START

case ID: 1986

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21 October 2009

The Manager
SA Heritage Recourses Agency
40A Summerset Street
GRANHAMSTOWN
6139

Dear Sir / Madam

RE: ENVIRONMENTAL MANAGEMENT PLAN FOR PORTION 3 OF FARM 860, DISTRICT: EAST LONDON
REF NO: EC 30/5/1/3/2/0363 MP

We regret to advise that the incorrect version of the EMPlan was sent to the DME, and then forwarded to your department.

Attached please find the correct document for your perusal. To compensate for time lost, we will try to arrange with the DME for an additional week to comment.

Please accept our sincere apologies for any inconvenience or confusion caused.

Sincerely

VC MABILLE
PRO-EARTH

File number: EC 30/5/1/3/2/1003 (MR)

DEPARTMENT OF MINERALS AND ENERGY

ENVIRONMENTAL MANAGEMENT PLAN

Submitted in support of application for a MINING RIGHT
Minerals and Petroleum Resources Development Act, 2002 (Act 28 of 2002)

Application for a	MINING PERMIT:	X

Applicant: VADUBA INVESTMENTS CC

Farm: PORTION 3 OF THE FARM 860

District: EAST LONDON

Mineral: WEATHERED DOLERITE

Date: SEPTEMBER 2009

CONTENTS

A. DOCUMENT DETAILS, REQUIREMENTS AND USE

A.1 INTRODUCTION

This document aims to provide a simplified national standard that complies with the relevant legislation and environmental regulations in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002)(MPRDA) and which can be used by applicants applying for a prospecting right or mining permit.

A.2 SCOPE

This document is intended for use by applicants applying for mining permits and prospecting rights.
Typically, operations in this sector of the mining industry:

- Use little or no chemicals to extract the minerals from the ore,
- Work on portions of land 1,5 hectares in size or smaller,
- Disturb the topography of an area somewhat but have no significant impact on the geology or hydrogeology.

A.3 PURPOSE

This document aims to:

- Provide a national standard for the submission of Environmental Management Plans for the types of applications mentioned in A.2.
- Ensure compliance with Regulation 52 of the MPRDA.
- Assist applicants by providing the information that the Department of Minerals and Energy (DME) requires in simple language and in a structured, prescribed format, as required in Regulation 52 (2) of the (MPRDA).
- Assist regional offices of the DME by providing enough information about a proposed prospecting/ reconnaissance or mining permit operation so that an informed assessment of the possible environmental impacts resulting from that operation and to determine corrective action even before such a right is granted and the operation commences.

Given this dual focus and the generic nature of a document like this, it might not be suitable for all types of operations under various circumstances.

The document has therefore been modified to suit the particular circumstances of the application in question.

A.4 USE OF THE DOCUMENT

This document is designed for use by non-professionals and newcomers to the environmental management industry and it incorporates a very simple Environmental Impact Assessment (EIA). The EIA is contained in Section C of this document and was designed specifically with the target sectors of the mining industry (described in A.2 above) in mind.

The **aim** is ultimately to:
(a) gather information from applicants themselves;
(b) to assess the impact of the operation based on that information and then
(c) to guide the applicant to mitigate environmental impacts to limit damage to the environment.

Section B of the document contains **demographic** information about the applicant. **Section C** contains the information that will be used in the **Environmental Impact Assessment (EIA)**. The applicant must complete the relevant sections of this document, but the regional office of the DME will do the scoring of these for the **Impact Assessment Rating** in **Section D**.

Section F (the Environmental Management Plan) of the document **is prescriptive** and provides guidance to the miner or prospector on how to limit the damage of the operation on the environment. The regional manager of the DME, who has the prerogative to decide whether this Environmental Management Plan will adequately address the environmental impacts expected from the operation or whether additional requirements for proper environmental management need to be set, may add requirements to this section. Where these **additional requirements** are set, they will appear in **Section G** of this document. The Environmental Management Plan (Section F) of the document is legally binding once approved and, in the **undertaking** contained in **Section H**, the applicant effectively agrees to implement all the measures outlined in this Environmental Management Plan.

A.5 LEGISLATION/ REGULATIONS

The relevant sections of Mineral and Petroleum Resources Development Act and its supporting Regulations are summarised below. The onus is on the applicant to familiarise himself/herself with the provisions of the full version of the Mineral and Petroleum Resources Development Act 2002 (Act 28 of 2002)(MPRDA) and its Regulations.

Table 1: Relevant sections of Mineral and Petroleum Resources Development Act

Section of Act	Legislated Activity/ Instruction/ Responsibility or failure to comply	Penalty in terms of Section 99
5(4)	No person may prospect, mine, or undertake reconnaissance operations or any other activity without an approved EMP, right, permit or permission or without notifying the land owner.	R 100 000.00 or two years imprisonment or both.
19	The holder of a Prospecting right must: lodge the right with the Mining Titles Office within 30 days; commence with prospecting within 120 days, comply with terms and conditions of the prospecting right, continuously and actively conduct prospecting operations; comply with the requirements of the approved EMP, pay prospecting fees and royalties.	R 100 000.00 or two years imprisonment or both.
20(2)	The holder of a prospecting right must obtain the Minister's permission to remove any mineral or bulk samples.	R 100 000.00 or two years imprisonment or both.
26(3)	A person who intends to beneficiate any mineral mined within SA outside the borders of SA may only do so after notifying the Minister in writing and after consultation with the Minister.	R 500 000.00 for each day of contravention.
28	The holder of a mining right or permit must keep records of operations including financial records AND must submit to the DG: monthly returns, annual financial report and a report detailing compliance with the social & labour plan and charter.	R 100 000.00 or two years imprisonment or both.
29	The minister may direct the owner of land or the holder/applicant of a permit/right to submit data or information.	R 10 000.00
38(1)©	The holder of a permit/right MUST manage environmental impacts according to the EMP as an ongoing part of the operations.	R 500 000.00 or ten years imprisonment or both.
42(1)	Residue stockpiles must be managed in a prescribed manner on a site demarcated in the EMP.	A fine or imprisonment of up to six months or both
42(2)	No person may temporarily or permanently deposit residue on any other site than that demarcated and indicated in the EMP.	A fine or imprisonment of up to six months or both.
44	When any permit/right lapses, the holder may not remove or demolish buildings, which may not be demolished in terms of any other law, which have been identified by the Minister or which are to be retained by agreement with the landowner.	Penalty that may be imposed by Magistrate's Court for similar offence.
92	Authorised persons may enter mining sites and require the holder of a permit to produce documents/reports or any material deemed necessary for inspection.	Penalty as may be imposed for perjury.
94	No person may obstruct or hinder an authorised person in the performance of their duties or powers under the Act.	Penalty as may be imposed for perjury.
95	The holder of a permit/right may not subject employees to occupational detriment on account of employee disclosing evidence or information to authorised person (official).	Penalty as may be imposed for perjury.
All sections	Inaccurate, incorrect or misleading information.	A fine or imprisonment of up to six months or both.
All sections	Failure to comply with any directive, notice, suspension, order, instruction, or condition issued.	A fine or imprisonment of up to six months or both.

A.6 OTHER RELEVANT LEGISLATION

Compliance with the provisions of the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002) and its Regulations does not necessarily guarantee that the applicant is in compliance with other regulations and legislation. Other legislation that may be applicable includes, but is not limited to:

Table 2: Acts and Regulations

TITLE	ABBREVIATION	COMMENT/S
South African Constitution Act 108 of 1996	"The Constitution"	National, provincial and local government are obliged to introduce legislative and other measures to prevent ecological degradation; promote conservation; and, secure ecologically sustainable development and use of natural resources, while promoting justifiable economic and social development.
National Environmental Management Act, 1998 (Act 107 of 1998)	NEMA	DE A& DP. Principles in NEMA include amongst other (a) that disturbance of ecosystems and loss of biological diversity are to be avoided, or, where they cannot be altogether avoided, are minimized and remedied; and, (b) that sensitive, vulnerable, highly dynamic or stressed ecosystems require specific management and planning, especially where they are subject to significant human resource usage and development pressure.
National Environmental Management: Biodiversity Act, 2004(Act No. 10 of 2004)	Biodiversity Act	DE A& DP. This draft legislation effectively takes a section on biodiversity from NEMA (107 of 1998) and expands it greatly. Defining biodiversity in the broadest terms, this Act will protect our incredible natural diversity while promoting sustainable utilization and "*fair and equitable sharing of benefits arising from the commercialization through bio-prospecting of traditional uses and knowledge of genetic resources*".
National Environmental Management: Protected Areas Act Act 57 of 2003	Protected Areas Act	Provides for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascape.
Environmental Conservation Act, 1989, Act 73 of 1989	ECA	Provides for the Environmental Impact Assessment regulations (promulgated in 1997), which seek to ensure sustainable development in both urban and rural contexts.
		Control of littering, pollution, activities which may have a detrimental effect on the environment, combating of noise, control and licensing of waste disposal (landfill) sites, preparation and contents of environmental impact reports. The Act also provides for the declaration and management of any property in private ownership as a Protected *Natural Enviornment (PNE)*, the control of environmental pollution and for imposing penalties where any provision of the Act is contravened.
Atmospheric pollution Prevention Act, 1965 (Act 45 of 1965)		Air Emissions
National Water Act, Act 36 of 1998	NWA	The NWA is revolutionary in its broad approach to biodiversity conservation, protecting aquatic ecosystems in order to ensure ecologically sustainable development and use of the water resource. Activities, which impact negatively on wetlands, such as draining or cultivating them, or allowing livestock to graze on them, are now controlled by this Act and in most cases will require licensing.
National Water Act, Act 36 of 1998		This Act provides for the reform and repeal of the Water Act, 1956 (Act 54 of 1956) As well as a number of other existing laws relating to water resources. In so doing, It reviews current practices and institutional arrangements for water management in the country.
National Veldt and Forest Fire Act, Act 101 of 1998		The Act provides for a variety of institutions, methods and practices for achieving the combating of veldt, forest and mountain fires. The Act regulates the establishment, registration, duties and functioning of fire protection associations, which must deal with all aspects of veldt fire prevention and fire fighting. It also provides for the prevention of veldt fires through a fire danger rating system and places a duty on owners to prepare and maintain firebreaks.
National Parks Act, Act 57 of 1976		This Act provides for the establishment of National Parks in the Republic. National Park status establishes the strongest claim to permanent protection that is possible. South African National Parks is charged with the control, management and maintenance of National Parks. The Act also provides for the declaration of private land as part of a National Park, i.e. Contractual National Park. In such a case, an agreement and a Management Plan are drawn up for the management of the property by S.A. National Parks. .
Mine Safety and Health Act, 1996 Act 29 of 1996		

		Control of littering, pollution, activities which may have a detrimental effect on the environment, combating of noise, control and licensing of waste disposal (landfill) sites, preparation and contents of environmental impact reports. The Act also provides for the declaration and management of any property in private ownership as a Protected *Natural Enviornment (PNE)*, the control of environmental pollution and for imposing penalties where any provision of the Act is contravened.
Conservation of Agricultural Resources Act, Act 43 of 1983	CARA	Regulations promulgated under section 29 of this Act include a listing of, and requirements for the control of, various categories and types of declared invasive and weeds in both urban and rural areas.
Draft Sustainable Utilization Of Agricultural Resources Bill 2003		Draft legislation that will replace the Conservation of Agricultural Resources Act (43 of 1983).
Mountain Catchment Areas Act Act 63 of 1970		Provides for the establishment of fire protection committees and preparation of fire protection plans. This Act provides for the conservation, use, management and control of land situated in mountain catchment areas. In terms of the Act any area of which the water yield is of great importance may be declared a Mountain Catchment Area. Mountain Catchment Areas are managed by means of management guidelines relating to conservation, use and control of land and vegetation.
National Heritage Resources Act (Act 25 of 1999)		The purpose of this Act, which is administered by the South African Heritage Resources Agency is to preserve and protect the historical and cultural heritage of this country, which includes natural and human-made assets. This Act provides for the proclamation of National *Monuments and* the designation of Conservation *Areas*, on the grounds of their historic, aesthetic or scientific interest. The Act stipulates that the Council must be consulted with respect to the planning of a Conservation Area.
National Veldt and Forest Fire Act Act 101 of 1998	Veldt fire Act	Imposes a duty on landowners to prepare and maintain firebreaks (that do not cause soil erosion and are free of inflammable material that reasonably prevent or allow control of a veldt fire.
National Forests Act, Act 84 of 1998	NFA	Protects indigenous forests and woodlands as well as specified tree species.
Nature Conservation Ordinance, Ordinance 19 of 1974	The Ordinance	Read in conjunction with the Western Cape Nature Conservation Board Act (1998) and the Western Cape Nature Conservation Laws Amendment Act (2000). This Ordinance is applicable in the Western and Eastern Cape and protects the natural (indigenous) flora and fauna at a Provincial level.
National Heritage Resources Act, Act 25 of 1999	NHRA	The NHRA promotes an integrated and interactive system for natural heritage resource management and to promote good governance at all levels. South African Heritage Resources Agency (SAHRA) – manages Archaeological, cultural, historical and other resources
Local Government Transition Act, Act 209 of 1993		This Act provides for interim measures for the restructuring of local government. The Local Government Transition Act requires all local authorities to draw up IDPs, i.e. a plan pertaining to the integrated development and management of the area of jurisdiction of the local authority concerned. The IDP is to be prepared in accordance with the general *principles as* well as LDOs contained in the Development Facilitation Act, 1995.
White Paper on Agriculture (Department of Agriculture, 1995)		The White Paper (Department of Agriculture, 1995) mandates an agricultural sector characterized by a range of farm sizes that are market directed, with access to agricultural land being broadened through land reform and supported by the provision of appropriate services. Agricultural production is to be based on the sustainable use of natural agricultural and water resources. Of particular to the formulation of the SDF, is the following: a) Productive agricultural land should be retained for agricultural use. b) All farmers are to be made aware of and be accountable for the sustainable utilization of natural agricultural resources. c) The land-user's responsibility towards the land will include the rehabilitation of mismanaged natural agricultural relevance resources.
Physical Planning Act (Act 125 of 1991)		This Act sets out South Africa's planning framework, i.e. regulates the levels at which plans operate, the responsibility for their drafting and implementation and their contents. In terms of this Act, policy and structure plans (SDFs) should promote the orderly development of the area to which they relate for the benefit of all its inhabitants.
Conservation of Agricultural Resources Act, Act 43 of 1983		This Act provides for control over the use of natural agricultural resources in order to promote the conservation of soil, water resources and vegetation and the combating of weeds and invader plants. Regulations were promulgated in Government Gazette 9238 of 25 May 1984, which provides, *inter alia,* for the use, control and protection of virgin soil, indigenous vegetation, wetlands or vlei areas, marshes, water sponges and water-courses.

A.7 WORD DEFINITIONS

In this document, unless otherwise indicated, the following words will have the meanings as indicated here:

Act (The Act)	Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002)
Borehole	A hole drilled for the purposes of prospecting i.e. extracting a sample of soil or rock chips by pneumatic, reverse air circulation percussion drilling, or any other type of probe entering the surface of the soil.
CARA	The Conservation of Agricultural Resources Act
EIA	An Environmental Impact Assessment as contemplated in Section 38(1) (b) of the Act
EMP	An Environmental Management Plan as contemplated in Section 39 of the Act
Fauna	All living biological creatures, usually capable of motion, including insects and predominantly of protein-based consistency.
Flora	All living plants, grasses, shrubs, trees, etc., usually incapable of easy natural motion and capable of photosynthesis.
Fence	A physical barrier in the form of posts and barbed wire and/or "Silex" or any other concrete construction, ("palisade"- type fencing included), constructed with the purpose of keeping humans and animals within or out of defined boundaries.
House	Any residential dwelling of any type, style or description that is used as a residence by any human being.
NDA	National Department of Agriculture
NWA	National Water Act, Act 36 of 1998
Pit	Any open excavation.
"Porrel"	The term used for the sludge created at alluvial diamond diggings where the alluvial gravels are washed and the diamonds separated in a water-and-resource medium.
Topsoil	The layer of soil covering the earth which- (a) Provides a suitable environment for the germination of seed; (b) Allows the penetration of water; (c) Is a source of micro-organisms, plant nutrients and in some cases seed; and (d) Is not of a depth of more than 0,5 meters or such depth as the Minister may prescribe for a specific prospecting or exploration area or mining area.
Trench	A type of excavation usually made by digging in a line towards a mechanical excavator and not pivoting the boom – a large, U-shaped hole in the ground, with vertical sides and about 6 – 8 meters in length. Also a prospecting trench.
Vegetation	Any and all forms of plants see also Fauna.
DWAF	The Department of Water Affairs and Forestry – both national office and their various regional offices, which are divided across the country on the basis of water catchment areas.
MPRDA	The Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002).
EMPlan	An Environmental Management Plan as contemplated in Regulation 52 of the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002) – this document.

MPRDA – Mineral and Petroleum Resource Development Act
DME - Department of Minerals and Energy
IAPs - Interested and Affected Parties
GOs - Government Organizations
NGOs - Non- Governmental Organizations
ABET - Adult Basic Education and Training
ADT - Average Daily Traffic
BAP - Biodiversity Action Plan
BID - Background Information Document
BSAP - Biodiversity Strategy and Action Plan
CBD - Central Business District
DEAET - Eastern Cape Provincial Department of Economic Affairs, Environment and Tourism
DEAT - Department of Environmental Affairs and Tourism
DM - District Municipality

EC - Eastern Cape
ECA - Environment Conservation Act (Act No. 73 of 1989), as amended
EIA - Environmental Impact Assessment
EIR - Environmental Impact Report
EMP - Environmental Management Plan
GDP - Gross Domestic Product
HDI - Historically Disadvantaged Individual
I&AP - Interested and Affected Party
IDP - Integrated Development Plan
PCE - Pondoland Centre of Endemism
RoD - Record of Decision
SA RDB - South African Red Data Book
SAHRA - South African Heritage Resources Agency
SANRAL - South African National Roads Agency Limited
SAPS - South African Police Services
SDI - Spatial Development Initiative
SDF - Spatial Development Framework
SEA - Strategic Environmental Assessment
SED - Socio-Economic Development
SMMEs - Small, Medium and Micro Enterprises
WCSDF - Wild Coast Spatial Development Framework

Sabunga - Dolerite is mined throughout the area both as hard rock source for concrete; road base course and surfacing; and in its weathered state as gravel wearing course for road where it is known colloquially as sabunga.

BACKGROUND TO THE APPLICATION

This is a new application and arose from the demand for material required for projects in the IDZ. The weathered dolerite was noted when machinery rented out to the farmer to excavate a shallow dam showed the presence of the material. Because of the need for the material in the immediate area and the resource being available, a mining permit application was submitted to the DME. The landowner sees this as an opportunity to help him with the development or layout of his land and the applicant and landowner located the best position to mine the material so that the activity would have the least impact on the future use of the farm.

The application for a mining permit was made in accordance with the requirements of the Mineral and Petroleum Resources Development Act (Act 28 of 2002) (MPRDA) and all the procedures and processes are therefore as required by this legislation. Vaduba Investments CC adheres to the requirements of the Mineral and Petroleum Resource Development Act, Act No. 28 of 2002 and also to the requirements of the Mining Charter by making provision for Black Economical Empowerment (BEE).

Mining provided resources that are suitable as road construction material and in certain circumstances also for use in concrete and mortar. The resource occurs in adequate volumes on the site to suppy the demand (e.g. the IDZ projects). The sabunga was tested in a soil laboratory and the quality of the material was found to be suitable.

Mining will basically be a simple load and haul operation and no crushing or screening will take place. No other processing of the resource will take place.

The farm, including the two sites, is zoned for agricultural use. After mining the use of the land is anticipated to be will again be agriculture or for activities associated with agriculture.

B. APPLICANT, PROPERTY, PROJECT AND OWNERSHIP DETAILS

B.1 BIOGRAPHIC DETAILS OF THE APPLICANT	
B.1.1 Full name (and surname) of person or company applying for permit or right	VADUBA INVESTMENTS CC
B.1.2 ID number of person or company/ CC registration number	**1999/025661/23**
B.1.3 Postal address	PO Box 78
	GONUBIE
	5256
E-mail address	blaire@riegers.co.za
B.1.4 Physical/ residential address	Vaduba Investments cc
	Off Main Road
	GONUBIE
B.1.5 Applicant's telephone and fax number	Tel: 043 – 732 1464; Fax: 043 – 732 1021
B.1.6 Applicant's cellular phone number	082 874 2306
B.1.7 Alternative contact's name	Ms. Blaire Rieger
B.1.8 Alternative contact's telephone/cell phone numbers	Mr. Gary Rieger

B.2 DETAILS OF THE PROPERTY	
B.2.1 Full name of the property on which mining/ prospecting operations will be conducted	Portion 3 of the Farm 860, District East London
B.2.2 Name of the subdivision	Bon Ami Farm
B.2.3 Approximate center of mining/prospecting area	See Attached Documentation for coordinates
B.2.4 Magisterial district	

Main Place Name	Local Municipal Name	District Municipal Name	Province Name
Mount Coke, Bon Ami Farm	East London	Buffalo City	Eastern Cape

B.2.5 Name of the registered owner of the property	Mr. John Ewers
B.2.6 His/her Telephone number	Tel: 043 – 736 9207 1464; 084 5606 285
B.2.7 His/ her Postal address	P.O. Box 5138
	Greenfields
B.2.8 Current uses of the site and surrounding areas	

A shallow water pit is currently being excavated by the landowner on a piece of land adjacent to Site A. The rest of the land is vegetated land (indigenous and alien vegetation), pastures or land used for crop cultivation. Most of the proposed mine site is used for grazing.

B.2.9 Are there any other, existing land uses that impact on the environment in the proposed mining/ prospecting area?

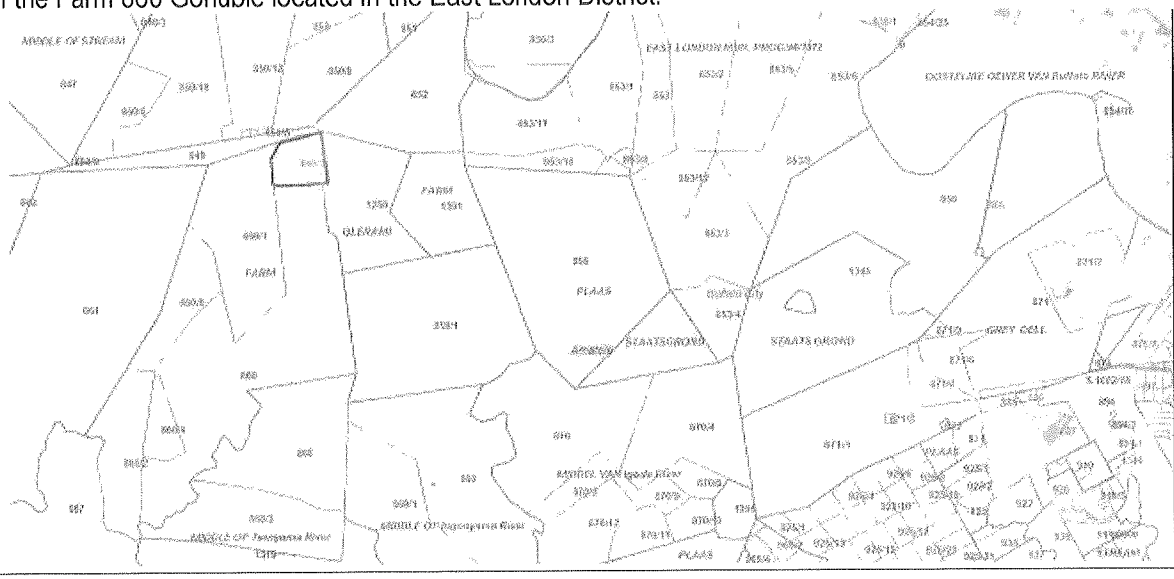
Agriculture, residential

B.2.10 What is the name of the nearest town?

Town	Direction
East London	South-east

See the locality map.

Developments or residential developments in the immediate vicinity are limited to homesteads and outbuildings on the farms and industry is limited to farming. The proposed mine site(s) is located on Portion 3 of the Farm 860 Gonubie located in the East London District.



B.2.10 Locality

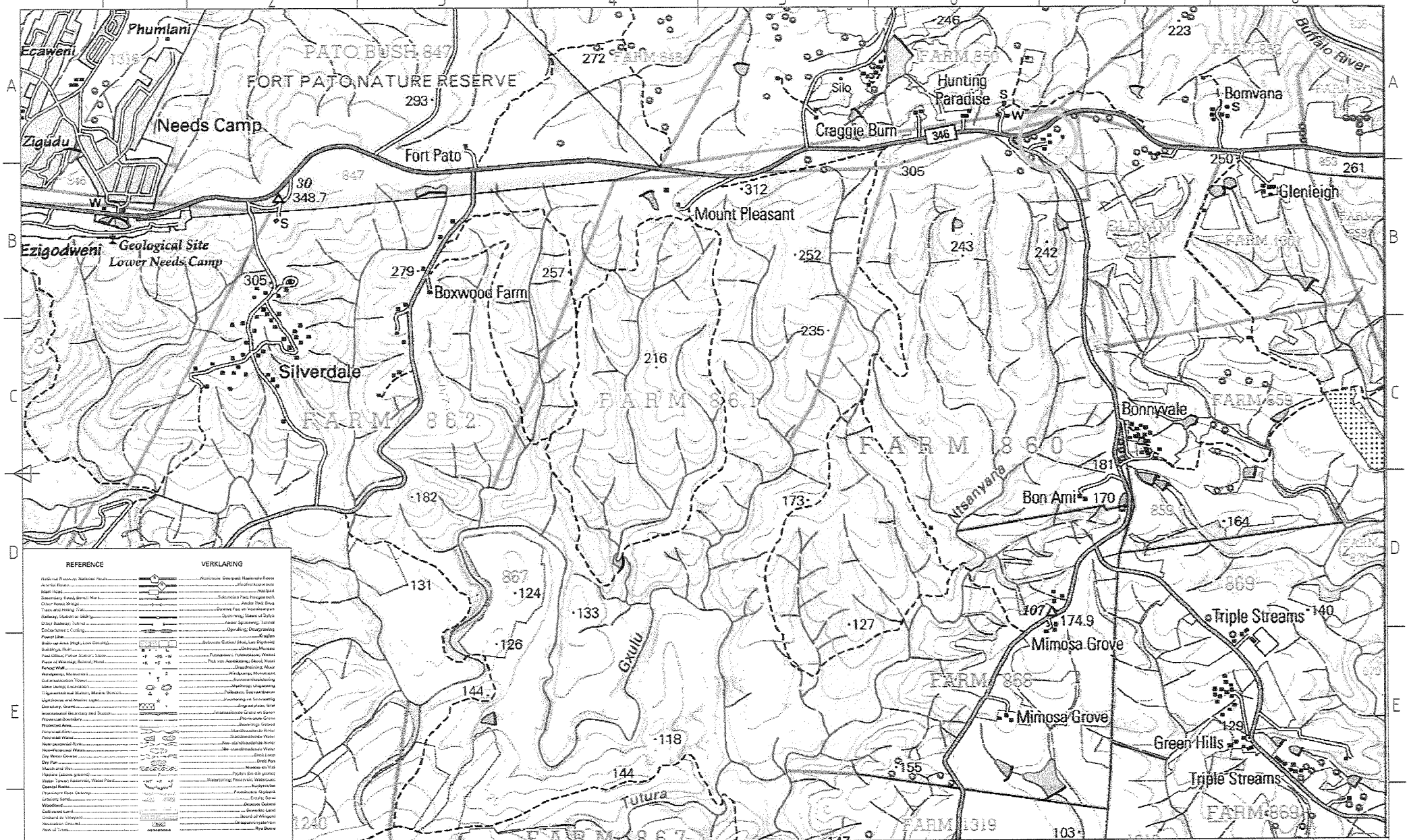
The area is not located directly to the coast but slightly more to the hinterland coastal plateau. The sites lie between 270 (±275) m and 300 (±290) meters above sea level. The site lies to the north-west of East London to the south of the R346.

Locality map.

The map Figure 1 indicates:

(a) The location of the mine
(b) The position of the mine in relation to the farm border
(c) The topography on and around the area is also indicated.

Figure 1. Locality map



Mine location

Erf
Portion 3 of Farm 860, East London

Topographical map

Area
Less than 1.5 Ha

Date
2009-07-03

System
Lo27

Signature

Name of Mine
Mount Coke

Name of Applicant
Vaduba Investments cc

File Name
Gonubie_Vaduba_860.dwg

Map reference
3327BA5

Figure

1000 0 1000 2000 3000
metres

B.2.11 REGULATION 2.2 MAP/PLAN

See Figure 2 for Regulation 2.2 plan/map

The Map includes:

- A north point
- The size of the area
- The name of the mine
- The description of the property
- The name of the applicant
- The signature of the applicant
- A space for the signature of the DME
- The coordinates
- Topography

Figure 2 (a) and 2(b). Layout of the mine

B.2.12 Details of Portion 3 of the Farm 860, East London

The annexed Diagram marked A.B.C.D.E.F.G. and bordered green represents One Thousand nine hundred and Eighty seven acres and seven hundredths of an acre of ground being

FARM No. 43

situate in the East London District, Territories of British Kaffraria

bounded North by Vacant Land,
South East by Farm No. 77 and the Tsenjana River,
South by Farm No. 74,
West by the Gooloo River
North West by Farm No. 41.

Copied from General Plan
framed by Mr. Surveyor Merriman
by me
(Sgd.) Wm. Percival Oak.
3rd Ck. Sur. Genls. office

Copied from diagram relating to
D/G E.L.Q.3-26

for Surveyor-General.

Date :

SHEET BQ-2AB

FOR ENDORSEMENTS . . . C
SEE BACK OF DGM.

DC

Figure 3 (a). Surveyor General details

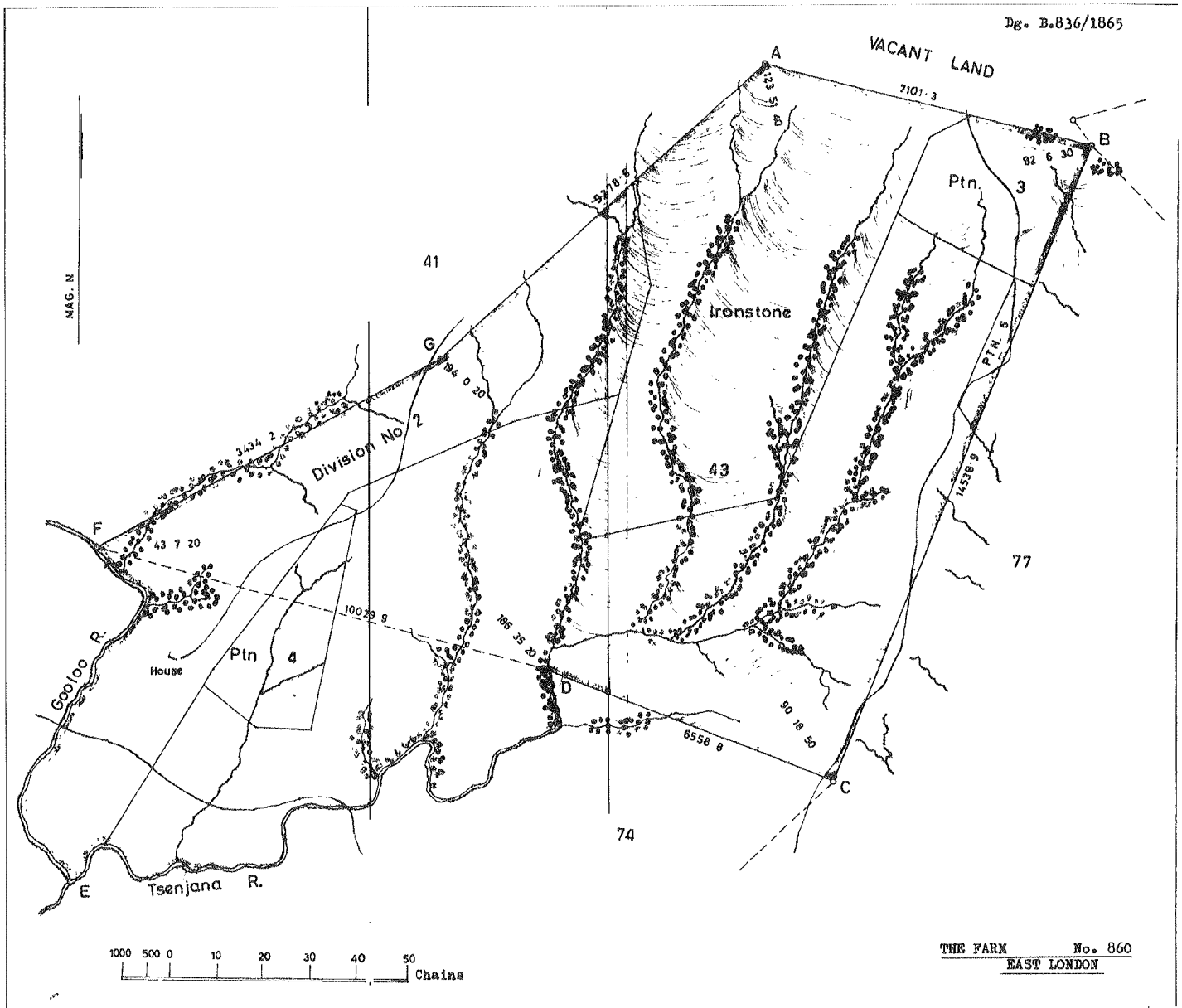


Figure 3 (b). Surveyor General diagram

B.2.13 What mineral will be mined?

The resource to be mined is weathered dolerite (sabunga). The sabunga resource will be a range of dolerite aggregate products. The weathered dolerite is currently used for fill on road surfaces and forms the layer just below the sub-base.

B 2.14 Regional Setting

The site will be referred to as Mount Coke. The site is located to the north-west of East London and falls within the Buffalo City Municipal area. The area comprises a coastal plane. The mine is located within the coastal plane.

B 2.15 Surface Infrastructure and presence of servitudes

Presence of servitudes on the Farm 860

(a) A Road Service Servitude
(b) Electrical Power Transmission Servitude
(c) A telephone line Servitude

There are also roads that cross the farm. Access to the farm and mine area is obtained from the R346 tarred road.

B.2.16 Climate

Climate data

Buffalo City's climate is mild and temperate with temperatures ranging from 10 degrees in June to 26 degrees in January. The average hours of sunshine are in excess of 200 hours per month. The region experiences dry periods in mid-summer and mid-winter, and pronounced spring rainfall over the region when predominant south-easterly winds bring rain to the coastal areas - the average annual rainfall is 889mm (450 mm inland in the south-west to 900 mm in the north-east) and decreases slightly from the coast inland. Main rainy months are March and October/November. The region has warm summers and mild, crisp winters. There is little variation in temperature from season to season. This weather is suitable for outdoor activities. Winters are usually mild, although snow falls on the mountain ranges of the Cape and Natal and occasionally in the lower-lying areas. In summer the predominant wind is south-easterly and in winter, south-western and north-westerly. The picture and table below is from the South African Weather Service.

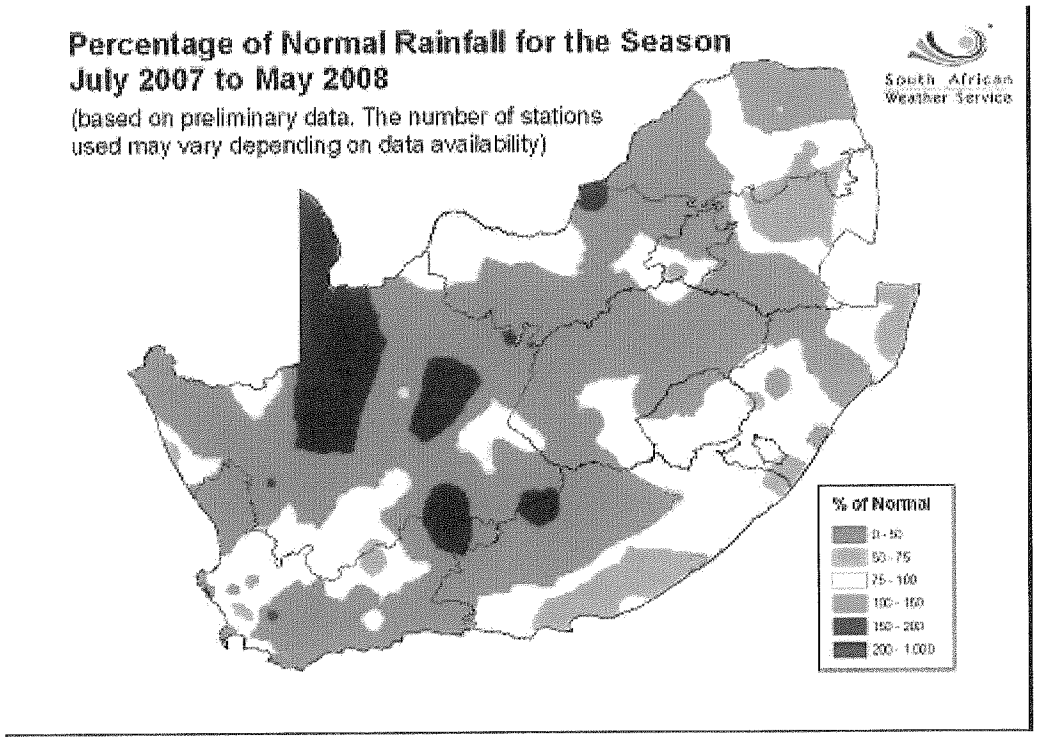


Figure 4: Rainfall map from the South African Weather Service website

B.3 DESCRIPTION OF THE PROPOSED MINING ACTIVITY

B.3.1 General background to mining and the resource available

The mine will be an opencast mine using a front-end loader or excavator to mine the sabunga. This is a basic load-and-haul operation with no screening, crushing or processing of the material on site. The total area to be mine will be slightly less than 1.5 hectares in size. The proposed depth to which the site will be excavated will be in the region of 15 m.

B3.1.1 Estimated reserves and extent of the mine site (Details of proven, indicated and inferred reserves/resources)

Determining the extent of the reserve is greatly dependent on, amongst others, the following factors (each discussed in Section 2 of this document):

- The depth of the resource below ground level
- The ground water table level
- The proposed end use of the area.
- The mining method
- Topography and whether an excavation and be landscaped so that it merge in with the surrounding areas.

B.3.1.2 Planned production rate

The estimated production rate can range between 4 200m^3 sabunga per month saleable product depending on the market demand. Unless the declining economy affects the demand, the annual consumption will most likely be as estimated 50 000 m^3 annum sabunga per month. Compaction factor is about 1:1.25. The price is quality dependent, and on this mine the price ranges between is about R75/m^3 within 5 km and R120/m^3 + at 5+ km and the applicant price for material without transport cost is R60/m^3.

B.3.1.3 Planned life of the mine

Based on the current mining rate, it will take between 2 years to mine the site optimally. Should the market demand decline or be less than anticipated, then period of two years will not be sufficient to complete mining on the proposed site within two years and application for an extension would be required. Should the demand be more than projected, mining will be completed before the two-year period had passed. Because the demand can vary, application is made for the entire 1.5 Ha in order to make allowance for the changes that can occur.

B.3.2 Depth of the mineral below the surface

The depth of the topsoil varies in depth across the site, but on average the topsoil is in the region of 500 mm deep. The mineable sabunga in most of the area lies directly below the topsoil with little or no weathered sabunga available as overburden/waste material. The large dolerite rocks embedded in the sabunga, which has not yet undergone complete weathering, will not be process on the site (crushed) and will, therefore, remain on site to be used for backfilling. This waste/overburden is estimated to be about one meter deep

Table 3. Reserves: Size of the deposit for this application

TOPSOIL AND OVERBURDEN ON SITE A			
Description of the soil	**Size of the area in m^2 (0.5 Ha)**	**Depth of the topsoil and overburden in mm**	**Volume of topsoil (in m^3) and overburden to be removed and stored**
Topsoil of 0.5 m	5 000 m^2	0.5 mm	2 500 m^3

Overburden – poorly weathered dolerite rocks of about 1 m	5 000 m^2	1.0 m	5 000 m^3

TOPSOIL AND OVERBURDEN ON SITE B			
Description of the soil	**Size of the area of 1 Ha (10000 m^2)**	**Depth of the topsoil and overburden**	**Volume of topsoil (in m^3) and overburden to be removed and stored**
Topsoil of 1 m deep	10 000 m^2	0.5 mm	5 000 m^3
Overburden – poorly weathered dolerite rocks of about 1 m	10 000 m^2	1.0 m	10 000 m^3

Table 4. Total saleable reserves

SITE A: SABUNGA (Saleable)				
Description of the soil	**Size of the area in m^3**	**Depth of the resource**	**Total volume in m^3**	**Volume mined per month**
Weathered dolerite	5 000 m^2	15 m	75 000 m^3	50 000 m^3

SITE B: SABUNGA (Saleable)				
Description of the soil	**Size of the area in m^2**	**Depth of the resource**	**Total volume in m^3**	**Volume mined per month**
Weathered dolerite	10 000 m^2	15 m	150 000 m^3	50 000 m^3

B.3.3 Mining and Rehabilitation Plan

B.3.3.1 Pre-mining preparation

Mining and rehabilitation activities and methodology

The following are anticipated for the proposed mining operation:

- Topsoil management plan
  - Determine the quantity of topsoil to be removed and stored. Determine the height and surface area required for the storage of the topsoil.
  - Plan and Manage the design, profile, maintenance and reclaiming of the topsoil.
  - Strip and stockpile in allocated areas.
  - Preparation of the mined areas and replacement of the topsoil over prepared areas.

- Mine surface layout
  See attached layout plan
- Mine plan
  - Mine in phases according to mine plan and schedule discussed in the document
  - Obtain co-ordinates of the mine area
  - Rehabilitation according to the plan and schedule provided in the document
  - Provide contours if necessary to control water drainage down the slopes
  - Address noise issues.
  - Manage dust.
- Excavation or Dozing of topsoil: removal and later replacement
  - Removal of topsoil.
  - Replacement of topsoil after mining
- Benching
  - Use mine method described to form benches.
  - The excavator or front-end loader loads the material onto tippers.
  - Except for the top of the borrow pit, the highest bench's face is 10 m high and the step or bench surface is 10 m wide.
- Loading
  - Loading of Sabunga from the mine area.
  - Loading resources from stockpiles onto tippers.
- Hauling
  - Hauling of topsoil to the stockpile.
  - Hauling of Sabunga to the stockpile or directly to client
  - Hauling of topsoil to replace back over the mined area.
  - Management of dust on the access road during hauling.
  - Management of noise during hauling.
  - Address danger of trucks on public roads during hauling.
- Slope stability
  - Management of slope according to planning and legal requirements.
  - Managing slope safety.
  - Managing surface water drainage away from mine sites – trenching to divert water away from the mine into the drainage channels – if and when necessary.
- Maintenance of topsoil stockpiles
  - Designing of stockpiles.
  - Surveying of stockpiles (positioning on annual mine plan).
  - Profiling of stockpiles to ensure safe and manageable slope angle.
  - Contouring of stockpiles where required to prevent loss of material
  - Maintenance of stockpiles – where topsoil sags to mostly lie on the toe of the stockpile where it can be trampled, the soil must be pushed back up onto the stockpile
  - Clearing topsoil ahead of advancing mine activity.
  - Dust control on stockpiles where required.
- Grade control
  - Apart from the topsoil and the material regarded as the overburden, the quality of the rest of the material is suitable for selling.
  - In between the weathered sabunga are rocks and allowance is made for about a 50% waste.
- Road maintenance and dust control
  - Maintenance of haul and access roads.
  - Conduct erosion control and management on the roads
  - Dust control on roads where required.

- Pollution control
  - Provide a mobile chemical toilet if there are no permanent facilities available. The chemical toilet must be cleaned and remove it regularly (before it is full).
  - Provide a bin with a lid for domestic waste collection.
  - Removal of petroleum product spills to the depth of penetration and placement in a bin with a lid.
  - Removal of bins when they are full and dispose of at appropriated landfill sites.
  - Prevent siltation of watercourses and channels – put preventative measures in place.
- Storm water control
  - Design, construction and maintenance of storm water control measures on the mine (contours after mining and trenches during mining to divert surface water from the site).
  - Design and build trenches above borrow pit area to divert water away from some of the slopes (where and if needed to prevent erosion)
  - Design trenches above areas on the site where stockpiles are.
- Auditing and Monitoring
  - Ambient dust monitoring at the perimeter of the mining area if required by the DME.
  - Noise monitoring if required by DME
  - Measuring the depth of the topsoil replaced

Rehabilitation and Decommissioning Phase:

- Final slope and bench design and construction or backfilling.
  - Slope stability and construction for safety and most effective rehabilitation.
- Levelling of for instance the floor area and slopes that are backfilled.
- Contouring
  - Cut contours across the slopes (where there are no benches).
- Depth of contours about 500 mm at least every 50 m.
  - Replacement of topsoil
  - Replace topsoil to a depth of at least 500 mm.
- Seeding with an annual seed mix as a mother crop or annual grasses to allow initially binding of the soil and to provide nutrients for re-vegetation.
  - Phases and method of rehabilitation as discussed below.
  - Seeding with an annual crop, to initially bind and stabilize the soil.
  - Seeding before rain season – irrigation will not be supplied.
- Road construction, maintenance and decommissioning
  - Remove and store topsoil adjacent to the construction path of the haul roads on site.
  - Repair and maintain all haul and access roads.
  - At decommissioning rip haul roads and replace stored topsoil
  - Upgrade the existing access road (which will remain for the use by the farmer as is currently the case).
  - Spread stored topsoil (if available) over ripped road areas.
- General site clean-up
  - Removal of all scrap metal and tyres.
  - Removal of all waste on site.

B.3.3.2 Mining preparation: Weathered dolerite

The mining process on site will consist of the following:

(a) Excavation of ±15 m deep over Site A = ± 0.5 ha and Site B = ±1.0 ha

- Topsoil will be removed and stored.
- Topsoil is removed i.e. pushed back about 10 m – 20 m where it is stored.

- If benching - Top bench: The top 2 – 3 m under the topsoil is sloped at a 1:2.5 angle (preferred gradient is 1:3) to form the top step of the bench.
- The overburden remains on site and can be used to backfill the mined areas.
- The borrow pit is excavated and as the pit becomes deeper, the face(s) of the borrow pit is then mined back.
- The borrow pit is deepened until the final depth is reached.
- The overburden (rocks) is first replaced followed by the topsoil is replaced. At least 500 mm of soil must be replaced over water and/or a root-limiting layer, some of the minable sabunga should remain to make up the 500 mm.
- The resource will be excavated from the borrow pit and will be loaded directly onto the trucks. The trucks will deliver the resource to the clients, but can also be stockpiled for later sale and delivery. Stockpiling would preferable occur on the floor of the mine (behind the face(s).
- After removing and storing the topsoil, the next bench will be a 3 m face on a 3 m bench unless the high 10 m bench can be made (when mine is shallower than the estimated 15 m). If the material is too loose and unstable to bench, the sabunga will be mined along a 1:2 gradient that will be flattened to 1:2.5 m (1:3 gradient is preferred and if too much material is not lost and optimal mining is not compromised).
- Excavation of the weathered dolerite occurs so as to construct 1 final bench with a 10 m face to final average batters of 45 degrees (10 m face on 10 m bench).
- Benching (bench formation):
  - Mining and benching is from the top down.
  - There will be a shallow bench (2 – 3 m high and 3 m wide benches) followed by 3 m high and 3 m wide bench and lastly a 10 m high face on 10 m wide benches. The latter bench width can be reduced.

Table 5. Bench formation

Bench number from top	Bench face height	Bench width	Total width removed to form the following bench (bench below) that will eventually result in the series of benches.
1	1 - 2 m	Top of the borrow pit	Top of the borrow pit sloped backed
2	3 m	3 m	2 + 3
3	10 m	10 m	2 + 3 + 10

(b) Stockpiling

- The resource (full range of road and concrete aggregates – G-series and fill) stockpiled separately or together, as required.
- Stockpile of materials for despatch (temporary)

(c) Despatch

- Despatch will be with tippers (dumper trucks).
- The tippers access to and from the mine is via the R346. Existing accesses are used
- Dispatch – the weight of the load carried by the truck will be controlled with a weigh bridge where necessary.

(d) Other processing

No other activities are planned.

B.3.3.3 Rehabilitation

(a) The aim of rehabilitation:

- To manage the site and conduct orderly housekeeping of the site in such as way as to not unnecessarily disturb the surrounding natural vegetation, streams or other special features. Also do not cause unnecessary visual or other impacts
- Conduct those rehabilitation measures possible during the life of the mine so as to minimize the post-mining cost and effort to restore the site.
- To conduct final rehabilitation of the site in order that leaves as little visual scarring as possible
- Based on the site characteristics, dust and erosion will require special attention.
- The site is mostly covered with grass and vegetation on the site has already been disturbed through previous bush clearing. Alien vegetation (including Black Wattle and Sesbania) occurs in the area. These vegetation types are likely to infest disturbed areas. There is also indigenous vegetation remaining on the farm and mine site.
- Once the subsoil is removed from the pit, the area is levelled, the faces between the mined and the un-mined areas sloped and the topsoil replaced.
- Once the topsoil has been replaced, the surface area is again levelled to remove all depressions. The topsoil is also spread over the sloped areas.

B.3.3.4 On-going site maintenance and rehabilitation

B.3.3.4.1 Site maintenance

- General housekeeping of the roadways, traffic signposting and restriction of vehicle to roadways in order to minimize unnecessary disturbance of natural vegetation
- Continued eradication of alien vegetation.
- Containment of oil polluted run-off from workshop area through the installation of oil collection (if used) in workshop areas. However, the workshop area is off site and this point is given as a guideline for best environmental practice.

B.3.3.4.2 Storm water control

- Construction of cut-off drains around the excavation perimeter and stockpiles to limit the erosion of these edges and avoid siltation of the trenches along the R346 or the water collection area (sump) on the borrow pit floor.
- Proper maintenance of storm water control

B.3.3.4.3 Topsoil and overburden handling

- All topsoil to be removed from the excavation site and stockpile in the designated areas.
- Topsoil to be stockpiled separately from the topsoil in designated areas.
- All topsoil and overburden stockpiles stored for a long period (exceeding a year) is to be to be grass seeded with indigenous grass seed for summer planting and winter planting to a seed rate of 200 grams per 100 m^2 to initially bind and stabilize the soil. More permanent vegetation will eventually settle (passively/naturally), although the area will potentially be covered with grass as prior to mining.
- Alternatively indigenous grasses and plants will be allowed to naturally settle on the stockpile.
- For more detail on topsoil management see C.6.6.1 in this document.

B.3.3.4.4. Bench trimming and rehabilitation planting

- As soon as any upper benches reach the final borrow pit perimeter such bench should be trimmed, backfilled and planted.

B.3.3.4.5 Screen planting

- There is currently vegetation along the R346 that will initially screen the activity from the road, but should it be required, further screen planting can occur. Once the borrow pit is developed, perimeter planting as part of good housekeeping could occur should it be required.

3.4 Post-mining rehabilitation

The following rehabilitation measures must be undertaken either the permanent early cessation of mining or on completion of long term mining as contemplated in this plan:

- Complete bench trimming, soil backfilling and upper bench planting
- On the resource pit area the topsoil must be replaced and re-vegetation must occur.
- Remove all structures, foundations and product stockpiles.
- Rotovate/rip all hardened surface and roadways to expose topsoil or replace topsoil where removed.
- Grass seeding of all rotovated/ripped areas using an indigenous grass mix.
- Collect all oversized boulders and stack these in an attempt to backfill some of the excavated area.

3.5 End use

The proposed end use is a borrow pit to the NW of the house and will be allowed to collect water (must be less than 50 000 m^3). The borrow pit to the east will be backfilled as far as possible or alternatively the benches will be covered with topsoil and planted.

B.3.2.3 Scheduling of Mining and Rehabilitation activities

(a) Phases of mining and rehabilitation

The measurements for the calculations of the phases were taken from the schematics considering the volume of the material as indicated in the profile holes. As far as possible, the area was divided into phases that will take the same duration to mine. Phases of mining are used to propose a sequence of mining and rehabilitation. This assists with the managing the planning and scheduling of mining and rehabilitation. Profile holes can only give an indication of where the material is located and how much material is available in the particular area and can be found to vary once actual mining takes place. Since the market demand also varies, the figures given are calculated estimate. Should more or less material be available than anticipated or the demand for the material increases or decreases, there could be variations in the time required to mine the site.

Rehabilitation takes place concurrently with mining as far as possible and what can be achieved in practice will depend on the layout of the mine and how excavation of the borrow pit will be occur. In the case of this borrow pits only sections will be mined at a time but rehabilitation of the pit will occur after the area has been mined out. The only control over the sections that will be mined is the exacavation of the faces to widen the borrow pit as it becomes deeper. Therefore, it is control is in of the size area exposed at a time. As far as possible the rehabilitation on one site must be completed before mining commences on the next site. Concurrent mining and rehabilitation will require at least that rehabilitation will commence immediately after a site has been mined and will continue while mining commences on the second site to allow the applicant to continue supplying material while rehabilitating. Rehabilitation on the site where mining has been completed must occur as quickly as possible and a maximum of three month period is proposed to complete the rehabilitation while mining the second site.

(b) Phases of mining

(Scheduling and planning of the various construction and implementation phases from the planning up to the commencement of full production.)

Mining and rehabilitation will occur in phases. Mining will occur in phases moving backwards in sections of 20 m at a time.

Table 6. Mining and rehabilitation schedule

SABUNGA BORROW PIT		
Series of steps No. (move each step back over the same distance as the initial series of steps)	**Site No.**	**Duration**
1	Site A (0.5 ha) – Complete mining on Site A and begin Mining on Site B.	Year 1. Duration of mining will depend on the demand and rate of mining.
2	Site B (0.5 ha – Complete mining on Site B)	Year 1 & Year 2. Duration of mining will depend on the demand and rate of mining.

C. ENVIRONMENTAL IMPACT ASSESSMENT

C.1 DESCRIPTION OF THE ENVIRONMENT LIKELY TO BE AFFECTED BY PROPOSED PROSPECTING/MINING OPERATIONS: (REGULATION 52(2)(a))

The information provided in this section will enable officials to determine how serious the impact of the prospecting/mining operation will be.

ENVIRONMENTAL ELEMENT/ IMPACTOR	VALUE	TICK	OFFICE USE

C.1.1 What does the landscape surrounding the proposed operation look like? (Open veldt/ valley/ flowing landscape/ steep slopes)

Topography and general description of the area: The region comprises a coastal plane and a hinterland coastal plateau and lies between 300 and 500 meters above sea level. The site highest point on the site is 290 m above sea level. The natural environment has an expansive landscape and the topography of the area is generally undulating hills and plains.

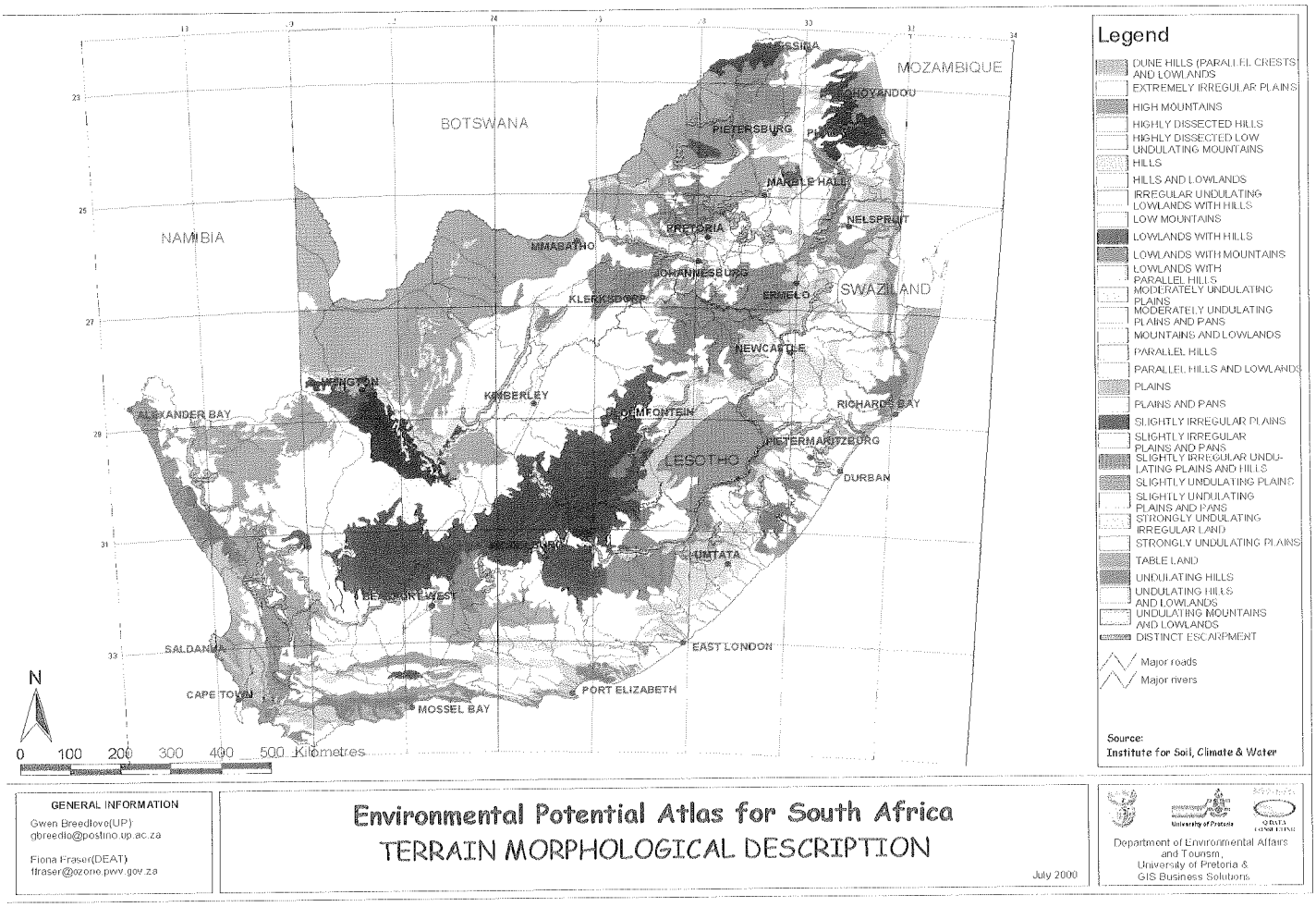


Figure 5. Map of the Terrain Morphology

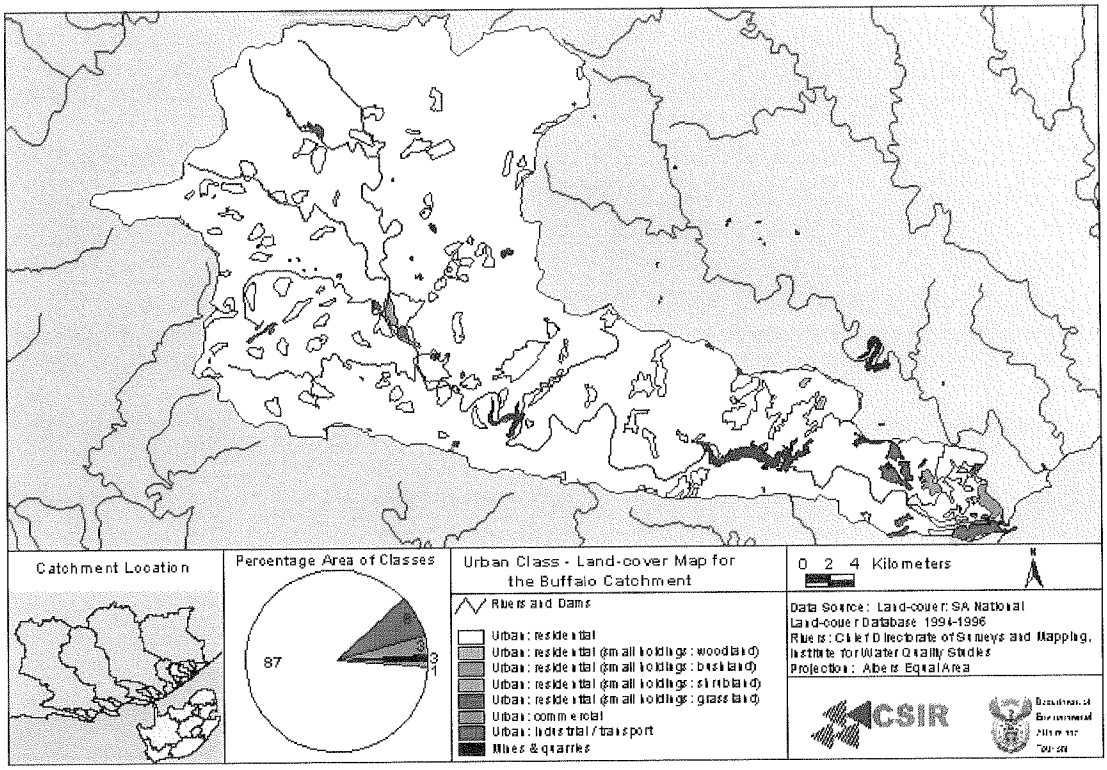


Figure 6: Map showing the urban areas in the Buffalo Catchment

C.1.2 Describe the type of soil found on the surface of the site	VALUE	TICK	OFFICE USE
	0 – 300mm		8
	300 – 600mm	X	4
	600mm +		2

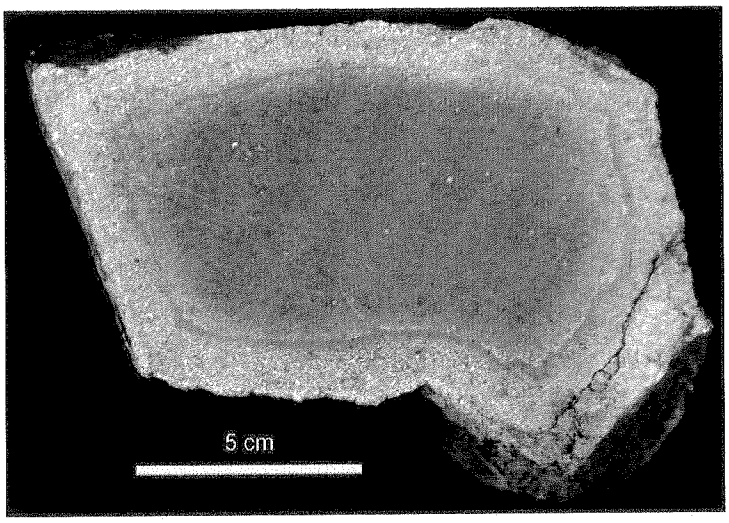


Figure 7. This is an example of dolerite showing the parent rock in the inside (blue) and the weathering on the outside (brown).

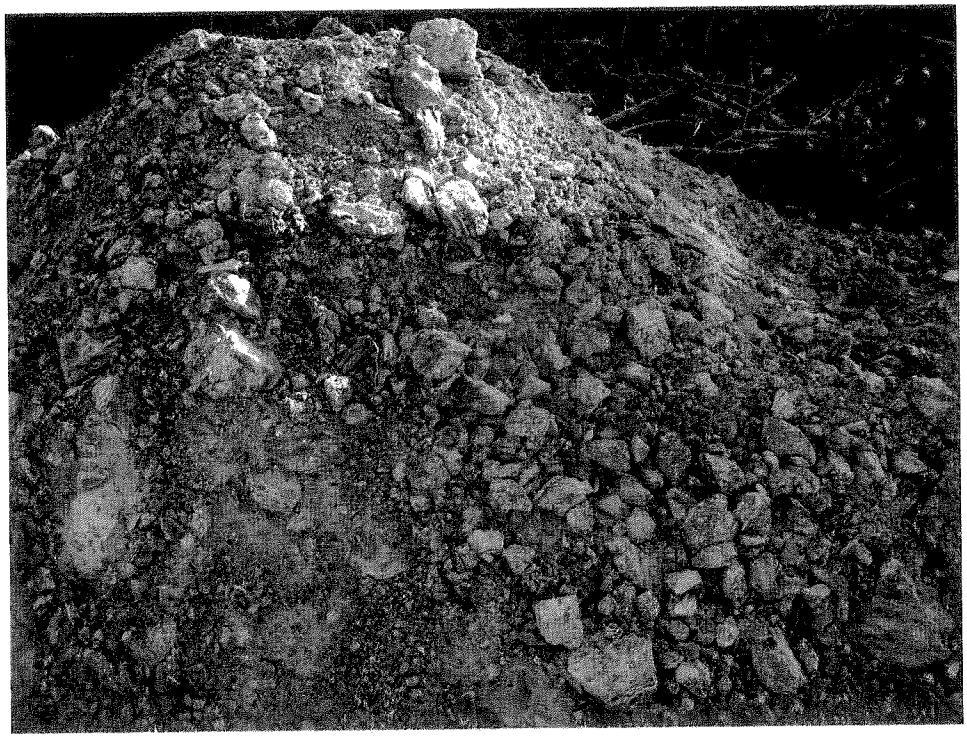


Figure 8. This is an example of sabunga from one of the profile holes showing the weathered material

General geology

(a) Introduction

Based on the vegetation that previously existed on the site (Albany Coastal Belt: Mucina and Rutherford, 2006), the geology is complex and includes Beauford Group mudstone and resource stone in the northeast, Nanaga Formation arenite and sand in the west and Bokkeveld, Wittenberg and Ecca sand stone and shale in between and also a thin strip of Quaternary resource along the coast. The pure grasslands are limited to the Nanaga formation and Quaternary resources where as the thornveld is prominent on the more finely textured soil derived from the Beauford and Bokkeveld mudstone, arenite and shale. The most important land types include Db, Fa and Ae.

(Details below from the Council for Geoscience).

(b) Bedrock geology

The evolution of the landscape in the Eastern Cape can be traced from the Late Proterozoic to the present (Toerien and Hill, 1989). This section provides a brief overview of the bedrock geology and the historical development of the various landforms, and outlines the geo-hazards prevalent in the study area, identifying areas potentially susceptible to slope failure and high erosion risk.

The oldest sequence of rocks in the area belongs to the Palaeozoic Cape Supergroup, which in turn can be divided into the Table Mountain, Bokkeveld and Witteberg Groups of decreasing age. These sediments are overlain by the Karoo Sequence, which is comprised of the Ecca and Beaufort Groups. The Dwyka Formation separates the Cape Supergroup and the Karoo Sequence. These sediments underlie the Uitenhage Group and Tertiary to Recent deposits associated with pedogenic and marine processes. Pelitic rocks with subordinate sand stones and quartzites of the Cape Supergroup, within an eroded anticline, form the resistant spine of the Zuurberg Range. These sediments are separated from the more recent Jurassic and Cretaceous sediments of the Uitenhage Group by the Jurassic basalts, tuffs and breccias of the Zuurberg Group. The sediments of the Uitenhage Group decrease in age towards the coast. The

geology of the area consists mostly of sandstone and mudstone of the Beaufort Group interspersed with dykes and sills of dolerite of the Post Karoo age. The proposed site lies within the upper and middle zone of a large dolerite sill. Structure geological investigations have confirmed the presence of medium grained dolerite on the proposed site. The study of the surface geology also revealed a reserve of "brown sugar textured" sabunga (decomposed dolerite), which forms a saleable overburden. The non-saleable overburden overlying the previous varies in depth between 1 – 2 m.

Unlike the mineral rich provinces in the rest of South Africa, the Eastern Cape does not have large deposits of valuable minerals. This is largely a function of the geology of the province. In particular the age of the rocks and strata are much younger than in provinces to the north. Not-withstanding, several mineral deposits are located in the province, but these remain largely undeveloped and unexploited. Most of these are not precious metal deposits, but are rather industrial-type minerals. Mineral deposits that show promise are: stone mining (for export), industrial minerals related to the building industry, such as resource, aggregate, limestone and heavy mineral resources.

Igneous rock formed below the Earth's surface, a form of basalt, containing relatively little silica (mafic in composition). Dolerite is a medium-grained (hypabyssal) basalt and forms in shallow intrusions, such as dykes, which cut across the rock strata, and sills, which push between beds of sedimentary rock. When exposed at the surface, dolerite weathers into spherical lumps as is the case on this site.

Dolerite intrusion is also common in the low-grade coal seams that occur in the province coal, forming ~30% of the surface area in the Molteno - Dordrecht -Indwe region. Dykes are typically 5-10 m in width and rarely exceed 10 km along strike; dips are vertical to sub-vertical. Dolerite sills and sheets are extensive and may approach 200 m in thickness, causing doming of the strata in some localities.

(c) Seismicity

There are two faults located to the north of East London, but earthquakes are not a frequent occurrence.

In general the area in which the proposed mine site falls is dominated by the Cape Fold Belt (CFB) topography, a Permian to Triassic orogenic event (Toerien and Hill, 1989). Axial planes dip towards the south-west providing guidance as to whether the site falls within the Buffalo Catchment or the Nahoon Catchment. The intensity of the folding decreases northwards.

Thrusts are present in places and show displacement of up to 4,5 km on the Baviaanskloof Thrust (Toerien and Hill, 1989). Normal faults subsequently developed south of the CFB due to tensional stresses, which accompanied the break-up of Gondwana. These faults now form the boundary along which the half-graben Algoa Basin developed, becoming filled with sediments of the terrestrial and marine Late Mesozoic Uitenhage Group (Toerien and Hill, 1989).

Evidence of epeirogenic tectonic activity during the Cenozoic, and the Quaternary has recently been found, although of much less magnitude than that described above (Partridge and Maud, 1987; De Klerk and Read, 1988; Hill, 1988; Toerien and Hill, 1989; Andreoli *et al.*, 1996). Fernandez and Guzman (1979a) have suggested that Modified Mercalli Scale Intensities (MMI) are unlikely to exceed VI every 100 years or VII every 500 years.

(d) Type, erodability and depth of Topsoil and Subsoil

The soil types are largely determined by the underlying geological formations, with those derived from intrusive dolerite differing markedly from those associated with the Beaufort sedimentary rocks. Red dolerite clays occur predominantly on the northern, north-western and western parts were it is hotter and are seldom found in valley beds or moist soils. The black dolerite clays, which are confined to the proximity

of dolerite intrusions, occur mainly on the cooler, southern and eastern parts, on poorly drained areas and the valley floor.

This site has little or no overlain Aeoline sand overlaying the soil collected as a result of weathering. Grey resource loams are derived from Beaufort sandstone and shales where dolerite is absent and differ noticeably in colour from the doleritic soils. Climate appears to have less differentiating influence on pedogenesis within the soil type and the soils are slightly better developed on the southern and western aspects than elsewhere. The sandy loams occur discontinuously along the coastal strip where Aeolian has not overlain them or calcareous Tertiary deposits.

Hartman (1988) describes the soils of the East London coastal belt as being weakly developed and occurring on rocks interspersed with black and brownish-black clay loams. They are derived predominantly from the argilla sediments or the Balfour and Middleton formation of the Beaufort group and the dominant associated soil series are Williamson, Kanonkop, Mispah and Rhutherglen. The topsoil associated with dolerite is strongly structured and are characterized by Msinsini, Mayo and Glengazi series. The soils in the catchment area are described by Reddering and Estruysen (1986) as being solonetzic and prone to erosion with lithosol occurring closer to the coast. However, according to Mucina and Rutherford (2006) the erosion potential of the soil is low to moderate. Observations of the proposed site and surrounding land appear to indicate the latter – low to moderate erosion.

(e) Type, erodability and depth of topsoil:

The topsoil is a maximum of about on average about 500 mm in depth and is easily recognizable due to the dark brown to charcoal colouring and the presence of organic material. The dark colour is mostly from the higher organic content compared to the reddish-brown or orange colour of the underlying sabunga.

The topsoil is well drained because of the higher organic content, lower clay content and also because the soil component has medium to coarse grains. Although erosion was not observed the topsoil could erode if the drainage during storage and after replacement is not addressed and large areas are unnecessarily exposed (vegetation removed). Removing vegetation from the site exposes the soil and makes it susceptible to wind and water erosion and when soil is disturbed an erosion plan should be in place especially if the land lies at an angle.

Figure 9. Geological Map

Figure 10. Sample area showing the topsoil and the saleable sabunga directly below the topsoil.

(f) Composition, erodability and depth of subsoil:

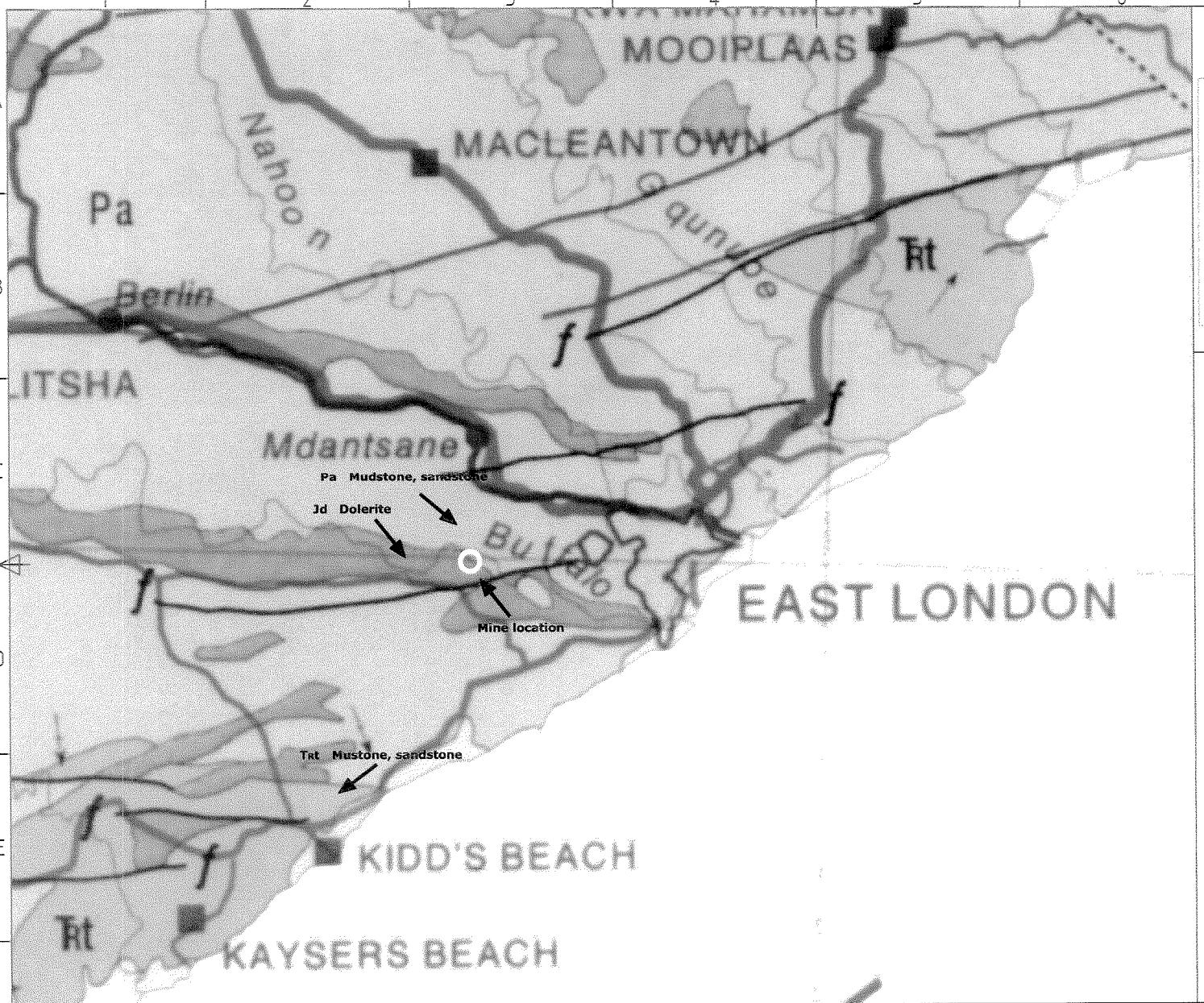
Directly under the topsoil lies the saleable sabunga, which is the weathered dolerite. The overburden material will be the rocks and stones, which are partially or un-weathered dolerite. No crushing will be required, but the option to screen could be required if the material has too many un-weathered material in between the weathered material. At this stage screening is not anticipated. Although erosion was not prevalent on the farm, the material could erode if the drainage is not addressed and large areas on the top of the borrow pit are unnecessarily exposed (vegetation removed). Removing vegetation from the site exposes the soil and makes it susceptible to wind and water erosion.

(g) Signs of misuse and/or soil erosion

Misuse of the soil on the proposed sites was not observed. Erosion in the area and associated with the soil is very low to moderate. However, where the slopes are relatively steep, proper drainage will be required and vegetation must only be taken off in areas where mining will actually take place (keep the exposed areas as small as possible) so that erosion can be prevented as far as possible. Erosion potential and sedimentation is aggravated by the variable characteristics of the regional climate and in particular, the periodic drought and floods of the region. Generally, reducing or removing vegetation cover as a result of the physical removal of the topsoil, intensive grazing and the poor inherent absorption capacity or low moisture percolation capacity of the clayey soils will also increase the potential for erosion. The precautionary measures should be adopted to ensure runoff water and drainage is managed as far as possible. This aspect is addressed in this document, which includes the assessment of impacts.

(h) Land capability before commencing with mining activity

The land is zoned agriculture and the particular sites are mainly covered with grass and are suitable for grazing. A small section of the vegetation will be removed form the approved 1.5 ha.



STRUCTURE SYMBOLS

- Diatreme
- Kimberlite pipe
- Vertical bed
- Fault, observed
- Horizontal bed
- Thrust fault
- Dip, 30° and less
- Shear zone
- Dip, 31° to 60°
- Linear feature, undifferentiated
- Dip, 61° to 90°
- Syncline
- Overturned dip
- Anticline

TOPOGRAPHIC DATA

- Freeway
- Arterial road
- Main road
- International boundary
- Provincial boundary
- Railway
- River
- Dam, lake, pan
- National park

Mine location

Erf
Portion 3 of Farm 860, East London

Geographical map

Area
Less than 1.5 Ha

Date
2009-07-03

System
Lo27

Signature

Name of Mine
Mount Coke

Name of Applicant
Vaduba Investments cc

File Name
Gonubie_Vaduba_860.dwg

Map reference
3327BA5

Figure

5000 0 5000 10000 15000 20000 25000 30000
metres

(i) Land use before mining

Domestic livestock farming, mostly cattle, is the most important agricultural activity in the Eastern Cape. Other livestock is sheep (mainly for their wool) and poultry. The particular sites are either not actively utilized or if used for grazing.

(j) Historical agriculture production

The farm is zoned agriculture and is either used for grazing or crop cultivation.

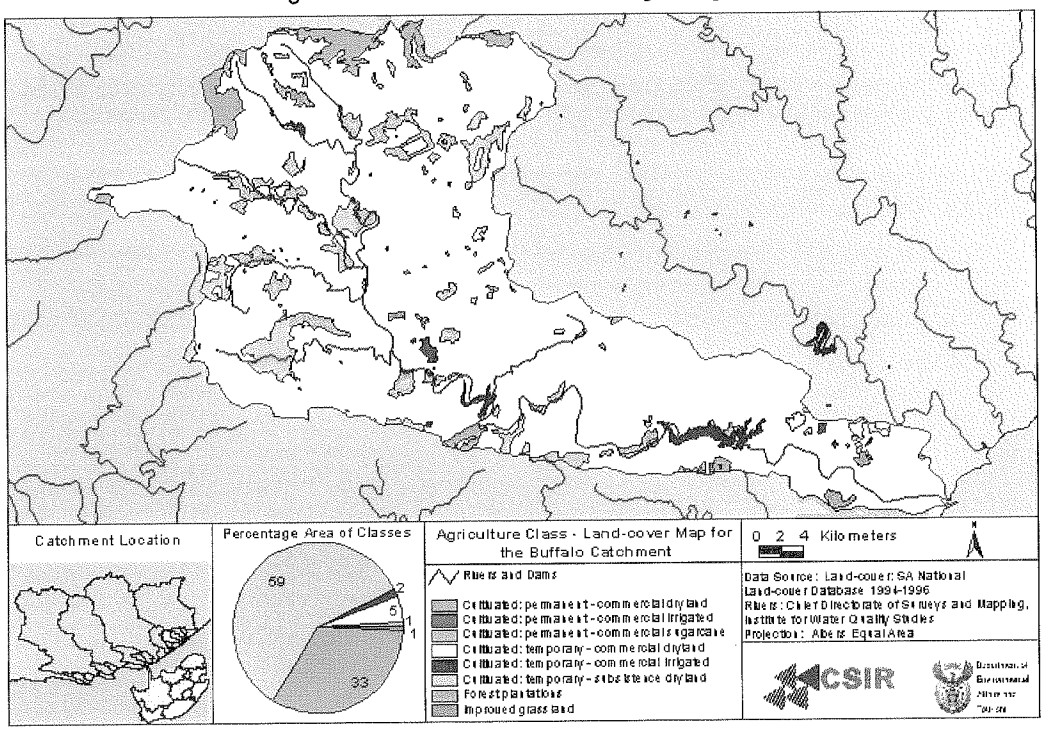


Figure 11. Agriculture class map in the Buffalo Catchment

C.1.3 What *plants, trees and grasses* grow naturally in the area around the site?

C.1.3.1 Flora of the region including the site

Indigenous vegetation is mostly absent from the site except along the fringes of the site. Considering the considerable representation of the vegetation on the rest of the farm and outside the borders of the site, the removal of the vegetation on these two sites will not be significant and a specialist botanical study was not deemed necessary.

The Eastern Cape has a fairly high provincial veldt degradation index, with commercial farming areas amongst the worst affected. Bush encroachment, change in species composition and alien plant invasions are the most serious veldt degradation problems that occur in commercial farming areas. Agriculturally important alien species include black wattle, prosopis, prickly pear and nasella tussock. In communal areas where mixed herds of cattle and goats limit bush encroachment, deforestation and loss of plant cover due to overgrazing are of greater concern. To best protect remaining natural or sensitive vegetation, there is a need to approach conservation with sincerity and to link the coastal zone with the hinterland. This is necessary because the majority of formal conservation areas are along the coast have no natural links to the inland areas. To achieve this it is important to establishment biodiversity corridors giving more meaning to the protection of the areas. The proposed mine sites on the farm is in a relative degraded condition and is not regarded as of conservation value judged on the status thereof. No conservation areas are present in the proposed mining area.

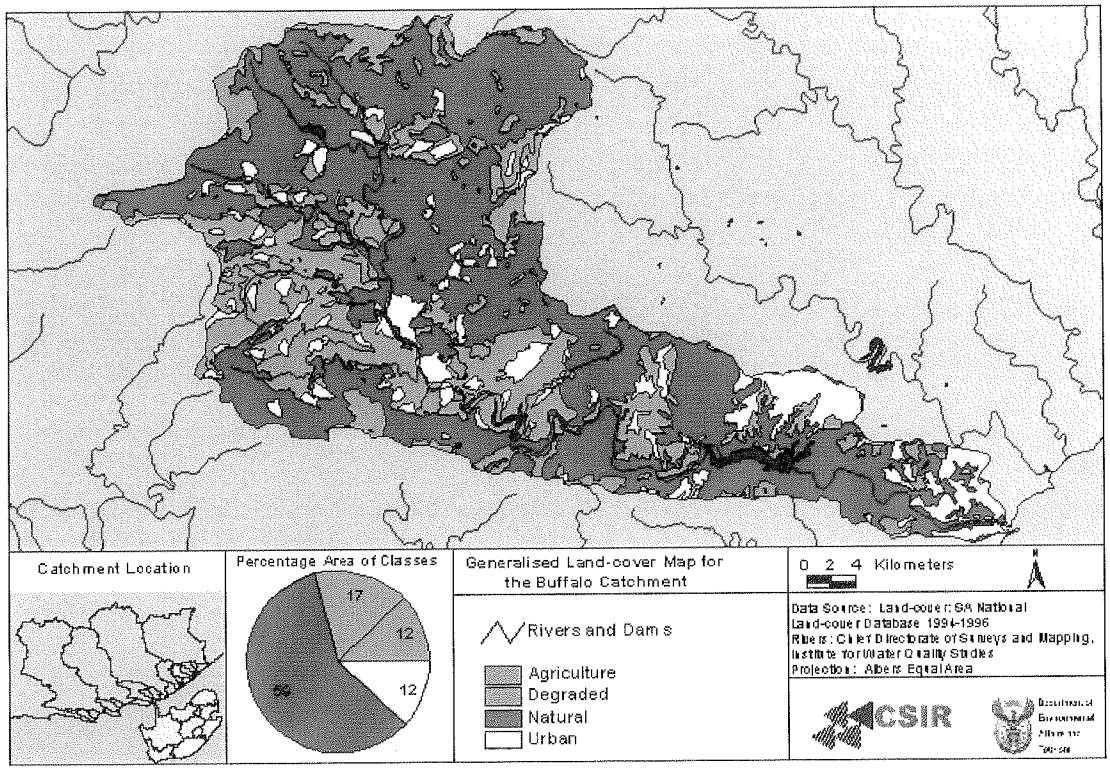


Figure 12. Utilization of the land of the Buffalo Catchment area

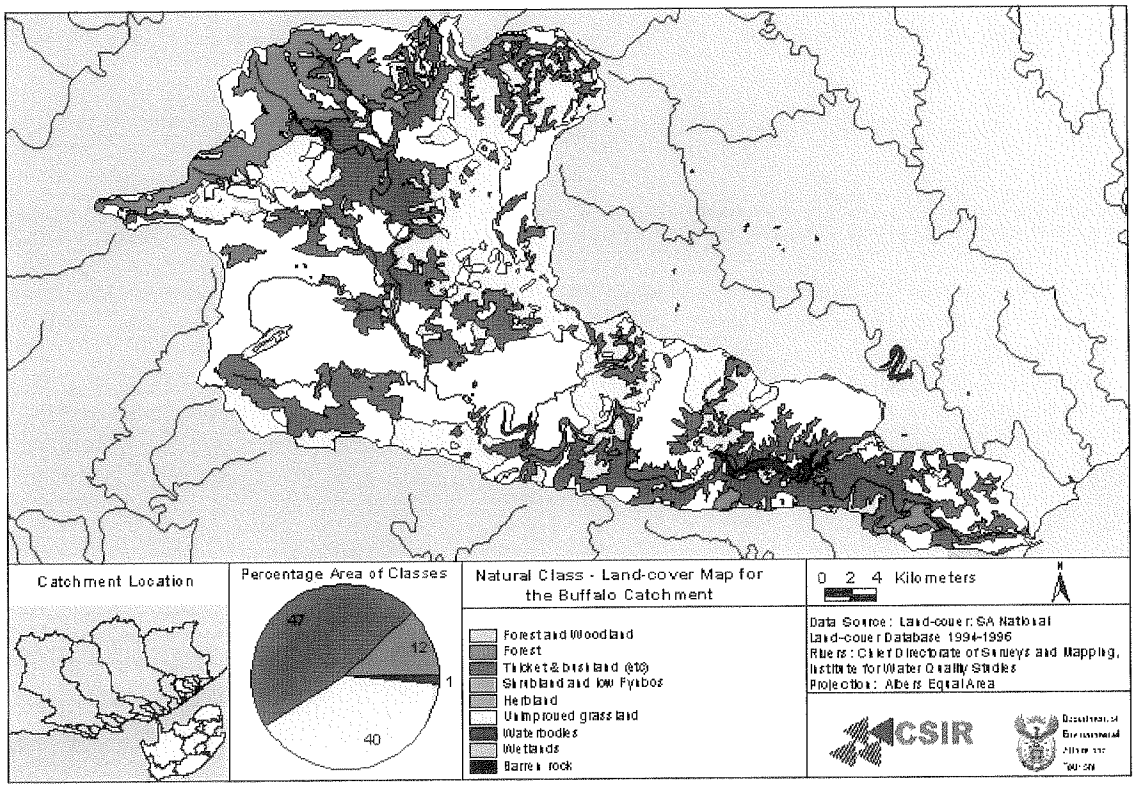


Figure 13. Land cover by indigenous vegetation of the Buffalo Catchment area

C.1.3.2 Vegetation description

Even though there is only a small area of the proposed sites covered with indigenous vegetation, some plants are present and for this reason a list of indigenous vegetation are listed.

Please note that the following map, legend and description (3.2.3.1 – 3.2.3.3) of the vegetation is extracted from Mucina and Rutherford, 2006

Some of the vegetation is from:

AT 9 Albany Coastal Belt

(a) Distribution: Eastern Cape Province

- Within 15 km (sometimes up to 30 km) of the Indian Ocean coastline, from Kei Mouth to the Sundays River, interrupted by many valleys.
- Altitude at which the vegetation occurs is10-400 m.

(b) Vegetation & Landscape Features

On the gently to moderately undulating landscapes and dissected hilltop slopes close to the coast, dominated by short grasslands punctuated by scattered bush clumps or solitary *Acacia natalitia* trees.

(c) Geology & Soils associated with the vegetation

The area covered by this unit is geologically complex and includes Beaufort Group mudstone and sandstone in the northeast, Nanaga Formation arenite and resource in the west and Bokkeveld, Witteberg and Ecca sandstone and shale in between, and a thin strip of Quaternary resource along the coast. The pure grasslands are limited to the Nanaga and Quaternary sans, whereas thornveld is prominent on the more finely textured soils derived from the Beaufort and Bokkeveld mudstone, arenite and shale. The most important land types include Db, Fa and Ae.

(d) Important Taxa

- **Tall Tree:** *Erythrina caffra.*
- **Succulent Tree:** *Euphorbia triangularis.*
- **Small Trees:** *Acacia natalitia* (d), *Brachylaena elliptica, Canthium spinosum, Cussonia spicata, Ficus sur, Ochna arborea, Sideroxylon inerme, Zanthoxylum capense.*
- **Tall Shrubs:** *Clausena anisata, Clerodendrum glabrum, Coddia rudis, Croton rivularis, Diospyros villosa* var. *parvifolia, Grewia occidentalis, Gymnosporia heterophylla, Hippobromus pauciflorus, Mystroxylon aethiopicum, Pavetta lanceolata, Psydrax obovata, Pterocelastrus tricuspidatus, Rhus lucida, Scutia myrtina, Tarchonanthus camphorates, Turraea obtusifolia.*
- **Low Shrubs:** *Rhynchosia ciliata* (d), *Carissa bispinosa* subsp. *bispinosa, Chaetacanthus setiger, Helichrysum asperum* var.*albidulum, Pelargonium alchemilloides, Phyllanthus maderaspatensis, Selago corymbosa, Senecio pterophorus, Tephrosia capensis* var. *acutifolia.* Semiparasitic
- **Epiphytic Shrub:** *Viscum obscurum.*

- **Woody Succulent Climbers:** *Crassula pellucida* subsp. *marginalis*, *Sarcostemma viminale*.
- **Woody Climbers:** *Asparagus aethiopicus*, *A. racemosus*, *Capparis sepiaria* var. *citrifolia*, *Clematis brachiata*, *Rhoiacarpos capensis*, *Rhoicissus digitata*, *R. tridentata*, *Secamone alpini*, *Tecoma capensis*.
- **Herbaceous Climbers:** *Rhynchosia caribaea*, *R. totta*, *Thunbergia capensis*, *Zehneria scabra*.
- **Graminoids:** *Brachiaria serrata* (d), *Cynodon dactylon* (d), *Dactyloctenium australe* (d), *Digitaria natalensis* (d), *Ehrharta calycina* (d), *Eragrostis capensis* (d), *E. curvula* (d), *E. plana* (d), *Heteropogon contortus* (d), *Panicum deustum* (d), *P. miximum* (d), *Setaria sphacelata* (d), *Sporobolus africanus* (d), *Themeda triandra* (d), *Tristachya leucothrix* (d), *Cymbopogon marginatus*, *Ehrharta erecta*, *Elionurus muticus*, *Melica racemosa*, *Setaria megaphylla*, *Trachypogon spicatus*.
- **Succulent Herb:** *Plectranthus verticillatus* (d).
- **Geophytic herb:** *Cheilanthes hirta, Moraea pallida*, *Oxalis smithiana*, *Sansevieria hyacinthoides*, *Strelitzia reginae*.
- **Herbs:** *Chamaecrista mimosoides* (d), *Abutilon sonneratianum*, *Acalypha ecklonii*, *Centella asiatica*, *Commelina africana*, *C. benghalensis*, *Cynoglossum hispidum*, *Eriosema squarrosum*, *Lactuca inermis*, *Lobelia erinus*, *Monsonia emarginata*, *Phyllopodium cuneifolium*, *Senecio burchellii*, *Sonchus dregeanus*.

(e) **Endemic Taxa**

- **Succulent Shrub:** *Bergeranthus concavus*.
- **Succulent Herbs:** *Brachystelma franksiae* var. *grandiflorum*, *Bulbine frutescens* var. nov. *('chalumnensis'* Baijnathined.), *Faucaria subintegra*,

Haworthia coarctata var. *tenuis*,
H. cooperi var. *venusta*,
H. reinwardtii var. *reinwardtii f. chalumnensis*,
Stapelia praetermissa var. *luteola*,
S. praetermissa var. *praetermissa*.

- **Geophytic Herbs:** *Bobartia gracillis*,
  Apodolirion amyanum,
  Aspidoglossum flanaganii,
  Drimia chalumnensis.
- **Low Shrub:** *Acmedenia kiwanensis*.
- **Herb:** *Monsonia galpinii*.

(e) Conservation

- Least threatened. Target 19%.
- Only 1% of this vegetation unit is protected in 20 local-authority and provincial nature reserves as well as in the Greater Addo Elephant National Park (including Alexandria Coast Reserve West) as well as in number of private conservation areas.
- About 12% of the Albany Coastal Belt has recently been altered by cultivation, 1% by plantation forestry and 4% by urbanization.
- According to land-cover data, at least 7% consists of degraded veget5ation.
- It is difficult, however, to determine the proportion of the vegetation that is in a secondary state, since land-cover data do not distinguish between primary and secondary vegetation.
- Erosion is very low to moderate.

(f) Remarks

- The seaboard region that contains this unit is a mosaic of a wide variety of structural vegetation types, ranging from grassland to forest. This variation reflects post-disturbance succession gradients as well as natural variation in geology, soil patterns and distribution of water in the landscape. The forests of the region have been mapped as different vegetation units. Admittedly, this vegetation unit exemplifies a deviation from our mapping philosophy by featuring current-state rather than potential vegetation. We assume that the current vegetation mosaic so typical of the Albany Coastal Belt is a creation of man and the original (pre-settlement) vegetation was dominated by non-seasonal, dense thicket. The area of this unit was prime agricultural land, which attracted early settlers who, presumably, cleared the dense thicket cloak for pastures.

Some of the vegetation is
AT 12 Buffels Thicket
Which consists of?

- VT1 Coastal Forest and Thornveld (40%),
- VT 23 Valley Bushveld (39%) (Acocks 1953).
- LR 48 Coastal Grassland (31%),
- LR 5 Valley Thicket (30%) (Low & Rebelo 1996).
- STEP Mountcoke Grassland Thicket (45%),
- STEP Buffels Thicket (32%) (Vlock & Euston-Brown 2002).

(a) Distribution

Eastern Cape Province: In river valleys centered around East London, including the Tyolomnqa River, Buffalo River, Nahoon River, Gqunube River, Kwelera River and stretching between 40 and 50 km inland (including some areas around King William's Town and Komga), and a small area in the Great Kei River Valley between about 10 and 20 km from the coast. It also occurs in the valley bottom in Keiskammashoek north of Dimbaza. Altitude 0-700 m.

(b) Vegetation & Landscape Features

The vegetation occurs on steep slopes of river valleys in highly dissected hills and moderately undulating plains, where short, dense and tangled thicket stands reach up to 10 m. At the edges of the valley slopes the dense thicket grades into more open, shorter thornveld.

(c) Geology & Soils

Mudstones and sandstones derived from the Beaufort Group of the Karoo Supergroup as well as Jurassic Dolerite Suite intrusions. The shallow soils (Glenrosa and Mispah) derived from these rocks are fine-grained, nutrient-poor silts, but the presence of forests leads to the development of humus-rich, deep soils. Half of the area is classified as Fa land type, while Fb and Bd are of subordinate importance.

(d) Important Taxa

- **Succulent Trees:** *Euphorbia triangularis* (d),

Aloe ferox,
Euphorbia grandidens.

- **Small Trees:** *Acacia natalitia,*
Apodytes dimidiata,
Brachylaena ilicifolia,
Calodendrum capense,
Canthium ciliatum,
C. mundianum,
Cussonia spicata,
C. thyrsiflora,
Dombeya tiliacea,
Elaeodendron croceum,
Eugenia zeyheri,
Harpephyllum caffrum,
Heteromorpha arborescens,
Ochna arborea, Pappea capensis,
Ptaeroxylon obliquum,
Schotia afra var. *afra,*
S. latifolia,
Sideroxylon inerme,
Trimeria trinervis,
Vepris lanceolata,
Zanthoxylum capense,
Ziziphus mucronata.
- **Tall shrubs:** *Allophylus decipiens* (d),
Azima tetracantha (d),
Scutia myrtina (d),
Suregada africana (d),
Acalypha glabrata,
Acokanthera oppositifolia,
Allophylus melanocarpus,
Buddleja dysophylla,
Carissa bispinosa subsp. *bispinosa,*
Chaetacme aristata,
Chrysanthemoides monilifera,
Clerodendrum glabrum,
Coddia rudis,
Croton rivularis,
Diospyros scabrida var. *cordata,*
D. simii,
D. villosa var. *parvifolia,*
Ehretia rigida,
Euclea natalensis,
E. undulata,
Grewia occidentalis,
Gymnosporia buxifolia,
G. heterophylla,
G. nemorosa,
Hippobromus pauciflorus,
Maytenus acuminata,
Mystroxylon eathiopicum,
Olea europaea subsp. *africana,*
Pavetta lanceolata,
Putterlickia pyracantha,
P. verrucosa,
Rhus gueinzii,
R. lucida,
Scolopia zeyheri.
- **Low shrubs:** *Pavonia praemorsa* (d),
Senecio pterophorus (d),
Euphorbia kraussiana,

Lauridia tetragona,
Lippia javanica,
Lycium cinereum,
Rubus rigidus,
Solanum regescens.

- **Succulent Shrubs**: *Aptenia cordifolia* (d),
  Exomis microphylla var. *axyriodes,*
  Senecio oxyodontus.

Woody Succulent

- **Climbers:** *Cyphostemma quinatum.*
  Sarcostemma viminale.
- **Woody Climbers:** *Rhoicissus digitata* (d)
  Asparagus aethiopicus,
  A. racemosus,
  Capparis sepiaria var. *citrifolia,*
  Dalbergia obovata,
  Jaminum angulare,
  Plumbago auriculata,
  Rhoicissus tomentosa,
  R. tridentate,
  Secamone alpini,
  Tecoma capensis,
  Uvaria caffra.
- **Graminoids:** *Cynodon dactylon* (d),
  Cyperus albostriatus (d),
  C. textilis (d),
  Digitaria argyrograpta (d)
  D. natalensis (d),
  Ehrharta erecta (d),
  Microchloa caffra (d),
  Panicum deustum (d),
  P. maximum (d),
  Schoenoxiphium sparteum (d),
  Setaria megaphylla (d),
  S sphacelata (d),
  Paspalum dilatatum.
  - **Herbaceous Climbers:** *Senecio deltoideus* (d),
    Coccinia quinqueloba,
    Cynanchum ellipticum,
    Helinus integrifolius.
  - **Succulent Herbs:** *Sansevieria hyacinthoides* (d),
    Plectranthus grandidentatus.
  - **Geophytic Herbs:** *Moaea pallida,*
    Ornithogalum longibracteatum,
    Cheilanthes hirta.
  - **Herbs:** *Commelina benghalensis* (d),
    Conyza scabrida (d),
    Galopina circaeoides (d),
    Hypoestes aristata (d)
    Abutilon sonneratianum,
    Sida ternata.

(e) Endemic Taxon

Woody Succulent Climber: *Ceropegia radicans* subsp. *smithii.*

(f) Conservation

- Vulnerable. Target 19%. About 1% is protected in statutory reserves (Umtiza, Bridle Drift, Fort Pato, Nahoon, Bluebend, King William's Town Nature Reserves) and in addition 0.7% in private nature conservation areas.
- Transformation 21%, mainly by cultivation, urban and built up areas, and plantations.
- At least 15% consists of vegetation in a degraded state.
- Erosion is very low to moderate."

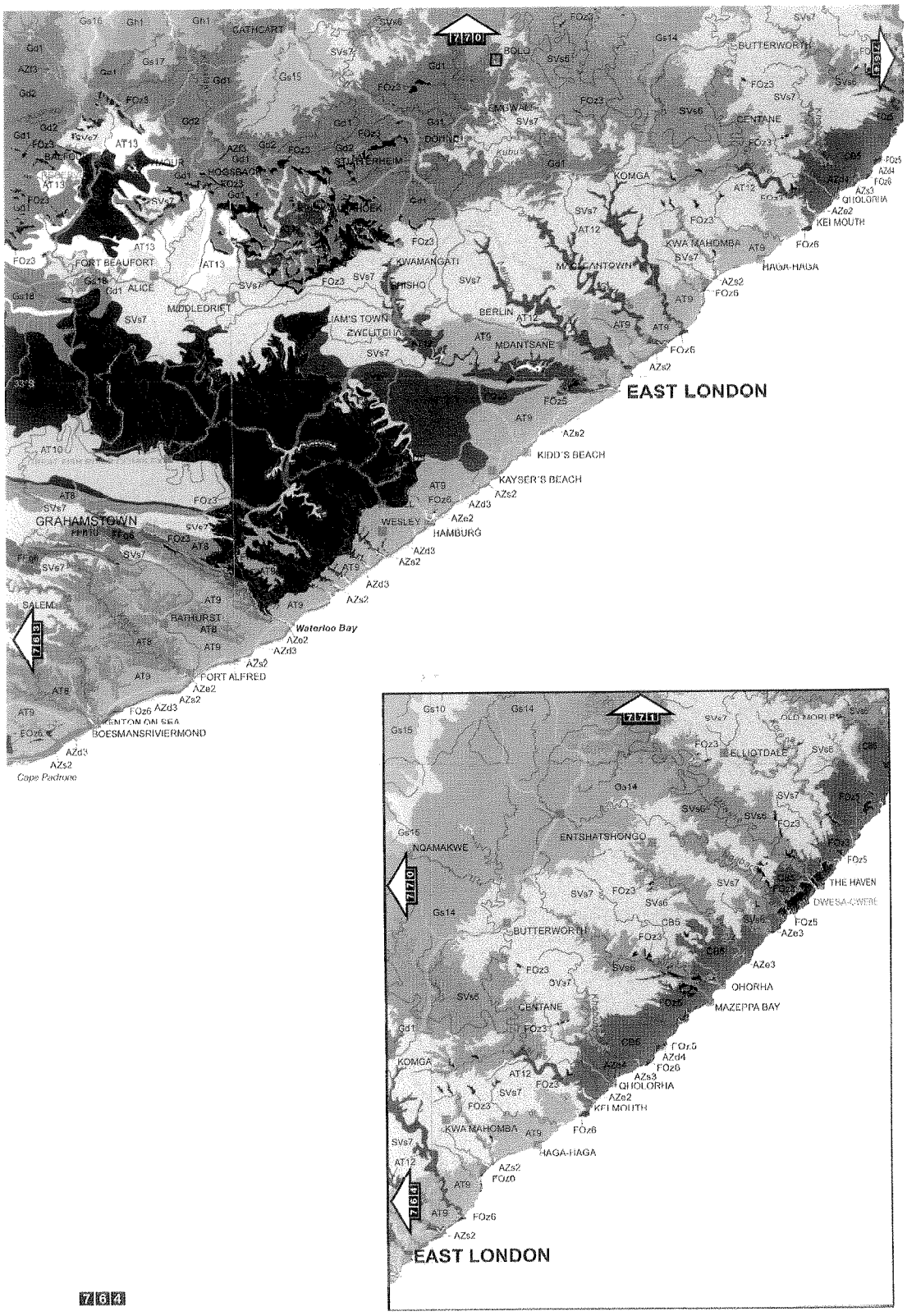


Figure 14. Vegetation map From Mucina and Rutherford, 2006

SVk 13 Olifantshoek Plains Thornveld
SVk 14 Postmasburg Thornveld
SVk 15 Koranna-Langeberg Mountain Bushveld
SVk 16 Gordonia Plains Shrubland

Kalahari Duneveld Bioregion

SVkd 1 Gordonia Duneveld
SVkd 2 Gordonia Kameeldoring Bushveld
SVkd 3 Auob Duneveld
SVkd 4 Nossob Bushveld

ALBANY THICKET BIOME

AT 1 Southern Cape Valley Thicket
AT 2 Gamka Thicket
AT 3 Groot Thicket
AT 4 Gamtoos Thicket
AT 5 Sundays Noorsveld
AT 6 Sundays Thicket
AT 7 Coega Bontveld
AT 8 Kowie Thicket
AT 9 Albany Coastal Belt
AT 10 Great Fish Noorsveld
AT 11 Great Fish Thicket
AT 12 Buffels Thicket
AT 13 Eastern Cape Escarpment Thicket
AT 14 Camdeboo Escarpment Thicket

INDIAN OCEAN COASTAL BELT

CB 1 Maputaland Coastal Belt
CB 2 Maputaland Wooded Grassland
CB 3 KwaZulu-Natal Coastal Belt
CB 4 Pondoland-Ugu Sandstone Coastal Sourveld
CB 5 Transkei Coastal Belt

Figure 15. Legend for vegetation map From Mucina and Rutherford, 2006

(g) Invader or exotic species

The alien plant species that are well established in the area are *Lantana camara*, *Sesbanea punicea*, *Acacia mearnsii* (black wattle), *Acacia saligna* (Port Jackson), *Acacia cyclops* (rooikrans), *Cestrum laevigatum* (ink berry), *Pereskia aculeate*, *Circium vulgare* (Scotch thistle), *Psidium guajava* (guava) and *Ricinus communis* (caster oil plant).

C.1.3.3 Degraded veldt

The vegetation is degraded over certain areas identified in the figure below. Areas further from the estuary are also degraded.

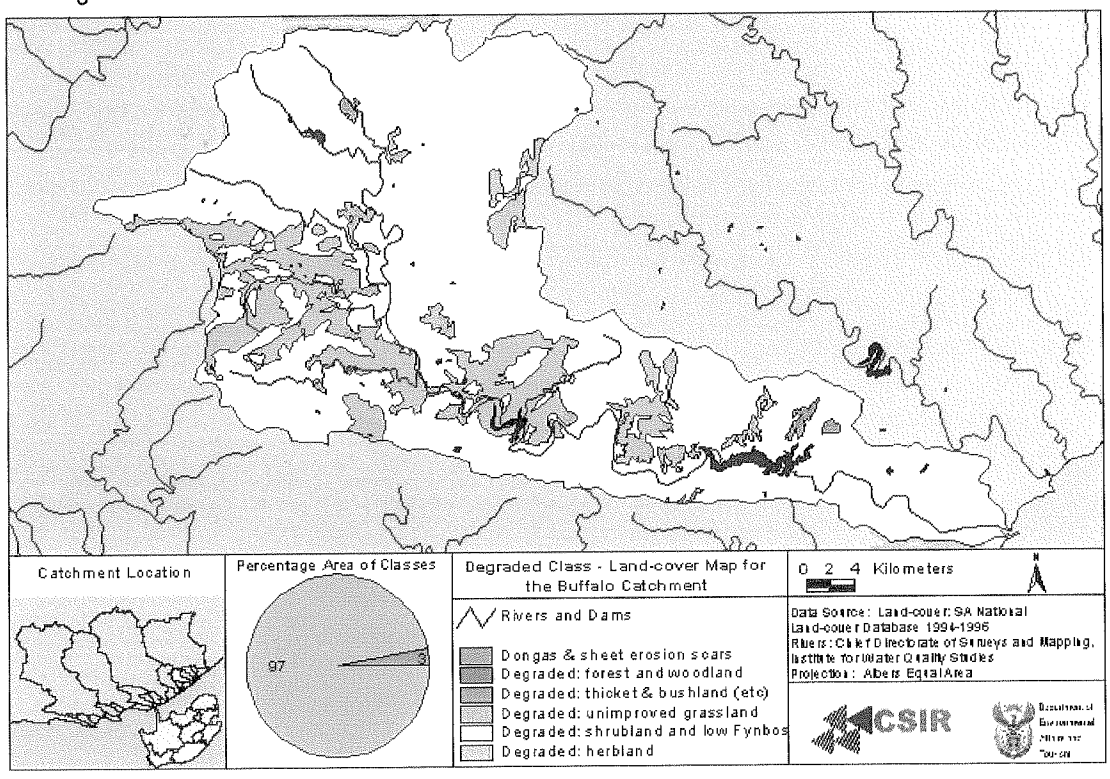


Figure 16. Degraded class. Land cover map for Buffalo Catchment area

Standard proposed invasive plant control: Method of alien vegetation control and eradication

A standard invasive plant eradication program has been complied with the assistance of a botanist, Dr Mark Berry, to provide a plan for the eradication of the invasive plants on mine sites (as well as other sites). The details are as follows:

All plants except those considered indigenous to the area are considered alien or invasive, but the eradication of the trees is especially important. Alien plants pose a threat to the valuable indigenous vegetation in the area. Alien plants require ongoing control for a period of time as they readily produce large quantities of seeds, which remain dormant in the soil for long periods. The following is suggested:

- Continuously control the existing seed bank in the rehabilitated areas as well as on the topsoil stockpile by removing alien seedlings at least bi-annually (check site specific requirements).
- Alien seedlings should preferably be pulled out by hand as soon as they are seen or as soon as possible. If they are left to grow it becomes increasingly difficult and costly to remove. Seedlings must preferably not be allowed to grow to a size that requires mechanical or chemical removal.
- Seedling removal is most effective after a rainy episode when seeds have water to geminate. One-year old seedlings can be hand-pulled, preferably when the soil is wet after a rainfall.
- Large alien plants should be cut as close as possible to the ground level to prevent re-sprouting. Tree poppers can be used for removing small trees.

- When required, stumps will need to be treated with herbicides to prevent re-sprouting. Herbicide is to be painted rather than sprayed onto the stumps, to prevent adjacent areas from being affected. As an added precaution, stumps may be split with an axe.
- If physical removal is not practical, re-growth of alien vegetation is to be chemically controlled (see table below), and this must be done under strictly monitored application techniques.
- When spraying herbicides, use nozzle cones to limit areas affected by the herbicide. Harmful herbicides, such as Garlon, may not be used in depressions or wet areas. Keep a strict record of herbicides used, date, method of application, and area treated. Also record climatic conditions.
- Integrate above clearing methods with bio-control methods, such as insects and diseases. Contact Tony Gordon at the ARC Plant Protection Research Institute (tel: 021-887 4690) for advice in this regard.
- All alien plant material removed from the site is to be disposed of at a licensed waste disposal site. Burning of this material as a means of disposal should not occur on site, but can be dumped with the other garden waste. Alternatively, dried alien plants could be used for stabilization of cleared areas to prevent erosion if the seeds are removed.
- Alien plant control is to be undertaken by a suitably trained and experienced contractor, especially when the handling of herbicides is required.
- Develop a monitoring protocol to assess the success of alien plant control. Make adjustments to the clearing program if required.

Table 7. Invasive plants: Chemical control method

Chemical control method (should be checked with a specialist to ensure it is suitable for the species to be eradicated)
• Spray foliage of seedlings, saplings and young trees with 0.75% Garlon or Touchdown • Large tree stumps are treated with 3% Timbrel
• Spray foliage of seedlings with 0.5% Garlon for less resilient plants

The recommendations with regards to alien vegetation control are as follows:
At all possible, do not use heavy machinery to remove the invasive plants as it encourages further infestation.

- Use the DWAF approved alien vegetation clearing methodology.
- The methods include painting of all cut stumps with suitable dye tinted herbicides within 5 minutes of cutting. If not painted within 5 minutes, the absorption or penetration of the herbicide would be restricted to a great extent.
- The cut branches must be stacked in piles and the botanist recommends that because the site is relatively small the majority of the cut vegetation be removed to a safe area to reduce the burnable material in the area thereby preventing hot burning fires (fuel build-up). Removing the alien vegetation will also reduce the build-up of seeds.

Trained personnel must be used (even current staff or personnel that are trained will be acceptable rather than persons with no training).

C.1.4 What animals naturally occur in the area?

C.1.4.1 Fauna before commencing with mining

(a) Introduction

With certain area characteristics such as vegetation, geology and topography, water availability, temperature (etc.) certain species have a high likelihood of occurring. Unlike in the case of a development where a site is permanently inaccessible to animals during and once the development is completed, with mining the habitat may

be altered but is neither permanently sterilised nor unavailable to animals. If only sections of the site are being worked or disturbed at a time the remainder of the site and the rehabilitated areas are available to fauna. If concurrent mining and rehabilitation occur the impact on the fauna is not permanent or irreversible as long as the animals are not hunted, trapped, snared or killed and are generally kept away from the mine site when the equipment is functional. To ensure this, the workers on site must receive environmental awareness training to ensure they understand and adhere to the policy that no animals may be killed, harmed or destroyed. There must also be management strategies in place to minimize and mitigate the impact the mining will have on the fauna as well as to manage the staff and monitor their actions or activities on site.

Location of development in relation to fauna and flora

Normally a site location is planned with the sensitivity and rarity of fauna and flora in mind, while considering the proposed land-end use as well as the mobility of the animals on the site. Development or mining near water including the wetlands, river, coastal area, estuary or the sea should receive special attention. For instance, development should not isolate sensitive and rare collection of organisms (plants and animals) so that there can be migration from one area to the next. The mining is located on the periphery of the property adjacent to a road that has made migration difficult already. However, the mining per se will not isolate the movement of fauna. The area size is spread out over two areas in all is 1.5 hectare in size. Besides this, the mining changes the surface area, such as the topography, but will not alter the state of the land so that animals cannot travel over it.

(b) Threats to biodiversity

Possible harm to fauna on the site has been identified as follows:

The decline in forest and coastal resources is enhanced by the exploitation of animals as well as other influences and this can have an effect of the biodiversity of fauna. The following points are regarded as having an impact and were considered as low in significance to the particular site:

- *Hunting.* According to the report by W.R. Branch (2002) hunting has been poorly managed and is unsustainable even over the short term. According to the report, the effect was compounded by the fact that the remaining small forest fragments are not viable to maintain large to medium sized mammals over the long term. The report states that target species have declined and the remaining populations of indigenous mammals are seriously threatened. Hunting does not take place on the particular site. The site is 1.5 hectare in size and as the location adjacent to a tarred road that is used regularly; the site cannot be regarded as particularly sensitive. This is private property and the landowner does not allow hunting on the property.
- *Pests.* Wild animals such as monkeys, raptors and small carnivores such as jackals, caracal and even crowned cranes were and are often branded as pests because they apparently impact on the farming of livestock and cause damage to crops. Alternatives to killing the animals are seldom considered. According to the landowner, animals are not trapped or killed on the farm and the applicant is adamant that no animals will be trapped or killed on the particular sites.
- *Predation.* Domestic animals prey on some of the small vertebrates in the area. With residential areas close to the site this is more likely to occur. This is possible, but the degree to what it occurs within the area, with all the residential properties, is not known. Domestic predators, such as dogs, normally avoid mine sites during operational hours. However, what happens on the site (which can also happen anywhere else) after dark to nocturnal animals have very little to do with the mining activity itself.
- *Road-kill.* The increase in traffic on the roads affects animals in two ways. They either contribute directly to (a) an increase in the mortality and decline of animals in the area, or (b) traffic can disturb the animals (such as during breeding or causing them to leave the area), which has an indirect impact on the decline in the animal populations. Working in the mine with earthmoving machinery as well as the trucks and other vehicles ('bakkies') could harm the animals in their way. However, animals (even insects where it is possible for them) would rather avoid the area. The animals will flee to a safer area with the advantage that the potential for harm to them will be negligible.
  (a) Mortality.

- Animals are killed when they cross the roads as part of their normal roaming (e.g. snakes and hedgehogs). Road kill is often seen on busy roads. However, it is not the size of the vehicle that causes the destruction, but rather the volume of traffic and the time of day they travel. Nocturnal animals are more likely killed during early morning or late after noon as well as specifically during the dark. Many of the animals found dead as result of road-kill are nocturnal. Snakes and other animals seeking out the road surface as an external heat source or to travel to look for food during the day are also likely to be killed. There will be more trucks on the road as a result of the mining operation and management and mitigation measures are proposed later in the document to address the increase in traffic. The time of operation from sunrise to sunset also limits the time the trucks travel on the roads (especially with regards to nocturnal road-kill incidents).
- Animals migrate when they need to find food or a suitable habitat.
- During annual breeding migrations when animals migrate to locate a mate (e.g. frogs, tortoises). These animals might migrate over the mine site, especially if there is water in the borrow pit. During seasonal migration for example migrate to areas where the weather is better such as in the case of birds or short-lived explosive breeders where there is mass migration. With all the activity on the site, the birds will not nest in or in very close proximity of the excavation, but the workings on the mine will also not deter them necessarily from breeding in areas that are in close proximity to the activities as long as these areas are not visited regularly by people or their pets.
- Also where there is well defined and long established breeding sites (e.g. in the case of many amphibians). This is specifically relevant where the road is close to a wetland when for instance local populations of, for instance amphibians, can be wiped out. There are no wetlands or any river or streams on the sites.
- Animals are attracted to roads for heat (cold-blooded animals such as snakes and lizards) especially during cold winter months. Snakes are especially vulnerable and some people purposely drive over these animals when they see them. This is, however, not a behaviour linked to the mining of resource, but rather as a result of the attitude of drivers of light vehicles (cars) as heavy vehicles such as delivery trucks (of all kinds), etc. It is important that environmental awareness of the workers on the mine occur.
- In the case of vultures, crows and carnivores the potential deaths of these animals increase when they feed on road-kill. Again this is not linked or limited to the mining *per se* but truckers are also not excluded from killing them. However, it is more likely the faster moving vehicles that can catch these animals unaware. Care (management and mitigation measures) to avoid animals on the roads are included in the environmental awareness programme/plan.
- Small granivorous passerines and rodents follow wind-blown seeds that are visible on the roads. As above, an increase in traffic in general will increase the potential for road kill and truckers should be taught to avoid animals on the road as far as is practicable and safe.

(b) Disturbances

- Vehicle traffic is noisy and the lights from the vehicles. Different animals have a different tolerance level to, for instance for, light and noise pollution. Sensitive birds and large mammals may become depressed and in particular large birds do not tolerate continuous disturbances and disturbances can also impact on breeding colonies of threatened bird species (in particular vultures). When mining is in progress, the sites will not be suitable for the breeding of birds. There are no breeding locations or perching spots and they will in all probability avoid the site. Large mammals normally avoid mining activities and are not harmed as a result. Because these animals are large, they are easy to avoid. Birds are also not known to occur in borrow pits unless it has been discarded and birds nest in the faces (mostly dig holes in the faces where they are able to dig in the soil). With the vegetation removed there is little shelter or food and the habitat offered by the borrow pit will not be preferred on the site and no breeding sites for large birds will occur within the borrow pit; especially not during operation.

Trucks normally travel from sunrise to sunset, but should they travel in winter they will possible require their headlamps to be on and the impact would be the same as for other vehicles that travel during that time of the day. Mining does not occur in the dark and there is no lighting on site. There are no floodlights or similar other large lights. Therefore, light pollution specifically related to mining or even the dumping of the waste will be small to negligible. Some animals are known to be "caught" in the bright lights of vehicles. Should it ever be necessary to travel in the dark with headlamps on, such animals must be given the opportunity to escape (dim lights or quickly put light on and off).

- Vibrations. Increased noise and vibrations near to wetlands can impact on the breeding of amphibians but the impact will be localized and apparently the amphibians are rather tolerant to vehicle noises, but are less tolerant to increases light be it either as a result of the duration or continuous lighting or the intensity (levels). There will be no mining activity within 25 m from a wetland and existing roads will be used to transport the material making sure that the activity remains. There are no water sources or water sources on or in close proximity to the proposed sites and breeding of amphibians near the site is not anticipated.
- Different habitats have different carrying capacities and/or biodiversity than others and the impact of disturbances and mortalities will have will vary accordingly. A portion of the farm that was not suitable for crop cultivation at this stage, next to the road and with the least amount of vegetation was selected for the mining activity. The area has been previously disturbed and is 1.5 hectares only. However, mining and loading will affect the biodiversity even of this local spot, but rehabilitation will be possible to a degree, although it will not be possible to rehabilitate the site to exactly the way it was prior to mining due to the lowering of the topography and the faces that are formed.

(d) Chemical pollution and the effect on fauna

The impact is regarded as mostly local and is as a result of exhaust fumes, oil spillage and accumulation of solid or domestic waste (or sewage if flush toilets facilities are made available on the farm). The document deals with the mitigation and management of oil, fuel and lubricant spills to ensure it is not a problem on the site, especially if runoff water will collect in the lower portion of the borrow pit. Exhaust emissions from the many petrol and diesel vehicles that exist is one of the major causes of pollution to the atmosphere. Exhaust fumes are not specific to mine vehicles since most large trucks (even delivery trucks to shopping centres, etc) are now diesel driven.

Some fuel-types still contain lead and smaller terrestrial animals are sensitive to lead, which can collect along roadsides or in depressions created by excavations.

Mining will result in the disturbance of runoff since a large depression is formed and special care must be taken to plan and manage drainage as well as control and manage pollution of the site especially where it is associated with runoff water (surface and ground water is discussed below).

C.1.4.2 Mammals

The mammals are diverse in the general region where the site is located, but this does not mean they necessarily occur on the particular site. Animals comprise insectivores, bats, primates, lagomorphs, rodents, carnivores, ant bear, hyrax, bush pig and small antelope. However, much of the large and medium-sized mammal fauna that previously occurred in the area is either locally extinct or occurs in a small fragmented populations, usually in isolated forests (none are close to the sites). Species endemic to the area are the golden mole (*Chlorotalpa duthiae*) and a pygmy hairy-footed gerbil (*Gerbillurus paeba exilis*), none observed by the landowner near or on the site.

In general mammals are can include Blue Duiker and Vervet monkey are still observed in dune bush and forest area whereas animals such as the bush pig, bushbuck, and grysbok are less common. The small Hottentot

golden mole is also often seen (or their mounds are) in locations where it is possible for them to dig. These animals are often the prey of domestic animals or road-kill. In the valley bushveld only populations of ant bear and porcupine still occur. No evidence of ant bear holes were seen on the proposed site If they do cross the site from time to time, the mining activity will not affect them as most of their activities occur nocturnally. Animals such as genets, water mongoose and Cape grey mongoose and grey duiker are apparently scarce and apart from the Cape mongoose that could theoretically occur near residential areas, are not expected on the site while there are people and especially while mining operations occur. The most common occurring animal in the valley bushveld that could occur in the coastal region is the rock dassie but is found mainly on cliffs (mountains) in crags, in storm water drains and sometimes on the roofs of houses.

Mammals occurring in the vicinity

(Source: C.J. Vernon, East London Museum)

Data was available for Nahoon catchment, but as the site lies on the border of the Buffalo and Nahoon estuary, the data available for the Nahoon Catchment is in all likelihood relevant.

The order and nomenclature follow that of Smithers (1983). Species listed in brackets may occur, or once did occur in the area but are now extirpated. The evidence supporting inclusion in this list is based on the following:

A. Museum specimen for the study area.
B. Known through observation to live in the study area.
C. Known from museum specimens to occur in the catchment of the three rivers and so could be found in the study area.
D. Known from observation to occur in the catchment and so could be found in the study area.
E. Evidence based on skeletal material in owl pellets.
F. Study area falls within the distribution of the species as reported by Smithers (1983).
G. Reported by McLachlan (1986).

Table 8. Common mammals that could occur in the area

Order Family Scientific Name	Common Name	Evidence
Insectivora		
Soriciidae		
Myosorex cafer	Dark-footed forest shrew	E
Myosorex varius	Forest shrew	F
Suncus infinitesimus	Least dwarf shrew	F
Crocidura cyanea	Reddish-gray musk shrew	F
Crocidura flavescens	Greater musk shrew	E
Chrysochloridae		
Chrysospalax villosus	Rough-haired golden mole	C
Amblysomus iris	Zulu golden mole	F
Amblysomus hottentotus	Hottentot golden mole	A
Chiroptera		
Pteropodidae		
Epomophorus wahlbergi	Wahlberg's epauletted fruit bat	A
Eidolon helvum	Straw-coloured fruit bat	F
Rousettus aegyptiacus	Egyptian fruit bat	A
Emballonuridae		
Taphozous mauritianum	Tomb bat	D
Molossidae		
Tadarida condylura	Angola free-tailed bat	F
Tadarida aegyptiaca	Egyptian free-tailed bat	F

Order Family Scientific Name	Common Name	Evidence
Vespertilionidae		
Miniopterus schreibersii	Schreiber's long-fingered bat	F
Myotus tricolor Pipistrellus kuhlii Pipistrellus nanus	Temminck's hairy bat Kuhl's bat	F F
Eptesicus hottentotus	Banana bat	BF

Eptesicus capensis	Long-tailed serotine bat	F
Scotophilus dinganii	Cape serotine bat	F
	Yellow house bat	F
Nycteridae		
Nycteris thebaica	Common slit-faced bat	F
Rhinolophidae		
Rhinolophus clivosus	Geoffrey's horseshoe bat	F
Rhinolophus capensis	Cape horseshoe bat	F
Rhinolophus swinnyf	Swinny's horseshoe bat	F
Hipposideridae		
Hipposideros caffer	Sundeval's leaf-nosed bat	F
Primates		
Cercopithecidae		
(Papio ursinus)	(Chacma baboon)	F
Cercopithecus aethiops	Vervet monkey	A
(Cercopithecus mitis)	(Samango monkey)	D
Lagomorpha		
Leporidae		
Lepus saxatilis	Scrub hare	B
Pronolagus repestris	Smith's red rock rabbit	D
Pronolagus crassicaudatus	Natal red rock rabbit	F
Rodentia		
Bathyergidac		
Cryptomys hottentotus	Common molerat	A
Hystericidae		
Hystrix africaeaustralis	Porcupine	B
Pedetidae		
Pedetes capensis	Springhaas	D
Gliridae		
Graphiurus ocularis	Spectacled dormouse	B
Graphiurus murinus	Woodland dormouse	F
Thryonimyidae		
Thryonomys swinderianus	Greater cane rat	A
Cricetidac		
Dendromus melanotis	Gray climbing mouse	D
Dendromus mesomelas	Brant's climbing mouse	F
Mystromys albicaudatus	White-tailed mouse	E
Otomys irroratus	Vlei rat	B
Saccostomus campestris	Pouched mouse	E
Hyracoidae		
Procaviidac		
Procavia capensis	Rock dassie	B
(Dendrohyrax arboreus)	(Tree dassie)	D
Perissodactyla		
Rhinocerotidae		
(Diceros bicornis)	(Black rhinoceros)	C
Artiodactyla		
Suidae		
Potamochoerus porcus	Bushpig	B
Hippopotamidae		
(Hippopotamus amphibious)	(Hippopotamus)	B
Bovidae		
Philantomba monticola	Blue duiker	B
Sylvicapra grimmia	Common duiker	B
(Raphicerus campestris)	(Steenbok)	F
Raphicerus melanotis	Grysbok	B
(Syncerus caffer)	(Buffalo) Bushbuck	F
Tragelaphus scriptus	(Eland)	B
(Taurotragus oryx)		C
(Redivica anindinum)		F

C.1.4.3 Birds

Unless they are ground breeders, birds are not affected by the type and scale of mining. Possible bird species are listed that could occur in the area. A specialist report has not been conducted and to verify the presence of specific species, a specialist study will not be required because the affected area is only 1.5 ha of which about 70% is grassed, there are more suitable and plentiful habitat adjacent and further away from the site where the animals can flee. Numerous bird species are expected to frequent the area but birds are unlikely to be harmed by mining activity, as they are able to migrate. Bush and trees on the site will be removed, but as stated above, there is more than undisturbed veldt in close proximity and in the area to which they can migrate. Trees outside the mine area will not be cut or removed.

Table 9. Possible bird species that currently could frequent the site or the areas around the site.

Scientific Name	Common Name	Roberts No.	Evidence
Calidris ferruginea	Curlew Resourcepiper	272	O
Calidris minuta	Little Stint	274	R
Calidris alba	Resourceerling	281	O
Philomachus pugnax	Ruff	284	R
Gallinago nigripennis	Ethiopian Snipe	286	-
Limosa lapponica	Bartailed Godwit	288	R
Numenius phaeopus	Whimbrel	290	O
Recurvirostra avosetta	Avocet	294	R
Burhinus vermiculatus	Water Dikkop	298	F
Tadorna cana	Shelduck	103	-
Anas undulata	Yellowbilled Duck	104	O
Anas sparsa	Black Duck	105	-
Anas capensis	Cape Teal	106	-
Anas erythrorhyncha	Redbilled Teal	108	-
Anas smithii	Cave Shoveller	112	R
Plectropterus gambensis	Spurwinged Goose	116	-
Haliaeetus vocifer	Fish Eagle	148	R
Circus ranivorus	Marsh Harrier	165	-
Pandion haliaetus	Osprey	170	R
Balearica regulonum	Crowned Crane	209	-
Porphyrio porphyrio	Purple Gallinule	223	-
Fulica cristata	Redknobbed Coot	228	-
Podica senegalensis	Finfoot	229	-
Haematopus moquini	Black Oystercatcher	244	F
Charadrius hiaticula	Ringed Plover	245	F
Charadrius marginatus	Whitefronted Plover	246	F
Charadrius tricollaris	Threebanded Plover	249	-
Charadrius leschenaultii	Resource Plover	251	R
Pluvialis squatarola	Gray Plover	254	O
Vanellus armatus	Blacksmith Plover	258	-
Arenaria interpres	Turnstone	262	F
Xenus cinereus	Terek Resourcepiper	263	F
Tringa hypoleucos	Common Resourcepiper	264	F
Tringa glareola	Wood Resourcepiper	266	-
Tringa stagnatalis	Marsh Resourcepiper	269	-
Tringa nebularia	Greenshank	270	F
Calidris canutus	Knot	271	-

C.1.4.4 Reptiles

Approximately 60 species of reptile are recorded or are likely to occur in the region. Some species are found in a wide area (for example snakes such as boomslang and puffadder), while others occur only in specific areas. Reptiles has not observed or studied on the site, however, like with other animals, they are able to migrate to adjacent areas and the impact caused by the mining is mitigated by the behavior of the animals themselves. The flight and fright reaction of the animals will cause them to flee the areas where they feel in danger. A number of species occur in the region but can vary regionally for example:

- The common slug-eating snake (*Duberria lutrix*).
- Giant legless skink (*Acontias plumbeus*). The southern population around East London is isolated quite well from northern populations with subtle differenced between them.
- Dwarf chameleons (*Bradypodion sp.*): Found in isolated populations in forest and thicket habitats.

The order and nomenclature follows that of Branch (1988) – as per his study the results are shown below.

B = Specimen recorded by Broadly (1988) in one or more of the grid squares 3227 A, 3227 C, 3227 D, 3228 C or 3327 BB.
M = Museum specimen exists for the area.
L = Likely to occur in the environs of the Nahoon, Quinira and Gqunube estuaries.

Table 10. Possible reptiles

Order Family Scientific Name	Common Name	Evidence
Chelonii		
Testudinidae		
Geochelone pardalis	Leopard Tortoise	L
Pelomedusidae		
Pelomedusa subrufa	Marsh terrapin	M
Squamata		
Typholopidae		
Typhlops bibronii	Bibron's Blind Snake	B
Typhlops lalandei	Delalande's Blind Snake	B
Leptotyphlopidae		
Leptotyphlops nigricans	Black Thread Snake	B
Leptotyphlops conjunctus	Cape Thread Snake	BM
Colubridae		
Lycodonomorphus laevissimus	Dusky-bellied Water Snake	BM
Lamprophis fuliginosus	Brown House Snake	BM
Lamprophis inornatus	Olive House Snake	BM
Lycophidion capense	Cape Wolf Snake	BM
Duberria lutrix	Common Slug Eater	BM
Pseudaspis cana	Mole Snake	B
Psammophylax rhombeatus	Spotted Skaapsteker	BM
Psammophis crucifer	Cross-marked Snake	B
Aparallactus capensis	Cape Centipede Eater	B
Macreplaps microlepidotus	Natal Black Snake	BM

Order Family Scientific Name	Common Name	Evidence
Colubridae		
Homoroselaps lacteus	Spotted Harlequin Snake	B
Philothamnus semivariegatus	Spotted Bush Snake	B
Philothamnus hoplogaster	Green Water Snake	BM
Philothamnus natalensis	Natal Green Snake	BM
Dasypeilis scabra	Common Egg Eater	BM
Dasypeilis inornata	Southern Brown Egg	B
Crotaphopeltis hotamboeia	Eater Herald Snake	BM
Dispholidus typhus	Boomslang	BM
Elapidae		
Naja nivea	Cape Cobra	L
Haemachatus haemachatus	Rinkhals	BM
Viperidae		
Causus rhombeatus	Common Night Adder	BM
Bitis arietans	Puff Adder	BM
Bitis atropos	Cape Mountain Adder	B
Scincidae		
Acontias meleagris	Cape Legless Skink	L
Acontias plumbeus	Giant Legless Skink	M
Mamuya capensis	Cape Skink	L
Mamuya homalocephala	Red-sided Skink	L
Mamuya varia	Variable Skink	L
Lacertidae		
Pedioplanis lineoocellata	Spotted Resource Lizard	L
Cordylidae		
Gerrhosauru flavigularis	Yellow-throated Plated Lizard	M
Chaemaesauria anguina	Cape Grass Lizard	M
Cordylus cordylus	Cape Girdled Lizard	L
Varanidae		
Varanus exanthematicus	Rock Monitor	L
Varanus niloticus	Water Monitor	M
Agamidae		
Agama atra	Southern Rock Agama	L
Chamaeleonidae		
Brachypodion sp.	Dwarf Chameleon	L
Gekkonidae		
Hemiductytus mabonia	Morcau's Tropical House Gecko	L
Pachydactytis maculates	Spotted Gecko	L

C.1.4.5 Invertebrates

The habitat on the proposed site is common and is well represented in the surrounding areas and the subsequent temporary loss of habitat will not reduce the insect population significantly especially if concurrent mining and rehabilitation takes place. The ability of most of the animals to flee to the surrounding habitat also reduces the potential fatalities in the local area where the disturbance will occur. Little is known about the effect of mining on the insects (how many are destroyed and which animals would most likely be affected). Insects from the four insect orders Coleoptera, Diptera, Hymenoptera and Lepidoptera occur. Beetles, ants, spiders and grasshoppers species were observed on the proposed site.

Species of Special Concern

Invertebrates

Invertebrates are often not discussed or looked at in detail when assessing the environment. There is a tendency to give more attention to butterflies because there is more detail or literature available on them. There does not appear to be a regional Red Data Book available for invertebrates but some invertebrate species have been identified as being of conservation value. These include:

- Butterflies: Rare butterflies from the Pondoland region are included in the South African Butterfly Red Data Book (Henning and Henning 1989):
- Southern Aslauga (*Aslauga australis*), Rare, East London, Mbashe River, Doutza Pass, Port St Johns.
- Bicolored Abantis (*Abantis bicolor*), Rare, East London, Mbashe River, Port St Johns.
- Lycaenid butterflies (small coppers: *Aloeides clarki*; *Peocilimitis pyroeis* and blues: *Lepidochrysops bacchus*), rare or possible restricted distribution.

Pulmonate Molluscs: Two terrestrial slugs have been indicated as candidates for inclusion in the IUCN 'Red List' of threatened species (Herbert 1997). The list includes the grasshopper *Acrotylos hirtus* that is endemic to dune veldt of Algoa Bay.

C.1.4.6 Invertebrates Invader or exotic species

The tropical house gecko (*Hemidactylus mabouia*) has spread throughout much of the KwaZulu-Natal south coast and scattered towns in the Eastern Cape and Free State (Branch 1998). The animals most likely spread into the region by passive transportation by vehicles. These animals are common in caravan parks as this is the most likely because of the high volume of traffic to the caravan park. The presence of these invasive species is thought to be directly responsible for declines in coastal populations of the Pondoland flat gecko (*Afroedura pondolia*) (Branch 1998).

Branch (1998) further writes that because of urbanization invasive bird species such as the Indian Myna and House Crow have spread along road routes. The same is true for urban rodent pests such as the house mouse (*Mus musculus*) and house rat (*Rattus rattus*). The Norway rat (*Rattus norvegicus*) is larger and more aggressive than the house rat, but is currently restricted to major cites and towns in the coastal region. It may prove a greater danger to indigenous small mammals than the local species. Both rats can serve as carriers of plague.

The African cat (*Felis lybica*) is threatened by interbreeding with a closely related domesticated cat. The yellow-billed duck (*Anas undulata*) species are threatened by hybridization with the mallard duck.
Roads criss crossing the region can create a suitable corridor for the invasion of alien species to allow migration from one area to the next.

Evaluation

Negative impacts due to the invasion of alien fauna to the region are highly probable. They will initially be *localized* but will spread and occur over the long term. The significance will generally be low, as the probable alien invaders (e.g. some birds, geckos and rodents) could presently already exist on the site and in urban area

throughout the area. Mitigation usually involves active culling programmes of problem animals undertaken by conservation authorities. Control by the applicant is impracticable, as the persons on the site responsible for the mining are not trained to identify alien species and also not familiar with the most humane methods for getting rid of the species.

C.1.4.7 Endangered and rare species

None are known to occur on site, but the following tables give a list of the red data book species in South Africa.

Table 11. Mammal listed Red Data Book Species, which would be considered during the EIA

No.	Common Name	Species name	Status
1.	Honey Badger	*Mellivora capensis*	Vulnerable
2.	Spectacled dormouse	*Graphiurus ocularis*	Rare
3.	Aardwolf	*Proteles critatus cristatus*	Rare
4.	Leopard	*Panthera pardus melanotica*	Rare
5.	White-tailed mouse	*Mystromys albicaudatus*	Vulnerable
6.	Antbear	*Orycteropus afer*	Vulnerable
7.	Grant's Golden Mole	*Eremitalpa granti granti*	Rare
8.	African Wild Cat	*Felis lybica*	Vulnerable

Table 12. Bird Listed Red data Book species

No.	Common Name	Species name	Status
1.	Black Stork	*Ciconia nigra*	Indeterminate
2.	Ludwig Bustard	*Neotis ludwigii*	Vulnerable
3.	Caspian tern	*Hydroprogne caspia*	Rare

Table 13. Reptile and Amphibians Listed Red data Book species

No.	Common Name	Species name	Status
1.	Cape Rain Frog	*Breviceps gibbosus*	
2.	Geometric Tortoise	*Psamobates geometricus*	Endangered
3.	Namaqua Plated Lizard	*Gerrhosaurus typicus*	Rare
4.	Southern Speckled Padloper	*Homopus signatus cafer*	Restricted
5.	Armadillo Girdled Lizard	*Cordylus cataphractus*	Vulnerable

Table 14. Insect Listed Red data Book species

No.	Common Name	Species name	Status
1.	Unknown	*Thestor dicksoni dicksoni*	Rare
2.	Unknown	*Pasis thero cedarrbergae*	Rare
3.	Unknown	*Poecilimitus pan*	Rare

The potential impacts on the fauna and mitigating factors that can be taken into consideration:

(a) Many of the wild animals (excluding most of the cold-blooded reptiles) are nocturnal and since mining does not occur at night the machinery or the activities on the site do not harm the animals. Other animals, such as deer, that are not nocturnal will avoid areas of human activity.

(b) The area to be mined is limited to small areas at a time. The area mined is cleared in sections and the topsoil and vegetation is not removed from the entire area at once.

(c) Animals, especially wild animals, instinctively flee from danger or what they perceive as dangerous. The sound and vibrations from earthmoving machinery will in all likelihood be perceived as dangerous and the animals will flee.

(d) The mining area will not attract animals and the chance that they will be harmed is negligible.

(e) The loss of habitat to animals is limited to a specific area at any specific time and the loss is temporary. Rehabilitation will be concurrent with mining and the disturbed areas will once again become available for the animals to inhabit. The principle of concurrent mining and rehabilitation requires that mined areas be rehabilitated as mining proceeds to prevent large un-rehabilitated areas without vegetation. Areas where the mining activities have not yet occurred, as well as the rehabilitated areas, are available to the animals although, in the case of this application a site will first be mined out before the next area is mined.

C.1.5 Are there any *protected areas* (game parks/nature reserves, monuments, etc) close to the proposed operation?	VALUE	TICK	OFFICE USE
	Yes	X	4
	No		0

The East London Coast Nature Reserve is found along the coast between Great Kei River in the north-east and the Tylomnqa River in the south-west.

Between these two rivers there are more than 3 000 hectares of conservation area that include ten coastal reserves and two inland state forests, known collectively as the East London Coast Nature Reserve. In the region of 57% of the 250 kilometer coastline between the two rivers is taken up by these ten nature reserves that include Cape Morgan, Double Mouth, Cape Henderson, Cintsa West, Kwelera, Nahoon, Cove Rock / Gulu, Kidds Beach Nature Reserve, Kayser's Beach and Chalumna, whilst the two inland state forest reserves lie north of East London along the north bank of the Buffalo River. The main reasons for the East London Coast Nature Reserve's existence are to preserve the biodiversity in the region, to protect the natural vegetation and manage alien vegetation.

C.1.6 Describe the type of equipment that will be used

Technology to be used

Excavator (although a front-end loader can also be used) and bulldozer will be used for:

- ❑ The removal of topsoil
- ❑ The mining of the resource
- ❑ Loading and transporting of resource to the market
- ❑ Scarifying the base layer where compaction occurred and where every necessary.
- ❑ Replacement of topsoil
- ❑ Constructing the access roads
- ❑ Rehabilitation of the access roads

Tractor and grader, ripper or scarifier:

- ❑ Remove all the depressions
- ❑ Levelling the mined areas

Tractor and Plough

Ploughing the area before planting

C.2 HOW WILL THE PROPOSED OPERATION IMPACT ON THE *NATURAL* ENVIRONMENT? (REGULATION 52(2)(b))

ENVIRONMENTAL ELEMENT/ IMPACTOR	VALUE	TICK	OFFICE USE
C.2.1 What would the ultimate depth of the proposed prospecting/mining operations be?	0 – 3m		2
	6 – 10m		4
	10 – 25m	X	8
	25m +		10

C.2.2 How large will the *total* area of all excavations be?

This is a permit application for a 1.5 ha area in total.

C.2.3 How large will each excavation be before it is filled up?	<10 X 10m		2
	<20 X 20m		4
	>20 X 20m	X	8

One site will be mined at a time and the sites will systematically increase in size. Site A is 0.5 ha and Site B is 1.0 ha. Each site will be rehabilitated once mining is completed. The area where the machinery operate within the borrow pit must be large enough for the equipment and trucks to maneuver safely and because of the size of the borrow pit size this make rehabilitation of sections of the site during mining difficult.

C.2.4 How many *prospecting* boreholes or trenches will there be?	The entire mine are will be 1.5 ha. Prospecting holes were 1.5 by 2 meters and the dam the landowner is making on the farm is outside but adjacent to the proposed mine site and showed the material present 25 x 50 m.

C 2.5 Will employees prepare food on the site and collect firewood?	VALUE	TICK	OFFICE USE
	Yes		4
	No	X	0

C.2.6 Will water be extracted from a river, stream, dam or pan for use by the proposed operation?	Yes		4
	No	X	2

Water is not required to excavate the resource. However, water collecting in the excavated area during a rainy episode can be used for rehabilitation or dust suppression if and when required. An alternative source of water for dust suppression can be from a dam on the farm. However, due to the scale and duration of the activity, dust created can be limited, mitigated and controlled. Water should be used sparingly and limited water will be required.

C.2.7 If so, what is the name of this water body?

When it rains, water will temporarily collect up in the borrow pit. There are no rivers or streams on or near the site. The on the farm is a man-made dam. Another watering hole is being construction to the west of Site A.

C.2.8 If water will not be extracted from an open surface source, where will it be obtained?	When the water collected in the borrow pit is used up water from the dam on the farm will be used will be used for dust suppression. Other methods of dust suppression will also be considered.

C.2.9 How much water per day will the *mineral processing* operation require?	VALUE	TICK	OFFICE USE
	1000 – 10 000 Liters		2

processing **operation require?**	20 000 – 40 000 L		3
	40 000 – 60 000 L		5
	60 000 – 100 000L		8
	More		10
Processing of minerals will not occur and water will only be required for dust suppression when and where it is required to needed in order to preserve the natural resource as far as possible.			
C.2.10 How far is the proposed operation from open water (dam, river, pan, lake)?	0 – 15m	X	8
	16 – 30m		6
	31 – 60m		4
	More than 60 meters		2
There are no natural dams on the proposed site or within 500 m from the site. There are also no rivers in close proximity to the proposed site. There are no watercourses on the proposed sites. There will be no mining within 25 m from any watercourse.			

C.2.11 (a) What is the estimate depth of the water table/ borehole?

Groundwater resources

Aquifer: a geological formation, which has structures or textures that hold water or permit appreciable water movement through them [from National Water Act (Act No. 36 of 1998)].

The aquifer comprises fractured Table Mountain Group sandstone confined in the eastern part of the basin by overlying siltstone and mudstone of the Kirkwood formation (Uitenhage Group). The Uitenhage Artesian Basin comprising two district systems: the Swartkops Aquifer and the Coega Ridge Aquifer. These are hydrogeologically independent of each other due to the presence of the Coega Fault, a major structural feature separating the two systems. The Basin was declared a Subterranean Government Water Control Area in 1957 in the order to protect the aquifers from over-exploitation and contamination. Due to the type and scale of mining, neither exploitation nor the contamination of the groundwater will occur.

Borehole: includes a well, excavation, or any other artificially constructed or improved groundwater cavity. None are present in the areas where mining will take place and the excavation is also not deep enough to impact on the ground water. Pollution of the groundwater is unlikely.

Confined aquifer: Groundwater below a layer of solid rock or clay is said to be in a confined aquifer. The rock or clay is called a confining layer. This area has a confining layer. A borehole that goes through a confining layer is known as an artesian well. The groundwater in confined aquifers is usually under pressure. This pressure causes water in an artesian well to rise above the aquifer level. If the pressure causes the water to rise above ground level the well overflows and is called a flowing artesian well. There are no artesian wells on the areas where mining will take place.

Groundwater: There are no boreholes on site (according to the landowner) and the depth of the groundwater below ground level (b.g.l.) is unknown. Water found in the subsurface in the saturated zone below the water table or piezometric surface i.e. the water table marks the upper surface of groundwater systems. The Uitenhage Artesian Basin in South Africa's most important artesian groundwater basin.

Ground water extracted

Groundwater is not extracted for mining purposes. Water from the existing dam on the farm will be used for dust suppression when required.

Water quality

The groundwater quality is not known, since as far as can be established has not been determined. Mining is not likely to impact on the groundwater because of the type of operation and with effective management techniques and mitigation measures in place and used during mining and rehabilitation, the potential for groundwater contamination will be negligible during the excavation of the resources with a decrease in intensity with distance from the source. The operation is not expected to present a problem in terms of the relevant legislation and in relation to the other noise created. Mitigating and management of this impact will also be addressed in the report. Mitigating measure will include limiting the operations to working hours (e.g. 7h00 – 18h00, sunrise to sunset or as acceptable to residents in the area) and using silencers and other of sound mufflers. It will be mandatory for staff to use personal protective equipment.

C.2.12 How much water per day will the proposed operation utilize for employees?	Water brought to site in 25 liters containers per person for drinking and sanitation. Sanitation – a minimum of 25 liters per day.

C.2.13 What toilet facilities will be made available to workers?	None		8
	Pit latrine (long-drop)		4
	Chemical toilet	X	2

A chemical toilet will be made available.

C.2.14 Would it be necessary to construct roads to access the proposed operations?	Yes	Haul roads on the mine	4
	No	X	0

Roads already exist but where necessary existing roads will be upgraded if and where necessary. Haul roads will be made on the mine area as mining proceeds. The following are suggestions for good road construction.

Road and erosion can be managed as follows:

Design and install adequate drainage measures

Include regular pipe culverts where and if necessary and control downstream erosion by incorporating velocity reduction measures and fanning outlets

Construct side drains upslope of roads and install velocity reduction measures such as Vetiver Grass to reduce flow.

Ensure the culverts drop inlets remain active; do not silt, and are not constructed above the channel invert with concomitant diversion across the road surface.

Drainage measures must ensure the integrity of the access roads remain intact. Inspect regularly and maintain

Therefore:

Protected side drains

Grass Verges

Unsilted cross drains

Inlets and pipes

Erosion protected pipe outlet areas (grassing, cobbled, concrete outlet drains)

Vetiver grass

Roads: Cut-slopes (rugged and steep terrain)

Cut-slopes constructed at stable batters

Drop zone and catch-wall construction in toppling rock

Nets and cabling on exposed disintegrating areas if and where necessary

Soil slopes grassed on 1:1.5 maximum slope where necessary

Road embankments (along steeper slopes)

Side-slopes fill embankments required on steeper slopes

Embankments shaped to stable batters

Slopes grassed and vegetated with indigenous seedlings

No slopes steeper than 1(vertical): 1.5 (horizontal) = 34 degrees

Vegetate all embankments side-slopes (vegetation will seldom grow on slopes steeper than 1: 1.5

Toe stabilization in problem soils

Drainage with no erosion

Roads: rivers & stream crossing

All structures founded rock or box culverts supported on gabion mattresses (per example)

Stable embankments grassed

No erosion of embankment toes or slopes

No downstream sedimentation

Roads: Borrow pits

Borrow pit roads and haul roads rehabilitation in strict accordance with this EMP

Access road design

Design adequate culverts at regular intervals along the route or trenches along the roads if and where necessary.
There must be adequate compaction and shaping (that will result in run-off) to prevent ponding
Stabilize embankment side slopes by providing vegetation

	VALUE	TICK	OFFICE USE
C.2.15 How long will these access road(s) be (from a public road to the proposed operations)	0 – 0,5 km		4
	0,6 – 1,5 km	X	2
	1,6 – 3 km		4

	VALUE	TICK	OFFICE USE
C.2.16 Will trees be uprooted to construct these access road(s)?	Yes	X possible	4
	No		0
Existing roads will be used. Few trees will most likely be uprooted if it is necessary for safety reasons to widen the road.			
C.2.17 Will any foreign material, like crushed stone, limestone, or any material other than the naturally occurring topsoil be placed on the road surface?	Yes		4
	No	X	0

Sabunga will be used on the roads on the mine and for the strengthening on the access roads.

Wherever the roads need to be maintained, strengthened or upgraded natural gravel, sabunga and resource will be used as far as possible. Only with permission from the DME will building rubble or foreign material will be used for this purpose.

Traffic and access management: Mitigating measures relating to traffic on the roads

(a) Traffic leaving and entering the site will adhere to the traffic rules and all trucks shall have a contactable phone number posted clearly on the vehicle to enable residents and road users to report unsafe driving or undesirable conduct by the drivers.
(b) Signage, warning of the mining activity and trucks entering and leaving the site, should preferably be posted within a reasonable distance from this entrance (on both sides of the road) to warn oncoming traffic and thereby attempt to prevent accidents.
(c) The signage/notice board should preferably be in 3 languages (English, Afrikaans and Xhosa). Preferably, international symbols for safety and danger can be placed on the board to accommodate the illiterate (if and where necessary). Generally the boards must be visible at night if any mining takes place before sunrise and after sunset.
(d) Road vehicles must be checked regularly to ensure that they are in a roadworthy condition. Drivers shall be instructed to repair the vehicles before their next entry onto the site. Vehicles must be fitted with noise muffler systems (silencers) so that disturbances and irritations are reduced to a minimum, and the vehicles must be mechanically sound so as to not leak oil or fuel.
(e) Drivers must be reminded to be alert at all times and to drive with care when passing the entrances and turning onto the site.
(f) After mining has been completed, the roads that will not be used again will be ripped and covered with at least 300 mm of topsoil.
(g) The dumping of waste will not be allowed. Often the trucks empty their trucks of waste on a mine site before loading a resource (paid for 2 trips). Therefore, the trucks must be checked before entering the site or dumping the waste. Trucks transporting material that is not acceptable or allowed on site must be turned away.
(h) Truck drivers must be licensed and trained.
(i) The site will not be accessible to any unauthorised persons and no one will be allowed on site without the permission of the applicant who takes responsibility for the mine site.
(j) All complains must be recorded and addressed immediately.
(k) Ensure that the view to and from the entrance is not obscured and that trucks leaving the site can be seen from a safe distance (trim non-indigenous bushes and trees if and where necessary. If required for safe access onto the main access roads, trim indigenous vegetation as well).

Traffic regulations are enforced by the local Traffic Department.

Traffic and access: management of impacts (also see assessment and management plan later in document)

To ensure safety the access roads must be maintained:

(l) The access road (private road) leading to and from the mine site to the main road will be kept in a good condition (maintained and repaired when necessary).

(m) Maintenance and repair of the access roads is required to prevent accidents. Repairs include repairing potholes by filling or scraping the road. Loose soil must also be removed.

(n) The roads must be continuously maintained to minimize the need for major repairs.

(o) As far as possible, existing roads will be used, but some new access / haul roads will need to be constructed on the mine site (within the mine borders) between the different mine section on the mine site (when the mine is made wider). Before a haul road or an access road can be used or constructed, the topsoil must be removed and stored alongside the road (about 2 m from the shoulder of the road).

(p) Access roads will for the most part (as far as possible) be made parallel to the contours to further reduce the potential for erosion. All haul roads

(q) Must be strengthened with gravel or other suitable material but no building rubble or other rubble will be used unless approval is obtained from the relevant authority.

C.3 TIME FACTOR			
C.3.1 For what time periods will mining operations be conducted on this particular site?	0 – 6 months		2
	6 – 12 months		4
	12 – 18 months		6
	18 – 24 months	X	8
	>24 months		10
This is a mining permit and a 1.5 ha area must be mined within a period of two years after which application to mine another year if all the resources were not optimally removed) may be applied for. This reapplication can be repeated until a maximum period of 5 year in total is used to mine the area.			

C.4 HOW WILL THE PROPOSED OPERATION IMPACT ON THE *SOCIO-ECONOMIC ENVIRONMENT*? (REGULATION 52(2)(b))

Mining is of importance as it is linked to development as well as building and maintenance of infrastructure. For all the developments building materials are required and building material means mining. According to Buffalo City Municipalities Housing Policy, in 2004, approximately 75,000 households, in both the rural and urban areas of Buffalo City, do not have access to adequate shelter. This backlog is evident in problems such as multiple families living within single formal houses, informal dwellers on vacant land within formal townships or on green belts, and scattered settlements on the urban fringes in rural areas. There is increasing pressure to develop outside the "urban edge", on the urban fringe, in areas such as the Gonubie Valley and the West Bank and the Buffalo City Municipality. The Urban Edge Framework provides guidance to prospective developers on where developments can take place. All the material required for the development comes from mining. The cost of the material is directly linked to the distance over which the material is transported.

From the IDP for Buffalo City Municipality it is clear that there is a high demand on public transport, but the system is not meeting the needs of the community. It is apparently unsustainable, unsafe, ineffective, not accessible and supply-driven. Making it clear that the public transport system must be improved. The Public Transport Plan was completed in 2006 and provides the long-term strategy and structure for developing an integrated public transport system for Buffalo City that will ensure that it is a formal system based on regulated competition. Deficiencies in the road infrastructure, lack of facilities for pedestrians and cyclists, lack of traffic safety awareness, inconsiderate and aggressive driving habits all impact on traffic safety in Buffalo City. To compensate for these a Traffic Safety Plan was developed in 2005. This plan provides strategies to address traffic safety issues in Buffalo City. The immediate focus area was around schools. The road network is one of the key components of the transportation system. A large percentage of Buffalo City's road infrastructure is old, rapidly deteriorating and in some cases past its functional life. Major rehabilitation is required to surface roads in the rural areas and in areas such as Mdantsane, where road infrastructure apparently has had little or no maintenance for the past 25 years. In addition, large number of the roads in these areas is dirt roads and requires gravel for resurfacing. Over time these roads must all be resurfaced. According to the report an amount of R730 million is required for upgrading of Mdantsane gravel roads to surfaced roads (surfacing of 310kms). Funding backlog for maintenance of roads is estimated at R270 million, R34 million must be spent annually so as to eliminate this backlog. At the time a prediction for the two financial years (2007 – 2008) R68 million was required for resurfacing of roads so as to avoid premature reconstruction and for the next five years (2007 – 2012) R252 million is required for carrying out roads rehabilitation (BCM Pavement Management System). The estimated replacement costs for 1 388.5 km of BCM road network is R1.34 billion (from the IDP for Buffalo City Municipality). Apparently the capital allocations are insufficient and only a small percentage of the road network is adequately maintained or upgraded on an annual basis.

The material for the upgrading and building of the infrastructure is obtained from mining and based on the large amount of work required the volume of road construction material is large. The further the source of the material is from the location where it is required, the more expensive the infrastructure. With cost and lack of funds already an issue, it does not make sense to make use of only existing mines, which already provide to existing markets but might also be further away from the location where it is needed. Monitoring of the road conditions is every 5 years for gravel roads and annually for surfaced roads.

The distance of a supply point to the delivery point can increase or decrease the cost significantly due to the maintenance cost of the vehicles, the damage to the roads during transport as well as the fuel cost. The mining sector is by law required to plan for and ensure skills development, career development, mentoring and make provision potential downscaling. The applicant extends his social responsibility by providing internships and bursary schemes to non-employees. Furthermore, mining laws enforces equity ruling, BEE requirement as well as the contribution to the local economic development.

The mine is on private land and in a rural area and apart from the impact on the landowner will not impact on nearby residents. The traffic load is not unacceptably high but the increase in trucks on the road could impact on the existing road users. The maximum number of trucks is about 10 – 11 per day.

ELEMENT/ IMPACTOR	VALUE	TICK	OFFICE USE
C.4.1 How many people will be employed?	2		
There will be about 12 permanent workers for the mine and 10 for the contractor, therefore, some are permanent others are contracted in:			
C.4.2 How many men?	10 - 12	X	
C.4.3 How many women?	2 – 4 (Two at least) X		
C.4.4 Where will employees be obtained? (Own or employed from local communities?)	VALUE	TICK	OFFICE USE
	Own	X	2
	Local	X	4
Employees are from the local area East London, Gonubie area. The specialists and contractors are also contracted in from as close as possible to the proposed site.			
C.4.5 How many hours per day will employees work?	Sunrise→ Sunset	X	4
	Less		2
	More		8
C 4.6 Will operations be conducted within 1 kilometer of a residential area?	VALUE	TICK	OFFICE USE
	Yes		6
	No	X	1
The mine is not located close to a residential area, but the landowners residents is adjacent to Site A and also lie to the south and between Site A & Site B.			
C.4.7 How far will the proposed operation be from the nearest fence/windmill/house/dam/built structure?	0 – 50 metres	X	8
	51 – 100 metres		4
	150 or more metres		2
C.4.12 Visual impact			
There are two critical viewpoints that must be considered on these mine sites. The first is the owner's residence and the other the R346. The owner has given permission for mining on the site and has selected the sections most suitable for the mine sites in accordance with his future land use options. The northern section borrow pits will be close to the R346 and without mitigation and could possibly be visible for a short duration during some phase of the mining activity. The R346 lies on the 283 (opposite Site B) –285 m (opposite Site A) with the highest point of Site A on 290 m contour (slightly elevated to the SE of the site above the R346) and the highest point on Site B at 285 m contour (the western border slightly elevated above the R346). On Site A the face will be higher than the road and will be visible from the road once the topsoil is removed. If the elevated section on Site B is mined so that the highest part of the site faces towards the south, the site will most likely not be visible. If the bush and trees directly along the R346 is not removed or additional trees are planted along the road, they will function as a visual screen screening the mining activity from the road users.			

C.5 HOW WILL THE PROPOSED OPERATION IMPACT ON THE *CULTURAL HERITAGE* OF THE SURROUNDING ENVIRONMENT? REGULATION 52(2)(b)			
ELEMENT/ IMPACTOR	VALUE	TICK	OFFICE USE
C.5.1 Are there any graveyards or old houses or sites of historic significance within 1 kilometer of the area?	Yes		8
	No	X	0

Area Background:
The MPRDA requires a heritage and archaeological assessment but there are further reasons for assessing the sites. The East London Museum has extensive collections of including an exhibit of the first Coelecanth to be caught in modern times and the only remaining Dodo egg. The presence of key reptilian fossils, such as *Dicynodon grimbeeki*, *Oudenobdon baini* and *Pristerodon spp.* have been discovered here within the so-called lower Cistecephalus horizon, and identify the sandstone as belonging to the Lower Beaufort Stage. Fossils of the fern *Dicroidium lancifolia* and several *Glossopteris spp.* common to the Upper and Lower Beaufort Stages respectively, have also been found here.

At the Bats Cave near the Nahoon Estuary there is an unusual outcrop of calcareous sandstone, or aeolianite, which rests upon a pebble layer above dolerite. Middle Stone Age implements have been found in this layer, and casts of human footprints and tracks of hyena and birds have been found in the strata. On the basis of this the deposit was identified as belonging to the Early Stone Age and has occasionally been found around East London and there is abundant evidence of Late Stone Age "strandlopers" in the many shell middens found in the coastal dunes.

A Phase 1 Heritage and Archaeological Assessment (see attached Annexure) no sites or artifacts were found.

C.5.2 How will the cultural/heritage views of interested and affected parties be considered during the mining activity.			

If any archaeological or heritage material is found during mining it must be dealt with in accordance with the National Heritage Resource Act (No. 25 of 1999). SAHRA as well as the South African Police will be notified if any graves are found.

C.6 SPECIFIC REGULATORY REQUIREMENTS

C.6.1 Air quality Management and Control (Regulation 64). Describe how the operation will impact on the quality of the air, taking into account predominant wind direction and other affected parties in the downwind\zone:

Particulates

The impact from dust depends on the type of dust generated. Based on her research Dr. Botha (2002) wrote: *"Wind blown dust and particulate matter from various origins is currently probably the greatest air pollution problem in South Africa. In addition to impairing the visibility and subsequently degrading the physical environment, particulate emissions can result in severe medical problems associated with respiratory disorder. Particulates are often regarded to be rather inert and to have little consequence on plant health. However, various forms of dust (and other types of dust such as from cement kilns, coal, etc.) have been demonstrated to inhibit photosynthesis significantly. In addition, dust coatings increased leaf temperatures by 2 – 4 °C, increased the number of bacteria and fungi on the leaves and increased transpiration. Water loss increased with increased concentration and decreased –particles size of applied dust."*

Nuisance impacts due to dust are associated with:

- Dust fall and soil impacts requiring more regular dusting ans sweeping.
- Reduction in visibility when dust blows - atmospheric particulates change the spectral transmission, thus reducing visibility by scattering light. To what extent the light is scattered depend on the mass concentration and size distribution of the particulates. Dust on this scale is unlikely unless unnaturally strong winds blow and the soil is very dry.
- Loss of visibility can have an impact on the economy by the need to artificial illumination and heating. This is highly unlikely on this mine.
- Traffic delays, disruption and accidents can be caused by the fall out dust (if it is significant). As previously stated, this is unlikely unless under very extra ordinary conditions
- Due to the scattering and reduction in light intensity, photosynthesis and therefore vegetation growth is reduced. Dust is generated during the preparation of soil for planting and seeding. During farming activities large volumes of dust is generates. To his knowledge the landowner professes that this has not impacted on the vegetation – either the indigenous vegetation or the crops.
- There can be commercial losses associated with aesthetics. This is a short-term mine for a period of two years and any impact will be short term. The screening of the mining activities by the trees and bush around the mine sites will further negated the activity.
- There is also the economic impact cleaning of buildings (washing, cleaning and repainting) and materials covered in dust and in some instances there can be damage to the building. Being a short-term activity, the dust from mining may throw dust on the nearby buildings, but apart from requiring cleaning and painting, the damage will be not cause lasting damage to the buildings.

Sources of air pollution

A possible cause of air pollution is also wind-blown resource or dust from the areas void of vegetation, during mining of the resource and from travelling on the dirt roads. This can be mitigated by suppressing dust with water or/and covering exposed topsoil stockpiles or rehabilitated area (topsoil replaced) with dry branches, shade cloth etc. to prevent or reduce the potential of sand and dust being liberated and blowing. Dust emissions can be managed.

Air pollution can also occur in the form of emission gases generated by light and heavier vehicles travelling along the roads in the vicinity. Exhaust gas emissions from vehicles and machinery contribute to the air pollution regionally and eventually on a global scale. Emissions from farming equipment, diesel engines on agricultural land, heavy vehicles and tractors using the roads in the vicinity also contribute to air pollution. During holiday season emissions from the increase in vehicles as a result of tourism is high.

A possible current cause of air pollution in the vicinity of the site is as a result of the windblown sand/soil (saltation and crawling) and dust liberated during agricultural activities (ploughing) that leave the land void of vegetation for a period of time. The liberation of dust as well as resource crawling and saltation is aggravated by strong winds. Dust is also liberated from the dirt roads that are used on and around the farms in the area. South-easterly winds bring rain and rain, when it occurs during the year, reduces the potential for airborne dust. During the rain periods the soil particles are bound and weighed down by the moisture and dust cannot be liberated. When water is available; crops, weeds and other new growth germinate and helps to bind and stabilize the soil thereby reducing the potential for airborne dust.

Indigenous vegetation is exposed to agricultural activities – such as when the land is prepared for planting and seeding and during these times the vegetation is exposed to fall-out dust. Currently fall–out dust is created when the dry soil is ploughed or ripped during the dryer months of the year as well as when the vegetation is cut back. There is no research available that can show whether the dust from the farming activity have resulted in damage to indigenous vegetation.

The impact resulting from the dust and emissions generated during mining are considered not to be significant if all the recommendations and management principals suggested in the EMP are followed and will then, in all probability, not result in any health risks. The levels can, however, be quantified only once a mine is active. The small scale of the operation will result in little dust being created or at least will not be created for a long or continuous period. Because this is a rural area and the residences are far apart with large open areas surrounding the houses, most dust released is likely to settle before it reaches the residents.

Cumulative impact

Mining will occur on farmland. Ambient dust levels increase significantly during the dryer periods due to agricultural activity such as preparation of the soil/planting and harvesting. In terms of cumulative impacts – dust created from the mining will add to the ambient dust levels, even if only at low levels and insignificant in relation. The disturbance due to the type and scale of mining is very small and will contribute an insignificant amount to the cumulative effect of dust in the area. Earthmoving machinery themselves move slowly and creates little dust and these machines only operate when the trucks come to load the resource. There is a correlation between the speed a vehicle travels and the dust it liberates. The faster the vehicle travels the more dust is released. Normally farm roads are dirt roads and using them will also add to the dust emitted into the atmosphere.

The earthmoving equipment and the trucks contribute to the emissions already in the atmosphere as a result of, for instance, equipment used on the farm. Even though the contribution is small in comparison with other industrial activities and the emissions dissipate relatively quickly in the rural areas (reduced cumulative impacts locally), all emissions collect in the atmosphere and cause pollution which can have an effect locally as well as regionally and globally and where possible must be limited.

Everything possible should be done to reduce the release of green house gasses and apart from using effective and efficient exhaust systems, pumps, vehicles and other fuel using material must not run unnecessarily.

The following extracts (to the ends of the discussion on dust/air pollution) from documentation provided by the department of Environmental Affairs on dust deposition limits and measure methods are added for the convenience of the applicant who will use the EMP document to assist him with best mining and rehabilitation practices.

To be able to assess the significance, **dust depositions limits were made available by the Department of Environmental Affairs:**

Dust Deposition Limits

Dust deposition may be gauged according to the criteria published by the South African Department of Environmental Affairs and Tourism (DEAT). In terms of these criteria dust deposition is classified as follows:

- SLIGHT - less than 250 mg/m²/day
- MODERATE - 250 to 500 mg/m²/day
- HEAVY - 500 to 1200 mg/m²/day
- VERY HEAVY - more than 1200 mg/m²/day

The South African Department of Minerals and Energy (DME) use the 1200 mg/m²/day threshold level maximum allowable. In the event that on-site dust fall exceeds this threshold, the specific causes of high dust fall should be investigated and remedial steps taken.

"Slight" dust fall is barely visible to the naked eye.
"Heavy" dust fall indicates a fine layer of dust on a surface
"Very heavy" dust fall being easily visible should a surface not be cleaned for a few days.
Dust fall levels of >2000 mg/m²/day constitute a layer of dust thick enough to allow a person to "write" words in the dust with their fingers.

Local experience, gained from the assessment of impacts due to dust from mine tailings dams in Gauteng, has shown that complains from the public will be activated by repeated dust fall in excess of ~2000 mg/m²/day.
Dust fall in excess of 5000 mg/m²/day impacting on residential or industrial areas generally provoke prompt and angry complaints.

Starting in ~1984, widespread monitoring of dust fall around gold tailing reclamation sites along the length of the Witwatersrand and around surface coal mines, using the American Standard Test Method (ASTM1739), has been undertaken. Although several other countries have dust fall guidelines, none have monitored dust fall as extensively as in South Africa. The accumulated data from over two hundred sites with continuous records extends as long as 17 years at the oldest sites. Considerable experience has been accumulated within the framework of the DEAT guidelines as to what is acceptable, tolerable and what is intolerable.

A perceived weakness in the current dust-fall guidelines is that they are purely descriptive, without giving any guidance for action or remediation (SLIGHT, MEDIUM, HEAVY, VERY HEAVY). On the basis of the cumulative South African experience of dust fall measurements, a modified set of dust fall standards are proposed that fall within the overall framework of the new Clean Air Legislation.

Dust fall Standards Proposed: Measurement Methods

The method of dust fall measurement shall be by capture of particles by gravitational settling across a horizontal surface into a deep container, following the American Standard Test Method (ASTM1739) or any subsequent amendments to that standard. Measurements shall extend over 30 days (± 3 days).

The number and location of samplers shall be sufficient to monitor dust fall at representative locations around the dust source, and will include monitors located at human residences and sensitive business, industrial or agricultural locations within a maximum distance of 2km from source boundary. At least one monitor shall be placed upwind or at some distance from the source to characterize typical background dust fall beyond the zone of influence of the source. For practical purposes this may be taken as more than 2km from source. Micro-surroundings of the samplers shall where possible follow the ASTM 1739 prescriptions.

Dust fall monitors may also be located within the boundaries of the site as defined by the legal, coordinated boundaries of the mine, for control purposes. Even when included in general environmental reports, these site-internal monitors shall not be evaluated against the standards in terms of the CAA.

Equivalent Methods

Equivalent methods may be accepted by the DEAT (specify responsible officer or Directorate) on submission of a technical report demonstrating equivalence. At a minimum equivalence testing shall consist of three co-located samplers of the reference type and the test type, operated continuously for a period not less than six months. The mean dust fall rates obtained by the test method shall agree with the reference method within one standard deviation as determined by the replicate measurements.

Variations of Method

To establish the contributions to dust fall rate by two sources located near to each other, directional samplers incorporating two or more dust fall collection containers and some movable lid may be used to monitor dust fall. While these samplers may be used in a qualitative manner to determine relative contributions from the sources, or determine the net difference in dust fall rate of air passing across an industrial boundary, sectorial dust fall rates obtained by such methods shall not be definitive for purposes of complying with the standards. The sum of all dust falls from all containers averaged over the entire sampling period may be used as equivalent to a single container sampler.

Bands of dust fall rates proposed for adoption

BAND NUMBER	BAND DESCRIPTION LABEL	DUSTFALL RATE (D) (mg/m²/day¹, 30-day average)	COMMENT
1	RESIDENTIAL	D < 600	Permissible for residential and light commercial.
2	INDUSTRIAL	600 < D < 1 200	Permissible for heavy commercial and industrial.
3	ACTION	1 200 < D < 2 400	Requires investigation and remediation if two sequential months lie in this band, or more than three occur in a year.
4	ALERT	2 400 < D	Immediate action and remediation required following the first expedience. Incident report to be submitted to relevant authority.

Target, action and alert thresholds for ambient dust fall

LEVEL	DUSTFALL RATE (D) (mg/m²/day¹, 30-day average)	AVERAGIN G PERIOD	PERMITTEED FREQUENCY OF EXCEEDANCES
TARGET	300	Annual	
ACTION RESIDENTIAL	400	30 days	Three within any year, no two sequential months.
ACTION INDUSTRIAL	1 200	30 days	Three within any year, not sequential months.
ALERT THRESHOLD	2 400	30 days	None. First exceedance requires remediation and compulsory report to authorities.

Margin of Tolerance

An enterprise may submit a request to the authorities to operate within the Band 3 ACTION band for a limited period, providing that this is essential in terms of the practical operation of the enterprise (for example the final removal of a tailings deposit) and provided that the best available control technology is applied for the duration.

No margin of tolerance will be granted for operations that result in dust fall rates in the Band 4 ALERT.

Responsible Agency

As sources of dust fall are readily identified and localized, responsibility for monitoring shall be with the owner or operator of the source enterprise(s). Results of monitoring from instruments located in public areas, taken to mean any monitor other than within the defined industrial/mining premises, shall be reported to regulatory authorities on a regular basis (monthly or quarterly). The cost of such monitoring shall be for the account of the operator or owner of the source enterprise.

Exceptions

Dust falls that exceed the specified levels but that can be shown to be the result of some extreme weather or geological event shall be discounted for the purpose of enforcement and control. Such events might typically result in excessive dust fall rates across an entire area or region, and not be localized to a particular operation. As an example: Natural seasonal variations, such as dry windy periods during the Highveld spring will not be considered extreme events for this definition.

From: Footprint ranking report for the Proposed Regional General and Hazardous Waste processing facility in the Eastern Cape. 11 November 2006. Only the section of the total suspended particles is relevant for this site.

Total suspended particles	The impact of total suspended particles on human health is largely dependent on: • The particle size • The chemical composition • The duration of the exposure • The magnitude of the exposure • The frequency of the exposure. • The aerodynamic characteristic of the particles in the flow stream (size, shape and density). • The deposition of the different particles in the reparatory system depends on their size. The nasal openings permit very large dust particles to enter the nasal region, along with much finer airborne particles. The nose hairs or bends in the nasal cavity capture the larger particles. Smaller particles (PM10) pass through the nasal region and are deposited in the tracheobronchial and pulmonary regions. Particles are removed when impacting with the wall of the bronchi when they are unable to the gas stream through the bifurcations of the bronchial tree. As the airflow decreases through the terminal bronchi, the smaller particles are removed by Brownian motion, which pushes them to the alveolar membrane.	Particle size fractions for: • Total Suspended particles (TSP) with aerodynamic diameter of 30 micron meter to 100 micron meter = limit at 300 microgram per m^3 (maximum daily) and 100 microgram per m^3 • Inhalable particulates or PM10 (i.e. particulates with an aerodynamic diameter of less than 10 micron) • Respirable particles of PM2.5 (i.e. particulates with an aerodynamic diameter of less than 2.5 micron meter) = maximum 24 hr average - 65 micrometer per m^3 and annual 15 micrometer per m^3. The three-year annual average needs to be less than 15 micrometer per m^3. PM10 and PM2.5 could potentially have an impact on health because they are so fine that they are able to deposit in, and can possibly cause damage to the lower airways and gas-exchanging portions of the lung.

Environmental Affairs	Inhalable Particulates (PM10)	
Details	Maximum 24-hour concentration (microgram/ m^3)	Annual average concentration (microgram/ m^3)
SA -current guideline	180 (not to exceed 3 times per annum)	60 (represents the arithmetic mean)
SA – proposed limits	75 (Proposed SA limit values SANS 1929 – Ambient air quality – Limits for common pollutants) 50 (Proposed target values, SANS 1929, Ambient air quality – limits for common pollutants)	40 (Proposed SA limit values SANS 1929 – Ambient air quality – Limits for common pollutants) 30 (Proposed target values, SANS 1929, Ambient air quality – limits for common pollutants)

However, the World Health Organisation (WHO) no longer supports air quality threshold levels for particulates. They recommend the following:

- Decide from which health effect the population is to be protected
- Determine the population of sensitive group to be protection from air pollution effect.
- Set a fixed value for the acceptable risks in a population so that a single value for a given exposure period may be defined.

Considering this approach, monitoring is required to be able to assess situations on a case-to-case basis.

C.6.2 Fire Prevention (Regulation 65)

Applicants for permits, rights or permissions involving ***coal or bituminous rock*** must:

- ***Indicate on a plan*** where the coal or rock discard dump will be located
  (If applied for a permit to mine or prospect for coal or bituminous rock, indicate the exact location of the discard dump on the plan and write" EMPlan C6.2" next to it)

Not applicable to this type of mining

Fire in general as a risk

The potential for fires occurring will depend on several factors:

- The habitat type. That is whether fire in the area is a natural phenomenon related to the ecosystem (such as in some grassland areas)
- Changes in drainage or water flow such as when roads are built that cut water off from an area and causing vegetation to dry out.
- Increase in the number of people in an area
- Whether activities associated with the people involve the making of open fires
- Dumping of waste such as glass bottles that can cause accidental fires
- Vegetation is removed from the mine area. Dry vegetation must not be left or stored adjacent to surrounding vegetation incase it catches fire and ignite the adjacent vegetation. Dried vegetation should preferably be removed from site.

Recommendations

- Cut vegetation short near roadsides or where next to the activity undertaken.
- Pick up glass bottles or pieces of glass, paper.
- Ensure environmental awareness plan/education include explaining the risks of dumping bottles, cigarettes, making fires near vegetation (especially dry vegetation.
- Also see emergency procedures and management and mitigation measures in this document. See C.11.5

C.6.3 Noise control (Regulation 66)

Indicate how much noise the operation will generate, and how it will impact on the surrounding environment, and who might be influenced by noise from your operation.

Environments that are recognised as being noise sensitive include residential areas, offices, schools, other training centres and well as churches. The activities occur in a rural area not near to residential areas, but rather with the farmhouses far apart. Noise dissipates the further one travels from the source and is also dependent on the prevailing wind.

The proposed site is situated in an area that, apart from the landowners residence, is not close to any residential areas
Potential noise impacts of the proposed mining activity include:

1. Removal of the resources (excavation/mining)
2. Loading and trucking of the resources
3. Light and heavy vehicles travelling on the R346, which lie adjacent and to the north of both Site A and Site B generate noise.
4. Generators, farming equipment, pumps, etc. also generate noise.

Noise generated by vehicles (including tractors) and farm equipment (including pumps and generators) is the main source of noise pollution. Current vehicular noise results from trucks and vehicle traveling on the roads in the area. The significance of the noise impact created by the trucks is determined by the type and number of receptors as well as the intensity and duration of the impact created by, for instance, the volume of vehicles or trucks passing the receptor at a given time. However, the severity of the impact also depends on the distance of the noise from the receptors as well as the frequency (pitch) of the noise. Any noise created by vehicles as well as the other activities will mask the noise created by the earthmoving machinery to some extent, but on the other hand the noise can also be

cumulative if added to the existing noise created in the area (mostly farm noises). Noise associated with the R346 (not only the mining activity) and other noise in the vicinity is continuous whereas mining is periodic, with removal and loading only occurring when a truck arrives on site and leaves the site. This situation is also expected to occur at this proposed mine. Measurements conducted by a specialist on other similar mines produce the results in Table 24 below. According to the readings there is little difference between the vehicles used on the farm and a mine truck. Looking at the measurements, the ideal would be for the trucks to drive around a steep area such as a hill, rather than over it (prevent the changing to lower gears). Because the site is located in a rural area, the noise receptors are few and far between. The sound is screened by the vegetation that remains on site

Vehicles	A(dB)		B(dB)		C(dB) (steepest area)		D(dB)	
	Up hill	Down hill	Up hill	Down hill	Up hill	Down hill	Up hill	Down hill
Truck (mining)	44.9	40.1	50.0	50.1	73.6	70.0	49.8	50.2
Tractor	44.9	43.6	61.0	59.0	78.9	74.8	49.7	46.9
Truck (farming)	44.7	43.9	61.4	58.6	74.1	70.9	48.7	48.8

C.6.4 Blasting, vibration and shock (Regulation 67)
Please indicate whether any blasting operations will be conducted.

Blasting: **No**	How often? **NA**

C.6.5 Disposal of waste material (Regulation 69)
Indicate on your plan **where waste will be dumped in relation to the beneficiation works/ washing pans Also indicate below how domestic waste material will be managed.**

Facilities for the management of solid waste

a) A mobile chemical toilet will be provided that will be cleaned and replaced regularly and before it is full. Where necessary, a trench or small berm is to be built around the toilet to divert the surface water run-off away from the chemical toilet to prevent spillage around the toilet from coming into contact with surface water run-off. Spillage must be removed with the soil and discarded with the other solid waste at an appropriate landfill site.
b) All solid waste and domestic waste will be removed daily. Containers with lids will be provided on site to contain the waste and will be removed before they are full and taken to an appropriate landfill site.
c) No dumping of any building rubble or scrap metal will be allowed. If dumping occurs, the area on the site and at the entrance to the site will be cleared weekly (at the entrance) or at least monthly (on the mine site).
d) Chemical spillage prevention: Any oil, diesel, grease or petroleum products spilled on the soil will be collected to the depth of penetration and stored in suitable containers with lids. These containers along with any waste oil, grease or fuel will be discarded at the appropriate designated facility and will not be dumped or buried on site.
e) Chemical spillage prevention: No fuel will be stored on site. Earth moving machinery will be refuelled daily by means of a diesel trailer towed behind a vehicle. During filling of the fuel tank, a suitable funnel will be used and the soil will be covered with impermeable plastic to collect any accidental spills. Should there be accidental spillage on the soil, it must be removed and discarded at an appropriate landfill site.
f) No burning of materials, and especially waste, may occur on site.
g) No waste may be buried.

Facilities for the management of water pollution

a) Except for the dumping of solid waste (such as domestic waste consisting of food containers, plastic bags, polystyrene, etc. as well as scrap metal), which will be prevented as far as possible, the type of mining is such that neither surface nor groundwater will be affected. Should dumping occur, it will be cleared.
b) Spillage during refuelling or emergency servicing of earthmoving equipment will be cleaned by removing the pollutant to the depth of penetration into the soil. The contaminated soil will be stored in containers with lids and

removed from site when the containers are full.

c) During re-fuelling, plastic sheeting will be strategically placed under the fill-point to collect any spillage. During periods of non-use (after-hours, weekends and holidays), drip trays will be placed under the vehicles to collect any possible leakage.
d) The chemical toilets will not be placed in a position where spills can pollute surface water. There will be berm or a trench around the facility to divert run-off water from the site where the toilet is located.
e) No waste may be buried.
f) No fuel will be stored on either Site A or Site B.

C.6.6 Soil pollution, topsoil management and erosion control (Regulation 70)

C.6.6.1 Indicate how topsoil will be handled on the area.

Topsoil and erosion management plan

Topsoil Management

Topsoil management is required to protect topsoil by removing, storing and replacing the topsoil over the disturbed area after mining. Topsoil management is required to topsoil and concurrent mining and rehabilitation.

- To start off, the topsoil is removed and stored. The stripping of topsoil from an area must preferable occur in sections at a time rather than removing the topsoil from the entire area or a large area at once. Storage of topsoil can take placed to visually screen a mining activity from any critical viewpoints.
- After mining has been completed on a section, the topsoil is removed from the next section and stored.
- Topsoil must be stored in an appropriate area where it is protected so that it remains as viable as possible until it can be returned during rehabilitation.
- Topsoil must be returned as soon as possible.
- Removal of the topsoil from only small sections at a time will minimize the possibility of erosion occurring when the surface water washes over the area and will also reduce any potential visual impact.
- Determine the quantity of topsoil to be removed and stored and spread it along the boundary or place it on a stockpile/berm (if used for screening). The spreading of the topsoil along the boundary is preferred if it will help the topsoil stockpile height from not exceeding 2 m.
- Preparation of the mined areas and replacement of the topsoil over prepared areas.
- Topsoil is replaced as soon as possible after mining (progressive reinstatement or concurrent mining and rehabilitation). If topsoil has been stored for longer than 6 months, it must be ameliorated. If the viability of the topsoil is compromised in any way during mining, the topsoil must also be ameliorated.
- Backfilling of depressions in the mine floor and slopes must occur before and after the topsoil has been replaced (level the surface of the mine to prevent depressions from remaining where water can collect). The areas around depressions with the particular function to drain and collect water needs to be rehabilitated.
- If topsoil was previously contaminated with alien vegetation, a stringent alien eradication plan must be followed to remove the invasive plants as soon as they are observed and to constantly manage the eradication of alien vegetation.
- All available topsoil will be removed (normally to an average depth of 500 mm). At least one meter of material is replaced above solid rock or clay or water table (surface or groundwater) during rehabilitation. The slope gradient on the mine is such that a raised water table is not expected to occur.
- A delineated dropper can be placed on the topsoil stockpile to monitor the loss of topsoil as result of wind and water erosion.
- After the topsoil is replaced, the topsoil layer is ripped or rotivated to loosen the soil and facilitate root penetration as well as water absorption, drainage as well as vertical and lateral movement of water within the soil.
- Contours will be constructed where they are necessary to minimize the possibility of erosion of the topsoil after replacement.
- Diversion ditches and trenches can be made above topsoil stockpiles to divert runoff water from the stockpile and reduce the potential for water erosion.

- Haul roads will be constructed on site so that it will not trampled or compact the topsoil stockpiles and rehabilitated area. Topsoil will be stored away from the mining activity. Topsoil will be removed from the areas where new haul roads are to be constructed. The topsoil will be stored along the road (about 2 m from the shoulder of the road) until the roads are decommissioned and the topsoil can be returned. After replacement of the topsoil, seeding and planting will commence (see section on access roads below).
- Topsoil is removed from small sections at a time to keep the topsoil covered with vegetation as long as possible. Unvegetated soil will be exposed to wind and water erosion.
- Topsoil stockpiles can be covered with mulch, straw or dried branches (or other suitable material such as reeds) to reduce the potential for wind erosion until the vegetation have rooted on the stockpile. Vegetation will bind and stabilize the soil. Water can also be used, but to conserve the resource, water should be used as a last resort especially in areas where it is scarce.
- After replacing the topsoil, the depth of topsoil will be determined (monitored) over the rehabilitated area. The position of each monitoring point/hole will be determined using a grid pattern with holes 50 m apart. The coordinated (GPS) points and the depth of the topsoil over the mined area can be determined for each hole. Where the topsoil is inadequate, it will be supplemented to ensure a uniform depth of at least 300 mm over rehabilitated areas. Topsoil data and measurements will be included in the Performance Assessment Report (Biennually) as stipulated in Regulation 55 of the Mineral and Petroleum Resource Development Act 2002, No. 28 of 2002.
- Prevent the replacement of the topsoil contaminated with seeds from the alien vegetation by; removing the aliens

C.6.6.2 Erosion Management Plan

According to Mucina and Rutherford, 2006 erosion is very low to moderate, but measures to prevent erosion are nonetheless provided.

- Protect all areas susceptible to erosion and prevent both wind and water erosion as far as possible.
- Remove vegetation and topsoil from small areas at a time.
- Cover topsoil areas with bark, straw or other suitable material to reduce the potential of wind erosion occurring.
- Avoid access onto seasonally wet areas during or immediately after a rain episode (let the soil first drain as much as possible) – wet soil compacts easier (relevant to topsoil).
- Where erosion is observed, repair immediately and plan and construct management mechanisms to prevent further erosion.
- Gradients may not exceed 1:3 and 1:1.5 along roadside.
- If necessary, use diversion or collection ditches, trenches or berms to divert runoff water from the topsoil stockpile, slopes without vegetation and mine area. If used, the ditches or trenches must be wide and shallow rather than deep and narrow.
- Access routes/haul roads should preferably be made along the natural contours of the land. When constructing roads within the mine, make allowance for diversion ditches or trenches to prevent erosion of the road surfaces.
- Topsoil stockpiles must preferable not be higher than 2 m to reduce the potential for wind erosion.
- Place a delineated marker on the topsoil stockpile to monitor topsoil loss as a result of wind erosion.
- To further prevent wind and water erosion, earthworks and vegetation removal will be limited to areas where site preparation is required for mining and for manoeuvring of machinery.
- Rip the surface after replacement of the topsoil and rip or in depth.
- Straw can also be spread over seeded rehabilitated areas to prevent soil being washed away and to help vegetation settle.
- Construct contours where necessary.
- Replace the topsoil and rip or rotivate the area to a depth not deeper than 200 mm to facilitate drainage and decrease potential water erosion of and also to facilitate root penetration with as little mixing of subsoil and topsoil as possible (reduce dilution of topsoil).
- Appropriate erosion controls (such as berms, diversion ditches or trenches) are to be put in place prior to mining and where necessary to protect the topsoil still on the site, on the stockpiles and after topsoil has been replaced.
- Earthworks and vegetation removal are to be limited to areas where site preparation occurs. Stripping is to be limited to areas where mining and site preparation (site establishment) is to take place. Therefore, remove

vegetation and topsoil from as small an area as possible.

- Re-vegetate as soon as possible after topsoil has been replaced or cover the topsoil with straw or bark in the interim (if and where necessary) until the vegetation has established
- Any rifts and fissures must be repair as soon as possible.
- The flow in the trenches or channels can be controlled by using the following:
  - Sandbags
  - Anchored straw bales
  - Reno mattresses
  - Plastic liners and/or coarse rock (underside rip-rap)
  - Vegetation or grass
- Access routes/ haul roads on slopes are to follow natural contours of the land as far as possible. Steep slopes should especially be parallel to the contours.
- Should it be necessary to access slopes where there is a risk of erosion, appropriate erosion controls (such as berms, diversion ditches or trenches) are to be constructed.

Storm water control and diversion

- Storm water control on the site is important to prevent erosion, destabilisation of cut faces and reduction of water within the site.
- Considering the profile and slope of the site, mitre drains can be cut to direct water away from the excavation. Water is also to be directed away from topsoil stockpiles.
- Mitre drains can be constructed in such a way that at least one half of the drain is in *in situ* material. The drain shall have a fall not exceeding 1:100unless the *in situ* material is not erodible. Where required reno mattresses packed with suitable material shall be placed in ditches to prevent erosion.
- All mitre drains and storm pipes shall be sized with due regard to the catchment served.
- In all cases on borrow pits with cut faces into a rising slope, there shall be a mitre drain off-set 3 m above the top of the cut face diverting water to either side of the excavation. Erosion control measure control measure should be placed at the discharge down the slope.
- Where practicable storm water should not be diverted into the excavation site where work is being conducted. However, where necessary cut off drains are to discharge via pipes or spillways to the base of the excavation and into a suitable settling/retention pond.
- Overflow from the settling pond is to be directed away from the roadways within the site and channelled to a suitable point for discharge to the environment. Under no circumstances may the water be discharged directly into a natural water feature.

Water from the settling pond can be used for dust suppression if it is not contaminated.

If, when and where necessary – the following additional erosion control methods that can possibly be used:

⇒ *Windbreaks where possible to reduce the potential for erosion, but also the function as a noise, dust and especially a visual screen*

⇒ *Topsoil covered with geotextile (preferably made of sisal) with openings of at least 225 mm² and guaranteed to last at least 2 years). Include or add specified indigenous grass seed mixture or seeds from other appropriate vegetation e.g. indigenous vegetation.*

⇒ *Logging or stepping: logs placed in continuous lines along the contours.*

⇒ *Earth or rock-pack cut-off berms (angled across the contour at approximately 30 degrees from the bisector of the contour.*

If, when and where necessary – Adjacent to roads, stabilizing access roads, etc. (Steeper slopes or unstable slopes):

Steep slopes or unstable slopes need to be stabilized with hard structures that (preferably with a natural look) and with facilities that will provide for the stabilization of plants on or near the structures. One of the following can be done:

⇒ *Retaining walls (loffel or others)*

⇒ *Stone pitching*
⇒ *Gabions*
⇒ *Shotcrete*

C.6.6.3 Describe how spills of oil, grease, diesel, fuel or hydraulic fluid will be dealt with.

- Toxic waste pollution on a mine site is limited to the spillage of oil, fuel and lubricants onto the soil during emergency repairs, refuelling and lubrication.
- Servicing of vehicles is normally done at the workshop and all scrap metal and tyres are stored at the workshop from where it is eventually disposed of.
- Water flowing over the contaminants (rainwater or water used for dust suppression) can theoretically transport the contaminants into the groundwater or wash into water bodies (man-made or natural). Water bodies, man-made or natural are not present on or near the proposed site to where the water can flow and this potential impact is excluded.
- Pollutants are removed to the depth of penetration where observed. Therefore, if management and mitigation measures are followed, pollutants will not enter surface and groundwater.

Mitigation and management:

- Immediately report any container, machine vehicle that may be damaged and/or leaking oil to the supervisor.
- All repairs and servicing should take place at a workshop. The workshop should be covered with an impermeable material such as a cement floor or similar and where none exists immediate clean up must occur after each spill (see below). Bunding or collection trenches would be preferred to collect the pollutant-runoff from the workshop floor.
- The only exception for repairs on site would be if the machine or vehicle is unable to move from the site and the vehicles are in need of emergency repairs. In this case there should be preparations to the soil (soil covering).
- Any oil, diesel, grease or petroleum products spilled on the soil will be collected to the depth of penetration and stored in suitable containers with lids. If not removed from the site daily, the contaminated soil will be stored in containers with lids and removed from site (when full). These containers along with any waste oil, grease or fuel will be disposed of at the appropriate, designated facility and will not be dumped or buried on site.
- Alternatively the contaminated soil can be treated on site. Microbes within the soil can break down hydrocarbons and contaminated soils can be recycled to be used again. The soil is then not lost. However, to prevent the toxic materials leaching into the soil during the breakdown process, an area should be prepared so that the bottom of the area is covered with an impermeable plastic layer or is on clay. The soil must be placed in a container, or suitably prepared area, for treatment. Microbes can be added to the soil to speed up the biodegradation process.
- Whenever fuel, lubricants or grease are brought to site temporarily, such as during emergency repairs and re-fuelling, the toxic material will be placed on an impermeable plastic covering. Sand bags can also be used to bund the area. Earthmoving machinery is normally refuelled by means of a diesel bowser towed behind a vehicle. During filling, a suitable funnel must be used and the ground immediately below the filling point can also be covered with impermeable plastic or a drip tray to take extra precaution and collect any accidental spills. Should there be accidental spillage on the soil, contaminated soil must be removed and discarded at an appropriate landfill site.
- Toxic material will generally not be stored on site, but will be stored at the workshop on the farm. The storage area will be on an impermeable material that is bunded and that can hold at least one and a half times the volume of the storage containers.
- In practice, a fuel bowser towed by a pick up truck ('bakkie') transports the fuel to the equipment and is removed from site when finished refuelling. This is preferred rather than storage of the fuel on site as the latter might require security arrangements to prevent theft and spillage.

Management of accidental toxic waste spillage

The principles of any clean-up operation are:

- Contain the spill and stop it from spreading.
- Remove the source of the polluting substance – i.e. close any taps or valves where necessary or replace leaking taps.
- Clean up by removing the contaminated soil to the depth of penetration. Store the contaminated soil in a container or treat (bioremediate) on site using an impermeable material to prevent toxins from entering the soil (see recovering contaminated soil below). The impermeable material can be removed after the microbes have broken down the contaminants.
- Rehabilitate the area.

Recovering contaminated soil

- Place any excess oil, diesel, chemicals and contaminated soil in a drum and label the container. A container in which contaminated soil is placed can also be made available for bioremediation.
- Add the bioremediation agent. The addition of soil to the contaminants will ensure that the microbes in the soil also aid in the break down process. Use a bioremediation agent (e.g. Enretech 1 or Spillsorb) containing "oil/diesel eating bacteria" (microbes).
- Bacteria are anaerobic, and need not be aerated. It is however, necessary to keep the mixture slightly moist for the bacteria to function optimally.

Procedure

- Any oil, diesel, petrol or hazardous chemical spill must be reported to the site manager.
- The responsible person must take steps to prevent the spill from spreading and immediately begin with clean up procedures.
- Personal protective equipment (PPE) must be worn when handling oil, diesel, solvents or other chemicals.

In the case of large spills i.e. more than 100 litres of diesel, oil, fuel or any other hazardous substance:

- This would be deemed an emergency.
- Report spill immediately to the responsible person who must contact a Pollution Control Specialist in the area whenever necessary.
- The number of the Pollution Control Specialist must be posted at the site and be available to the person(s) responsible for working with the oil, fuel and lubricants.
- Pump/scoop excess material or fluid into 210 liter drums immediately. Place any contaminated soil or material into drums labeled for that purpose.
- Chemicals and fuels should only be stored once the necessary permits and have been obtained.
- In addition to this, all Occupational Health and Safety guidelines need to be followed with regards to fire extinguishers, safety signage (incl. UN boards) and instructions for emergency handling of these chemicals/fuels. The applicable MSDA's (Material Safety Data Sheets) should be readily available where the chemicals/fuels are stored – in this case at the manager's office. In addition products required to safely and efficiently contain any accidental spill as per the material safety data sheet must be on site. Employees need to do a study of the material safety data sheet; so that they are informed and trained as to how one would contain and clean up any spill.
- The area allocated to store fuel/chemicals needs to be clearly sign posted (no flames, no smoking etc). The bunding wall around this area needs to be high enough to contain one and a half times the volume of fuels to be kept.

C.6.6.4 Briefly describe the storage facilities available for the above fluids:

Fuel is not stored on site. Temporary storage facilities for diesel will consist of a diesel bowser, which will be refuelled at the nearest filling station (in town or on the nearby farm). When not in use, the diesel bowser will be parked on a plastic-lined area with resource bags around the area that is able to contain the one and a half times the volume of the bowser (if a permanent parking area with impermeable flooring and drain or catchment system is not in place). The area must be large enough to cope with minor spillage and leaks that may occur from time to time. During storage drip trays must be placed under the bowser to collect smaller spills. Appropriate empty drums will be provided to temporarily store waste and these drums will be placed on an impermeable plastic (such as PVC) lining that is bunded with sandbags so the area can contain one and a half times the volume of the storage drums. Temporary measures are required if it is not possible to make more permanent arrangements.

The reason for storing would be to reduce travelling on the roads when transporting fuel backwards and forwards, which in turn will reduce the emissions, fuel consumption and any impact on the roads. All fuel stored will be stored as described above in this paragraph. Topsoil must be removed from these storage areas and stored separately for later replacement.

There is a workshop on the farm with an impermeable floor where fuel and other toxins (oils, hydraulic fuels) can be stored. The area is not bunded, but sandbags can be used to bund the area.

C.6.8 If significant impacts on any element of the environment mentioned in Section C 1 to C 6.6 above have been identified, summarise all of them here: (Regulation 52(2)(c))	C.6.7 How will the negative impacts on the environment be mitigated or managed as described in C 6.11 to the left? (Regulation 57(2)(c))
Example: Section C 6.4 Blasting. I have identified that the people living on the neighbouring property are sensitive to loud noises as they have children that must study during the afternoons	**Example:** I will mitigate the impact of my blasting operations on the Interested Parties by limiting blasting operations to school hours, when no one in the affected area is at home.
1 **Please see attached EMP.**	1 **Please see attached EMP.**
2	2
3	3
4	4
5	5
6	6
7	7
8	8

SABUNGA MINE AREA				
Activity per phase of the operation	**C.6.7 If significant impacts on any element of the environment mentioned in Section C 1 to C 6.6 above have been identified, summarise all of them here: (Regulation 52(2)(c))**		**C.6.8 How will the negative impacts on the environment be mitigated or managed (as described in C 6.11 to the left? (Regulation 57(2)(c))**	
Phase 1 of the operation is the preparation phase	**Potential impacts of the activities in each phase**	**Rating: High/medium/ low/negligible**	**Mitigation**	**Management (a management plan is also provided in the next table)**
Activities during this phase				
Mine and site planning preparations	Plan the layout of the site	Negligible	• The site is small and non-compliance will have a small impact until the site is rehabilitated.	• Plan the layout of the site prior to handing in the application and prior to entering the site.
	Not considering the landowner and the IAP's regarding access onto the site, the roads to use, problems or requirements regarding the gates and fences, as well as availability of water, the most acceptable times of operation, etc. can eventually cause poor relations.	Negligible	• The landowner approves of the application submitted by Vaduba Investments cc (applicant) on condition that the mining and rehabilitation occurs according to the approved environmental management plan (EMP). • With current available data there is little indication that mining will significantly impact on him over the long term if the requirements in the EMP are followed. The statement is based on the current use of the land. • Arrangements between the landowner and Vaduba Investments cc were made with regards to the infrastructure and other potential impacts and usage of the land.	• Arrange with I&APs and landowner regarding access to the site, gates and fences, the roads and water that can be used
Demarcation of the mine area	Not demarcating the area will result in haphazard mining with excavations occurring randomly across the site.	Low to negligible	• A mining and rehabilitation plan is included in the EMP • Site A is 0.5 hectares and Site B is one (1) hectare. The size of the area is relatively small and can be mined and rehabilitated effectively with or without benching. • Mining will occur in a structured manner according to an approved mine and rehabilitation plan. • Mining will create a depression with the faces either sloped or benched depending on the volume of backfill material available.	• Demarcate the mine area to ensure mining will only occur within the designated mining area and to assist with auditing and monitoring of the activity. • Mining will take place according to the approved mine and rehabilitation plan.

Topsoil Management prior to mining	Not removing the topsoil prior to excavating the resource.	Negligible	♦ If the topsoil is removed stored and the stockpiles managed, there will be no loss of topsoil. ♦ Topsoil management is discussed in this document.	♦ Remove the topsoil for an area earmarked for mining prior to any location being excavated. Remove only from the area that will be mined immediately. Do not remove topsoil from too large areas at a time (e.g. the entire 0.75 ha). Because of the space required for the vehicles to manoeuvre the borrow pit will become wider as mining extends deeper into the soil. To achieve this the faces move back. Also see topsoil management in C.6.6.1
	Removing the topsoil from the mine area and selling it	Negligible	♦ Topsoil cannot be used in the construction or building industry because it contains organic material and the decompositions of the organic as well as roots and impurities plans and these cause cracks in cement or grow through the road surface ♦ Although topsoil can be used in landscaping, the soil is required on site for rehabilitation. With the submission of the performance assessments done biennually, the loss of topsoil will be recorded. If topsoil is lost, it must be brought in from elsewhere at a cost and this is not economically viable (moneys paid for topsoil is more than the profit that can be made from the sales of the topsoil). Therefore, selling topsoil normally will not occur.	♦ Topsoil will not be removed from site (sold or given away). ♦ Topsoil will not be used for other purpose than rehabilitation of the mined areas.
	Removing the topsoil and subsoil (overburden – unusable sabunga) together will reduce the viability of the topsoil for rehabilitation	Low	♦ Topsoil is removed from above the weathered dolerite. ♦ Topsoil is removed and stored separately from any overburden. ♦ In the case of this mine the **overburden is mostly waste rock (larger boulders of weathered dolerite and un-weathered larger rocks that will remain on site since crushing of material will not take place).** ♦ The overburden in the case of this mine can easily be separated from the topsoil.	♦ Remove and store the topsoil before removing the subsoil. ♦ Any mineable material and overburden is excavated after the topsoil has been removed and is kept separate from the topsoil. ♦ Topsoil and subsoil must not be mixed when replacing the material after mining has been completed. Use the roll-over method where the subsoil is replaced first followed by the replacement of the topsoil.

	Topsoil that is removed and stockpiled for storage until required for rehabilitation looses its viability.	Negligible to low	• The removal, storage and replacement of the topsoil are planned (see topsoil management plan) to reduce the effect of mining, storage and replacement will have on the topsoil's viability to sustain vegetation. • Not removing and storing the topsoil will be disastrous compared to the removal and storage for later rehabilitation.	• Topsoil is removed from small areas at a time. Topsoil is, therefore, only removed from areas be mined in the short term. In the case of this mine the borrow pit widens as it becomes deeper. The benches or slopes as mined back in sections at a time (topsoil is pushed back or removed from about 20 m at a time from the top of the borrow pit). • Store topsoil for as short time as possible and if stored longer than 6 months the topsoil must be ameleorated. • Store topsoil away from roads or areas where it can be trampled on and compacted. • Store topsoil away from any invasive plants that have been removed. • Replace topsoil as soon as possible after it has been removed and stored. See C.6.6.1 in document for information on the management of topsoil

	Erosion of the topsoil on the stockpiles can occur.	Negligible to low if the management principles are followed.	• Small areas are opened at a time – vegetation and then topsoil is removed from small areas at a time and not from the entire area to be mined. • Topsoil is placed in a position and with the necessary precautionary mechanisms to reduce the potential loss of the topsoil through erosion. • The erosion potential of the soil is very low to moderate.	• Protect topsoil from water erosion (positioning, trenches, diversion ditches, etc)\ • When and wherever necessary, place trenches or diversion channels to divert runoff surface water from the stockpile and prevent the topsoil from washing away. Reduce the effect of wind erosion on the topsoil stockpile (cover the stockpile with straw, branches (etc.) or wet the stockpile). • Place the topsoil above the area that will be mined or away from the mining activity at the bottom of the borrow pit (normally that used for the rehabilitation of the borrow pit floor). • High stockpiles on this site will be more exposed to wind and water erosion. The height of 5 m for a topsoil stockpile may not be exceeded, but to improve the viability of the topsoil, it is better to spread the topsoil out along the face of the mine to allow vegetation growth on as large a surface as possible and reduce the potential for wind and water erosion. A height of 2 m will suffice and is preferred. • Monitor loss of topsoil with a delineated dropper placed on the stockpile taking into account the natural tendency of the resource to sag to the natural recline of the angle for the particular material. • Reduce the potential effect of erosion on rehabilitated areas and topsoil stockpiles by covering with straw, bark, or other suitable material until vegetation starts to grow that will bind and stabilized the soil. • See C.6.6.2 in document for information on the prevention and management of erosion

PHASE 2 OF THE OPERATION IS THE MINING PHASE	Potential impacts of the activities in each phase (mining phase)	Rating: High/medium/ low/negligible	Mitigation	Management
Concurrent mining and rehabilitation	Too large areas are left open (un-rehabilitated) at a time exposing the uncovered soil (no vegetation) to wind and water erosion.	Low to moderate	• The mine areas are relatively small (1.5 ha for both sites) reducing the overall impact of the mine. Because this mine is divided into two sites, the impact is less for each site, but is spread over a wider area. Rehabilitation is easier in smaller areas • Because the borrow pit is relatively small and space is needed to manoeuvre trucks and earthmoving machines safely, the area is not divided into blocks or sections that can be mined and rehabilitated concurrently. However, the size of the areas from which vegetation and topsoil is removed is controlled by removing the topsoil systematically as the benches or slopes are mined back and not clearing the entire area prior to mining. •	• Mine only one site at a time. Concurrent mining and rehabilitation in the case of this borrow pit would be that as mining on one site is completed, rehabilitation will begin immediately and continue until finished while mining commences on the other site. • Remove topsoil from the areas where the roads will be constructed. Store the topsoil along the road (about 2 m from the shoulder of the road) and prevent driving over the topsoil so that it can be replaced after the roads are lifted.
	Topsoil is removed from too a large area at time before rehabilitating exposing large areas to erosion	Medium if the proposed mine and rehabilitation plans are implemented.	• Because sabunga is mined in a borrow pit (borrow pit) that will become relatively deep, a larger excavated area is required to work safely within the borrow pit. The topsoil is already removed from the excavated area. To widen the borrow pit to be able to work safely within the borrow pit, the topsoil has also been removed from a new area to the east so it can be mined in the near future.	• Topsoil may only be cleared from an area that will be mined at the time. • The areas exposed in the borrow pit while mining will increase in size as mining proceeds and dust and erosion must be manager effectively until such time that rehabilitation can occur.
	The entire mine area is mined before rehabilitation commences	Medium to high	• Impacts stemming from the exposed nature of the burrow pit can be mitigated if the if the proposed mine and rehabilitation plans are implemented (rehabilitate as soon as possible) and the potential impacts are managed. • Although best practice is for the mine and rehabilitation to take place on a 1:1 basis for every area mined and area similar in size is rehabilitated) it is not practicable on this mine. On the borrow pit with a certain amount of space required for the machinery and vehicles to manoeuvred.	• Remove topsoil in section and do not expose the entire mine area at once. Push back or remove topsoil back in section of 20 m at a time.

Topsoil management mixing with minable material during mining	Topsoil is stored too close to the mining area resulting in the topsoil being removed along with the mineable material or at least being mixed (diluted) with the resource or is removed with the resource.	Negligible to low	♦ Every time topsoil is cleared from an area it is pushed back at least 20 m from the edge of the borrow pit where it is stockpiled.	♦ The topsoil is pushed at least 20 m back from the edge of the borrow pit faces. ♦ Store the topsoil away from the border of the excavation and also away from the path of the trucks. ♦ If topsoil do fall in or mix with the subsoil, it must be removed and replaced on the stockpile. Sabunga with topsoil is regarded as contaminated because of the presence of seeds and roots. ♦ Topsoil mixing with the overburden (basically larger rocks) can be separated from the overburden. See C.6.6.1 in document for information on the management of topsoil
	Topsoil is stockpiled until the end of mining (for the duration of mining), therefore, impacting on the viability of the topsoil for later rehabilitation.	Low	♦ The mine and rehabilitation plan addresses concurrent mining and rehabilitation where the topsoil is stored for as short a time as possible. However, due to the type of mining, the topsoil is mostly stored for an extended period until the area is backfilled.	
	Vehicles trample the topsoil during mining by driving over it or backing up against the stockpiles. Vehicles do not stay on the haul roads. The topsoil that has been replaced after mining of one area and during mining of the next area is compacted when the trucks or machinery drive over or back up onto the rehabilitated area.		♦ In the case of this mine the topsoil is stored at the top of the borrow pit away from the access and haul roads. ♦ Haul roads are constructed, as they are needed on the mines. Therefore, it is possible to construct the haul roads on the mine that they will not result in the trucks and vehicles driving over stockpiles or rehabilitated areas. ♦ Topsoil is not replaced if there is any chance that the trucks or earthmoving machinery will have difficulty in avoiding driving over it.	♦ Store all the topsoil away from any mining activity, trucks and in a safe place until it can be replaced. ♦ Topsoil is pushed away from the edges/faces of the borrow pit place and at least 2 m from the access and haul roads (from where it is removed) ♦ Topsoil storage must be away from the area where the trucks and earthmoving machines operate. ♦ Construct haul roads away from or around rehabilitated areas. ♦ If not possible, then do not replace topsoil in an area that could be affected until such time as topsoil will not be compacted or destroyed

	Not enough topsoil is replaced to retain the agricultural capability of the site	Negligible to low	• Rehabilitation aims to re-establish the site so it is as to as close as possible to the state it was prior to mining. In this case the aim would be to establish pastures on the site. If any of the benches remains, indigenous trees or bush can be planted on them. • A topsoil management plan and erosion control measures are provided in this document to address and manage the possible loss of topsoil. • All the topsoil on the site must be removed and stored to ensure there is efficient material above any root-limiting layer. The topsoil varies in depth but is on average about 500 mm thick. However, if the faces are sloped the surface area of the mine will increase and the topsoil will be in the region of 300 mm thick and if located above solid rock or impermeable clay, not all the sabunga can be mined.	• Retain all topsoil removed to ensure there is efficient material to be replaced over the root-limiting layer to decrease the potential loss of agricultural potential of the soil (planting of pastures). • The soil above solid rock or any impermeable layer must be at least 500 mm thick. Therefore, where the topsoil replacement will result in the topsoil coverage is less than 500 mm, retain some sabunga to place under the topsoil • <u>See C.6.6.1 in document for information on the management of topsoil</u>

Management of drainage	Drainage patterns of the area can be affected as a result of the mining activity.	Negligible to low	• The drainage pattern of the area will not be affected. Any impact will be localized. There are no drainage channels on the site. • However, drainage can be managed if it is a problem as discussed in adjacent column where management of the impact is addressed. • Drainage will be managed to prevent erosion and to ensure runoff water from the high point reaches to vegetation and other users below the mine area. • Where necessary diversion ditches or trenched will be used to control the water flow and prevent erosion spoiling the landscape. • Contours will also be used to manage the water flow down the slope and prevent erosion. See C.6.6.2 in document for information on the prevention and management of erosion	• Ensure the faces are either sloped at no more than 1:2.5 (1:3 is preferred) or are benched. • Construct contours on the slopes at about 50 m offset on the down slope and water behind the contours drained towards the sides. Along the sides the water is drained in shallow planted drainage channels rather than deep channels. The contours on the slopes will control the water running down the slope. • The gradient between the mined and the un-mined areas must not exceed 1:2.5 as this complicates the reinstatement of vegetation – especially when using mechanical equipment. Again the success rate is expected to have a higher success rate over the short term on a preferred 1:3 slope. • Drainage will be managed at the top of the borrow pit by constructing diversion ditches or trenches to divert the runoff water away from the edge of the borrow pit from where the water can be collected in a collection ditch or trench and the flow of the runoff can be controlled. Control will involve the construction of wide, shallow ditches rather than deep trenches. • The water that do fall on the floor, benches or sides or of the borrow pit during a downpour cannot be prevented from running into the borrow pit and collecting at the lowest portion of the mine floor. However, water collecting in the borrow pit will be less than if all the water from the top of the borrow accumulated on the floor of the pit. With the only option remaining to pump the water out to make it accessible for alternative uses on and off the site. Sods can be laid down within the diversion ditches/trenches as these require moisture to thrive. ***The following can be done to place the sods:*** ○ Trim the area to be grassed ○ When laying the sods, the soil must be moist to a depth of 150 mm before placing them. ○ Rake or spike the area to provide a loose surface to a depth of 100 mm. ○ Starting at the lowest point of the trench/ditch lay the sods in a straight line

				○ Place the next row adjacent and tightly against the previous row with the joints staggered and cover the rest of the area in this way. The sods must not be stretched or overlap. Fill spaces in between with parts of sods. ○ If the slope is steep, stakes (wood, 300 mm in length) can be used to secure them ○ The ditches and trenches in this area would be suitable for sodding because of the continual drainage of water down the slope of the mountain and irrigation will in all probability not be required. ○ Alternative and suitable plants can also be used.
	Depressions formed as a result of mining can collect water or dam water up.	Negligible to low	♦ The proposed rehabilitation activity includes the leveling of the surface area to remove any depressions that can dam-up water. The area is landscaped and all depressions are removed so that the drainage is not affected.	♦ Level all the heaps and fill all the depression to ensure the surface area is level and the water can flow evenly over the rehabilitated area.
The impact of the lowering of the topography or the removal of the subsoil on the soil or agricultural capability/capacity of the soil or the land end-use	The removal of the subsoil will impact on the post mining agricultural or other post mining development potential of the soil or land.	Low to Medium if the rehabilitation is efficient so the land can be used again for agriculture.	♦ The removal of the subsoil will not affect the agricultural capacity or capability of the soil since the some of the sabunga will remain and the topsoil will be replaced after mining (and if the proposed mine and rehabilitation plan is adhered to). ♦ The agricultural potential of the soil is low to begin with mainly because of the low clay content, loose structure of the sabunga and the depth of this subsoil that has a low water holding capacity. ♦ The removal of the resource will, therefore, not reduce the agricultural capability (for grazing) if the mitigation and management measures are followed, topsoil is retained and rehabilitation is effective.	♦ At least 500 mm of soi lmust remain over the water- or root-limiting layer. If there is not enough topsoil, it must be supplemented with mineable sabunga. (Some of the sabunga remain with topsoil to make up the required 500 mm). ♦ Replace all the topsoil if the agricultural potential of the soil is to be retained. ♦ Further landscaping (that will include backfilling, sloping, levelling (see next point below)) and re-vegetation will improve the effect of the lowering and changing of the topography on the site.

	The possibility that the lowering of the topography will have an effect on (a) the agricultural capability/capacity of the soil. (b) the land end-use		• The excavation of the sabunga will result in a borrow pit being formed, which will change the way in which the land can be used. Backfilling will allow the sloping of the faces of the borrow pit and with a gradfient not more than 1:2.5 (preferably 1:3) planting on the slopes will be possible. Agricultural implements can drive on a slope of 1:3 . With proper rehabilitation the land can again be used for agriculture and associated activities. On the sites the agricure activity will most likely be what it was prior to mining, which is grazing.	• Sloping the area between the mined and the un-mined area to a workable angle (1:2.5 but preferably 1:3) • Enough soil will remain for the roots to penetrate and for water to drain into the soil vertically and spread horizontally without the soil becoming water logged. • The area will also be sloped so that drainage from the site can occur. If necessary, drainage pipes or channels can be used. • Run off water must be diverted around the borrow pit to drain into the settling ponds and then into the existing dams or fan out to at the bottom to spread over the un-mined, vegetated land adjacent or below the borrow pit. • This water must be diverted via a wide planted trench or channel rather than a narrow channel to reduce the potential for erosion as well as provide an opportunity for suspended solids to settle. This sump area is normally located in a low section of the mine floor. The water can be used for irrigation or for dust suppression.

	The lowering of the topography and the mining has a visual impact	Impact of lowering of the topography is low if the mitigation and management measures are followed.	• The excavated area is not clearly visible from the R346 – the top of the borrow pit may be visible. At the moment there are trees that screen the site from the R346 and if some of the trees remain the screening will be even more effective. • The landscape is undulated and this could be advantages if the mined area is rehabilitated to blend in with the un-mined areas. • The visual impact can also be managed, but the extent of the impact during mining will depend on the receptors and distance between them and the activity. • The mine is visible from the landowner's residents and although trees can be planted, this is a permit application and the trees may not have grown substantially during the mining period to screen the mining activity. • The mine and rehabilitation plan makes provision for only sections of the entire mine area to be mined at a time and for rehabilitation to occur concurrently with mining. Good practice is to rehabilitate an area equal in size that is mined at a time. However, this is a small mine and with most of the mine area required for manoeuvering of the earthmoving vehicles and the trucks to load and turn. Concurrent mining and rtehabilitation will basically be exposing only small sections (20 m) of the faces of the mine at a time thereby controlling the area that is mined. In addition to this control, the second site is mined while rehabilitation is completed on the first site. The rehabilitation of the first site should not take longer than 3 months.	• Concurrent mining and rehabilitation must take place as far as possible to reduce the visual impact. • Do not remove all the trees and bushes along the R346 to assist with the screening of the mining activity from the road. • The mined area must as far as possible blend in with the surrounding landscape so that it is not aesthetically unacceptable. • The mined areas must blend in with the un-mined areas. Sloping, rounding off of sharp edges and basic landscaping will prevent this. • Backfilling will be necessary to reduce the gradient of the slopes and also, where possible, the depth of the borrow pit. • Level the mine area. Level all the heaps and fill in the depressions. • Ensure the slope gradient between the mined and un-mined area does not exceed 1:2.5 (preferably be 1:3) for areas shallower than 1.5 m to 2m and a maximum of 1:2 to 1:2.5 for deeper excavations. The preferred slope gradient is 1:3. • The impact can even be negligible if the planting of trees or bushes around the excavation occurs. • Trees/bush can be planted to visually screen the borrow pit (trees may not grow fast enough) any scaring that cannot be rehabilitated will in time be screened by the trees/bush as they grow taller.

Erosion control	Erosion can occur as a result of mining - because of the removal of vegetation and exposed soil.	Low to medium if management and mitigation measures are followed	• Erosion is also discussed above. • The topsoil and underlying sabunga that will remain must not be less than 500 mm above any water or root-limiting layers, therefore, there will be enough soil into which the water can be absorbed and the potential for water erosion as a result of runoff will be reduced.	• Where necessary, contours will be made parallel to the natural contours of the land. This will: o Stabilize disturbed surfaces, o reduce speed of surface water run-off, o reduce or even eliminate erosion if natural slope is maintained. • After topsoil replacement vegetation must be reinstated as soon as possible to bind and stabilize the soil. • Make use of trenches and ditches above the mine area or to drain water away from mine area. See C.6.6.2 in document for information on the prevention and management of erosion
Pollution and mining	Mining could potentially result in pollution. • Pollution from toxic materials and chemicals can only be as a result of spillage during refueling, emergency repairs or leaks from the machinery.	Negligible to low. The impact is local and can be monitored, mitigated and managed.	• Pollution as result of the excavation of the sabunga is minimal and the pollution that can occur can be managed (spillage of fuel, oil and lubricants). • The only toxic materials are from the fuel, oil and lubricants. No other chemicals are used during mining. • Apart from the potential leakage of oil, fuel and lubricants, the activity is such that the chemical nature of the soil will not be altered if all the proposed management measures for dealing with spills are followed (as described in this EMPlan) and the removal, storage and replace of topsoil is managed according to the mine and rehabilitation plan. • The impact will be local and can be managed. The containment, removal and treatment of spills ensure the impact is dealt with immediately. If any pollutants remain in the soil, the effect of the impact can remain until bioremediation occurred. Bioremediation will occur over time since there are microbes in soil that breakdown the hydrocarbon in the fuel, oil and lubricants. Heavy metals present in fuel can be released into the soil. The volume of metals release is small and will, therefore, in all probability not change the chemistry of the soil. When controlled contaminated soil is remediated on site, an impermeable material must be placed under the contaminated soil.	• Specific details on how solid and toxic waste will be managed during the mining of the resource are discussed in this report in C.6.5 • Spilled toxic waste must be removed to the depth of penetration into the soil and discarded at an appropriate landfill site. • Solid waste must be removed from site and stored at appropriate allocated areas (scrap) and in suitable containers. • The control of pollution is discussed in the environmental management plan given below as well as in C.6.5, C.6.6.3 & C.6.6.4 of the document.

	Leaking and Contamination of soil when driving or parking on the site.	Negligible and low to. The impact is local and can be monitored, mitigated and managed	♦ Leaking from vehicle used on the site. ♦ Should there be an impact it will be small. ♦ The impact of this phase will be for a very short period and the impact will be local. ♦ The impact will be insignificant if all the mitigation and management measures discussed in the document are followed. ♦ There is a workshop on the farm where the services can be conducted.	♦ See waste management in C.6.5, C.6.6.3 & C.6.6.4 ♦ Collection trays or drip trays must be placed under stationary vehicles. ♦ To prevent fuels, lubricants and oils leaking from vehicles used to replace the topsoil, the vehicles are serviced regularly. Regular services must be done at the workshop or repair shop preferably on an impermeable layer (such as a concrete floor) that is bunded sandbags can be used as temporary bunded.
	Impact of chemical pollution impact on the agricultural capacity of the soil.	Low and negligible	♦ Apart from the potential leakage of oil, fuel and lubricants, the activity is such that the chemical nature of the soil will not be altered if all the proposed management measures for dealing with spills are followed (as described in this EMPlan) and the removal, storage and replace of topsoil is managed according to the mine and rehabilitation plan. ♦ The impact will be local and can be managed. The containment, removal and treatment of spills insure the impact is dealt with immediately. If any pollutants remain in the soil, the effect of the impact can remain until bioremediation occurred. There are microbes in soil that breakdown the hydrocarbon in the soil. Heavy metals present in fuel can be released into the soil. The volume of metal release is small and will, therefore, in all probability not change the chemistry of the soil.	♦ Contain and manage spills as indicated in the document in C.6.6. ♦ Treat any remaining affected soil with microbes to enhance the bioremediation process. The treatment of contaminated soil on site should be as described in C.6.6. ♦ Soil can be tested after cleanup of a large spill to determine if there was an increase in the heavy metals in the soil.
Depth of and consistency of the soil required for successful rehabilitation	Not leaving enough soil above any impermeable layer that can absorb surface water. Not leaving an adequate amount of soil so that subsurface water can drain laterally and vertically. Or not leaving enough soil for root-penetration	Negligible to low (if mitigation and management measures are followed)	♦ The topsoil and overburden that will be replaced will be at least 500 mm in depth, which is adequate for vertical water absorption, lateral movement of water and root-penetration. ♦ The soil depth above the root-limiting layer will be reported in the performance assessment report on a biennial basis to ensure the applicant adheres to the stipulations in this EMPlan.	♦ Remove and storage of the topsoil as stipulated in the document (correct depth and store separately from subsoil). ♦ Mine to a depth that will ensure that there will be an adequate amount of soil above the root limiting-layer to not only absorb surface water but also allow for lateral and vertical water movement in the soil. ♦ Conduct measurements of soil depths on the rehabilitated areas and provide the information in a performance assessment report.

	Enough soil is left above the ground water table so that the ground water table is exposed and can be contaminated.	Negligible to low (if mitigation and management measures are followed)	♦ Mining does not extend to the entire depth of the sabunga.	♦ Do not mine deeper than 500 mm above the groundwater table.
	During topsoil replacement the soil surface can be compacted preventing water from being absorbed into the soil.	Negligible to low (if not corrected during rehabilitation)	♦ During rehabilitation soil is treated (ripped or tilled) to allow optimal water absorption and root penetration for the reinstatement of vegetation.	♦ To prepare the soil for planting and seeding, compacted soil are loosened to allow water to be absorbed into the soil as well as allow the vertical and lateral movement of the water in the soil. ♦ Loosen the soil by ripping or tilling, grading, scarifying or ploughing depending on the depth of the compaction and the post mine usage of the soil.
Visual impact of the mining and rehabilitation (resource area)	The area can be visually unacceptable if the landscaping is not done properly.	Negligible to Low (if mitigation and management measures are followed)	♦ The 1.5 hectares is divided into two sites reduce the visual impact. One site will be mined at a time and that will reduce the visual impact compared to exposing the entire area at once.	♦ Mine only one site will be mined at a time. ♦ Landscape and level the area so that mined areas blend in with un-mined areas. ♦ Rehabilitate mined areas as soon as possible (concurrent mining and rehabilitation must occur) ♦ Remove all waste from the site. See C.4.12
The impact of the excavation of the resource on the groundwater (resource area).	The following aspects were considered: Recharging of the groundwater (by the surface water) and the impacts of: Altering the topography so that the flow of the surface water is affected and recharging of the groundwater by the surface water is affected		♦ The excavation will not be so deep that the groundwater will be encountered. At the resource area the ground water is located below the impermeable solid dolerite or clay layer. ♦ Apart from spillage of fuel, lubricants, and oils during oil changes, refueling and the application of the lubricants when necessary, no other toxic waste spillage is anticipated that will leach from the surface water into the ground water. ♦ Sewage will be contained (a chemical toilet will be used and replaced before full).	♦ Do not mine into the ground water. The final floor level must be at least 500 mm from the groundwater table. ♦ At least 500 mm of soil should remain above a perch surface water table. ♦ Where the mine area is uneven or there are depressions that can collect water, then they area must be smoothed over (levelled to remove them) and thereby promote drainage from the area.
The impact of the excavation of the sabunga on the groundwater and drainage.	Compaction of the soil during rehabilitation so that it causes a disturbance of the drainage/seepage of the surface water into the soil.	Low if mitigation and management measures are followed.	♦ During rehabilitation, after replacement of the overburden and the topsoil, the soil surface is landscaped and prepared for re-vegetation.	♦ Rip, till, grade, and scarify the compacted soil to loosen the soil prior to planting and seeding to allow absorption of water and root-penetration.

	Pollution of the groundwater either as result of the contamination of the surface water or direct exposure of the groundwater to pollutants	Negligible to low to for mining.	• Resource and sabunga mining results in very little pollution occurring and good housekeeping can reduce and even prevent the contamination of the soil and subsequently the surface and groundwater. The excavation does not extend into the ground water and direct exposure of the groundwater to pollutants are, therefore, not possible.	• The management of pollution is addressed in the previous section of the document. • Do not mine so deep that groundwater is exposed. • Practice general good housekeeping controlling spillage and removing pollutants. • As soon as possible remove pollutants to the depth of penetration into the soil. • If vehicles are parked for an extended period of time, drip trays or impermeable plastic should be placed over the soil (under the vehicle). • Vehicles must be in a good working order, not leaking fuels and oils – service and repair vehicles regularly. • Remove contaminated soil and place in container. To prevent contamination of soil and runoff water flowing over the soil surface. • Discard contaminated soil at appropriate landfill site or remediate as discussed previously on an impermeable surface or in a container (discussed in Section C 6.6.3). • See section C6.6.3 for management of spillage and management plan below for the management of waste.
	If vehicles are not in a good condition they can leak oil, fuel and/or lubricant (hydrocarbons) while travelling or when stationary).	Negligible to low. When mitigated and managed.	• Hydrocarbons can leak from especially poor maintained vehicles or from faulty mechanical parts. A plan to remove spills and manage the treatment and storage is provided in the document (see C.6.6.3).	• Vehicles must be serviced regularly and faulty mechanical parts repaired or replaced. • Check vehicles daily for leaks
	Extraction of water to use for mining or the processing of the mineral.	None	• Water is not required for the excavation of the resource or sabunga and processing of the mineral will also not occur. Therefore, water will not be required for mining *per se*, but will be required to control dust on the access road(s). Water collecting in the borrow pit can be used for dust suppression or water from the landowners man-made dam can be used. • There are no boreholes on the site.	• Water for dust suppression can be obtained from the borrow pit if and where it collects.

Impact of mining on the vegetation	Mining could permanently affect the vegetation on and around the site either as physical damage and fall-out dust (primary impact), by damaging the soil for later re-vegetation (secondary impact). Any impact on the natural vegetation will be negative.	Negligible	• The site has minimal indigenous vegetation coverage. • Most of the site has been disturbed and is not earmarked for conservation.	• Only the vegetation on areas where mining will occur is removed. • No vegetation outside the mine site or indigenous vegetation outside the mine site will be damaged. • Vegetation will be removed systematically and not over the entire site all at once. • Mining will remain within the designated mine area. • No driving through or on indigenous vegetation, outside the mine site. • No trees may be felled unless it is alien vegetation, the landowner requests this or unless it is absolutely necessary (such as being located in a mine area). • Remove alien bushes and trees from the site as mining proceeds and continue after rehabilitation until closure of the mine. • Re-vegetate mined areas (covered with topsoil) as soon as possible to bind and stabilise the soil.

Impact on the fauna	The potential that mining can impact on the fauna in the area by either physical damage, harassing the animals, noise, dust.	Negligible to low. Due to the nature, scale and duration of the activity as well as the tendency of animals to flee from disturbance.	• The duration of the activity per day limits the time available to hunt or set traps for animals. • Animals may be scarred away by the vehicles and so will avoid being in harms way. • The fight and flight reaction in animals ensure they normally flee areas where unusual disturbances are present or where they sense danger. • Animals can and will flee from dust and noise if it becomes unbearable. • No scientific data is available, but experience has shown that these animals flee the area when it is ploughed or mined. No animals have to date been killed or lifted (burrowing species) from the soil by the earthmoving machinery. • The operator normally starts the machine up and allows the engine to heat up before actually starting the mining activity. The noise and vibration will also be a warning to the animals. • Workers on the mine load the resource required for the day and then leave the site. There is no loitering and the workers normally do not have the opportunity to hunt or set traps. • Visitors are only allowed with the permission of the landowner, or mine owner and they must all abide by the rules set out for the mine. • Animals are killed on the roads by vehicles or any size. The more vehicles on the road, the higher the likelihood of roadkill. • Many of the animals are nocturnal and are active during the night when there is no mining and the trucks do not transport the resource. • The burrowing species as well as other animals will return to area once mining has been completed, as it is not like a development where the habitat is completely changed. • For the most part animals (excluding insects and small reptiles or rodents) can be avoided or chased away if they do not flee the area by themselves.	• Harassing, hunting and setting traps for wild animals will not be allowed. • Farm animals will not be caught, slaughter or harassed • If necessary (and possible) remove or chase animals from the site for their own protection. • Staff must not be given the opportunity to set traps, snares or hunt (no loitering). This is also necessary for the safety of the landowner. • Start the engine up and let it idle before mining starts to give the animals an opportunity to flee. • Do also not disturb, harass, harm, and hunt, etc animals on or off the mine area. • Do not speed so that it is possible to avoid animals crossing the road (try to avoid road kill as far as possible). • Check the site prior to mining to ensure there are no animals (above ground) on the site. Remove or chase away if they are found.