to 6 above)	57,619,684.00
7	Contingency	10.0% of Subtotal 1		4,413,122.00
			Sub Total 3 (Subtotal 2 plus contingency)	62,032,806.00
			VAT (14%)	5,758,371.36
			GRAND TOTAL (Subtotal 3 plus VAT)	67,791,177.00

1.5 Step 5: For Class C mining operations

1.5.1 Step 5.1: Determine minimum rate per hectare for closure

Use Table B.10

1	Minimum rate per hectare for closure (Rands)	

1.5.2 Step 5.2: Determine overall size of mine

Use suitably scaled topographical maps and/or site visits to the mining operations.

2	Overall size of mine (ha)	

1.5.3 Step 5.3: Calculate closure costs

Closure cost (Rands)	1 * 2	

Annexure K: Riparian Delineation Report