GOPE DIAMOND MINING PROJECT, BOTSWANA

SOCIAL AND ENVIRONMENTAL IMPACT ASSESSMENT AND STATEMENT (SEIS)

AUGUST 2008

FINAL SEIS REPORT FOR SUBMISSION TO THE DEPARTMENT OF ENVIRONMENTAL AFFAIRS, BOTSWANA

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Gope Diamond Mining Project, Botswana

Social and Environmental Impact Assessment Report

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Executive Summary

Introduction

Gope Exploration Company (Pty) Ltd, fully owned by Gem Diamonds Limited, is proposing to mine a known diamondiferous Kimberlite deposit, Go 25 in an area of the Central Kalahari Game Reserve, called Gope. The Gope Project Site is located some 300 km north-west of Gaborone and 160 km south-west of Orapa.

In addition to the proposed mine, Marsh have assessed the construction of a power line from Orapa to Gope as well as two options for site access, one via Kaudwane and one via Lephepe. These components of the project are outlined in this report.

Assessment Methodology

Although a detailed Environmental Impact Assessment was conducted by De Beers in 1998, Marsh have undertaken a new Social and Environmental Impact Assessment, due to the study being too old to reflect the current environmental situation as well as the legislative changes, viz. the enactment of the EIA Act.

The Preliminary Environmental Impact Report was submitted to the Department of Environmental Affairs in December 2007 and was approved on 10 December 2007. A Communication Strategy Report was compiled by Marsh and a workshop conducted with governmental stakeholders, where after approval of the strategy was granted. The Environmental Scoping Study was conducted and comprised the following aspects:

- A review of the existing data pertaining to the GDMP;
- Reconnaissance level specialist investigations pertaining to the biophysical and socio-economic environment were conducted;
- Authority consultation was undertaken at both National and Local Government level;
- Extensive public consultation was undertaken;
- Impacts and alternatives identification investigations were conducted, and
- A proposed plan of study for the SEIA phase was developed.

The Environmental Scoping Study was approved in April 2008 and the Social and Environmental Impact Assessment phase of the project commenced.

The Social and Environmental Impact Assessment details the following aspects pertaining to the project:

- Specialist assessments detailing assumptions, uncertainties and gaps in knowledge;

- A description and comparative assessment of all alternatives identified during the ESS phase;
- An assessment of the significance of each impact and issue as well as an indication of the extent to which the issue could be addressed by the implementation of mitigation measures, namely:
  - Cumulative impacts;
  - The nature of the impact;
  - The extent and duration of the impact;
  - The probability of the impact occurring;
  - The degree to which the impact can be reversed;
  - The degree to which the impact may cause irreplaceable loss of resources, and
  - The degree to which the impact can be mitigated.
- A SEIA Phase Public Consultation / Public Participation Process;
- A recommendation be drafted as to whether the GDMP should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;
- The development of an Social and Environmental Impact Statement (SEIS) which contains:
  - A summary of the key findings of the SEIA, and
  - A comparative assessment of the positive and negative implications of the proposed activity and identified alternatives.
- The compilation of an Social and Environmental Management Plan (SEMP);
- The compilation of a Decommissioning Programme which includes:
  - A rehabilitation and remediation plan for mine closure, and
  - Financial quantum determination for rehabilitation.

The following specialist investigations were undertaken as part of both the Environmental Scoping Study and Social and Environmental Impact Assessments:

- Geology, soils, land use and land capability;
- Topography;
- Natural vegetation;
- Animal life;
- Surface water;
- Groundwater and hydrogeological model;
- Air quality;
- Noise & vibration;
- Archaeological (and heritage) Impact Assessment;
- Sensitive landscapes;
- Visual impact assessment;
- Waste management;

- Socio-economic;
- Social impact assessment;
- Legal assessment, and
- Road assessment.

Description of the Gope Diamond Mining Project

The construction phase for the Gope Diamond Mining Project is expected to be approximately 3 years, while the operational phase is estimated at 15 years. A decommissioning and closure phase of approximately 3 years is expected.

The diamondiferous Kimberlite ore body will be mined by open pit mining method to a depth of 500 mbgl. The total surface area of the pit will be approximately 87 ha. The following volumes of material will be removed from the open pit:
- Kimberlite: ~ 88 million tonnes
- Sand overburden: ~ 100 million tonnes
- Waste material: ~ 159 million tonnes

A production rate of 6 million tonnes of Kimberlite per year is targeted, totalling 85.4 million tonnes over the expected 15 years life of mine.

The following mineralogical waste structures have been designed for:
- Sand overburden dump;
- Waste rock dump;
- Tailings management facility;
- Slimes dam, and
- Crater stockpile.

The mineral processing plant will comprise the following:
- Primary crusher;
- Autogenous milling plant;
- Dense medium separation plant, and
- Recovery building, including magnetic, X-ray and grease recovery as well as hand sorting and acidisation.

Water supply to the plant will be obtained from a ring of dewatering boreholes that will be installed around the perimeter of the open pit. Hydrogeological modelling has proven that a suitable supply of water will be available from this source. However, should it be required during the life of mine, a well field may be constructed within the Mineral Lease Area for additional abstraction.

An earth moving vehicle workshop, explosives magazine, fuel storage facility and security infrastructure will also be constructed.

Employees at the Gope Diamond Mining Project will be accommodated in a single status accommodation camp located on site. The operation will run on a 24 hour, 365 days a year (contops) basis. Various recreational facilities have been designed for. People will be transported to and from the Gope Project Site by a dedicated contractor.

Due to the salinity of groundwater found at the Gope Project Site, a Reverse Osmosis plant will be installed in order to provide potable water. Sewage will be managed through means of a formal sewage plant on site.

The existing Gope airstrip have fallen into disrepair over the years that it had not been in use and in addition, falls well outside the Mineral Lease Area held by Gope Exploration Company. For these reasons, a new air strip (2 km in length) will be constructed inside the Mineral Lease Area.

Access to the site will be gained through a route from Lephepe to Gope. The route currently comprises a sand track along the cut line of the CKGR’s eastern boundary and a two track sand road from the boundary in a westerly direction to Gope. The road will be upgraded and surfaced to the required standard for access of the mine traffic. Various borrow pits have been identified as part of this investigation that will be mined for aggregate material for road building and other civil construction requirements. Ideally though, materials sourced at the Gope Project Site itself (basalt from the open pit, material removed from the old runway and material from an existing borrow pit) will be utilised prior to the opening of new borrow pits.

A recruitment centre and staging camp will be located in Lephepe. In order to avoid a congregation of people around the Gope Project Site, all final recruitment will be conducted at Lephepe. In order to maintain control of vehicular movement inside the CKGR, mine supplies will be transported to the Lephepe staging camp and transported to the site using a dedicated contractor.

Bulk power will be supplied to the Gope Diamond Mining Project by the Botswana Power Corporation via a new power line that will be constructed from Orapa to the Gope Project Site. The power line route is located along an existing sand track.

The total capital investment associated with the Gope Diamond Mining Project is estimated in the order of $470 million (US).

Alternatives Analysis

A comprehensive alternatives analysis was undertaken and the following alternative types were considered:

- Activity alternatives;
- Location alternatives;
- Process alternatives;
- Input alternatives;
- Routing alternatives;
- Site layout alternatives, and
- Design alternatives.

Impact Assessment & Mitigation Measures

91 Impacts were assessed for the Gope Diamond Mining Project construction phase. The following provides a summary of findings:

ASPECT	IMPACT RATING PRIOR MITIGATION	IMPACT RATING AFTER MITIGATION	% OF MITIGATION THAT COULD BE ACHIEVED	DIVISIONAL FACTOR	WEIGHTED RATING
Climate	-6.67	-4.67	30.00	2	-2.33
Geology	-13.00	-13.00	0.00	2	-6.50
Soils	-12.67	-3.42	73.03	2	-1.71
Land Capability & Land Use	-12.00	-10.50	12.50	2	-5.25
Natural Vegetation / Plant Life	-12.20	-10.20	16.39	3	-3.40
Animal Life	-11.14	-7.43	16.39	3	-2.48
Surface Water	-3.33	-2.33	33.33	2	-1.17
Groundwater	-10.00	-9.00	30.00	2	-4.50
Air Quality	-8.38	-6.62	10.00	2	-3.31
Noise & Vibration	-9.00	-6.14	21.10	3	-2.05
Archaeology & Heritage	-9.67	-3.33	31.75	1	-3.33
Visual	-10.00	-7.20	65.52	3	-2.40
Waste	-8.00	-4.43	28.00	2	-2.21
Social	-2.67	5.44	44.64	1	5.44
Economic	7.67	10.17	304.17	1	10.17

There are no impacts that cannot be suitably mitigated during the construction phase of the Gope Diamond Mining Project. The highest impact resulting from the construction phase, is that upon geology. This impact is inevitable as the nature of mining implies a significant impact upon geology. The impact will be very localised in extent.

All impacts, apart from that upon geology, can be adequately mitigated.

The construction phase of the Gope Diamond Mining Project will have a moderate positive impact upon the social environment, while it will have a high positive impact upon the socio-economic environment,

Particular notice should be taken of the high level of mitigation achievable upon soils, archaeology and heritage and socio-economic impacts.

89 Impacts were assessed for the Gope Diamond Mining Project operational phase. The following provides a summary of findings:

ASPECT	IMPACT RATING PRIOR MITIGATION	IMPACT RATING AFTER MITIGATION	% OF MITIGATION THAT COULD BE ACHIEVED	DIVISIONAL FACTOR	WEIGHTED RATING
Geology	-13.00	-13.00	0.00	2	-6.50
Soils	-12.25	-5.25	57.14	2	-2.63
Land Capability & Land Use	-12.00	-10.00	16.67	2	-5.00
Natural Vegetation / Plant Life	-10.75	-6.75	37.21	3	-2.25
Animal Life	-11.50	-7.25	36.96	3	-2.42
Surface water	-9.75	-7.00	28.21	2	-3.50
Ground Water	-10.25	-8.50	17.07	2	-4.25
Air Quality	-9.00	-5.75	36.11	2	-2.88
Noise & Vibration	-9.83	-7.33	25.42	3	-2.44
Archaeology & Heritage	-6.00	-5.00	16.67	1	-5.00
Visual	-10.60	-9.00	15.09	3	-3.00
Waste	-7.86	-3.79	51.82	2	-1.89
Social	-2.67	2.78	204.17	1	2.78
Economic	0.00	0.00	0.00	1	0.00

The highest impact, albeit moderate in intensity during the operational phase, is associated with geology. This is to be expected as the geology will be altered permanently through the mining operation.

A low positive impact will be associated with the socio-economic aspect.

All impacts can be adequately mitigated during the operational phase. This is made possible in part due to the extensive ongoing rehabilitation programme that has been developed and incorporated into the Environmental Management Plan. Particular notice should be taken of the high level of mitigation achievable upon the social environment.

41 Impacts were assessed for the Gope Diamond Mining Project decommissioning and closure phase. The following provides a summary of findings:

ASPECT	IMPACT RATING PRIOR MITIGATION	IMPACT RATING AFTER MITIGATION	% OF MITIGATION THAT COULD BE ACHIEVED	DIVISIONAL FACTOR	WEIGHTED RATING
Geology & Soils	9.00	10.00	9.09	2	5.00
Land Capability & Land Use	11.00	12.00	76.74	2	6.00
Natural Vegetation / Plant Life	-10.75	-2.50	83.13	3	-0.83
Animal Life	-11.86	-2.00	40.63	3	-0.67
Surface Water	-10.67	-6.33	85.71	2	-3.17
Groundwater	-2.33	-0.33	61.54	2	-0.17
Air Quality	-5.20	-2.00	46.43	2	-1.00
Noise & Vibration	-9.33	-5.00	75.00	3	-1.67
Archaeology & Heritage	-4.00	-1.00	50.00	1	-1.00
Visual	-10.00	-5.00	22.22	3	-1.67
Waste	-9.00	-7.00	500.00	2	-3.50
Social	-0.50	2.00	23.08	1	2.00
Economic	-3.25	-2.50	23.08	1	-2.50

A high impact during the decommissioning and closure phase will be on the social environment due to the closure of the mining operation. As can be seen from the table above, bio-physical environmental aspects will improve during this phase, due to the comprehensive end of life of mine rehabilitation programme outlined in this report.

32 Impacts were assessed for the Orapa-Gope power line construction phase. The following provides a summary of findings:

ASPECT	IMPACT RATING PRIOR MITIGATION	IMPACT RATING AFTER MITIGATION	% OF MITIGATION THAT COULD BE ACHIEVED	DIVISIONAL FACTOR	WEIGHTED RATING
Geology & Soils	-4.33	0.67	115.38	2	0.33
Land Capability & Land Use	-2.50	3.00	220.00	2	1.50
Natural Vegetation / Plant Life	-7.71	-4.86	37.04	3	-1.62
Animal Life	-6.25	-1.50	76.00	3	-0.50
Surface water	-9.00	0.00	100.00	2	0.00
Ground water	0.00	0.00	0.00	2	0.00
Air Quality	0.00	0.00	0.00	2	0.00
Noise & Vibration	-9.33	-7.33	21.43	3	-2.44
Archaeology & Heritage	0.00	0.00	0.00	1	0.00
Visual	0.00	0.00	0.00	3	0.00
Waste	-8.86	-6.57	25.81	2	-3.29

ASPECT	IMPACT RATING PRIOR MITIGATION	IMPACT RATING AFTER MITIGATION	% OF MITIGATION THAT COULD BE ACHIEVED	DIVISIONAL FACTOR	WEIGHTED RATING
Social	6.00	7.00	16.67	1	7.00
Economic	12	13.5	12.50	1	13.50

No high or medium negative impacts are expected to occur from the construction of the power line infrastructure. High positive social and economic impacts are expected.

Soils, land use and land capability, as well as surface water and animal life have a high possibility of mitigation.

20 Impacts were assessed for the Orapa-Gope power line operational phase. The following provides a summary of findings:

ASPECT	IMPACT RATING PRIOR MITIGATION	IMPACT RATING AFTER MITIGATION	% OF MITIGATION THAT COULD BE ACHIEVED	DIVISIONAL FACTOR	WEIGHTED RATING
Geology & Soils	-6.00	-6.00	0.00	2	-3.00
Land Capability & Land Use	-5.00	-3.00	40.00	2	-1.50
Natural Vegetation / Plant Life	-5.75	-3.50	39.13	3	-1.17
Animal Life	-11.00	-6.00	45.45	3	-2.00
Surface water	0.00	0.00	0.00	2	0.00
Ground Water	0.00	0.00	0.00	2	0.00
Air Quality	0.00	0.00	0.00	2	0.00
Noise	-7.50	-5.50	26.67	3	-1.83
Archaeology & Heritage	0.00	0.00	0.00	1	0.00
Visual	-12.00	-11.00	0.00	3	-3.67
Waste	-8.57	-5.42	8.33	2	-2.71
Economic	11.50	12.50	36.67	1	12.50

No high or medium negative impacts are expected to occur from the construction of the power line infrastructure. High positive social and economic impacts are expected.

High levels of mitigation can be implemented for land use and land capability, natural vegetation and animal life, while significant enhancement of economic impacts is possible.

15 Impacts were assessed for the Lephepe-Gope access road construction phase. The following provides a summary of findings:

ASPECT	IMPACT RATING PRIOR MITIGATION	IMPACT RATING AFTER MITIGATION	% OF MITIGATION THAT COULD BE ACHIEVED	DIVISIONAL FACTOR	WEIGHTED RATING
Geology and Soils	-10.00	-5.00	50.00	2	-2.50
Natural Vegetation / Plant Life	-8.00	-5.00	37.50	3	-1.70
Animal Life	-12.00	-11.00	8.33	3	-3.70
Groundwater	-5.00	-5.00	0.00	2	-2.50
Air Quality	-11.00	-5.00	54.54	2	-2.50
Noise	-7.00	-5.00	28.57	3	-1.70
Waste	-11.00	-5.00	54.54	2	-2.50
Traffic	-6.00	-5.00	16.67	3	-1.70
Socio-Economic	3.40	4.00	17.64	1	4.00

All bio-physical impacts are considered to be low in significance and there will be a positive impact upon the socio-economic environment.

7 Impacts were assessed for the Lephepe-Gope access road operational phase. The following provides a summary of findings:

ASPECT	IMPACT RATING PRIOR MITIGATION	IMPACT RATING AFTER MITIGATION	% OF MITIGATION THAT COULD BE ACHIEVED	DIVISIONAL FACTOR	WEIGHTED RATING
Animal Life	-11.00	-5.00	54.54	3	-1.70
Air Quality	-10.00	-5.00	50.00	2	-2.50
Traffic	-4.50	-3.00	33.33	3	-1.00
Socio-Economic	4.33	6.33	46.15	1	6.30

Only low negative impacts are expected post the implementation of mitigation measures associated with the operation of the access road. A moderate positive impact upon the socio-economic environment is expected.

A comprehensive environmental management and mitigation programme has been compiled for each aspect of the project:

Mining Operation:

- Construction phase;
- Operational phase, and
- Decommissioning and closure phase.

In addition, a detailed ongoing rehabilitation plan has been compiled for implementation from end of construction to the end of life of mine.

A final rehabilitation plan for closure has been detailed in this report.

Power Line:

- Construction phase, and
- Operational phase.

No decommissioning of the power line infrastructure is expected to take place.

Access Road:

- Construction phase, and
- Operational phase.

No decommissioning of the road infrastructure is expected to take place.

Conclusion & Recommendation

In the assessment conducted by Marsh and its specialist teams, no fatal flaws have been found to pertain to the Gope Diamond Mining Project and associated infrastructure for any of the bio-physical or socio-economic environmental aspects investigated.

All impacts associated with the project can be suitably mitigated or managed and positive impacts can be adequately enhanced.

It is therefore Marsh' recommendation that approval of the Gope Diamond Mining Project (including the power line and road infrastructure) be granted to Gope Exploration Company.

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ABBREVIATIONS

ABBREVIATION	DESCRIPTION
%	Percentage
‘	Minutes (in coordinates)
“	Inch (2.54 cm) / Seconds (in coordinates)
°	Degrees
µS	Micro Siemens
AAC	Anglo American Corporation
ACP	African, Caribbean and Pacific
ADT	Articulated Dump Truck
AGOA	African Growth and Opportunity Act
AIA	Archaeological Impact Assessment
AIDS	Acquired Immune Deficiency Syndrome
ARV	Anti-Retroviral drugs
AU	African Union
BATNEEC	Best Available Technique Not Entailing Excessive Cost
BID	Background Information Document
BNMMAG	Botswana National Museum, Monuments and Arts Gallery
BOS	Bureau of Standards
BPC	Botswana Power Corporation
BPEO	Best Practicable Environmental Option
BPM	Best Practicable Means
BTC	Botswana Telecommunications Corporation
CBNRM	Community Based Natural Resources Management
CBOs	Community Based Organisations
CEC	Cation Exchange Capacity
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CKGR	Central Kalahari Game Reserve
cm	Centimetre
CPR	Competent Persons Report
CR	Critically Endangered
CSI	Corporate Social Investment
CSO	Central Statistics Office
CSR	Corporate Social Responsibility
CSRI	Corporate Social Responsibility Initiatives
dB	Decibel
dB(A)	Decibels Audible
DCA	Department of Civil Aviation
DD	Due Diligence
DDC	District Development Committee
DEA	The Department of Environmental Affairs (Botswana)

ABBREVIATION	DESCRIPTION
DEAT	The Department of Environmental Affairs and Tourism (South Africa)
DME	Department of Minerals and Energy (South Africa)
DMS	Dense Medium Separation / Separator
DoL	Department of Lands
DoM	Department of Mines
DoR	Department of Roads
DoT	Department of Tourism
DTC	Diamond Trading Company (De Beers, London Based)
DTM	Digital Terrain Model
DWA	Department of Water Affairs - Botswana
DWAF	Department of Water Affairs and Forestry (South Africa)
DWNP	Department of Wildlife & National Parks
EAP	Environmental Awareness Programme
EC	Electrical Conductivity
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EIAP	Independent Environmental Impact Assessment Practitioner
EMP	Environmental Management Programme / Plan
EMV	Earth Moving Vehicle
EN	Endangered
EPA	Environmental Protection Agency
ERD	Effective Rooting Depth
ESS	Environmental Scoping Study
EU	European Union
FGD	Focus Group Discussion(s)
FMS	Fuel Management System
FPK	First People of the Kalahari
FWD	Food Waste Disposer
g	Grams
GDMP	Gope Diamond Mining Project
GDP	Gross Domestic Profit
GEC	Gope Exploration Company (Pty) Ltd
GDL	Gem Diamonds Limited
GGP	Gross Geographic Product
GIIP	Good International Industry Practice
GIS	Geographical Information Systems
GPS	Global Positioning System
GSM	Global System for Mobile (communications)
h	Hour
H:H	High hazard rating
ha	Hectares

ABBREVIATION	DESCRIPTION
HDI	Human Development Index
HDPE	High Density Polyethylene
HIV	Human Immunodeficiency Virus
HPGR	High Pressure Grinding Rolls
Hz	Hertz
I&APs	Interested and Affected Parties
IS	Irrigation Suitability
ISR	Irrigation Suitability Rating
ICP	Inductively Coupled Plasma
ICP-MS	Inductively Coupled Plasma Mass Spectrometry
IDT	Illegal Diamond Trading
IFC	International Finance Corporation
IFSC	International Financial Services Centre
IOE	Index Of Erosion
IUCN	International Union for the Conservation of Nature
IWM	Integrated Waste Management
JV	Joint Venture
kg	Kilograms
km	Kilometre
kPa	Kilopascal
kVA	Kilo Volt-Amps
ℓ	Litre
L&VIA	Landscape and Visual Impact Assessment
LDPE	Low Density Polyethylene
LIA	Late Iron Age
LOM	Life of Mine
LSA	Later Stone Age
m	Metre
MAP	Mean Annual Precipitation
Marsh	Marsh Environmental Services
mbgl	Meters Below Ground Level
me	Milli-equivalents
MFDP	Ministry of Finance and Development Planning
mg	Milligrams
MIA	Middle Iron Age
MLA	Mine License Area
mm	Millimetre
mm/hr	Millimetres per hour
MM5	Modelled MM5 Meteorological Data sourced from Lakes Environmental Software, Canada
MMEWA	Minerals, Energy & Water Affairs, Ministry

ABBREVIATION	DESCRIPTION
MoA	Ministry of Agriculture
MRA	Monuments and Relics Act
MSAge	Middle Stone Age
MSDS	Material Safety Data Sheet
msl	Mean Sea Level
MTP	Medium Term Plan (for HIV/AIDS)
N/A	Not applicable
NACA	National AIDS Control Agency
NBS	New Business Sales
NBSAP	National Biodiversity Strategy and Action Plan
NDB	National Development Bank
NGO	Non-Governmental Organisation
NIA	Noise Impact Analysis
NPD	National Development Plan
NT	Near Threatened
OP	Operational Policy
Org. Mat.	Organic Matter
OWE	Open Water Evaporation
PCB	Polychlorinated byphenol
PEIR	Preliminary Environmental Impact Report
PM	Particulate Matter
PM10	Particles of 10 micrometer or less
PP	Polypropylene
PPAH	World Health Organization: Pollution Prevention and Abatement Handbook
PPE	Personal Protective Equipment
PPV	Peak Particle Velocity
RAD	Remote Area Development
RADP	Remote Area Development Programme
RB1 / RB2	Radio Botswana (station 1 or 2)
RD	Red Data
RO	Reverse Osmosis
ROWs	Right of Ways
RWD	Return Water Dam(s)
s	Second
SAR	Sodium Absorption Ratio
SA	South Africa
SABS	South African Bureau of Standards
SACU	Southern African Customs Union
SADC	Southern African Development Community
SANAS	South African National Accreditation System
SANS	South African National Standard

ABBREVIATION	DESCRIPTION
SAR	Specific Absorption Rate
SCS	Soil Conservation Services
SDF	Spatial Development Framework
SEIA	Social and Environmental Impact Assessment
SEIS	Social and Environmental Impact Statement
SEMP	Social and Environmental Management Plan
SIA	Social Impact Assessment
swl	Static water level
SWOT	Strengths, Weaknesses, Opportunities and Threats
TCLP	Toxicity Characteristic Leaching Procedure
TCU	True Colour Unit
TDS	Total Dissolved Solids
ToR	Terms of Reference
TPH	Total Petroleum Hydrocarbons
TWINSPAN	Two- Way Indicator Species Analysis classification technique
USEPA	United States Environmental Protection Agency
VIA	Visual Impact Assessment
VOC	Volatile Organic Compounds
VU	Vulnerable
WHO	World Health Organisation
WIMSA	The Working Group of Minorities in Southern Africa
WRD	Waste Rock Dump
WTO	World Trade Organisation
WUC	Water Utilities Corporation

LIST OF CHEMICAL SYMBOLS

ACRONYM	DESCRIPTION
Al	Aluminium
As	Arsenic
B	Boron
BOD	Biological Oxygen Demand
C2H5OH	Ethanol
Ca	Calcium
CaCO3	Calcium carbonate
Cd	Cadmium
Cl	Chloride
CN	Cyanide
Co	Cobalt
CO2	Carbon dioxide
COD	Chemical Oxygen Demand
Cr	Chromium
Cu	Copper
F	Fluoride
Fe	Iron
FeSi	Ferrosilicon
H2SO4	Sulphuric acid
HCL	Hydrochloric acid
Hf	Hydrofluoric acid
Hg	Mercury
K	Potassium
KCL	Potassium chloride
Mg	Magnesium
Mn	Manganese
N	Nitrogen
Na	Sodium
Ni	Nickel
NO2	Nitrite
NO3	Nitrate
O2	Oxygen
P	Phosphorus
Pb	Lead
S	Sulphur
Se	Selenium
SO4	Sulphate
TSS	Total Suspended Solids
Zn	Zinc

GLOSSARY OF TERMS

TERM	DESCRIPTION
“S” Value	The sum of the exchangeable (as opposed to soluble) Ca, Mg, Na, K expressed in cmol (+) kg/soil.
Aeolian erosion	The direct erosive action of wind.
Air quality	A measure of exposure to air which is not harmful to your health. Air quality is measured against health risk thresholds (levels) which are designed to protect ambient air quality. Various countries including South Africa have Air Quality Standards (legally binding health risk thresholds) which aim to protect human health due to exposure to pollutants within the living space.
Alluvium	Refers to detrital deposits resulting from the operation of modern streams and rivers.
Ambient air	The air of the surrounding environment.
Atmospheric pressure	The pressure created by the mass of air above a point or level, the total force per unit is the pressure.
Aya	A vernacular (San) term for settlement.
Base Saturation Percentage	The sum of exchangeable Ca, Mg, Na, and K expressed as a percentage of the cation exchange capacity measured at a specific pH.
Base status	A qualitative expression of base saturation. See base saturation percentage.
Baseline	The current and existing condition before any development or action.
Batswana	Citizens of Botswana. Plural (Motswana singular).
Biodiversity	The variability within and among living organisms and the systems they inhabit
Boundary layer	The layer directly influenced by a surface.
Buffer capacity	The ability of soil to resist an induced change in pH.
Building Downwash	The dispersion and buoyant rise of plumes released from short stacks can be significantly modified by the present of buildings or other obstacles to the flow. In essence, the present of an obstacle (building) in the path of the plume, forces the plume to ground prematurely resulting in higher peak concentrations at ground level.
Calcareous	Containing calcium carbonate.
Catena	A sequence of soils of similar age, derived from similar parent material, and occurring under similar macroclimatic conditions, but having different characteristics due to variation in relief and drainage.
Clast	An individual constituent, grain or fragment of a sediment or sedimentary rock produced by the physical disintegration of a larger rock mass.
Climatology	The study of the long term effect of weather over a certain area during a certain period.
Cohesion	The molecular force of attraction between similar substances. The capacity of sticking together. The cohesion of soil is that part of its shear strength which does not depend upon inter-particle friction. Attraction within a soil structural unit or through the whole soil in apedel soils.
Concentration	When a pollutant is measured in ambient air it is referred to as the concentration of that pollutant in air. Pollutant concentrations are measured in ambient air for various reasons, i.e. to determine whether concentrations are exceeding available health risk thresholds (air quality standards); to determine how different sources of pollution contribute to ambient air concentrations in an area; to validate dispersion modelling conducted for an area; to determine how pollutant concentrations fluctuate over time in an area; and to determine the areas with the highest pollution concentrations.
Concretion	A nodule made up of concentric accretions.
Condensation	The growth of water or ice by diffusion from contiguous water vapour.

TERM	DESCRIPTION
Crumb	A soft, porous more or less rounded ped from one to five millimetres in diameter. See structure, soil.
Cutan	Cutans occur on the surfaces of peds or individual particles (sand grains, stones). They consist of material which is usually finer than, and that has an organisation different to the material that makes up the surface on which they occur. They originate through deposition, diffusion or stress. Synonymous with clayskin, clay film, argillan.
Decibel	A unit of sound measurement which quantifies pressure fluctuations associated with noise and overpressure.
Denitrification	The biochemical reduction of nitrate or nitrite to gaseous nitrogen, either as molecular nitrogen or as an oxide of nitrogen.
Dispersion model	A mathematical model which can be used to assess pollutant concentrations and deposition rates from a wide variety of sources. Various dispersion modelling computer programs have been developed.
Dispersion potential	The potential a pollutant has of being transported from the source of emission by wind or upward diffusion. Dispersion potential is determined by wind velocity, wind direction, height of the mixing layer, atmospheric stability, presence of inversion layers and various other meteorological conditions.
Diversity	The number of species per area, sample site, study area, region, etc.
Dystrophic	The leaching status of a soil, Eutrophic = Slightly leached, Mesotrophic = Moderately leached, Dystrophic = Highly leached
Ecology	The interaction of living animals and plants with the non-living environment
Emission	The rate at which a pollutant is emitted from a source of pollution.
Emission factor	A representative value, relating the quantity of a pollutant to a specific activity resulting in the release of the pollutant to atmosphere.
Endoreic	Areas that don’t drain to a particular stream, river or the sea.
Erosion	The group of processes whereby soil or rock material is loosened or dissolved and removed from any part of the earth’s surface by agents such as gravity, river flow, waves, currents, wind and more.
Evaporation	The opposite of condensation.
Facies	Archaeological: Stylistic ceramic design structure for Iron Age groups, also called a ceramic unit. Geological: A body of rock with specified characteristics. Should be distinctive rock that forms under certain conditions of sedimentation, reflecting a particular process or environment.
Fertilizer	An organic or inorganic material, natural or synthetic, which can supply one or more of the nutrient elements essential for the growth and reproduction of plants.
Fine sand	(1) A soil separate consisting of particles 0, 25-0,1mm in diameter. (2) A soil texture class (see texture) with fine sand plus very fine sand (i.e. 0, 25-0,05mm in diameter) more than 60% of the sand fraction.
Fine textured soils	Soils with a texture of sandy clay, silty clay or clay.
Focus Group Discussion	Extended discussions with homogeneous groups using a semi-structured instrument.
Front	A synoptic-scale swath of cloud and precipitation associated with a significant horizontal zonal temperature gradient. A front is warm when warm air replaces cold on the passage of the front; with a cold front cold air replaces warm air.
Fugitive dust	Dust generated from an open source and is not discharged to the atmosphere in a confined flow stream.
Hardpan	A massive material enriched with and strongly cemented by sesquioxides, chiefly iron oxides (known as ferricrete, diagnostic hard plinthite, ironpan, ngubane, ouklip, laterite hardpan), silica (silcrete, dorbank) or lime (diagnostic hardpan carbonate horizon, calcrete). Ortstein hardpans are cemented by iron oxides and organic matter.

TERM	DESCRIPTION
High pressure cells	Regions of raised atmospheric pressure.
Inversion	An increase of atmospheric temperature with an increase in height.
KCl	The measure of the acidity/alkalinity of a solution in potassium chloride instead of water.
Key Informant Interview	Detailed, one-on-one interviews using a semi-structured instrument.
Kgosi	Setswana word meaning chief or traditional leader.
Land capability	The ability of land to meet the needs of one or more uses under defined conditions of management.
Land type	(1) A class of land with specified characteristics. (2) In South Africa it has been used as a map unit denoting land, mappable at 1:250,000 scale, over which there is a marked uniformity of climate, terrain form and soil pattern.
Land use	The use to which land is put.
Landscape and Visual Sensitivity	Refers to the general visibility of the proposed activity and the scope to mitigate the visual effect
Landscape Capacity	The amount of change of a particular type that can be accommodated within the change in land-use having an adverse effect of on the character of the landscape and without compromising the value attached to the particular landscape
Landscape Impacts	Change in the physical landscape, which results in a change to the character of the landscape and how it is perceived
Meq	Milli equivalents – a measure of the mass of a substance that will combine with or replace parts by weight.
Mesoscale	A spatial scale intermediate between small and synoptic scales of weather systems.
Mixing layer	The layer of air within which pollutants are mixed by turbulence. Mixing depth is the height of this layer from the earth's surface.
Monuments	Architectural works, works of monumental sculpture and painting, elements or structures of an archaeological nature, inscriptions, cave dwellings and combinations of features, which are of outstanding universal value from the point of view of history, art or science.
Motswana	A citizen of Botswana. Singular (Batswana plural).
Mottling	A mottled or variegated pattern of colours is common in many soil horizons. It may be the result of various processes inter alia hydromorphy, illuviation, biological activity, and rock weathering in freely drained conditions (i.e. saprolite). It is described by noting (i) the colour of the matrix and colour or colours of the principal mottles, and (ii) the pattern of the mottling. The latter is given in terms of abundance (few, common 2 to 20% of the exposed surface, or many), size (fine, medium 5 to 15mm in diameter along the greatest dimension, or coarse), contrast (faint, distinct or prominent), form (circular, elongated-vesicular, or streaky) and the nature of the boundaries of the mottles (sharp, clear or diffuse); of these, abundance, size and contrast are the most important.
Nitrogen fixation	The process by which atmospheric nitrogen is converted to forms usable by organisms. It is carried out only by certain micro-organisms such as free-living soil bacteria and bacteria or microbes in symbiotic associations with fungi, ferns or in the roots of legume plants.
Nodule	Bodies of various shapes, sizes and colour that have been hardened to a greater or lesser extent by chemical compounds such as lime, sesquioxides, animal excreta and silica. These may be described in terms of kind (durinodes, gypsum, insect casts, ortstein, iron-manganese, lime, lime-silica, plinthite, salts), abundance (few, less than 20% by volume percentage; common, 20 – 50%; many, more than 50%), hardness (soft, hard meaning barely crushable between thumb and forefinger, indurated) and size (threadlike, fine, medium 2 – 5mm in diameter, coarse).
Overburden	A material which overlies another material difference in a specified respect, but mainly referred to in this document as materials overlying weathered rock

TERM	DESCRIPTION
Overpressure	A pressure wave in the atmosphere, which is caused by the detonation of explosives. Overpressure consists of both an audible (noise) and inaudible energy is measured in dB (L in Peak).
Particulate matter (PM)	The collective name for fine solid or liquid particles added to the atmosphere by processes at the earth's surface and includes dust, smoke, soot, pollen and soil particles. Particulate matter is classified as a criteria pollutant, thus national air quality standards have been developed in order to protect the public from exposure to the inhalable fractions. PM can be principally characterised as discrete particles spanning several orders of magnitude in size, with inhalable particles falling into the following general size fractions.
Peak Particle Velocity	PPV is a measure of ground vibration magnitude and is the maximum instantaneous particle velocity at a point during a given time interval in mms^{-1}. (PPV can be taken as the vector sum of the three component particle velocities in mutually perpendicular directions (x, y, z = 3 dimensional)).
Ped	Individual natural soil aggregate (e.g. block, prism) as contrasted with a clod produced by artificial disturbance.
Pedocutanic, diagnostic B horizon	The concept embraces B horizons that have become enriched in clay, presumably by illuviation (an important pedogenic process which involves downward movement of fine materials by, and deposition from, water to give rise to cutanic character) and that have developed moderate or strong blocky structure. In the case of a red pedocutanic B horizon, the transition to the overlying “A” horizon is clear or abrupt.
Pedology	The branch of soil science that treats soils as natural phenomena, including their morphological, physical, chemical, mineralogical and biological properties, their genesis, their classification and their geographical distribution.
Photosynthesis	The synthesis in green plants of carbohydrate from carbon dioxide as a carbon source and water as a hydrogen donor with the release of oxygen as a waste product, using light energy.
Physiognomy	The physical appearance of vegetation including attributes such as grassland, woodland, savanna, shrubveld, open or closed, etc.
Pioneer plants	Plants that are initial invaders of disturbed sites or the early seral stages of succession. Succession is the replacement of one plant community by another, often progressing to a stable terminal community called a climax.
PM10	Refers to particulate matter that is 10µm or less in diameter. PM10 is generally subdivided into a fine fraction of particles 2.5µm or less (PM2.5), and a coarse fraction of particles larger than 2.5µm. Particles less than 10µm in diameter are also termed inhalable particulates.
Precipitation	Ice particles or water droplets large enough to fall at least 100 m below the cloud base before evaporating.
Productivity	In plants is the amount of organic matter fixed over a period of time and is related to rate of photosynthesis.
Quantitative Survey	Survey conducted in a manner that allows the statistical generalisation of data from surveyed households to all households in the strata.
Receiving water body	The point to which the mine drains, below which any impacts would be considered negligible. Typically a large dam some distance downstream of the site.
Relative Humidity	The vapour content of the air as a percentage of the vapour content needed to saturate air at the same temperature.
Relevè	Information compiled at a sample plot
Respiration	The process used by organisms to generate metabolically useable energy from the oxidative breakdown of foodstuffs.
Sample plot	An area of similar habitat factors, including vegetation physiognomy as well as biophysical attributes.
Sesarwa	Term used in Botswana to describe a variety of San languages.
Setswana	One of two official languages in Botswana (the other being English). The lingua franca of Botswana. Can also be used to describe ‘Setswana culture’.

TERM	DESCRIPTION
Simpson's Evenness Index	Species Diversity Index using number of species and relative abundances
Sites	Works of man or the combined works of nature and man, and areas including archaeological sites which are of outstanding universal value from the historical, aesthetic, ethnological or anthropological point of view.
Slickenslides	In soils, these are polished or grooved surfaces within the soil resulting from part of the soil mass sliding against adjacent material along a plane which defines the extent of the slickenslides. They occur in clayey materials with a high smectite content.
Sodic soil	Soil with a low soluble salt content and a high exchangeable sodium percentage (usually EST > 15).
Solar radiation	Electromagnetic radiation from the sun.
Species diversity	As indicated with an index, calculated using relative abundances
Species richness	Number of species
Stomata	Minute openings on the surface of aerial parts of plants through which air and water vapour enters the intercellular spaces, and through which water vapour and carbon dioxide from respiration are released.
Swelling clay	Clay minerals such as the smectites that exhibit interlayer swelling when wetted, or clayey soils which, on account of the presence of swelling clay minerals, swell when wetted and shrink with cracking when dried. The latter are also known as heaving soils.
Synoptic scale	The minimum horizontal spatial scale of weather observations defined in a synoptic observation network. Synoptic observations are simultaneous observations taken at recognised weather stations.
Tcamm	A vernacular (San) term for grave.
Texture, soil	The relative proportions of the various size separates in the soil as described by the classes of soil texture shown in the soil texture chart (see diagram on next page). The pure sand, sand, loamy sand, sandy loam and sandy clay loam classes are further subdivided (see diagram) according to the relative percentages of the coarse, medium and fine sand sub separates.
Total suspended particulates (TSP)	All particulates which can become suspended and generally noted to be less than 75µm in diameter (TSP).
Vehicle entrainment	The lifting of dust particles in the turbulent wake of a vehicle passing over an unpaved road or exposed area. The force of the wheels on the road causes pulverisation of the surface material and the particles are lifted and dropped by the rolling wheels
Vertic, diagnostic "A" horizon	A horizons that have both a high clay content and a predominance of smectitic clay minerals possess the capacity to swell and shrink markedly in response to moisture changes. Such expansive materials have a characteristic appearance: structure is strongly developed, ped faces are shiny, and consistence is highly plastic when moist and sticky when wet.
Visual Impact	Relates to people's response to the changes to the landscape
Water balance	An assessment of the overall water make, water generated and water used, and the extent to which there is a surplus or deficit of water on the mine.
Water make	Water associated with rainfall and groundwater which will enter or flow off the pit or other mining infrastructure and may need to be managed due to possible impacts on water quality.

SECTION 1. SCOPE OF WORK

1.1. BACKGROUND

During May 2007, Gem Diamonds Limited (GDL) acquired 100% Gope Exploration Company (Pty) Ltd (GEC), a Botswana based company. GEC was originally set up as a joint venture by De Beers Prospecting (Pty) Ltd (De Beers) and Falconbridge Exploration Botswana (Pty) Ltd (Falconbridge), now a subsidiary of Xstrata plc, to explore a known Kimberlite deposit in the Gope region of the Central Kalahari Game Reserve (CKGR) in the Ghanzi district, Botswana.

The following section describes in brief terms the history of the Gope Diamond Mining Project (GDMP):

The Gope Go 25 Kimberlite deposit lies in a remote and essentially uninhabited part of central Botswana, within the CKGR. The deposit is located approximately 300 km north-west of Gaborone, and 160 km south south-west of Orapa.

The deposit was located by Falconbridge Exploration in 1980, and a Joint Venture (JV), GEC, was formed with De Beers in 1983. An evaluation programme was completed by the end of April 1996. The mineral resource to a depth of 300 mbgl. A pre-feasibility study was conducted in 1997.

Despite the marginal nature of the resource, the JV nevertheless embarked on a full feasibility study, which included mining down to a depth of 400 mbgl in 1998.

De Beers conducted a review of the feasibility study in 2003, and again concluded that while the project was not viable, there was potential to improve the business case through increasing extraction rates, and adopting different treatment technologies. The review recommended that a feasibility study update should be conducted to explore the options further.

A further re-evaluation took place in September 2006, which concluded that there was potential to improve the business case for the project, by mining to a depth of 500 mbgl and employing different treatment technologies.

Despite the history of the Gope pipe, the JV decided to dispose of GEC, and GDL acquired 100% of the shares in May 2007. At the time, GEC held a suspended Retention Licence over the concession area.

GEC initiated a new feasibility study in June 2007, as required in terms of the Mines and Minerals Act 16 of 1999. Marsh Environmental Services (a division of Marsh Pty) was appointed as independent environmental consultants to undertake a revision of the Geoflux (Pty) Ltd Environmental Impact Assessment (EIA). A decision was undertaken to expand the EIA to incorporate an assessment of the social component surrounding the project, resulting in Marsh undertaking a Social and Environmental Impact Assessment (SEIA) and compiling a Social and Environmental Management Plan (SEMP) for the proposed GDMP.

The suspension of the Retention License was lifted in October 2007.

1.2. METHODOLOGY

The SEIA for the proposed GDMP was undertaken in agreement with the process as stipulated by the Department of Environmental Affairs, Botswana (DEA) and in accordance with the relevant Environmental Impact Assessment Act (Act 6 of 2005) and associated guidelines:

- Folio Number 1: General Guidelines for Conducting EIA and SEA Studies Under the EIA Act 2005;
- Folio Number 3: Guidelines for Conducting EIA Studies for Infrastructure Projects Under the EIA Act 2005,
- Folio Number 4: Guidelines for Conducting EIA Studies for the Extractive Industry Under the EIA Act 2005, and
- Folio Number 5: Guidelines for Conducting EIA Studies for the Energy Industry Under the EIA Act 2005.

In accordance with the requirements of the EIA Act, Marsh submitted a Preliminary Environmental Impact Report (PEIR) to the DEA on 07 December 2007 for review. Following the review of the PEIR, Marsh received instruction from the DEA on 10 December 2007 to continue to the Environmental Scoping Study (ESS) of the environmental assessment process.

The following ESS methodology was adopted by Marsh in order to adhere to the ESS phase objectives:

- A review of the existing data pertaining to the GDMP;
- Reconnaissance level specialist investigations pertaining to the biophysical and socio-economic environment were conducted;
- Authority consultation was undertaken at both National and Local Government level;
- Extensive public consultation was undertaken;
- Impacts and alternatives identification investigations were conducted, and
- A proposed plan of study for the SEIA phase was developed.

During the ESS, feasible alternatives and potential environmental impacts were identified that would require further investigation during the SEIA. The following methodology was adopted for this phase of the study as outlined by the General Guideline for Conducting EIA and SEA Studies under the EIA Act 2005:

a) Specialist assessments detailing assumptions, uncertainties and gaps in knowledge;
b) A description and comparative assessment of all alternatives identified during the ESS phase;
c) An assessment of the significance of each impact and issue as well as an indication of the extent to which the issue could be addressed by the implementation of mitigation measures, namely:
   - Cumulative impacts;
   - The nature of the impact;
   - The extent and duration of the impact;
   - The probability of the impact occurring;
   - The degree to which the impact can be reversed;
   - The degree to which the impact may cause irreplaceable loss of resources, and
   - The degree to which the impact can be mitigated.
d) A SEIA Phase Public Consultation / Public Participation Process;
e) A recommendation be drafted as to whether the GDMP should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;
f) The development of an Social and Environmental Impact Statement (SEIS) which contains:
   - A summary of the key findings of the SEIA, and
   - A comparative assessment of the positive and negative implications of the proposed activity and identified alternatives.
g) The compilation of an Social and Environmental Management Plan (SEMP);
h) The compilation of a Decommissioning Programme which includes:
   - A rehabilitation and remediation plan for mine closure, and
   - Financial quantum determination for rehabilitation.

It must be noted that this environmental assessment takes cognisance of the EIA undertaken by Geoflux (Pty) Ltd for De Beers Prospecting (Pty) Ltd (De Beers), titled An Environmental Impact Assessment for a New Diamond Mine at Gope, Botswana, dated 13 May 1999.

A detailed description of methodology followed by each specialist scientist is contained in each specialist report (refer to Appendixes 1 – 11).

1.3. Objectives and Requirements of the Environmental Study

1.3.1 Environmental Scoping Study

The primary function of the ESS phase of the environmental assessment process can primarily be described as:

- The identification of the potential significant environmental and socio-economic impacts associated with a development activity;
- The identification of alternatives for:
  - Consideration in the decision making process;
  - The detailed investigation of the identified alternatives in the SEIA phase of the assessment process, and
- To define the Terms of Reference (ToR) of the Plan of Study for SEIA for assessment by the relevant authority.

The secondary function of the ESS process is the following:

- Informing the public of the development proposal;
- Identifying the concerns and values of the main stakeholders, and
- Setting the requirements for the collection of baseline and other information.

1.3.2 Social and Environmental Impact Assessment and Social and Environmental Management Programme

1.3.2.1 Social and Environmental Impact Assessment

SEIA is the systematic process to identify, predict and evaluate the environmental impacts of proposed development (i.e. the GDMP). The overarching purpose of the SEIA is to:

- Provide information for decision making on the social and environmental consequences of proposed development project, and
- Promote environmentally sound and sustainable development through the identification of appropriate mitigation measures.

During this phase of the environmental assessment process the impacts identified during the ESS phase of the study are comprehensively quantified and appropriate mitigation measures identified to either reduce or avoid such potentially adverse impacts identified.

1.3.2.2 Social and Environmental Management Plan

The SEMP is a tool used to ensure potentially adverse impacts transpiring during the construction, operation, decommissioning and rehabilitation phase of the project life cycle are prevented, mitigated and/or managed. The SEMP translates recommended mitigation and monitoring measures into specific actions to be implemented by the project proponent and various other role players.

The following characteristic objectives of the SEMP are considered important:

- Ensuring compliance with the regulatory authority stipulations and guidelines;
- Verifying environmental performance through monitoring;
- Responding to changes in project implementation;
- Responding to unforeseen events, and
- Providing feedback for continual improvement in environmental performance.

According to the legislative requirements guiding the EIA process in Botswana it is evident that an SEMP should adhere to the following requirements:

- The objectives of the SEMP should be noticeably stated;
- Inclusion of a list of environmental characteristics and impacts associated with the proposed development activity;
- Measures to manage the impacts associated with the proposed development activity;
- A comprehensive indication of the environmental responsibilities of respective role players (i.e. applicant, contractor, government departments, other), and
- Highlight emergency response procedures, if applicable.

1.4. SPECIALIST INVESTIGATIONS

In order to ensure that a comprehensive assessment of the relevant bio-physical and socio-economic components making up the environment was performed, the following specialist investigations were conducted:

Table 1: Specialist Investigations.

ASPECT	COMPANY	LEAD CONSULTANT	KEY QUALIFICATIONS
Geology, Soils, Land Use, Land Capability	Earth Science Solutions	Ian Jones	B.Sc. Geology Pr.Sci.Nat
Topography	Marsh Environmental Services	Kerry Quinn	B.Sc. Environmental Science
Natural Vegetation	Bathusi Environmental Consulting	Riaan Robbeson	M.Sc. Plant Ecology Pr.Sci.Nat
Animal Life		Dewald Kamffer	M.Sc. Grassland Ecology Pr.Sci.Nat
Surface Water	Jones and Wagener Consulting Civil Engineers	Chris Waygood	B.Sc. Civil Engineering Pr.Eng.
Groundwater	Rison Groundwater Consulting	Marius van Biljon	M.Sc. Geohydrology Pr.Sci.Nat.
		Dr. Hugo van der Merwe	P.hD. Geohydrology MBL
Air Quality	Bohlweki Environmental	Dr. Raylene Watson	P.hD. Air Quality
Noise	Marsh Environmental Services	Kerry Quinn	B.Sc. Environmental Science
Heritage and Archaeological Assessment	Archaeology Africa	Polke Birkholtz	B.A. Hons Pr.Arch.
Sensitive Landscapes	Marsh Environmental Services	Kerry Quinn	B.Sc. Environmental Science
Visual Assessment	Marsh Environmental Services	Lizelle Prosch	B.L Landscape Architecture Pr.LA
Waste Management	Marsh Environmental Services	Jonathan Sevitz	M.Sc. Environmental Engineering
Socio-Economic	Demacon Market Studies	Hein du Toit	M.Sc. T&RP PhD in progress
Social Assessment	Social Impact Assessment and Policy Analysis Corporation	Dr. David Cownie	Ph.D. in Political Science & Sociology
Legal	Marsh Environmental Services	Sally-Ann du Preez	M.A. Environmental Management LLM in progress
Road Assessment	EHES (Pty) Ltd	Prof. Francis Sefe	Ph.D

1.5. ASSUMPTIONS

The scope of work for the Social and Environmental Impact Assessment (SEIA) was derived from the analysis of key data of based on the outcomes of the feasibility study conducted by GDL during 2007.

1.6. Statement of Marsh Environmental Services Consulting Independence

Neither Marsh nor its employees has had or will have any financial or other interest in the GDMP, GEC or its parent company, GDL, other than the payment of our normal consulting fees as agreed with the client, prior to commencement of this project. Payment of Marsh' consulting fees are not dependent on the receipt of a Record of Decision (positive or negative) from the DEA or any other Government Agency involved in this project. Revenue derived from this project constitutes less than 50% of Marsh' total annual revenue. In the absence of a definition of "independent" in Botswana legislation, these above criteria fulfil the definition as per the South African EIA regulations.

1.7. Disclaimer

This document has been prepared by Marsh Environmental Services (a division of Marsh Pty) for the specific purpose of assessing the environmental impacts related to the development and operation of the Gope Diamond Mining Project as proposed by the Gope Exploration Company (Pty) Ltd (GEC), the proposition of mitigation and management measures relevant thereto and for assessment by the Department of Environmental Affairs of the Government of Botswana for decision making purposes. Should information in this document be utilised by a third party for any other purpose, such third party will carry all related responsibility for any decisions made or actions taken based thereon. Marsh or its officers shall in no way be responsible for any damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

This document was compiled by Marsh Environmental Services, a division of Marsh Pty Ltd, based upon findings of specialist assessments as outlined below:

Table 2: Specialist Assessments

ASPECT	COMPANY
Geology, Soils, Land Use, Land Capability	Earth Science Solutions
Topography	Marsh Environmental Services
Natural Vegetation	Bathusi Environmental Consulting
Animal Life	
Surface Water	Jones and Wagener Consulting Civil Engineers
Groundwater	Rison Groundwater Consulting
Air Quality	Bohlweki Environmental
Noise	Marsh Environmental Services
Heritage and Archaeological Assessment	Archaeology Africa
Sensitive Landscapes	Marsh Environmental Services
Visual Assessment	Marsh Environmental Services
Waste Management	Marsh Environmental Services

ASPECT	COMPANY
Socio-Economic	Demacon Market Studies
Social Assessment	Social Impact Assessment and Policy Analysis Corporation
Legal	Marsh Environmental Services
Road Assessment	EHES (Pty) Ltd

Table 3: Approval and Quality Assurance

COMPILED BY:	DATE:	SIGNATURE:
Anneli Botha	August 2008	
CHECKED BY:	**DATE:**	**SIGNATURE:**
Kerry Quinn	August 2008	
APPROVED BY:	**DATE:**	**SIGNATURE:**
James Brice	August 2008	

Table 4: Distribution List First Submission

AGENCY, ORGANISATION OR PERSON	NUMBER OF COPIES
Attorney General's Office	1
Botswana Tourism Board	1
Central District Council	1
Department of Environmental Affairs	2
Department of Environmental Affairs Library	1
Department of Forestry and Range Resources	1
Department of Geological Surveys	1
Department of Lands	1
Department of Mines	1
Department of National Museum and Art Gallery	1
Department of Town and Regional Planning	1
Department of Waste Management and Pollution Control	1
Department of Water Affairs	1
Department of Wildlife and National Parks	1
District Commissioner: Ghanzi	1
District Commissioner: Serowe	1
District Commissioner: Molepolole	1
Gantsi District Council	1
Gantsi Land Board	1
Gantsi Library	1
Gantsi Tribal Administration (Kgotla)	1
Gope Exploration Company (Pty) Ltd	4
Kaudwane Tribal Administration (Kgotla)	1

AGENCY, ORGANISATION OR PERSON	NUMBER OF COPIES
Kweneng District Council	1
Kweneng Land Board	1
Lephepe Tribal Administration (Kgotla)	1
Marsh Environmental Services – Gaborone, Botswana	1
Marsh Environmental Services – Johannesburg, South Africa	1
Molepolole Library	1
Molepolole Tribal Administration (Kgotla)	1
New Xade Tribal Administration (Kgotla)	1
Ngwato Land Board	1
Serowe Library	1
Serowe Tribal Administration (Kgotla)	1

Table 5: Distribution List Final Submission

AGENCY, ORGANISATION OR PERSON	NUMBER OF COPIES
Botswana Tourism Board	1
Central District Council	1
Department of Environmental Affairs	1
Department of Geological Surveys	1
Department of Mines	1
Department of National Museum and Art Gallery	1
Department of Town and Regional Planning	1
Department of Waste Management and Pollution Control	1
Department of Water Affairs	1
Department of Wildlife and National Parks	1
Gantsi District Council	1
Gantsi Land Board	1
Gope Exploration Company (Pty) Ltd	4
Kweneng District Council	1
Kweneng Land Board	1
Marsh Environmental Services – Gaborone, Botswana	1
Marsh Environmental Services – Johannesburg, South Africa	1
Ngwato Land Board	1

SECTION 2. INTRODUCTION AND BRIEF PROJECT DESCRIPTION

2.1. NAME AND ADDRESS OF APPLICANT / PROJECT PROPONENT AND SENIOR GENERAL MANAGER / RESPONSIBLE PERSON

Project Proponent:	**Gope Exploration Company (Pty) Ltd**
Physical Address:	Plot 165 Pilane Road Gaborone Botswana
Postal Address:	P.O. Box 401304 Broadhurst Gaborone Botswana
Contact Persons:	Haile Mphusu (Managing Director) Howard Marsden (Operations Manager)
Telephone:	+26 7316 5376
Fax:	+26 7318 2795

2.2. NAME AND ADDRESS OF THE OWNER OF THE LAND / TITLE DEED DESCRIPTION

The GDMP is located within the CKGR. The site is located on state owned land and therefore the Government of Botswana, Department of Land is responsible for the land.

2.3. DETAILS OF INDEPENDENT ENVIRONMENTAL IMPACT ASSESSMENT PRACTITIONER (EIAP)

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2.4. Regional Setting

2.4.1 General Location of Project

The Gope Project Site is located approximately 45 km west of the CKGR's eastern boundary (Figure 1). Geographical coordinates for the centre of the site are 22°38.4'S and 24°48.07'E.

Direct distances to several towns and villages to the project are given below:

Table 6: Distances to Towns and Villages

TOWN / VILLAGE	DIRECTION	DIRECT DISTANCE
Gaborone	South east	300 km
Orapa	North east	160 km
Lephepe	South east	138 km
Kaudwane	South west	86 km
Ghanzi	North west	339 km
Molapo	East	112 km
Metsimanong	North east	61 km
Kugama	East	76 km

The Mining License Area (MLA) comprises of approximately 45 km^2 of which approximately 1,990 ha, the Gope Project Site, are expected to be directly impacted by mining activities. The impacted area will include an open pit, slimes dam and Tailings Management Facility (TMF), stockpiles, Waste Rock Dump (WRD), a mineral processing plant, water reservoir and treatment works, interconnecting access and haul roads, an air strip, mine offices and a camp / accommodation units.

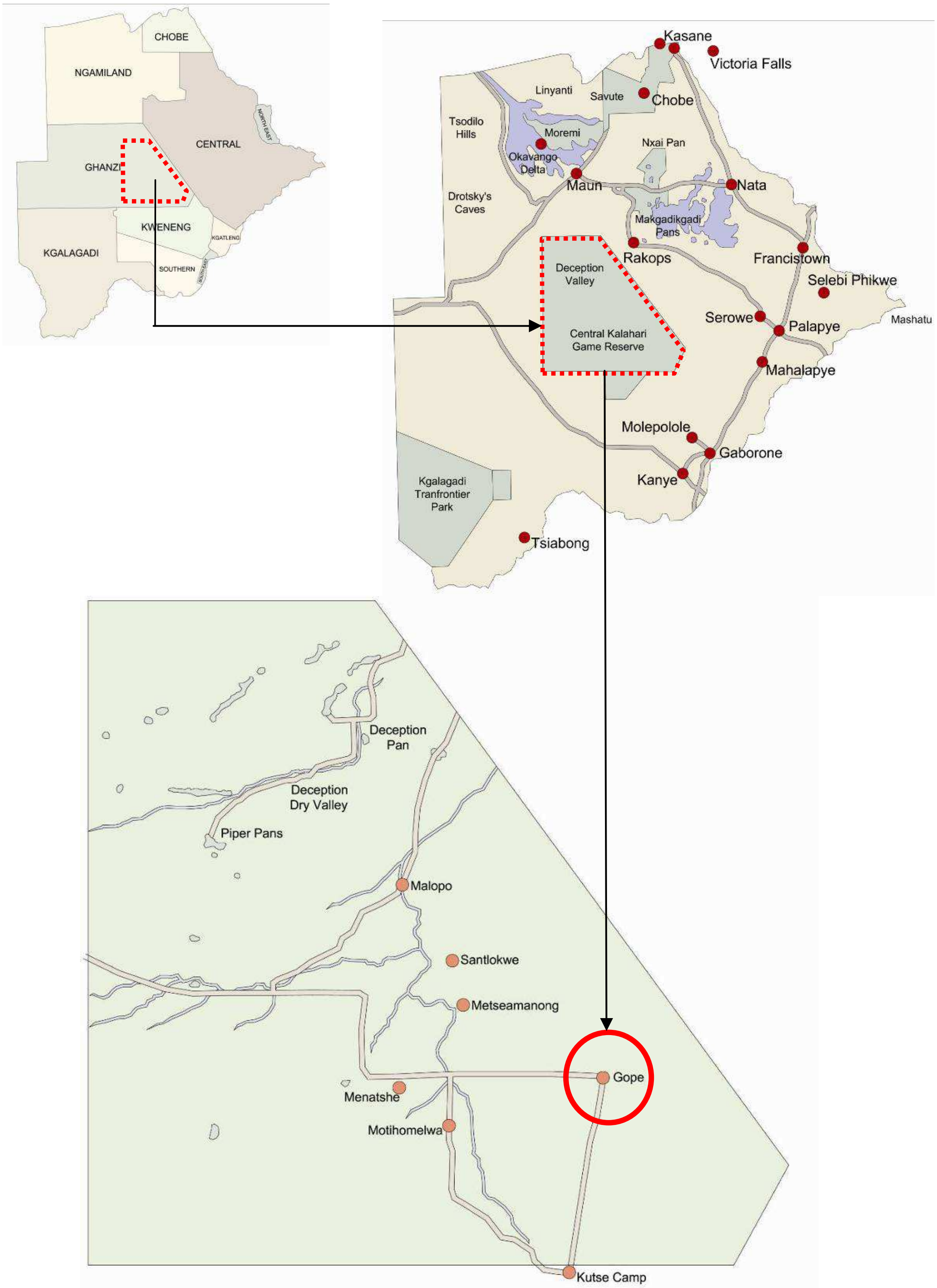

Figure 1: Regional Location of Proposed GDMP.

2.4.2 Magisterial District and Relevant Regional Services Council Authority

The Gope Project Site is located within the Ghanzi District. The district capital is located in the town of Ghanzi, located some 339 km from the project site (direct distance).

2.4.3 Description of Area Occupied by and Surrounding the Project

The Gope Project Site is located within the south eastern CKGR and is considered to be a very remote location. The area surrounding the site comprises only open veld of pristine natural ecosystem. Towards the end of the SEIA investigations, former Gope residents started moving back to, and settling at the Gope area.

2.4.4 Land Tenure and Use of Immediately Adjacent Land

During the majority of the time during which investigations were undertaken at the Gope Project Site, the only activities on site comprised that of exploration and technical investigations. However, at the beginning of May 2008, several former Gope residents started returning to the Gope area. This group comprised of approximately 18 people including men, women and children. No livestock were present at the settlement.

SECTION 3. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

3.1. INTRODUCTION

A detailed review of Botswana's environmental policy and legislative framework has been undertaken, within which the proposed Gope Diamond Mining Project (GDMP) Social and Environmental Impact Assessment (SEIA) will be conducted, and in the context of which the proposed mine will be required to operate. Outlined hereunder is an overview of the legal framework as well as the enviro-legal and authorisation requirements relevant to the GDMP.

3.2. POLICY AND LEGAL FRAMEWORK

The Botswana environmental policy and legislative framework within which the proposed GDMP SEIA will be conducted, and in the context of which the proposed mine will be required to operate, is outlined in detail in Appendix 12. As well as providing an overview of the legal framework, enviro-legal and authorisation requirements relevant to the GDMP are highlighted.

The review outlines the plans, policies and laws that have a bearing on the proposed GDMP. Accordingly, the following has been considered:

- National legislation;
- Plans and policies;
- Relevant Multilateral Environmental Agreements (MEAs), and
- Relevant standards as developed by the Botswana Bureau of Standards.

The following legislation was consulted in the compilation of this legal framework:
The following legislation and policies was consulted in the compilation of this legal framework:

- State Land Act of 1966;
- Environmental Impact Assessment Act 6 of 2005;
- Mines and Minerals Act 17 of 1999;
- Mines, Quarries, Works and Machinery Act of 1978;
- Precious and Semi-Precious Stones (Protection) Act of 1969;
- Factories Act of 1979;
- Explosives Act of 1962;
- Monuments and Relics Act of 2001;
- Tourism Policy (Government Paper No. 2 of 1990);
- Tourism Act 22 of 1992;
- Botswana National Ecotourism Strategy (March 2002);
- Wildlife Conservation Policy (Government Paper 1 of 1986);
- Wildlife Conservation and National Parks Act of 1992, as Amended;

- National Parks and Game Reserves Regulations;
- Community Based Management Natural Resources Policy (Government Paper 2 of 2007);
- Botswana National Biodiversity Strategy and Action Plan (2004);
- Agricultural Resources Conservation Act 39 of 1972;
- Herbage Preservation (Prevention of Fires) Act of 1978;
- Atmospheric Pollution (Prevention) Act 18 of 1971;
- Public Health Act of 1981;
- Botswana's Strategy for Waste Management, First ed., 1998;
- Waste Management Act 15 of 1998;
- Water Act of 1968;
- Boreholes Act of 1976, and
- Waterworks Act of 1962, as amended.

3.2.1 State Land Act of 1966

State land is administered through this Act. "State land" means unalienated State land[1] and reacquired State land. State land comprises 23% of the total land area of the country and includes National Parks, Game Reserves and leasehold ranches. The President of Botswana may make and execute grants or other dispositions of any State land or any interest in them. No contract of sale or other disposition of any State land or any interest in State land is valid unless it is done in writing and approved by the President or any person delegated to represent him.

The CKGR is State Land and thus controls the use of that land. Therefore the use of any land within the CKGR by the GEC must be authorised by the President of Botswana.

3.2.2 Environmental Impact Assessment Act 6 of 2005

Before any activity that may impact on the environment may be undertaken, environmental authorisation must be obtained from the relevant authorities, i.e. the Department of Environmental Affairs (DEA). The process to obtain environmental authorisation is prescribed in Botswana's Environment Impact Assessment Act (Act 6 of 2005) (EIA Act). This Act states that no person may undertake or implement an activity prescribed in terms of the Act, unless the environmental impact of the proposed activity is fully assessed and authorization for such activity is issued by the Competent Authority. EIA Regulations are in the process of being developed and it is expected that these will identify activities for which an EIA should be done. Notwithstanding the above, Section 9(1) of the Act states that where the Competent Authority determines that the proposed activity is likely to have a significant adverse environmental impact, an EIA shall be

[1] "Unalienated State land" means any land in Botswana other than *inter alia* land included in any tribal territory or the Barolong Farms other than land within a township established under the Townships Act.

required. Accordingly, the proposed development of an open pit diamond mine has been deemed to be an activity likely to have a significant adverse environmental impact, and accordingly an EIA is required by the DEA.

The EIA process requires that the following be undertaken:

- Identification and evaluation of the potential impacts of the proposed development on the environment. It must be noted that the Act provides a broad definition of 'environment', which includes the physical, ecological, archaeological, aesthetic, cultural, economic, institutional, human health and social aspects of the surroundings. In support of this, in terms of Section 9(2), an EIA must identify and evaluate the environmental impact of an activity, with particular reference to the:
  - Health, safety or quality of life of people;
  - Archaeological, aesthetic, cultural or sanitary conditions of the environment, and
  - Configuration, quality and diversity of natural resources.
- A public consultation process to seek the views of the people and / or communities likely to be affected by the proposed development;
- Identification of measures to mitigate the identified adverse environmental impacts and, where relevant, to enhance the positive effects the proposed development will have on the environment, and
- The development of an environmental monitoring process, or an Environmental Management Plan (EMP), i.e. a document representing the administration of efforts that will be made to manage any significant environmental impact resulting from the implementation of the project (Section 10(2)).

GEC is in the process of updating an existing EIA conducted by De Beers. During a meeting held on 15 October 2007 between the DEA and Marsh, it was indicated that the full EIA process was to be undertaken in line with current legislation (refer to the minutes in Appendix C). This includes the submission of the following documents to the DEA:

- Preliminary Environmental Impact Report (PEIR) submitted in terms of Section 6(1);
- ESS Report and Terms of Reference (ToR) for the SEIA submitted in terms of Section 8, and
- Social and Environmental Impact Statement (SEIS) submitted in terms of Section 9.

The SEIA process is currently being undertaken in accordance with the provisions of the Act, as outlined in Figure 2.

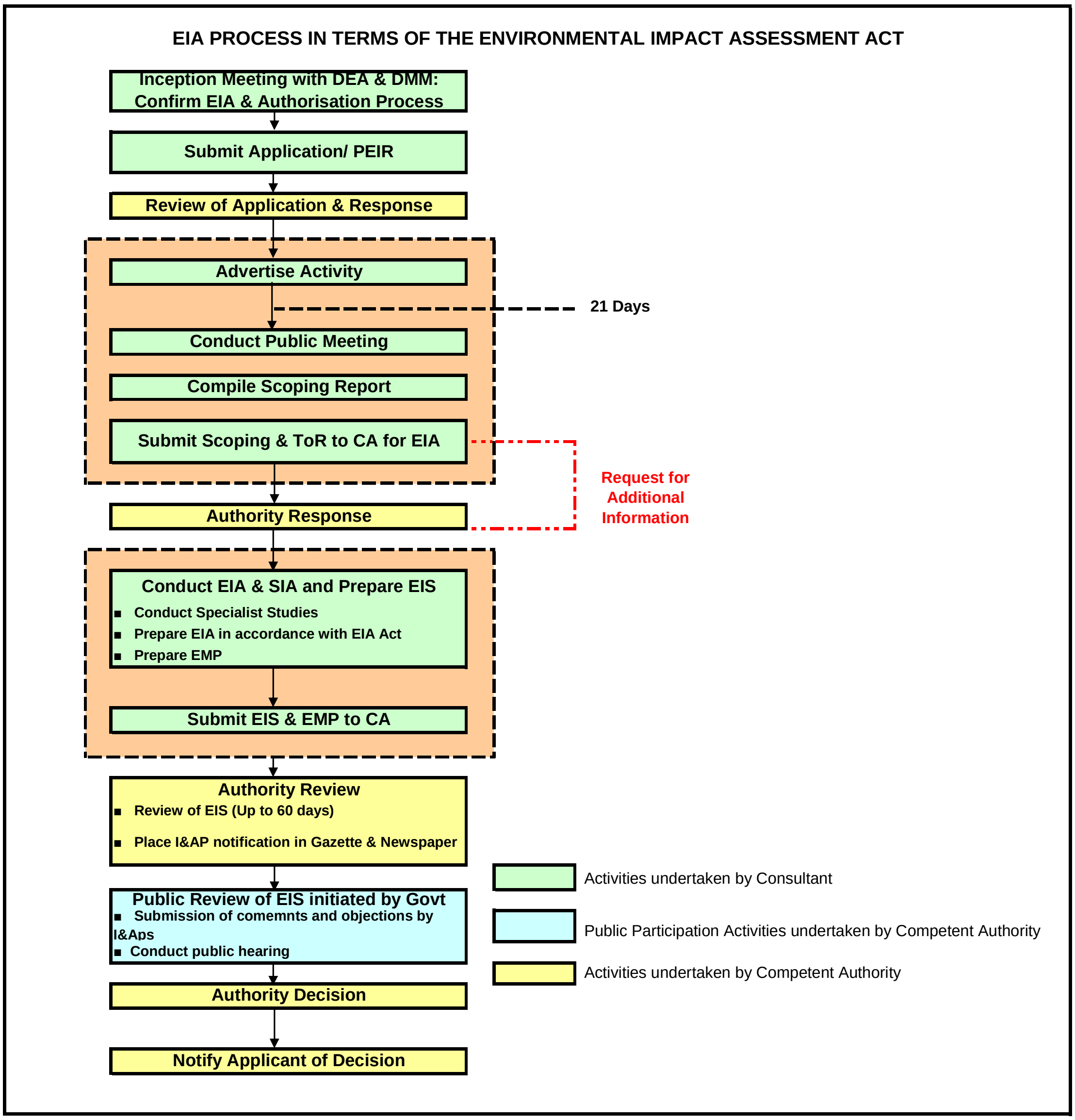

Figure 2: SEIA Process in terms of the EIA Act

3.2.3 Mines and Minerals Act 17 of 1999

The Act prohibits anyone from undertaking mining-related operations without a mineral concession being obtained from the Department of Mines (DoM). The Mines and Minerals Act sets out various environmental requirements for applying for a mining licence, including the requirement for an applicant to prepare and submit a comprehensive SEIA as part of the Project Feasibility Study Report. In addition to the submission of this SEIA and SEMP, the following is required:

- Archaeological clearance certificate from the Department of National Museum, Monuments and Art Gallery, and
- Clearance from the Department of Wildlife and National Parks (in instances where the area to be mined is within the game reserve or national park). As the CKGR was established as a

Game Reserve under the Game Proclamation of 14 February 1961 (which has been superseded by the Wildlife Conservation and National Parks Act 28 of 19922), such clearance is required.

In addition to the above, environmental obligations in mining operations are prescribed in Part IX of the Act. A duty of care is imposed on all holders of mineral concessions, who are required to conduct all mining operations in such manner as to preserve, as far as is possible:

- The natural environment;
- To minimise and control waste or undue loss of or damage to natural and biological resources, and
- To prevent and where unavoidable, promptly treat pollution and contamination of the environment.

The Act further stipulates that no holder of mining concessions may take steps which may unnecessarily or unreasonably restrict or limit further development of the natural resources of the concession area or adjacent areas.

In terms of Section 65(3) of the Act, the concession holder is required from time to time to rehabilitate the land throughout the mining operation, and to ultimately reclaim land in, so far as is practicable, a manner acceptable to the Director of Mines. In addition to this, during and at the end of operations in any mine or excavation of a waste dump, the concession holder is required to maintain and restore the top soil of affected areas and implement immediate corrective actions to treat pollution in cases of emergencies or accidents. The Act also requires the holder to make financial provisions for the implementation of these environmental obligations (refer to Part X of the Act). In instances where the concession holder fails to carry out the requisite rehabilitation work, the Minister may cause such operations to be undertaken, and to recover the costs for such work from the concession holder.

3.2.4 Mines, Quarries, Works and Machinery Act of 1978

The Mines, Quarries, Works and Machinery Act and its Regulations provide for the safety health and welfare of persons engaged in *inter alia* mining and quarrying operations (including any works[3] which are part of and ancillary to mining and quarrying operations), and allocates

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[2] This Act makes provision for the conservation and management of wildlife and fauna and flora. In terms of Section 12 of the Act, game reserves may be declared as a sanctuary in respect of the animals, species or variety, specimen or sex of animal. Regulations may be made in respect of *inter alia* the prohibition, restriction control or regulation of entry therein. In terms of the Second Schedule to the Act, the CKGR has been declared to be a game reserve.

[3] Works means any place connected with prospecting, mining or quarrying operations, at which any of the following operations and any operation necessary or incidental thereto are carried out –
the crushing, screening, washing, classifying, concentrating or leaching of any mineral;
the treating of any mineral or mineral product in the form obtained from a mine or quarry including the production of coke, and including the production of a metal in any shape or form by smelting;
the working and treating of any mine tailings deposit or mine or quarry dump for the recovery of any content thereof;
the extracting of any metal from any mineral or concentrate;

responsibility of these functions to the Mining Company. This entails compliance with operational procedures stipulated in the Act that pertain to *inter alia*:

- Accidents (Part V);
- Precautions to be taken in respect of noise, radioactive substances, ventilation, dust and toxic gases (Parts XI and XII);
- Fire Precautions (Part XIII);
- Surface Protection (Part XV);
- Dumps (Part XVII), and
- Underground fuel storage (Part XIX).

Accordingly, in enforcing the above the Act promotes environmentally responsible practices in that the legislation requires:

- That specific measures be put in place to abate emissions to the atmosphere;
- The rehabilitation and protection of open pits, mine shafts and other excavations;
- The prevention of pollution emanating from waste disposal facilities (i.e. rock waste dumps, fines dumps and slimes dams), and
- The safe storage and disposal of hazardous substances.

In particular, the following provisions of the Act are noted for the purposes of the GDMP and are to be incorporated into the SEMP during the operational phase of the mine:

3.2.4.1 Part VIII: Safety and Protection in Working Places

- Regulation 68: Every entrance to a working place underground or other dangerous excavation which is either vertical or steeply inclined must be properly closed by an adequate fence, barrier, door or gate, or must be kept adequately covered so as to prevent any person having unintentional access thereto or accidentally falling into the excavation.
- Regulation 80: The manager must ensure that suitable precautions are taken to prevent or reduce to a minimum any danger to any part of any mine from flooding from any source whatsoever.
- Regulation 81: In any place on surface (or underground) where there is water where a person working adjacent to such place is liable to fall into the water, with the risk of downing, suitable rescue equipment must be provided and maintained in good order and ready for immediate use in the prompt rescue of any person. Where the elevation of the ground immediately adjacent to any place where a person, in the course of his or employment, may fall into the water, is at least 1 metre above the level of the water or where a floating stage is used on the

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the extracting or treating of any mineral or mineral product by chemical means;
the refining of any metal;
the drying or calcinating of any mineral;
the making, repairing, re-opening or closing of any sub-terranean tunnel;
the generating, transmitting and distributing of any form of power at or to a mine or quarry;
the making, repairing and maintaining of engines, machinery and vehicles.

water or there is a structure immediately adjacent to the water, adequate fencing or similar safeguards must be provided and maintained to a height of not less than 1.4 metres at all edges of the ground or structure immediately adjacent to the water.

3.2.4.2 Part X: Health and Labour

- Regulation 91: No person may be employed at a mine unless he or she has been medically examined by a registered medical practitioner and has been certified fie for employment. The examination must include a chest x-ray.
- Regulation 94: No person may be employed in any work except under the instruction and supervision of a person competent to give instruction in and supervise the doing of the work unless he or she has received adequate instruction in, and training for, the doing of that work and is competent to do it without supervision.
- Regulation 95: No person is or who appears to be under the influence of alcohol or narcotic drugs may enter any mine. The manager (or any person designated by him) may if it is necessary in the interests of the safety of other people, arrest any person whom he or she, on reasonable grounds, suspecting of being under the influence of alcohol or narcotic drugs, and must hand such person over to the nearest police officer or police station as soon as is practicable to be dealt with according to law.
- Regulation 100: Drinking water must be supplied at points reasonable accessible to working places.
- Regulation 101: Sufficient changes houses must be provided.
  - Separate facilities must be provided for men and women
  - Showers must be screened from observation

3.2.4.3 Part XII: Ventilation, Dust and Toxic Gases

- Regulation 140: Adequate ventilation must be provided in any surface plant or building.

3.2.4.4 Part XV: Surface Protection: Abandoned Shafts

- Regulation 207: Any person who digs any excavation for prospecting purposes must throw the earth excavated there from in such a manner as to form, as far as is possible, regular ridges around the boundaries of the excavation, or other safe measures must be taken either by filling, fencing or covering so as to prevent any person from inadvertently falling into the excavation.

  Any person who digs any excavation other than a prospecting excavation must throw the earth excavated there from in such a manner as to form, as far as is possible, regular ridges around the boundaries of the excavation, or other safe measures must be taken either by filling, fencing or covering so as to prevent any person from inadvertently falling into the excavation: Provided that this does not apply to mining in any open cast working or quarry where the manager has taken such steps as he may have deemed necessary to ensure that no person is liable inadvertently to fall into the working.

- Regulation 208: No mining or quarrying may take place on or under any land lying within a horizontal distance of 100 metres from any building, road, railway, river, water right, tailings dam, lake or any other object or surface feature requiring protection except with the written permission of the Engineer: Provided that this does not apply to any building, road or railway constructed by or on behalf of the mine and intended for the use by the mine.
- Regulation 211: Any tailings dam or any other place where slimes are stored must be constructed in such a manner as to prevent, as far as is reasonably practicable, any possible collapse or partial collapse of such dam or place which may cause danger to any person or property.
- Section 213: Where any excavation ceases to be used, it must be kept safely and securely fenced, covered over or filled in. This does not apply to excavations which, in the opinion of an inspector, are not likely to be dangerous.
- Section 214: Where an excavation is not longer used, no person may, without the consent of the Engineer, damage or render it useless or dangerous by the removal of any timber, fencing, casing, lining, ladder, platform, etc., or remove any part of any mound or dump so as to lessen or destroy its usefulness in protecting people and animals from falling into the excavation.
- Section 215: When the mineral concession lapses, the holder has a duty to fill up, fence or secure to the satisfaction of the Engineer all pits, holes and excavations, in such manner as to prevent people or stock from inadvertently entering them, but must not remove beacons, pegs or boundary posts thereon.

3.2.4.5 Part XVII: Dumps

"Classified dump" means a dump of any of the following classes:

a) A dump consisting of material accumulated or deposited wholly or mainly in a solid state and not in solution or suspension where:
   - (i) The superficial area of the land covered by the material exceeds 10 000m^2 and the height of the dump exceeds 2m;
   - (ii) The height of the dump exceeds 15m; or
   - (iii) The average gradient of the land covered by the material exceeds 1 in 12;

b) A dump consisting of material accumulated or deposited wholly or mainly in solution or suspension where:
   - (i) The dump is at any one point of a greater height than 4m above the level of any part of the neighbouring land within 50m of the perimeter of the dump;
   - (ii) The volume of the dump (including any liquid in it) exceeds 10 000 m^3:

provided that for the purpose of determining whether material has been accumulated or deposited wholly or mainly in a solid state or wholly or mainly in solution or suspension any wall or other structure retaining or confining the dump is excluded, but for all other purposes the term ‘dump’ includes the wall or any other retaining structure.

- Regulation 229: Dumping operations may not be carried out in a manner so that such operations cause an accumulation of water in, under or near the dump which may make the dump insecure or dangerous. Every dump must be kept properly drained and drainage must be diverted away from and prevented from entering any mine openings or subsiding ground over any mine workings, whether abandoned or not.
- Regulation 230: Dumping of material which is wholly or mainly in solution or suspension or of material which under any circumstances can act as a fluid in an area vertically above any mine workings (whether abandoned or not) or within a horizontal distance of 100m of such area or where the line or break from the mine workings will intersect the surface is prohibited.

3.2.4.6 Part XVIII: Excavations, buildings, construction and demolition

- Regulation 249: The Manager must cause every excavation to the public or which is adjacent to public roads or paths and whereby the safety of any person may be endangered to be adequately protected by a barrier or fence at least 1.0m high and as close to the excavation as practicable and provided with red warning lights at night.

3.2.4.7 Part XXX: Opencast Workings and Quarries

- Regulation 558: Where mechanical equipment is not used, no working face in workings of clay, sand, gravel or other types of unconsolidated material may have a vertical height of more than 3m unless the material is at a suitable angel to ensure safety.
- Regulation 559: Where the thickness of the material exceeds 3m in vertical depth, the work must be done in benches or at a suitable angle to ensure safety. Where a multiple bench system is used in any opencast working or quarry, beams of sufficient width to catch and retain any material falling from above must be maintained.
- Regulation 560: Where mechanical equipment is used in loading clays, sand, gravel or any other type of unconsolidated material, unless the material is at a suitable angel of repose, no working lace may have a vertical height of more than 1.5 metres above the top of the boom of the bucket raised to its highest operating position.
- Regulation 561: Use of Internal Combustion Engines – No internal combustion engine may be installed or operated in any opencast working or quarry unless adequate provision is made to ensure that exhaust gases and fumes will not accumulate therein to a degree that it is likely to endanger the safety of any persons.
- Regulation 562: Unless permission in writing is first obtained from the Engineer, all opencast operations in consolidated material over 20m in depth must be worked in benches not more

than 20m high, and due precautions must be taken to maintain the walls, benches and broken material in a safe working condition, and no working face may be advanced by undercutting, except where a tunnelling method is used.

- Regulation 563: Every opencast working or quarry dangerous by reason of its depth must be securely fenced or otherwise protected against inadvertent access.
- Regulation 564: In all opencast workings and quarries, all unconsolidated materials, such as clay, earth, sand, gravel and loose rock, lying within 2m of the rim of the opencast working or quarry must be removed. Beyond this strip, all overburden must be sloped to an angle less than its natural angle of repose.
- Regulation 565: Unless the adjoining owners agree to dispense therewith, in sand, clay or gravel or other natural unconsolidated material, excavation operations may not be carried on within a distance from the property boundary of half the height of the total opencast working face, and material which sloughs from within this distance may not be removed.
- Regulation 568: When dumping material from a vehicle to a stockpile, appropriate precautions considering the weather and other relevant conditions must be taken to keep the vehicle at a safe distance from the edge of such stockpile. Not less than 2 exits must be provided from a tunnel under a stockpile.
- Regulation 569: In opencast workings, where the area that has been mined is backfilled, waste must be placed in the worked out area in such a manner that there will be no danger from waste sliding into any operating area of such opencast working. In opencast workings where the worked out area is backfilled, the backfilling must be graded and drained as far as is practicable.

3.2.4.8 Part XXXII: Miscellaneous

- Regulation 589: Notwithstanding Section 7 of the Water Act (refer to 3.2.25 hereunder), the manager must comply with the directions of the Water Registrar in relation to the design and construction of dams and reservoirs for the purpose of carrying out mining operations and domestic water supplies. The directions given by the Water Registrar will be in accordance with the procedures approved by the Water Apportionment Board in respect of dams required to be authorised by the grant of a water right.
- Regulation 590: The manager must securely fence off any water effluent containing poisonous or injurious chemicals and may not permit such water to escape beyond the limits so fenced without having previous rendered it harmless. The manager must ensure that periodic sampling, testing and analysis of liquid effluents are carried out by a qualified laboratory and the results recorded.

3.2.5 Precious and Semi-Precious Stones (Protection) Act of 1969

The Act provides for the protection of the precious stones industry and the regulation of dealings in precious stones and semi-precious stones. The most relevant aspects of this Act pertain to the fact that the Minister can declare the mining area to be precious stone protection area in accordance with Part IV of the Act. Arrangements will have to be made to have the proposed mining area declared as such an area and to have it incorporated into the Precious and Semi-Precious Stones (Protection) Act Schedule or Protected areas. The declaration means that people living within this area will be required to relocate and that no person may enter or remain within this area for any form of trade and without permission.

3.2.6 Factories Act of 1979

The Act regulates conditions of employment in factories with respect to the safety, health and welfare of employees, and for the safety and inspection of certain plant and machinery. The Act requires registration with the Chief Inspector of existing and new factories before any person occupies or uses such factory.

In terms of Section 5(1) of the Act, "factory" means any premises in which persons are employed in manual labour in any process for or incidental to any of the following purposes, namely:

a) The making of any article or part of any article;
b) The altering, repairing, ornamenting, finishing, cleaning, washing, breaking up or demolition of any article, or
c) The adopting of any article for sale.

Section 5(5) of the Act states that no premises to which the provisions of the Mines, Quarries, Works and Machinery Act of 1978 apply will be deemed to be a factory. Accordingly, the Act will not apply to the GDMP (refer to discussion at 3.2.4 for further discussion).

3.2.7 Explosives Act of 1962

The use of explosives will be undertaken during the operational phase of the mining concession. Regulations promulgated in terms of the Act provide for the storage of explosives and the use of explosives.

In terms of Part VI of the Act, no person may store explosives on or below the surface of the ground otherwise than in accordance with the provisions of the Regulations. Any surface magazine used for the storage of more than two cases or 50 kilograms of explosives, other than detonators, or more than 500 detonators (unless a license issued by the Chief Inspector of Explosives has been obtained). Where a quantity of explosives not exceeding 100 cases or

2,500 kilograms of fracture explosives or 15,000 detonators is required for temporary purposes, the Chief Inspector of Explosives may license such magazine for such time and subject to such conditions as he or she may prescribe.

It must also be noted that in terms of Regulation 72, no person may sell explosives unless authorised by license issued by the Chief Inspector of Explosives. Accordingly, the supplier of explosives to the GDMP will be required to be licensed.

3.2.8 Monuments and Relics Act of 2001

This Act provides for the preservation and protection of ancient monuments, ancient workings, relics and other objects of aesthetic, archaeological, historical or scientific value or interest. In terms of Section 19 of the Act, both a pre-development Archaeological Impact Assessment (AIA)[4] and EIA are required to be undertaken for major developments such as construction or excavation for the purposes of mineral exploration and prospecting, mining, construction of roads or dams, or erection of any other structure which will physically disturb the earth's surface. The AIA will determine the extent to which the proposed GDMP activities will negatively impact on archaeologically and culturally significant material. The AIA and EIA reports are required to be submitted to the Commissioner of Monuments and Relics at the Department of National Museum, Monuments and Art Gallery for review within 60 days of completion of both studies, together with a written application for the development of the area in which the studies have been conducted. The proposed development may not commence in the absence of written permission from the Commissioner.

Section 12 of the Act provides for the notification of discoveries. In the event that during the SEIA process or the construction or operational phases of the project, any monument, artefact, relic or other archaeological feature is discovered, the Commissioner must be notified immediately, in writing, of such finding (by the discoverer and the owner or occupier of land). In such instances, all excavation or construction must be immediately suspended until the Commissioner has advised otherwise.

3.2.9 Tourism Policy (Government Paper No. 2 of 1990)

Tourism has been identified as being central to the Government of Botswana's economic development strategy. Wildlife and the wilderness experience represent the principal tourist attractions. The main objective of the Tourism Policy, developed by the Government of

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[4] The study, by an archaeologist, of any are in which development or any ground disturbing activity is to be carried out, to determine the likelihood of the development or activity impacting negatively on any cultural material or evidence that may be present in the area to be disturbed and any recommendation may by the archaeologist on how to prevent or mitigate any negative impact to the cultural material or evidence.

Botswana, is to obtain from the tourism resources in the country, on a sustainable basis, the greatest possible net social and economic benefits.

In terms of the Policy, the Department of Wildlife and National Parks (DWNP) is responsible for all aspects of wildlife management in the Parks and Reserves, including the CKGR, and for the implementation of the Government's policy of wildlife conservation and sustained utilisation). Accordingly, DWNP is primarily responsible for the provision of tourism facilities in the Parks and Reserves and the control and management thereof, in consultation with the Department of Tourism.

3.2.10 Tourism Act 22 of 1992

This Act regulates the tourism industry and allows for the establishment of a Tourist Industry Licensing Board. In terms of Section 4 of the Act, no person shall carry on, or assist in carrying on, any tourist enterprise[5] otherwise than under and in accordance with the terms and conditions of a license issued under this Act. No tourist enterprises will be operated as part of the mining operation. Accordingly, the Tourism Regulations, in terms of which the licensing process is outlined, are not elaborated on herein.

3.2.11 Botswana National Ecotourism Policy (March 2002)

The goal of the National Ecotourism Strategy is to create an environment in which all elements of tourism development planning and management facilitate, promote and reward adherence to the key principles of ecotourism by all of those involved in the tourism industry. These are:

- Minimising negative social, cultural and environmental impacts;
- Maximising the involvement in, and the equitable distribution of economic benefits to, host communities;
- Maximising revenues for reinvestment in conservation;
- Educating both visitors and local people as to the importance of conserving natural and cultural resources, and
- Delivering a quality experience for tourists.

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[5] Operations that offer facilities only on site, such as hotels, motels, guest houses and apartments; operations that offer facilities on and off site, such as tourist camps, lodges, caravans, hunting camps and tented tourist camps, which also operate tours which require the services of professional guides or professional hunters licensed under the Wildlife Conservation and National Parks Act of 1992; operations that offer facilities off site only, such as safari or tour operators, and any enterprise that receives and transports travelers and guests, providing them with sleeping accommodation and food and beverages in equipment that is not geographically fixed; and operations that act as agents only, such as travel agents.

3.2.12 Wildlife Conservation Policy (Government Paper 1 of 1986)

The Policy was developed in response to a recognition that Botswana needed to obtain an economic return from its wildlife land areas, while ensuring the continuity of the resource. The specific objectives of the policy are:

- To realise the full potential of the wildlife resource;
- To develop a commercial wildlife industry in order to create economic opportunity, jobs and incomes for the rural population;
- To increase the supply of game meat as a consequence of the further development of wildlife commercial utilisation.

As stated in the Policy, government control will be assured by implementing legislation to permit, encourage and monitor development of the industry.

3.2.13 Wildlife Conservation and National Parks Act of 1992, as Amended

The Act makes provision for the conservation and management of the wildlife in Botswana, giving effect to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (refer to Section 3.3.2 below) and any other international convention for the protection of fauna and flora to which Botswana is a party, and provides for the establishment, control and management of national parks and game reserves and matters incidental thereto or connected therewith.

Part II of the Act designates specific areas as National Parks, and gives power to the President to declare any State or bequeathed land as a national park and to declare game reserves and sanctuaries, and private game reserves. Part III provides for the establishment of wildlife management areas and controlled hunting areas. Part IV specifies a list of protected animals in Botswana, and imposes a fine of P10 000 and imprisonment of seven years for persons who hunt or capture such animals without authorization (with higher fines for rhinoceros). Part V deals with hunting generally, and provides that licenses are required for the hunting of all animals, except in the case of personal consumption of non-protected animals outside of a national park or game reserve, or in the case of hunting non-protected animals by someone holding “landholder’s privileges” on the land subject to that privilege. Even in the latter cases, however, hunting is subject to certain restrictions.

3.2.14 National Parks and Game Reserves Regulations

These Regulations provide for the management of national parks and reserves and regulate activities and facilities in national parks and reserves.

In terms of Regulation 4 of the National Parks and Game Reserves Regulations, no person may enter or be within a national park or game reserve unless he or she is in possession of a valid entry permit issued by the Officer-in-Charge of the Department of Wildlife and National Parks. Accordingly, during the SEIA process, as well as all phases of the proposed GDMP, all persons entering the CKGR will require authorisation from the Department prior to such entrance.

Regulation 45 states that persons resident in the CKGR at the time of the establishment of the Game Reserve, or persons who can rightly lay claim to hunting rights in the CKGR, may be permitted in writing by the Director (Wildlife and National Parks) to hunt specified animal species and collect veld products[6] in the game reserve. The meat and trophies of any animal killed in terms of the above may be used for the consumption of the holder of a written authorisation from the Director, or his dependants and may not otherwise be disposed of or sold unless a written authorisation to do so from the Director is obtained.

Additional provisions important for the proposed GDMP include the following:

- Regulation 15: Airstrips must be constructed or used in locations designated for this purpose in the management plan and airstrips not so designated must be closed by the display of a sign or notice or the construction of an appropriate barrier and must be rehabilitated. Any person who lands or parks an aircraft on an airstrip within a game reserve must pay the fee as provided for in the Regulations. No person may keep an aircraft on an airstrip within a game reserve for more than five consecutive days, without a written authorisation from the Officer-in-Charge. No person shall construct any structure or leave any motor vehicle, fuel, oils or other materials on an airstrip within a game reserve without a written authorisation from the Director.
- Regulation 27: No person may fly an aircraft at less than 1,500 feet above ground level in game reserve except at the time an aircraft is landing or taking off and within five kilometres of the airstrip, or prior written permission has been granted to the person by the Officer-in-Charge for such flying. No person may use an aircraft in a game reserve between the hours of sunset and sunrise unless under exceptions as specified in the Regulations.
- Regulation 26: No person may drive a motor vehicle at a speed exceeding 40 kilometres an hour within a game reserve: Provided that this does not apply to a tarred public road traversing a game reserve and designated as a transit route, in which case motor vehicle speeds may not exceed 80 kilometres per hour. No person shall drive or cause to be driven a motor vehicle in such a way as to harass a wild animal or disturb other persons within a national park or game reserve.
- Regulation 37: No person may within a national park or game reserve:

[6] "veld products" means non-domesticated, vegetative biological resources that may be used for construction, medical, food and cultural activities.

- Remove or destroy any flora, fauna or avifauna, or any part thereof either living or dead, or in any way hunt, harass, disturb or molest any living thing except inter alia with the written authorisation of the Director;
- Cause any damage to or disturb any object of geological, ethnological, historical, archaeological or other scientific interest or, remove any such objects from the national park or game reserve unless with the written permission of the Director;
- Introduce any wild or domestic animal, or any fish or any vegetation, or permit any domestic animal to stray in the national park or game reserve, except with the written permission of the Director or as provided for under these regulations;
- Cut, damage, destroy, or deface any tree or other vegetation or any other animate or inanimate object without the written authorisation of the Officer-in-Charge;
- Wilfully or negligently cause a veld fire;
- Erect or modify any building, structure or facility, except with the written authorisation of the Director and any structure, building or facility not so constructed or modified may be demolished without compensation;
- Leave any moveable property and any property so left may be confiscated and sold by order of the Director;
- Bury, burn or leave any refuse of any kind except in accordance with the written instructions from the Officer-in-Charge or as provided for under these regulations;
- Leave any materials capable of causing a fire;
- Operate any radio or electronic equipment for the reproduction of sound or use any mechanical device which creates sound, in a manner likely to disturb another person or the animal life in the national park or game reserve except the normal use of motor vehicle, an aircraft or a boat, or
- Interfere in any way with or feed or provide food or water for any animal except as may be authorised in writing by the Director or where any provision of food or water by the DWNP is necessary for the survival or management of animals.

3.2.15 Community Based Natural Resources Policy (Government Paper 2 of 2007)

Rural livelihoods in Botswana are less dependent on arable and livestock-based agriculture that previously. Diversification of the rural economy is regarded as a major challenge and opportunity to fight poverty and sustain livelihoods. The Community Based Natural Resources Management (CBNRM) concept is founded on the premises that all members of a community share in interest in improving their livelihoods through sustainable management and utilisation of natural resources in their surroundings. The CBNRM Policy is intended to guide and facilitate the strengthening of, and support to, existing and future CBNRM activities. The objectives of the Policy are to:

- Specify land tenure and natural resources user rights, which may be devolved to communities;

- Establish a framework that provides incentives for communities to manage natural resources in a sustainable manner;
- Create opportunities for community participation in natural resources management;
- Promote conservation and CBNRM strategies that are based on sound scientific principles and practices;
- Enhance the relationship between protected areas' management and CBNRM;
- Protect the intellectual property rights of communities with regard to natural resources and the management of such natural resources;
- Encourage communities to participate meaningfully in the monitoring of CBNRM;
- Facilitate capacity building within communities to engage in natural resources-based tourism, and
- Promote communication, education and public awareness on CBNRM.

The Ministry of Environment, Wildlife and Tourism are responsible for co-ordinating and overseeing the implementation of the Policy and guidelines will be prepared to support its implementation.

In terms of the Policy, communities may obtain a 15-year Community Natural Resource Management Lease from the relevant Land Authority for the commercial use of natural resources and may receive benefits from the use of the natural resources in the area specified in the lease.

3.2.16 Botswana National Biodiversity Strategy and Action Plan (2004)

The Botswana National Biodiversity Strategy and Action Plan (NBSAP) were compiled in respect of the Convention on Biological Diversity, to which Botswana is a signatory. The objectives of the Strategy are:

- To gain a better understanding of biodiversity and the ecological processes within the country;
- To provide for the long-term conservation and management of the country's biodiversity and resources;
- To promote the efficient and sustainable utilisation of all components of biodiversity through appropriate land and resource use and management;
- Appropriate valuation of biodiversity and raised public awareness on the role of biodiversity in sustainable development;
- Public participation in biodiversity-related activities and decision-making;
- Fair access to biological resources and equitable sharing of benefits arising form the use of these resources;
- Safe industrial and technological development and other services based on national biodiversity resources for future prosperity;

- Improved availability and access to biodiversity data and information and the promotion of information exchange;
- Recognition of the country's role with regards to biodiversity, and
- Implementation of the NBSAP.

As part of the SEIA undertaken for the GDMP, detailed ecological investigations are being undertaken (refer to Appendix 2) in which an assessment of the proposed development's operations on the biodiversity of the area is being undertaken.

3.2.17 Agricultural Resources Conservation Act 39 of 1972

The Act *inter alia* makes provision for the conservation and improvement of the agricultural resources of Botswana. 'Agricultural resources' means the following matters in their relation to agriculture:

a) The soils of Botswana;
b) The waters of Botswana;
c) The plant life ad vegetation and the vegetable products of the soil;
d) The animal life and fauna, including animals, birds, reptiles, fish and insects;
e) Any other thin as may be declared to be an agricultural resource.

The Act establishes the Agricultural Resources Board, Conservation Committees and Subordinate Conservation Committees, defining their functions and powers. The principal function of the Board is to exercise supervision as provided in this Act over the agricultural resources of Botswana. To conserve or protect agricultural resources, the Board may issue orders to owners and occupiers of land to adopt certain measures, and it may make Regulations to regulate agricultural land use practices in areas designated thereby.

3.2.18 Agricultural Resources Conservation (Harvesting of Veld Products) Regulations

Regulation 3 states that no person may, in Botswana, harvest[7] any veld product[8] for any purpose other than for domestic use unless he or she has obtained the written permission of the Agricultural Resources Board or any person authorised by the Board.

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[7] "harvesting" means cutting, burning, uprooting, transplanting, cultivating, digging up and collecting.

[8] "veld product" includes (Mosukudu - Lippia scaberrima), (Mosukujane - Lippia javanica), (Lengana - Artemisia afra), (Mahupu - Terfezia pfeilii), (Tlhokabotshwaro/ Sekopane/ Seboka - Hoodia species), (Mokolwane / Fan Palm - Hyphane pertesiana), (Monna-o-nkgang/ Gala la tshwene - Myrothamnus flabellifoliuos), (Letlhaka/ Reeds - Phragmite australis), (Kombi/Poison vine - Strophanthus kombe), (Mhetola/Indigo (basket dyes) - Indigofera species), (Phane - Imbrasia belina), (Mogorwagorwane), (Morula fruits - Sclerocarya birrea), (Mmupudu fruits - Mimusops zeyheri), (Mmilo fruits - Vangueria infausta), (Motsintsila fruits - Betchemia discolor), (Mogwana/Moretlwa - Grewia species), (Morojwa - Azanza garckeana), (Motshikiri - Eragrostis pallens), (Mogorwagorwana - Strychmos Cocculoides), (Monepenepe - Cassia Abbreviate), thatching grass, fire wood/dikgong or their parts or by-products.

3.2.19 Herbage Preservation (Prevention of Fires) Act of 1978

The Act provides for the control of bush and other fires. In the event that the mining operation requires a fire event for bush clearing purposes, the written permission of the Herbage Preservation Committee must first be obtained. In such instances, the mine may only set fire to any vegetation on land which it owns or is lawfully occupying.

It should be noted that it is not anticipated that any burning will take place at the GDMP Site, however, in the event that it does, the above will apply.

3.2.20 Atmospheric Pollution (Prevention) Act 18 of 1971

The Act provides for the prevention of the pollution of the atmosphere by industrial processes. Industrial processes are defined as "*any process prescribed by the Minister which is involved in any trade, occupation or manufacture devoted to production by physical, mechanical, electrical, chemical or thermal means, including any process involving metallurgical operations, operations for the generation of power, and ancillary operations*". A registration certificate is required to carry on industrial processes within a controlled area which are capable of causing or involving the emission of objectionable matter to the atmosphere. Objectionable matter, as defined in the Act, includes smoke, gases including noxious or offensive gases, vapours, fumes, grit, dust or other matter capable of being dispersed or suspended in the atmosphere, and which is produced by any industrial process. Mining areas are generally declared to be controlled areas in terms of Section 7(a) of the Act, and it can therefore be assumed that the area proposed for the GDMP will be declared a controlled area by order published in the Government Gazette. An application for a registration certificate must be lodged with the Air Pollution Control Officer (APCO) in the prescribed form and must be accompanied by the prescribed information. As outlined in Section 10(1) of the Act, a registration certificate will specify the following:

- The situation and extent of the building or plant, or proposed building or plant, to which it relates;
- The nature of the industrial process intended to be carried out;
- The raw materials intended to be used, the nature of the operations to be carried out, and the products to be produced;
- The appliances to be installed and any other measures intended to be taken with a view to preventing or reducing to a minimum the escape of any objectionable matter to the environment, and
- The proposed measures for the disposal of effluents discharged from appliances installed.

In terms of Section 9(4), no registration certificate will be granted until such time as the APCO is satisfied that the industrial process to be undertaken may reasonably be permitted to be carried on in the location concerned. The operator of an industrial process for which a registration certificate has been issued must use Best Practicable Means (BPM) to prevent the escape of objectionable matter. This requires the provision and efficient maintenance of appliances necessary to prevent the escape of objectionable matter to the environment, the proper supervision of any operation in which noxious and offensive gases are evolved and the adoption of any other methods which, having regard to local conditions and circumstances, the prevailing extent of technical knowledge and the cost likely to be involved, may be reasonably practicable and necessary for the protection of any section of the public against the emission of objectionable matter.

In addition to the above, it must be noted that in terms of Section 8(1)(b) of the Act, no person may within a controlled area erect any building or plant which is intended to be used for undertaking industrial processes, without written authorisation from the APCO.

3.2.21 Tribal Land Act of 1968

Land administration in rural Botswana is regulated by the Tribal Land Act 54 of 1968, as amended. The Act inter alia governs access to, use and disposal of 71% of land in Botswana (i.e. communal land) and will have application to the GDMP insofar as certain components of the operation, e.g. the power line and the road, should the Lephepe route be recommended, will traverse tribal lands9. The duties and responsibilities of the Land Board, as outlined in Part III of the Act, include:

- Land allocation;
- Imposing restrictions on the use of land;
- Cancellation of land rights;
- Authorisation of the change of land use and transfer of land rights, and
- Hearing land disputes and appeals.

In terms of the Act, a land board may lease land to any person, together with ancillary rights, subject to such terms and conditions as it may determine and / or prescribe. The power-line (and accompanying servitude), proposed as part of the GDMP will traverse the Ngwato Tribal Land administered by the Ngwato Tribal Land. Accordingly, the Botswana Power Corporation (BPC) will be required to submit an application for the use of the land to the Ngwato Land Board prior to the development of the power-line.

In addition to the above, the proposed Lephepe access road to the mine will traverse through the Kweneng Tribal Land area administered by the Kweneng Land Board. At the eastern border of CKGR, the road will follow the District boundary in the form of a cut-line between the Central and

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[9] Accordingly, the public consultation process must ensure the inclusion of the affected tribal communities and land boards.

Kweneng Districts. The proposed cut-line is also between State-owned land (i.e. the CKGR) and Ngwato Tribal Land. Accordingly, GEC will be required to reach agreement with the Ngwato Land Board (as well as the Department of Land in respect of state-owned land) for the development of the proposed cut-line, the result of which may be that a lease agreement for the use of land may be required. The process to be followed in respect of the leasing of tribal land is prescribed in the Act.

3.2.22 Public Health Act of 1981

This Act provides for a wide range of health measures including Regulations pertaining to the prevention, management and control of diseases, cleanliness and sanitation, and the control of nuisances, and accordingly cognisance of its provisions will need to be taken in the construction and operation of the proposed mine. Part VII of the Act provides for the regulation of sanitation and housing, in terms of which no person may cause or allow a nuisance to continue on any land or premises which is likely to be dangerous or injurious to health. *Inter alia* the following are considered to be nuisances in terms of the Act:

- Any dwelling or premises or part thereof which is or are of such construction or in such a state or so situated or so dirty or so verminous as to be in the opinion of the health officer injurious or dangerous to health, or which is or are likely to promote the spread of any disease;
- Any street, road or part thereof, any stream, pool, ditch, gutter, watercourse, sink, water tank, cistern, water closet, privy, urinal, cesspool, soak-away pit, septic tank, cesspit, soil pipe, waste pipe, drain, sewer, garbage receptacle, dustbin, dung-pit, sewer, refuse pit, slop-tank, ash-pit or manure heap so foul or in such a state or so situated or constructed as in the opinion of a health officer to be offensive or to be injurious or dangerous;
- Any well or other source of water supply or any cistern or other receptacle for water, whether public or private, the water from which is used or is likely to be used for drinking or domestic purposes, and
- Any accumulation or deposit of refuse, offal, manure or any other matter whatsoever which is offensive or which is injurious or dangerous to health.

3.2.23 Botswana's Strategy for Waste Management, First ed., 1998

This Strategy for Waste Management was developed following recognition that historical practices for waste management were inadequate.

Waste is described in the Strategy as anything which is no longer useful and needs to be gotten rid of. It is defined by the type of place in which it is produced, i.e. household, industrial, mining, agricultural, etc. It categorises waste into hazardous[10] and non-hazardous wastes. The crux of the Waste Management Strategy is that waste management in Botswana must be undertaken in a manner which adequately protects human health and the environment, consistent with the affordability and available expertise of the country. The following principles, which are aligned to international principles, are central to the Strategy:

- The Principle of Prevention: Environmental pollution must be minimised as far as possible and measures should be taken before damage occurs.
- The Polluter Pays Principle: The costs of preventing, eliminating or compensating for damage to the environment must be borne by the party responsible.
- The Principle of Co-operation: Co-operation among all social groups is necessary in order to solve environmental problems.

In terms of the Strategy, the internationally accepted Waste Management Hierarchy is adopted. Central to the hierarchy is the principle of Integrated Waste Management (IWM), which is a holistic and integrated course of action that incorporates waste avoidance, the minimisation of the generation of waste at source (through reduction and/or cleaner production), recycling (reuse), waste collection and transportation, waste treatment and/or waste disposal (as a last resort), with the overall objective being to optimise and maximise the efficiency of waste management whilst minimising any negative impacts on the environment. Thus, IWM requires the following processes to be considered when managing waste, listed in order of preference (graphically presented at Figure 3 below):

- Waste Avoidance: i.e. the prevention and avoidance of the production of waste;
- Waste Minimisation: i.e. the economic reduction of the volume of waste during production (by means of different processes or clean technology)
- Waste Recycling, Re-use, Utilisation: i.e. in-house or external re-use or recycling of the wastes or use of the calorific value of the waste for energy use;
- Waste Treatment: i.e. the treatment of waste to reduce waste volumes or hazardousness; and
- Waste Disposal: i.e. the environmentally safe disposal of waste.

[10] Hazardous waste is waste which has the potential, even in low concentrations, to have a significant effect on public health or the environment because of its chemical or physical characteristics. It includes chemical wastes, clinical wastes, asbestos and other dangerous materials.

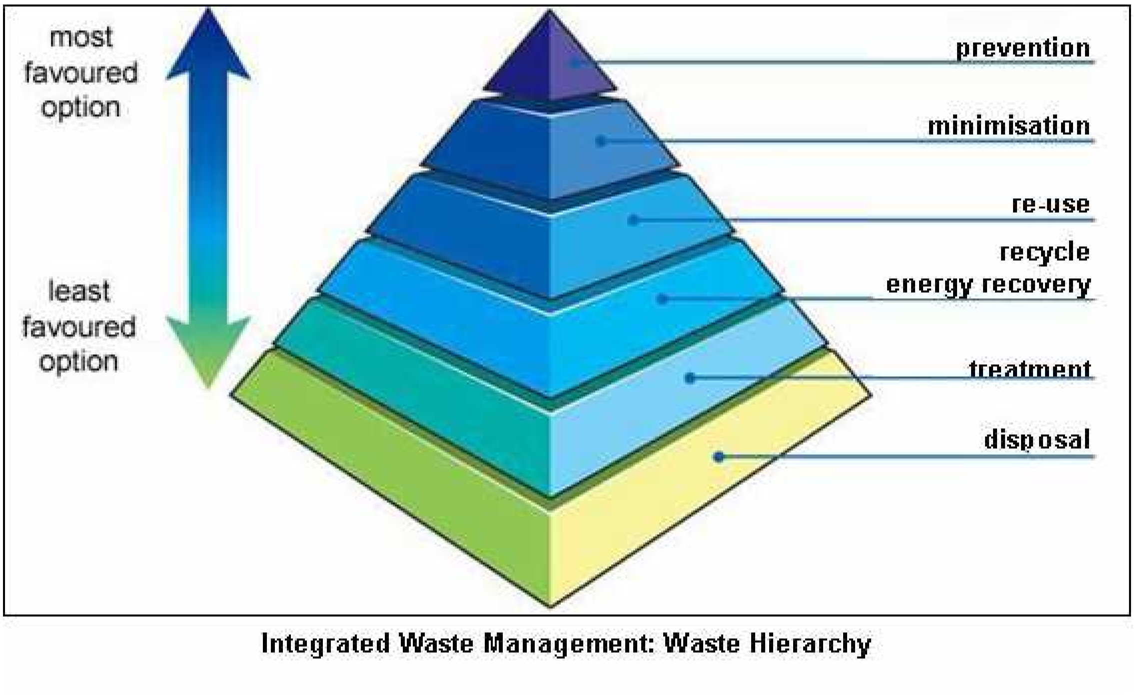


Figure 3: Waste Hierarchy inherent to Integrated Waste Management.

The Strategy furthermore states that for any particular type of waste generated, the Best Practicable Environmental Option (BPEO) must be established, taking into account the environmental and economic costs and benefits of the different waste management options. Essentially, therefore, the application of BPEO to waste management requires the analysis of alternatives. The preferred option is that which minimises harm to the environment as a whole, taking account of what is affordable and practicable.

Botswana's waste management objectives therefore consist of:

- Minimising and reducing wastes;
- Maximising environmental sound waste reuse / recycling, and
- Promoting environmentally sound waste collection, treatment and disposal.

3.2.24 Waste Management Act 15 of 1998

Arising out of the Strategy for Waste Management was a requirement to develop and implement appropriate legislation to control and regulate waste management within Botswana. The Waste Management Act 15 of 1998 provides for the management and control of waste in order to prevent harm to human, animal and plant life, and the environment, and to conserve natural resources. Waste is defined in the Act as "*the following substances and any combination thereof which are discarded by any person or are accumulated or stored by any person for the purpose of recycling –*

a) Undesirable or superfluous by-products;

b) Residue or remainder of any process or activity, and

c) Any gaseous, liquid or solid matter."

Given the above definition, mine process waste, including tailings, slurry and waste rock, is defined as waste, and must be therefore handled in accordance with the provisions of this Act. Section 14 of the Act states that no person may operate a waste disposal site unless such site is registered in terms of the Act. A waste disposal site is defined as a site "*for the accumulation of waste to be disposed of or treated and includes a mobile or immobile waste treatment plant, waste storage or transfer facility or landfill site*". As the requirements for the registration of waste disposal sites refers to waste and not to controlled waste (which includes clinical[11], commercial[12], household[13], hazardous[14] and industrial[15] waste), this may require that various waste management facilities to be operated by the GEC be registered as waste disposal sites, including tailings disposal facilities waste rock dumps, slimes dams, waste rock and sand overburden dump, temporary storage areas (i.e. salvage and sorting yards), transfer station and the sewage treatment plant need to be registered under this Act. Section 15, however, also outlines licensing requirements for waste management facilities used for the purposes of controlled waste management. A person managing controlled waste, however, may be exempted from holding a waste management facility license if the deposits of controlled waste being managed are small, innocuous or of a temporary nature, if adequate controls are provided under any other legislation or the person meets such requirements as may be prescribed by the Minister.

In terms of Section 12 of the Act, any person causing or effecting the movement of controlled waste within Botswana or the transboundary movement of such controlled waste is required to be registered as a waste carrier (i.e. is licensed to transport waste). Therefore, in the event that GEC transports any controlled waste from its operation, it will be required to register as a waste carrier. In the event that a contractor is used for such purposes, the contractor will be required to be so registered. An application for registration in terms of this section must be made in the prescribed manner.

[11] Waste which, unless rendered safe, may prove hazardous to any person, animal or plant coming into contact with it, arising from human or animal tissue, blood or other body fluids, excretions, drugs or other pharmaceutical products, radioactive materials, swabs or dressings, microbiological cultures and potentially infected waste from pathology departments or syringes, needles or other sharp instruments, or any other waste which may cause infection to any person, animal or plant coming into contact with it arising from medical, nursing, dental, veterinary, pharmaceutical or similar practice; investigation, treatment, care teaching or research; or the collection of blood for transfusion.

[12] Waste from premises used wholly or mainly for the purpose of a trade, business, sport, recreation, entertainment or as local or central Government offices, and excludes household waste, industrial waste or excavated waste from a mine or mine tailings impoundment as defined under the Mines and Minerals Act, save for that mine waste for which the Minister may prescribe a different categorization.

[13] Waste from any building used wholly for the purposes of living accommodation, a residential home or premises forming part of a university or school or other educational establishment.

[14] Controlled waste which has the potential, even in low concentrations, to have significant adverse effects on public health or the environment on account of its inherent chemical and physical characteristics, such as toxic, ignitable, corrosive, and carcinogenic or other properties.

[15] Waste from any premises used for the purposes of or in connection with the provision of public transport services by land, air or water, the supply to the public of gas, water or electricity or the provision of sewerage services, the provision to the public of postal or telecommunication services, forming part of a hospital or nursing home, or that are subject to a license to manufacture under the Industrial Development Act.

Part X of the Act relates to the application of the Basel Convention for the Control of the Transboundary Movement of Hazardous Wastes in Botswana (refer to Section 3.3.1 below for additional information). If it is required that that hazardous waste will be transported to South Africa for disposal, these provisions will apply to the mining operation. Should this be the case, GEC will be required to minimise the amount and the hazardous nature of the hazardous waste being generated at the Gope Project Site. Prior approvals, as required in terms of the Basel Convention, will be required prior to the transboundary movement of hazardous waste.

In terms of Section 49, hazardous or clinical waste, of a kind as may be specified by Order, must be collected, disposed of or treated in such manner as the Minister may prescribe, packed and clearly marked and labelled as may be prescribed, or conveyed by road, rail or over water, on motor vehicles or vessels whose design construction will be subject to the prescribed standards.
Thus, based on the above, the Waste Management Act will require the GEC to:

- Utilise a registered waste carrier for the collection and disposal of controlled waste;
- Ensure compliance with the provisions of the Basel Convention for the transboundary movement of hazardous wastes;
- Ensure that all waste generated by the mining operation is disposed of at a registered waste disposal site and that any waste disposal sites operated by the company are registered in accordance with the provisions of the Act;
- Ensure that all controlled waste generated by the mining operation is disposed of in a registered waste management facility;
- Locate waste disposal facilities and/or sites (e.g. rock waste dumps and slimes dams) away from water sources to avoid the risk of polluting them, and
- Undertake operations in a manner that will not result in the pollution of underground water resources.

3.2.25 Water Act of 1968

The Act makes provision for the ownership of and inherent right to the use of public water. Important definitions in this regard, as contained in the Act, are:

- *"Public water"* means all water flowing over the surface of the ground or contained in or flowing from any river, spring or stream or natural lake or pan or swamp, or in or beneath a watercourse and all underground water made available by means of works, but does not include any water which is used solely for the purposes of extracting mineral substances there from or water which have been lawfully appropriated for use;
- *"Underground water"* means water naturally stored or flowing below the surface of the ground and not apparent on the surface of the ground, and
- *"Public stream"* means a watercourse of natural origin wherein water flows, whether or not such watercourse or any portion thereof is dry for any period or whether or not its conformation has been changed by artificial means.

Section 4 of the Act states that there is no right of property in public water (i.e. it remains the property of the State). Subject to the provisions of the Act or other relevant legislation, the owner or occupier of land may, in terms of Section 6, perform the following without a water right:

- Sink or deepen a well or borehole and abstract and use water there from for domestic purposes, not exceeding any amount prescribed by the Minister in relation to the area in which the well or borehole is located (it should be noted that this provision does not authorise the sinking of any borehole within 236 metres of any other borehole, other than a dry borehole, or the deepening of any borehole which is within this distance of any other borehole);
- Construct any works on the land for the conservation of public water and abstract the use the water conserved for domestic purposes. However, the construction of any works in a public stream is not authorised unless:
  - The whole of the catchment area of the stream above the works lies within a distance of the works as may be prescribed by the Minister in relation to the location of the works, or in cases where no such distance is prescribed, within 4km of the works;
  - The Minister has prescribed that the stream (or part thereof) has been deemed not to be a public stream.

Section 7 regulates the right to water for mining purposes. The holder of a mining right has, in respect of the land to which the right relates, the same rights as detailed in Section 6 and may also abstract any use any underground water encountered in the workings and construct any works required for or in connection with the use of such water. The holder of any right to prospect may, within the area prospected (and subject to all rights which others may have to use water):

- Abstract and use for prospecting purposes any public water to which he has lawful access;
- Construct or enlarge any well or borehole in any land on which he has a right to explore or prospect and abstract water there from (not to exceed 22,750 litres per day), and
- Abstract and use any underground water encountered in any workings and construct any works required for or in connection with the use of such water.

Section 9 states that no person may divert, dam, store, abstract, use or discharge any effluent into, public water or for any such purpose construct any works, except with a water right granted in terms of the Act (unless existing rights were in place). Accordingly, water use rights would be required for the overflow or discharge of effluent water from the proposed processing plant at the GDMP and tailings facilities. Water rights are also required for boreholes to be such during the construction or operational phases of the GDMP. The Water Apportionment Board may grant to any person the water rights for such quantities, for such period (definite or indefinite) and for such purpose as specified in the water right, which is ordinarily subject to terms and conditions as per their specifications / conditions. Application for the grant of a water right is made to the Board through the Water Registrar (in the form prescribed in the First Schedule to the Water

Regulations as published in the Government Gazette on 6 September 1968). Any interested person may notify the Water Registrar within such period as may be prescribed that he or she objects to the grant of a water right. The Board will consider every application and any objections made to it and may grant such right as it considers appropriate, or it may dismiss the application. The Act also states that nothing in the right implies any guarantee that the quantity of water, as specified in the right, is or will be available.

As outlined in Section 17 of the Act, the following conditions are implied for every water right granted for *inter alia* mining or industrial purposes:

- That the water used will be returned, if reasonably practicable, to the stream or body of water from which it was taken or to such other stream or body of water as may be authorised by the Water Registrar;
- That the water will, insofar as the use to which it is put allows, be substantially undiminished in quantity, and
- That the water will not be polluted with any matter derived from such use to the extent as to be likely to cause injury either directly or indirectly to public health, livestock, animal life, fish, crops, orchards or gardens that are irrigated by the water, or to any product in the process of which such water is used.

Precautions must be taken by the holder of a right (to the satisfaction of the Water Registrar) to prevent accumulations in any river, stream or water course of silt, sand, gravel, stones, sawdust, refuse, sewage, waste or any other substance likely to affect the use of such water.

In terms of Section 36 of the Act, it is an offence to pollute any public water, or alter the flow of any public water, save under the authority of this Act or other written law.

3.2.26 Boreholes Act of 1976

In terms of this Act, a borehole means a well sunk by means of a rig or machinery, but does not include a well sunk by hand labour only in any of the Tribal Territories defined in the Tribal Territories Act.

As outlined in Section 3 of the Act, where any person contracts to sink or deepen any borehole on land belonging to, or occupied by, any other person, and the execution of the work is under the control of the contractor, the contractor will be deemed to be the person sinking or deepening the borehole.

Section 4 of the Act requires any person who, for the purpose of searching for or abstracting water, proposes to:

- Sink a borehole intended to reach a depth of more than 15 metres;

- Deepen an existing borehole of less than 15 metres so as to exceed 15 metres in depth;
- Deepen any exiting borehole of 15 metres or more in depth;
- Sink from headings a borehole intended to reach a depth or more than 15 metres below the surface, and
- Must, prior to the commencement of the activity, notify the Director of the Geological Survey of Botswana, of the intention to do so, and maintain a record of the progress of the work, which must include measurements of the strata passed through and of the levels and which water is struck and subsequently rests. Labelled samples of the superficial deposits and strata passed through must be taken at every change formation or in uniform formations at 3 metres, and must be kept in containers as supplied by the Director.

Section 9 of the Act states that the owner of any land on which a borehole is sunk or any person having title to the mineral rights thereof may give notice in writing within one month of the completion of the borehole to the Director, requiring him to treat as confidential any copy of or extract from the record required to be kept under Section 4, or any specimen taken under that section.

3.2.27 Waterworks Act of 1962, as amended

The Act provides for the establishment of water authorities in townships and other areas designated by the Minister as waterworks area, mandated with the responsibility of supplying water and other waterworks, as well as providing for the acquisition of existing waterworks and matters incidental thereto.

"Waterworks" means reservoirs, dams, weirs, tanks, cisterns, tunnels, adits, wells, boreholes, filters, settling tanks, purifying plants, conduits, aqueducts, mains, pipes, foundations, stand-pipes, hydrants, taps, pumps, engines and all other structures and appliances for obtaining, storing, purifying, conveying, distributing, measuring or regulating water.

The Minister is required to appoint a Waterworks Authority for every waterworks area declared under Section 4 of the Act. Waterworks areas are established where an undertaking for public water supply exists or where the Minister considers that such undertaking should be established. Powers and duties allocated to the Water Authorities for purposes of realizing waterworks for the supply of water are defined, and include the purchase, taking over and expropriation of waterworks. The following are offences in terms of the Act:

- Tampering with or wilfully or negligently injuring any waterworks, or any service through or with which water from the waterworks is supplied, or any meter installed by a Water Authority under this Act, or unlawfully drawing off, diverting or taking water from the same, or polluting or any such water, or allowing any foul liquid, gas or other noxious matter to enter into the waterworks or any pipe or fitting connected therewith;

- Wilfully or negligently misusing or wasting any water from the waterworks;
- Without the consent of the Water Authority, altering any service through which water is supplied to any premises;
- Altering any service with intent to avoid the accurate measurement or register of water by means of any meter;
- Using water supplied by the Water Authority for purposes other than those for which the water is supplied;
- Constructing or erecting any building or structure over any main or pipe laid by a Water Authority without the written permission of such Authority and subject to such conditions as such Authority may require for the protection of such main or pipe, and
- Supplying water to any other person except for use or consumption on those premises or for the purpose of extinguishing a fire, or with the approval of the Water Authority.

The proposed GDMP will not be obtaining water from a waterworks, as it will be abstracting groundwater for use in the mining operation. However, in the event that water will be received from a Water Authority in the future, the above provisions will apply.

3.3. MULTILATERAL ENVIRONMENTAL AGREEMENTS

3.3.1 Basel Convention on the Transboundary Movement of Hazardous Wastes

This international agreement was adopted on 22 March 1989 and entered into force on 5 May 1992. Its objectives are to reduce to a minimum the transboundary movements of hazardous wastes consistent with sound environmental management, to dispose of the hazardous wastes and other wastes generated as close as possible to their source of generation, to ensure strict control over the movement of hazardous wastes across borders and to prevent illegal traffic. Botswana ratified the Convention on 20 May 1998 (and has subsequently ratified the Convention's amendment and Protocol on Liability and Compensation). The Competent Authority in respect of the implementation of this Convention in Botswana is the Department of Sanitation and Waste.

In terms of the Convention, "wastes" are substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law. "Disposal" means any operation specified in Annex IV to the Convention, and includes the following disposal operations:

- Section A: Operations which do not lead to the possibility of resource recovery, recycling, reclamation, direct re-use or alternative uses:
  - Deposit into or onto land (e.g. landfill, etc.)
  - Land treatment (e.g. biodegradation or liquid or sludgy discards in soils, etc.)

- Deep injection (e.g. injection of pumpable discards into wells, salt domes of naturally occurring repositories, etc.)
- Surface impoundment (e.g. placement of liquid or sludge discards into pits, ponds or lagoons etc.)
- Specially engineered landfill (e.g. placement into lined discrete cells which are capped and isolated from one another and the environment, etc.)
- Release into a water body except seas / oceans;
- Biological treatment not specified elsewhere in Annexure IV which results in final compounds or mixtures which are discarded by means of any of the operations in Sections A;
- Physico-chemical treatment not specified elsewhere in Annexure IV which results in final compounds or mixtures which are discarded;
- Incineration on land or at sea;
- Permanent storage (e.g. emplacement of containers in a mine etc.);
- Blending or mixing prior to submission to any of the operations outlined in Section A of the Convention;
- Repackaging prior to submission to any of the operations in Section A;
- Storage pending any of the operations in Section A.

- Section B: Operations which may lead to resource recovery, recycling, reclamation, direct re-use or alternative uses:
  - Use as a fuel (other than in direct incineration) or other means to generate energy;
  - Solvent reclamation / regeneration;
  - Recycling / reclamation of organic substances which are not used as solvents;
  - Recycling / reclamation of metals and metal compounds;
  - Recycling / reclamation of other inorganic materials;
  - Regeneration of acids or bases;
  - Recovery of components used for pollution abatement;
  - Recovery of components from catalysts;
  - Used oil re-refining or other reuses of previously used oil;
  - Land treatment resulting in benefit to agriculture or ecological improvement;
  - Uses of residual materials obtained from any of the above Section B operations;
  - Exchange of wastes for submission to any of the Section B operations;
  - Accumulation of material intended for any operation in Section B.

Parties must prohibit or may not permit the export of hazardous wastes and other wastes to the Parties which have prohibited the import of such wastes (Article 4(1)(c)). It is furthermore prohibited, in terms of the Convention, to permit hazardous or other wastes to be exported to a non-Party or to be imported from a non-Party (Article 4(5)). All hazardous wastes and other wastes are required to be accompanied by a movement document from the point at which a transboundary movement commences to the point of disposal (Article 4(7)(c)) (Notification and Movement Documents).

For the purposes of the Convention, “hazardous wastes” subject to the provisions of the Convention are:

a) Wastes that belong to any category contained in Annex I , unless they do not possess any of the characteristics contained in Annex III ; and
b) Wastes that are not covered under (a) above but are defined as, or are considered to be, hazardous wastes by the domestic legislation of the Party of export, import or transit.

In addition to the above, wastes that belong to any category contained in Annex II to the Convention, and that are subject to transboundary movement, are “other wastes” for the purposes of the Convention.

Hazardous wastes or other wastes may only be imported subject to the written authorisation or permission of the Competent Authority, who may consent in a written form to the import of hazardous wastes and other wastes, provided the following conditions are met:

a) The exporting State is a Party to the Basel Convention or a Party to a bi-lateral, multi-lateral or regional agreement or arrangement regarding transboundary movement of hazardous wastes or other wastes in accordance with Article 11 of the Basel Convention;
b) It is not possible to dispose of the wastes within the territory of the exporting State in an environmentally sound and efficient manner or the wastes in question are required as raw material for recycling or recovery industries in the State of import, or the import is in accordance with an agreement or arrangement that conforms with the requirements of Article 11 of the Convention;
c) The request which complies with the requirements of part IV(2) has been received for a transboundary movement containing the information required by Annex V of the Basel Convention and the Competent Authority is satisfied with such information;
d) The labelling packaging and transportation identified in the notification conforms to the requirements of recognised international rules, standards and practices;
e) The specified approved site or facility is capable of managing and disposing of waste in an environmentally sound manner;
f) The disposer guarantees in his contract with the exporter the environmentally sound management of the wastes in question;
g) The disposer is obliged to inform the exporter, the Competent Authority of the State of export, and the Competent Authority of receipt of the hazardous wastes in question and, in due course, the completion of disposal as specified in the notification;
h) An adequate binding contract exists between the exporter and disposer specifying environmentally sound management of the wastes in question;

i) The importer and the disposer have a valid licence to deal with the categories of hazardous wastes or other wastes proposed for importation;

j) The generator, exporter, importer, disposer and carrier have appropriate insurance or other adequate financial guarantee;

k) The importer or any agent acting on his/her behalf are resident in the country of import, or in the case of a corporation, have a place of business in the country of import;

Transboundary movement procedures:

(a) Hazardous wastes and other wastes that are to be the subject of transboundary movement must be packaged, labelled and transported in conformity with generally accepted and recognised international rules and standards.

(b) Hazardous wastes and other wastes must be accompanied by a movement document from the point at which a transboundary movement commences to the point of disposal.

(c) Parties are required to take the appropriate measures to ensure that the transboundary movement of hazardous wastes and other wastes is only allowed if:

   – The State of export does not have the technical capacity and the necessary facilities, capacity or suitable disposal sites in or to dispose of the wastes in question in an environmentally sound and efficient manner;
   – The wastes in question are required as a raw material for recycling or recovering industries in the State of import; or
   – The transboundary movement in question is in accordance with other criteria to be decided by the Parties, provided those criteria do not differ from the objectives of this Convention.

Transboundary Movement between Parties (Article 6):

The State of export is required to notify, or requires the generator or exporter to notify, in writing, through the channel of the competent authority of the State of export, the competent authority of the States concerned of any proposed transboundary movement of hazardous wastes or other wastes. These notifications are required to contain the declarations and information specified in Annex V A.

The State of import must respond to the notifier, in writing:

- Consenting to the movement with or without conditions;
- Denying permission for the movement; or
- Requesting additional information.

A copy of the final response of the State of import must be sent to the competent authorities of the Party States concerned.

The State of export may not allow the generator or exporter to commence the transboundary movement until such time as it has received written confirmation that:

- The notifier has receive the written consent of the State of import;
- The notifier has received from the State of import confirmation of the existence of a contract between the exporter and the disposer specifying environmentally sound management of wastes in question.

Each State of transit which is a Party must promptly acknowledge to the notifier receipt of the notification. It may subsequently respond to the notifier in writing, within 60 days, consenting to the movement with or without conditions, denying permission for the movement, or requesting additional information. The State of export may not allow the transboundary movement to commence until it has received the written consent of the State of transit. If at any time a Party decides not to require prior written consent, either generally or under specific conditions, for transit transboundary movements of hazardous wastes or other wastes. If no response is received by the State of export within 60 days of the receipt of a given notification by the State of transit, the State of export may allow the export to proceed through the State of transit.

3.3.1.1 General Notification and Written Consent

The procedure for the notification of transboundary movements of wastes or other wastes forms the foundation of the control system of the Basel Convention.

The State of export may, subject to the written consent of the States concerned, allow the generator or the exporter to use a general notification where hazardous wastes or other wastes having the same physical and chemical characteristics are shipped regularly to the same disposer via the same customs office of exit of the State of export via the same customs office of entry of the State of import, and in the case of transit, via the same customs office of entry and exit of the State or States of transit.

The Parties must require that each person who takes charge of a transboundary movement of hazardous wastes or other wastes sign the movement document either upon delivery or receipt of the wastes. The disposer must inform both the exporter and the competent authority of the State of export of receipt by the disposer of the wastes and of the completion of the disposal as specified in the notification. If no such information is received within the State of export, the competent authority or the State of export, or the exporter, must notify the State of import.
Any transboundary movement of hazardous wastes or other wastes may be covered by insurance, bond or other guarantee as may be required by the State of import or any State of transit which is a Party.

3.3.1.2 Annex V A: Information to be Provided on Notification

1. Reason for waste export;
2. Exporter of the waste;
3. Generator(s) of the waste and site of generation;
4. Disposer of the waste and actual site of disposal;
5. Intended carrier(s) of the waste or their agents, if known;
6. Country of export of the waste its competent authority;
7. Expected countries of transit and its / their competent authority;
8. Country of import of the waste and its competent authority;
9. General or single notification;
10. Projected date(s) of shipment(s) and period of time over which waste is to be exported and proposed itinerary (including point of entry and exit);
11. Means of transport envisaged (road, rail, sea, air, inland waters);
12. Information relating to insurance;
13. Designation and physical description of the waste including Y number and UN number and its composition and information on any special handling requirements, including emergency provisions in case of accidents;
14. Type of packaging envisaged (e.g. bulk, drummed, tanker);
15. Estimated quantity in weight / volume;
16. Process by which the waste is generated;
17. For wastes listed in Annex I, classifications from Annex III: hazardous characteristic, H number, and UN class;
18. Method of disposal as per Annex IV;
19. Declaration by the generator and exporter that the information is correct;
20. Information transmitted (including technical description of the plant) to the exporter or generator from the disposer of waste upon which the latter has based his or her assessment that there was no reason to believe that the wastes will not be managed in an environmentally sound manner in accordance with the laws and regulations of the country of import, and
21. Information concerning the contract between the exporter and disposer.

3.3.1.3 Annex V B: Information to be Provided on the Movement Document

1. Exporter of the waste;
2. Generator(s) of the waste and site of generation;
3. Disposer of the waste and actual site of disposal;
4. Carrier(s) of the waste or his or her agent(s);
5. Subject of general or single notification;

6. The date the transboundary movement started and the date(s) and signature on receipt by each person who takes charge of the waste;
7. Means of transport (road, rail, inland waterway, sea, air) including countries of export, transit and import, also point of entry and exit and where these have been designated;
8. General description of the waste (physical state, proper UN shipping name and class, UN number, Y number and H number, as applicable);
9. Information on special handling requirements, including emergency provision in case of accidents;
10. Type and number of packages;
11. Quantity in weight / volume;
12. Declaration by the generator or exporter that the information is correct;
13. Declaration by the generator or exporter indicating no objection from the competent authorities of all States concerned which are Parties, and
14. Certification by disposer of receipt at designated disposal facility and indication of method of disposal and of the approximate date of disposal.

3.3.2 Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES)

CITES is a conservation tool which was adopted in 1973 and came to force on 01 July 1975. the objectives of CITES are to ensure, through international co-operation, that the international trade in species of wild fauna and flora does not threaten the conservation of the species concerned and to protect certain endangered species from over-exploitation by means of a system of import / export permits issued by a management authority under the control of a scientific authority. CITES operates by categorizing species into three appendices, as follows:

- Appendix I offers the highest protection and prohibits (with limited exemptions) the commercial international trade in wild-caught specimens of species threatened with extinction;
- Appendix II assigns the responsibility to exporting states to control, through a permit system, such trade in species which could become threatened with extinction if there were no such restriction, and
- Appendix III consists of species that have been put forward for protection by individual states.

Botswana acceded to this Convention on 4 November 1977 and it entered into force in 1978. The Convention is embraced by the fifth schedule of Wildlife Conservation and National Parks Act (refer to 3.2.13 above). This makes the Convention part of the national legislature. Thus, any international trade in specified animals and / or fauna by the GEC will require permission in terms of the Convention. Such animals include cheetah, brown hyena, wild cat, lion, leopard, aardvark, elephant, ostrich, Cattle Egret and Little Egret. The full list of fauna and flora, however, must be considered and the GEC must control the capturing and trading of such species within its mining concession area.

3.4. BOTSWANA BUREAU OF STANDARDS

The standards outlined hereunder have been developed by the Botswana Bureau of Standards (BOS), the official body responsible for all issues related to standardisation and quality assurance at the national level.

3.4.1 Botswana Bureau of Standards: Standard BOS 32: 2000 – Water Quality – Drinking Water – Specification

This standard specifies three classes of water, defined in terms of physical, organoleptic, chemical and microbiological constituents that are suitable as drinking water, and to which the GDMP will need to comply. Class I is closely comparable to current international standards for water quality and Class II is known to be acceptable for whole lifetime consumption. Class III specifies requirements that are considered to be the maximum allowable for short-term consumption[16]. Any determinant that falls within Class III is a potential problem that poses a health risk to consumers, and should only be used as an interim measure while efforts are being made to remedy the situation.

Water to be supplied to the mining operation for human consumption must comply with the requirements of Class I or Class II for lifetime consumption or with the requirements for Class III for short-term consumption, in relation to the physical, organoleptic and chemical requirements specified in Table 7 - Table 11. All classes of water must comply with the microbiological requirements specified in Table 7.

[16] Usual and continuous daily consumption for periods not exceeding one year.

Table 7: Physical and Organoleptic Requirements.

DETERMINANDS	UNITS	UPPER LIMIT AND RANGES		
		CLASS I (IDEAL)	CLASS II (ACCEPTABLE)	CLASS III (MAX. ALLOWABLE)
Physical and organoleptic (aesthetic requirements)				
Colour	TCU	15	20	50
Conductivity at 25°C	µS/cm	700	1 500	3 100
Dissolved solids	mg/l	450	1 000	2 000
Odour	n/a	Not objectionable	Not objectionable	Not objectionable
pH value at 25°C		6.5 – 8.5	5.5 – 9.5	5.0 – 10.0
Taste	n/a	Not objectionable	Not objectionable	Not objectionable
Turbidity	NTU	0.5	5	10

Table 8: Chemical Requirements: Inorganic Macro-Determinants.

DETERMINANDS	UPPER LIMIT AND RANGES		
	Class I (Ideal) mg/l	Class II (Acceptable) mg/l	Class III (Max. Allowable) mg/l
Chemical requirements: Inorganic – Macro-determinants			
Ammonia as N	0.2	1.0	2.0
Calcium as Ca	80	150	200
Chloride as Cl	100	200	600
Chlorine residual	0.3 – 0.6	0.6 – 1.0	1.0
Fluoride as F	0.7	1.0	1.5
Hardness as $CaCO_3$	20	200	500
Magnesium as Mg	30	70	100
Nitrate as NO_3	45	45	45
Nitrite as NO_2	3.0	3.0	3.0
Potassium as K	25	50	100
Sodium as Na	100	200	400
Sulphate as SO_4	200	250	400
Zinc as Zn	3.0	5.0	10.0

Table 9: Chemical Requirements: Inorganic Micro-Determinants.

DETERMINANTS	UPPER LIMIT AND RANGES		
	CLASS I (IDEAL) MG/L	CLASS II (ACCEPTABLE) MG/L	CLASS III (MAX. ALLOWABLE) MG/L
Chemical requirements: Inorganic – Micro-determinants			
Ammonia as Al	100	200	200
Antimony as Sb	5.0	5.0	5.0
Arsenic as As	10	10	10
Cadmium as Cd	3.0	3.0	3.0
Chromium as Cr (total)	50	50	50
Cobalt as Co	250	500	1 000
Copper as Cu	1 000	1 000	1 000
Cyanide (free) as CN	70	70	70
Cyanide (recoverable) as CN	70	70	70
Iron as Fe	30	300	2 000
Lead as Pb	10	10	10
Manganese as Mn	50	100	500
Mercury as Hg (total)	1.0	1.0	1.0
Nickel as Ni	20	20	20
Selenium as Se	10	10	10

Table 10: Chemical Requirements: Organic Determinants.

DETERMINANTS	UPPER LIMIT AND RANGES		
	CLASS I (IDEAL) MG/L	CLASS II (ACCEPTABLE) MG/L	CLASS III (MAX. ALLOWABLE) MG/L
Chemical requirements: Organic determinants			
Total organic carbon	8 000	8 000	8 000
Total trihalomethanes	1 000	1 000	1 000
Phenols	10	10	10
Chloroform	30	30	30
Total pesticides[a]	5.0	5.0	5.0
Pesticide[b]	1.0	1.0	1.0
Poly-aromatic hydrocarbons	100	100	100
Benzene	10	10	10
Toluene	700	700	700
Xylene	500	500	500
Ethyl benzene	300	300	300

[a] The limit given is for pesticides that make up a certain group together. Therefore, the "total pesticides" refers to all the pesticides in that group of pesticides, such as carbamates pesticides, chlorinated pesticides, organo-phosphates pesticides, pyrethroids pesticides and atriazones pesticides.

[b] Pesticide refers to any one give pesticide, such as methoxychlor, DDT, etc.

Table 11: Microbiological Requirements.

DETERMINANTS	UNITS	ALLOWABLE COMPLIANCE CONTRIBUTION [1)]		
		95% min.	4% max.	1% max.
		Upper Limits		
Total Coliform	Count/100ml	Not detected	10	100
Faecal Coliform	Count/100ml	Not detected	1	10
Faecal streptococci	Count/100ml	Not detected	10	100

Note 1 If any Coliform bacteria are found in a sample, take a second sample immediately after the tests on the first sample have been completed. This shall be free from Coliform bacteria; and

Note 2 Not more than 5% of the total number of water samples (from any one reticulation system) tested per year may contain Coliform bacteria.

[1)] The allowable compliance contribution shall be at least 95% to the limits indicated in column 3, with a maximum of 4% and 1% respectively, to the limits indicated in columns 4 and 5. The objective of disinfection should, nevertheless, be to attain 100% compliance to the limits indicated in column 3.

3.4.2 Botswana Bureau of Standards: Standard BOS 93: 2004 – Water Quality – Waste water – Physical, Microbiological and Chemical Requirements – Specification

This standard specifies the physical, microbiological and chemical limits for wastewater that is to be discharged to the environment and is applicable throughout the country. It does not include trade effluent agreements[17].

Table 12: Physical and Microbiological Requirements.

DETERMINANTS	UNITS	UPPER LIMIT AND RANGES
Temperature	°C	35
Ph	-	6.0 – 9.0
Dissolved oxygen (min.)	% sat.	60
BOD_5 (max.)	mg/l	30
COD (max.)	mg/l	75 (filtered)
COD (max)	mg/l	150 (unfiltered)
Colour	TCU	50
Turbidity	NTU	30
Total dissolved solids (TDS)	mg/l	2 000
Total suspended solids (TSS)	mg/l	25
Faecal Coliform	Counts/100ml	1 000

Table 13: Chemical Requirements – Macro-Determinants.

DETERMINANTS IN MG/L, UNLESS OTHERWISE STATED	UPPER LIMIT AND RANGES
Free and saline ammonia (as N)	10
Ortho phosphate (as P) or soluble phosphate	1.5
Calcium as Ca	500
Chloride as Cl	600
Chlorine residual	1.0
Fluoride as F	1.5

[17] All industries and commercial activities linked to municipal sewage systems are required to enter into a Trade Effluent Agreement with the relevant Local Authority. These agreements regulate the amount of effluent discharged and the payment to be made in respect of the discharge of such effluent to the system.

DETERMINANTS IN MG/L, UNLESS OTHERWISE STATED	UPPER LIMIT AND RANGES
Nitrate as N	22
Potassium as K	100
Sodium as Na	400
Sulphate as SO_4	400
Zinc as Zn	5.0
Note: Nitrate as N indicates the nitrogen component in the nitrate.	

Table 14: Chemical Requirements – Micro-Determinants.

DETERMINANTS IN MG/L, UNLESS OTHERWISE STATED	UPPER LIMIT AND RANGES
Arsenic as As	0.100
Boron as B	0.50
Cadmium as Cd	0.02
Chromium VI as Cr	0.25
Chromium as Cr (total)	0.5
Cobalt as Co	1.00
Copper as Cu	1.00
Cyanide as CN	0.100
Iron as Fe	2.00
Lead as Pb	0.05
Manganese as Mn	0.100
Mercury as Hg (total)	0.01
Nickel as Ni	0.30
Selenium as Se	0.02

3.5. INTERNATIONAL BEST PRACTICE STANDARDS

According to screening criteria used by various international lending institutions, the extent, duration and potential social and environmental issues associated with the proposed GDMP trigger the requirement for an SEIA to be undertaken. The content of the SEIA is determined by the identification of key issues and policy and legal approaches for addressing such issues. In the case of the proposed GDMP, various policies and legal drivers, including those of international lending institutions and Botswana legislative requirements, have shaped the methodology adopted for the purposes of the SEIA and the specialist studies being undertaken. The legal requirements have been discussed in more detail above.

In order to promote responsible environmental stewardship and socially responsible development, the proposed GDMP will, as far as is reasonably practicable, incorporate the environmental and social policies of the International Finance Corporation (IFC). These policies provide a frame of reference for international lending institutions to review of environmental and social risks of projects, particularly those undertaken in developing countries. Through the Equator Principles[18], the IFC's standards are now recognized as international best practice in project finance.

The IFC screening process categorises projects into A, B or C in order to indicate relative degrees of environmental and social risk. Category A projects are those that are expected to have "adverse impacts that may be sensitive, irreversible and diverse", (OD 4.01) with attributes such as direct pollutant discharges large enough to cause:

- Degradation of air, water or soil;
- Large-scale physical disturbance of the site or surroundings;
- Extraction, consumption, or conversion of substantial amounts of forest and other natural resources, and
- Involuntary displacement of people and other significant social disturbances. These impacts may affect an area broader than the site or facilities subject to physical works.

Accordingly, large-scale mining projects such as the proposed GDMP are categorised as Category A projects. The Environmental Assessment process for Category A projects examines the project's potential negative and positive environmental impacts and compares them with those of feasible alternatives (including the 'without project' scenario). Category A projects requires the most comprehensive SEIA approach and this is being undertaken for the GDMP.

In line with the above, scoping of issues to be addressed in the SEIA was conducted early in the assessment process so that the appropriate baseline information was collected and that the SEIA currently in processed is focused on the relevant issues. The IFC's Operational Policy (OP) 4.01 (replaced by Performance Standard 1 in April 2006), as well as other operational policies and the supporting Guidance Notes and Good Practice Publications, are being applied to the GDMP SEIA. In addition, policy directives that will be examined throughout the SEIA include the IFC

[18] Equator Principles are a voluntary set of guidelines for managing environmental and social issues in project finance lending. The signatories of the Equator Principles believe that adoption of and adherence to these principles offers significant benefits to the financiers, their customers and other stakeholders. These principles will foster the ability of financiers to document and manage their risk exposures to environmental and social matters associated with the projects they finance, thereby allowing them to engage proactively with their stakeholders on environmental and social policy issues. The adopting institutions view these principles as a framework for developing individual, internal practices and policies, and are doing so voluntarily and independently.

Performance Standards and Environmental, Health and Safety (EHS) Guidelines. The EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP), as defined in IFC's Performance Standard 3 on Pollution Prevention and Abatement Handbook (and are discussed in the relevant specialist studied undertaken, where appropriate). For the SEIA process, these IFC standards have been incorporated into the Scoping and Environmental Assessment Phases of this project.

3.6. KEY ENVIRONMENTAL AUTHORISATIONS

Arising out of the legal review are various authorisation requirements that will attach to the GEC should the proposed GDMP proceed. These key requirements are outlined in Table 15 below:

Table 15: Key Environmental Authorisations.

LEGISLATION	AUTHORISATION REQUIRED	LEAD AUTHORITY
Atmospheric Pollution (Prevention) Act 18 of 1971	Registration certificate to carry on industrial process	Air Pollution Control Officer
	Written authorisation for the erection of a building or plant intended to be used for undertaking industrial processes	Air Pollution Control Officer
Boreholes Act of 1976	Notification of the intention to sink or deepen borehole (for abstraction or searching for water) prior to the commencement activity	Director of the Geological Survey of Botswana
Environmental Impact Assessment Act 6 of 2005	Environmental Authorisation	Department of Environment and Conservation
Explosives Act of 1962	License for the storage of explosives in excess of prescribed quantities.	Chief Inspector of Explosives
Herbage Preservation (Prevention of Fires) Act of 1978	Written permission to set fire to any vegetation on land owned or lawfully occupied.	Herbage Preservation Committee
Monuments and Relics Act of 2001	Archaeological clearance certificate	Department of National Museum, Monuments and Art Gallery
National Parks and Game Reserves Regulations	Valid permit to enter or be within a game reserve	Department of Wildlife and National Parks
Waste Management Act 15 of 1998	Registration to operate waste disposal sites and waste management facilities	Department of Sanitation and Waste Management
	Registration as a waste carrier	
	Written authorisation for the transboundary movement of hazardous waste	
Water Act of 1968	Water rights to divert, dam, store, abstract, use, or discharge any effluent into, public water or for any such purpose construct any works	Water Apportionment Board

SECTION 4. DETAILED DESCRIPTION OF THE PROJECT

4.1. GDMP SITE PLAN

A layout of the GDMP site is provided in Figure 5 below. A description of both the physical infrastructure, as well as the processes is outlined in this section of the report.

4.2. ORE BODY

4.2.1 Introduction and Description

A cross section through the Gope Kimberlite is illustrated in Figure 4. This figure summarizes the local geology and mineralization of the orebody.

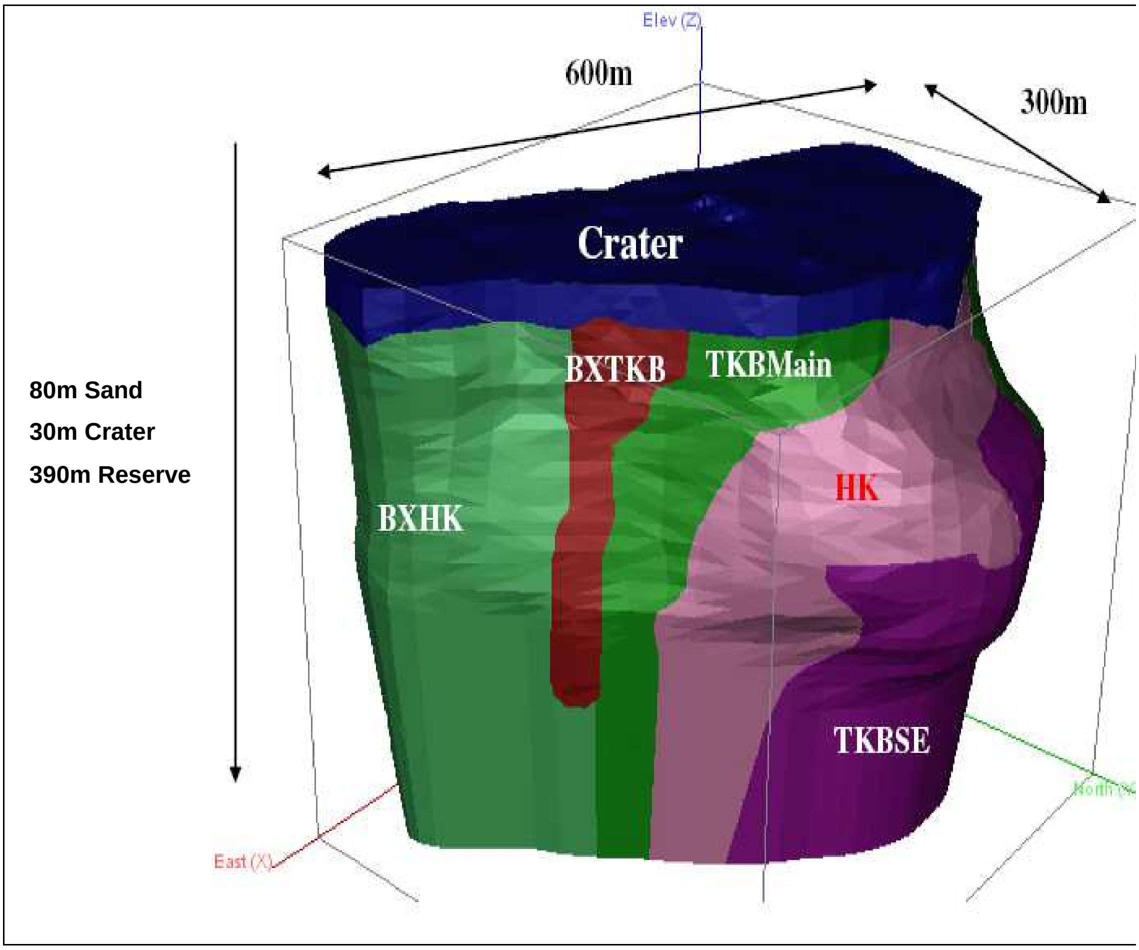


Figure 4: 3D Representation of the Ore Body.

Figure 5: Proposed Site Layout of the GDMP

Refer to fold out map.

The Gope Kimberlite lies beneath approximately 75m of Kalahari sand (Kalahari Formation). Only the upper 5-10m of the Kalahari Formation consists of loose, un-compacted sand as is observed on the surface; the remainder of the Kalahari Formation comprises variably calcified and silicified (hardened) sands. Below the pre-Kalahari surface the wall rocks of the Gope Kimberlite consist of Karoo basalt to 391m and Ntane sandstone from 391m to an unconfirmed depth. The surface topography is very flat with a maximum elevation difference over the Kimberlite of 1m.

Below the pre-Kalahari surface, the first Kimberlite pipe lithology to be intersected is a basalt mega-breccia which has been termed the 'Crater Facies' in the geological model and is interpreted to extend over the whole pipe area. This basalt mega-breccia is of very low diamond grade and does not constitute part of the mineral resource.

A major control on the diamond grade of the kimberlitic material at Gope is country rock dilution, in particular that of basalt. During the kimberlitic eruption process, country rock was incorporated into the Kimberlite magma in varying amounts, and thereby diluting the Kimberlite to differing degrees. The basalt mega-breccia, while representing a kimberlitic lithology that defined the original crater of the Kimberlite volcano, is simply a kimberlitic lithology that is dominated by angular basalt fragments and blocks. The high proportion of basalt within this facies has resulted in the very low diamond grades associated with this lithology.

This is quite unlike crater facies material from some other well known Kimberlite pipes with identified crater facies material such as at the Orapa and Williamson (Tanzania) mines where the crater facies material represents higher grade material. In these cases the crater facies material represents re-sedimented kimberlitic material which has concentrated diamonds through natural winnowing processes in the crater of the Kimberlite volcano. In the case of the Gope Kimberlite, the basalt mega-breccia represents country rock fragmental material that has collapsed into the crater subsequent to the Kimberlite eruption, displacing (and hence diluting) the Kimberlite in this region of the pipe. Re-sedimentation and upgrading of kimberlitic material was either absent at Gope or has been removed by erosive processes over time.

Below the Crater Facies, is the orebody proper. Five distinct Kimberlite facies (three tuffisitic Kimberlite breccia (TKB) facies and two hypabyssal facies) have been identified in the Gope orebody:

- Tuffisitic Kimberlite Breccia (TKB) Facies Rocks: TKB Main, TKB SE and BXTKB, and
- Hypabyssal Kimberlite (HK) Facies Rocks: HK and BXHK.

The three TKB Facies are distinguished by varying amounts of basalt breccia (country rock dilution). The TKM Main and TKB SE facies are distinguished essentially by differences in grade and to a lesser extent by density. The BXTKB represents a TKB facies with a high (average of 44%) basalt breccia content. The BXTKB consequently has the lowest diamond grade of the TKB

Facies rocks. The Hypabyssal Facies types are more variable, harder, have a higher density and are more resistant to weathering than the TKB facies types. The BXHK is differentiated from the HK facies type by its high (average of 48%) basalt breccia content and consequent lower diamond grade.

A summary of the types and location of the various kimberlitic facies at Gope is included in Table 16. It has been observed that, with increasing depth, the higher grade hypabyssal Kimberlite facies rocks (HK and BXHK) occupy increasingly larger volumes of the pipe, with the BXHK commonly dominating over the HK. The sub-cropping area of the pipe is 10.8ha. This area decreases to 6.3ha at a depth of 500m, although drilling has indicated a bulge in the pipe between a depth of 200m and 300m from surface. The pipe has an almost elliptical shape in plan view. While the orebody has been defined to a depth of 500m, it is believed that the ore body extends well beneath this depth (Venmyn, 2008).

Table 16: Description of the Ore Body.

<table>
<tr><th>GEOLOGICAL UNIT</th><th>LITHOLOGY / FACIES</th><th>FROM (m)</th><th>TO (m)</th><th>ABBRV.</th><th>DESCRIPTION</th><th>LOCATION</th></tr>
<tr><td rowspan="2">Kalahari Formation</td><td>Sand</td><td>0</td><td>5</td><td rowspan="2"></td><td>Unconsolidated, loose sand.</td><td>Overburden</td></tr>
<tr><td>Calcified or silicified sand</td><td>5</td><td>75</td><td>Hard, calcified or silicified.</td><td>Overburden</td></tr>
<tr><td rowspan="2">Karoo Supergroup</td><td>Basalt</td><td>75</td><td>391</td><td rowspan="2"></td><td>Tholeitic lavas (Jurassic in age)</td><td>Country rock</td></tr>
<tr><td>Ntane sandstone</td><td>391</td><td>N/A</td><td>Monotonous sequence of pink, buff and white fine to medium grained aeolian, sandstones.</td><td>Country rock</td></tr>
<tr><td rowspan="7">GO25 (Gope) Kimberlite</td><td>Crater</td><td>Min 74</td><td>Max 129</td><td>Crater</td><td>Basalt mega-breccia with altered tuffaceous matrix, cabonatised & silicified.</td><td>Top of pipe</td></tr>
<tr><td>Tuffisitic kimberlite breccia</td><td rowspan="6"></td><td rowspan="6"></td><td>TKB Main</td><td rowspan="2">Extremely homogenous mass of varying basalt dilution. 1-2% of larger (+10cm) basalt clasts. TKB is divided into two facies as a result of different grades and densities. No petrographic difference between the two facies. The contact is difficult to accurately define.</td><td>Remainder of pipe.</td></tr>
<tr><td>Tuffisitic kimberlite breccia</td><td>TKB SE</td><td>In the southeast.</td></tr>
<tr><td>Hypabyssal kimberlite</td><td>HK</td><td>Dark blue-grey colour and mottled with brick-red heamatised olivine. Contact with TKB is sharp but undulose. More variable, harder and more resistant to weathering than TKB. Average dilution from basalt is <10%. Carbonate veins present which increase up to 50% in proximity to BXHK. Two varieties of HK identified, 2nd variety has more garnet & ilmenite.</td><td>Northwest of pipe only. Increasing in volume with depth.</td></tr>
<tr><td>Basalt breccia with tuffisitic kimberlite matrix</td><td>BXTKB</td><td>TKB with a dilution of 44% basalt. Basalt blocks of up to 7m in size.</td><td>Northwest of pipe only.</td></tr>
<tr><td>Basalt breccia with hypabyssal kimberlite matrix</td><td>BXHK</td><td>HK with a dilution of 48% basalt. Highly variable occurrence of basalt up to 11m in size. Definition of HK & BXHK boundary difficult to define in some areas.</td><td>Remainder of pipe. Increasing in volume with depth, and over HK.</td></tr>
<tr><td>Basalt (Floating Reef)</td><td>Basalt</td><td>Basalt blocks which were large enough to warrant individual mapping.</td><td>Beneath crater facies.</td></tr>
<tr><td>Xenoliths</td><td></td><td></td><td></td><td></td><td>Mainly basalt, small amount of Karoo sandstones & shales and basement granites & gneisses. 100 mantle xenoliths recovered.</td><td></td></tr>
</table>

Source: Venmyn, 2008

4.2.2 Ore Resource Statement

The ore resource statement that was completed by Venmyn Rand (Pty) Ltd during 2008 as part of the Competent Persons Report (CPR) and is outlined below in Table 17.

Table 17: Gope 2008 Mineral Resource.

RESOURCE CLASSIFICATION	DEPTH (m)	FACIES	VOLUME (m^3)	DENSITY (t/m^3)	TONNAGE	REC. GRADE (cpht)	CONTAINED CARATS	VALUE (USD/ct)	BOTTOM SIZE CUT OFF (mm)
Indicated	Base of Crater - 300m	TKB SE	5,389,723	2.53	13,636,000	28.13	3,836,000	123	1.5
		TKB Main	8,524,291	2.47	21,055,000	16.95	3,569,000	143	1.5
		HK	2,522,008	2.59	6,532,000	20.15	1,316,000	123	1.5
		BXTKB	725,483	2.59	1,879,000	9.90	186,000	123	1.5
		BXHK	4,596,958	2.63	12,090,000	10.97	1,326,000	123	1.5
INDICATED TOTAL / AVE			**21,758,463**	**2.54**	**55,192,000**	**18.54**	**10,233,000**	**131**	**1.5**
Indicated	300 - 400m	TKB SE	2,203,396	2.65	5,839,000	29.47	1,721,000	123	1.5
		TKB Main	3,289,200	2.50	8,223,000	19.83	1,631,000	143	1.5
		HK	806,107	2.62	2,112,000	17.57	371,000	123	1.5
		BXTKB	76,923	2.60	200,000	18.50	37,000	123	1.5
		BXHK	2,785,171	2.63	7,325,000	13.84	1,014,000	123	1.5
INDICATED TOTAL / AVE			**9,160,797**	**2.59**	**23,699,000**	**20.14**	**4,774,000**	**130**	**1.5**
Indicated	400 - 500m	TKB SE	1,663,025	2.66	4,428,000	30.82	1,364,000	123	1.5
		TKB Main	3,033,428	2.50	7,577,000	19.00	1,439,000	143	1.5
		HK	395,952	2.62	1,037,000	15.89	164,000	123	1.5
		BXHK	2,006,629	2.62	5,257,000	17.50	919,000	123	1.5
INFERRED TOTAL / AVE			**7,099,034**	**2.58**	**18,299,000**	**21.25**	**3,889,000**	**131**	**1.5**
GRAND TOTAL / AVE			**38,018,295**	**2.56**	**97,190,000**	**19.44**	**18,896,000**	**131**	**1.5**

Source: Venmyn, 2008

4.3. Mining Method

4.3.1 Introduction

A trade-off study was undertaken during the Bankable Feasibility Study (BFS) to determine the most suitable mining method. Two options were considered:

- Open pit mining, and
- Underground mining using the block caving method.

A comparative analysis of these two options is discussed in Section 8.2.1.

The open pit mining method was selected based on the above mentioned investigation.

4.3.2 Description of Open Pit

Based on the current modelling of the orebody, the pit will reach a final depth of 500 mbgl. This will be achieved through mining the orebody through means of an east-west split shell design with two cuts being made in the pit. The surface area of the final pit will comprise 86,75 ha.

The following design criterion has been implemented:

- Bench Height – 12 m;
- Face Batter Angle – as close to vertical as is possible;
- Berm width;
- Slope Angle;
- Ramp width – 28 m upper benches; 25 m lower benches;
- Ramp Gradient – 10%, and
- Minimum bench operating width – 100 – 120 m.

The following material will be mined from the open pit:

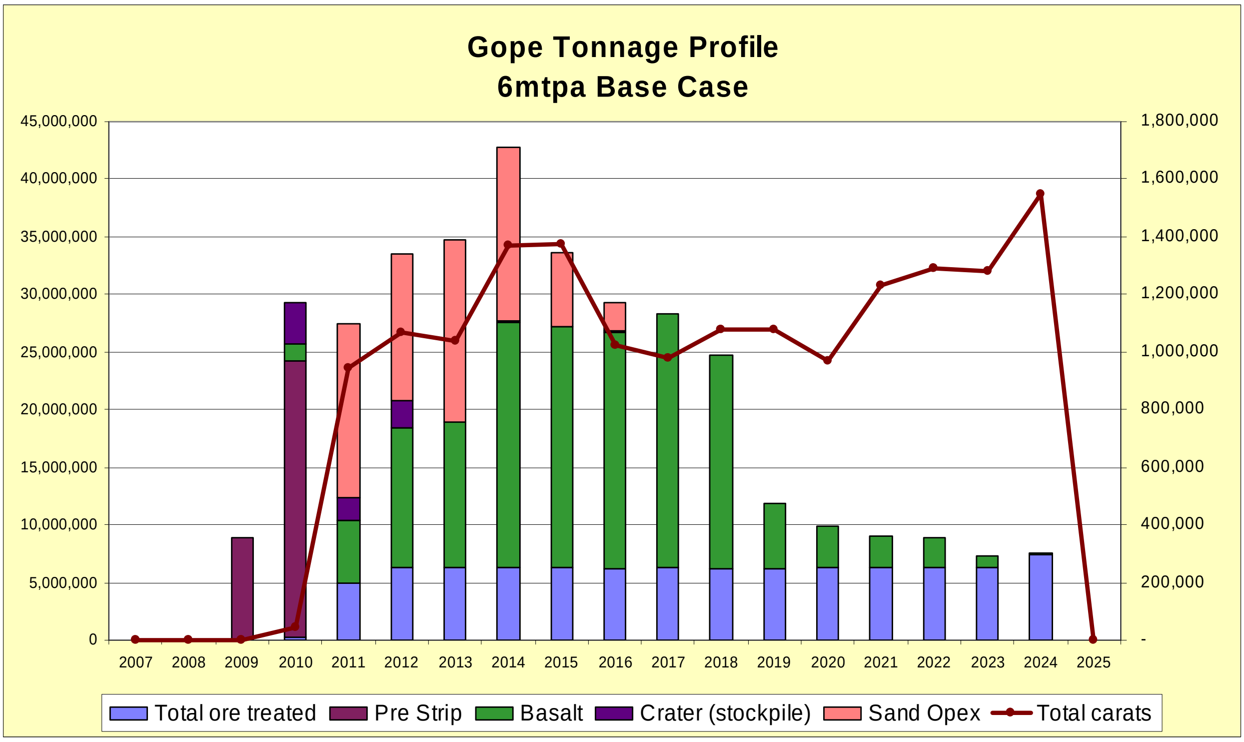
- Kimberlite (incl. dilution): 88,126,000 t
- Sand overburden: 100,408,000 t
- Waste material: 158,732,000 t

The open pit Life of Mine (LOM) covers the period from 2009 - 2023, however pre-stripping of the overburden is expected to begin in the year 2008. The pre-stripping is necessary to expose sufficient ore to create a six month exposed reserve. The pre-stripping will be conducted by using a fleet of hydraulic excavators and 40 ton Articulated Dump Trucks (ADTs). There is the possibility of extending the pit deeper this will be determined by further resource drilling and estimation and the economics of the day.

4.3.3 Planned Production Rate & Project Schedule

A production rate of 6 million tonnes of Kimberlite per year is targeted totalling 85.4 million tonnes of ore that will be processed through the plant over the mine's expected 15 years of production. The tonnage profile is indicated in Figure 6.

Figure 6: Tonnage Profile.



4.3.4 Final Mining Product

The final product will be uncut diamonds which would have undergone the acidisation process.

4.4. Proposed Surface Infrastructure

4.4.1 Mining Operations

Apart from the open pit operation itself, the following surface infrastructure will be associated with the mining operation.

4.4.1.1 Waste Rock & Sand Overburden Dumps

The following mineralogical waste material will be generated as a result of the open pit mining operation over the LOM and stockpiled:

- ~ 100 million tons of sand;
- ~ 9 million tons of crater material, and
- ~ 150 million tons of waste rock.

A portion of the sand and basalt will be used for construction material (roadways, slimes dams primary crusher and tailings dump ramps, construction pads, roads etc.). The remainder will be dumped on the Waste Rock and Sand Overburden dumps.

The Waste Rock Dump (WRD) is semi-circular in shape and is located to the east of the open pit. The sand dump is L-Shaped and is located to the west of the open pit. The inner toe of the waste rock and sand dumps fall outside the 100 m no-go zone as relevant to the theoretical outline of the double revenue pit.

The general characteristics of WRD are as follows:

Surface Area:	2.41 km^2
Total Volume:	153.7 Million m^3 – Basalt
Height of Dump:	50 metres
Side Slopes:	18º

The general characteristics of sand dump are as follows:

Surface Area:	1.73 km^2
Total Volume:	0.045 Million m^3 – Sandstone
	97.59 Million m^3 – Sand
Height of Dump:	50 metres
Side Slopes:	18º

4.4.1.2 Strategic Stockpile

A strategic stockpile will be located adjacent to the primary crusher tipping bin ramp and will accommodate ore equivalent to three weeks of operation based on the current plant design. Material from this stockpile will be used in case of production problems being experienced in the open pit as well as allow for the blending of ore when required.

The strategic stockpile will comprise approximately 350,000 t of material.

4.4.1.3 Crater Stockpile

The crater stockpile is generated from basalt breccia. The purpose of the stockpile is to store material, which could be processed at some future date should this become economically feasible. The stockpile is located directly to the west of the primary tip ramp.

The general characteristics of crater stockpile are as follows:

Surface Area:	167,428 m^2
Total Volume:	4.428 Million m^3 (7.97 Million Ton)
Height of Dump:	30 m
Side Slopes:	35º

4.4.1.4 Explosives Plant

Two explosives magazines will be constructed:

- Type A Explosives: Containing fracture explosives and detonating fuses, and
- Type B Explosives: Containing detonators.

The explosives magazines will be constructed as outlined in the Explosives Act CAP 24:02 Reg. 51-66.

4.4.1.5 Earth Moving Workshops

The Earth Moving Vehicles (EMV) workshops will include a temporary facility for the pre-stripping fleet, a daily service bay, main workshop, fuel and lubricant storage facility, offices and a washbay.

4.4.1.5.1 Sand Stripping Facility (Temporary):

The temporary sand stripping facility will comprise of the following:

- Porta-cabins / containers for offices and stores;
- Workshop structure / steel framed building with cladding on three sides and roof;
- One open service bay;
- Concrete apron for two vehicles, and
- Fuel and Lube facility.

4.4.1.5.2 Daily Service Bay (Mine Operations):

The daily service bay will comprise of the following:

- Offices;
- Workshop structure / steel framed building with cladding on three sides and roof (no crane), and
- One open service bay for CAT 785 Dump Truck.

4.4.1.5.3 Main Workshop (Mine Operations):

The workshop will comprise of the following:

- Seven service bays and repair bays for CAT 785 dump trucks with a floor area of 1,050 m^2;
- 20 ton gantry crane;
- Boiler maker bay;
- Tyre bay, tyre store & concrete apron;

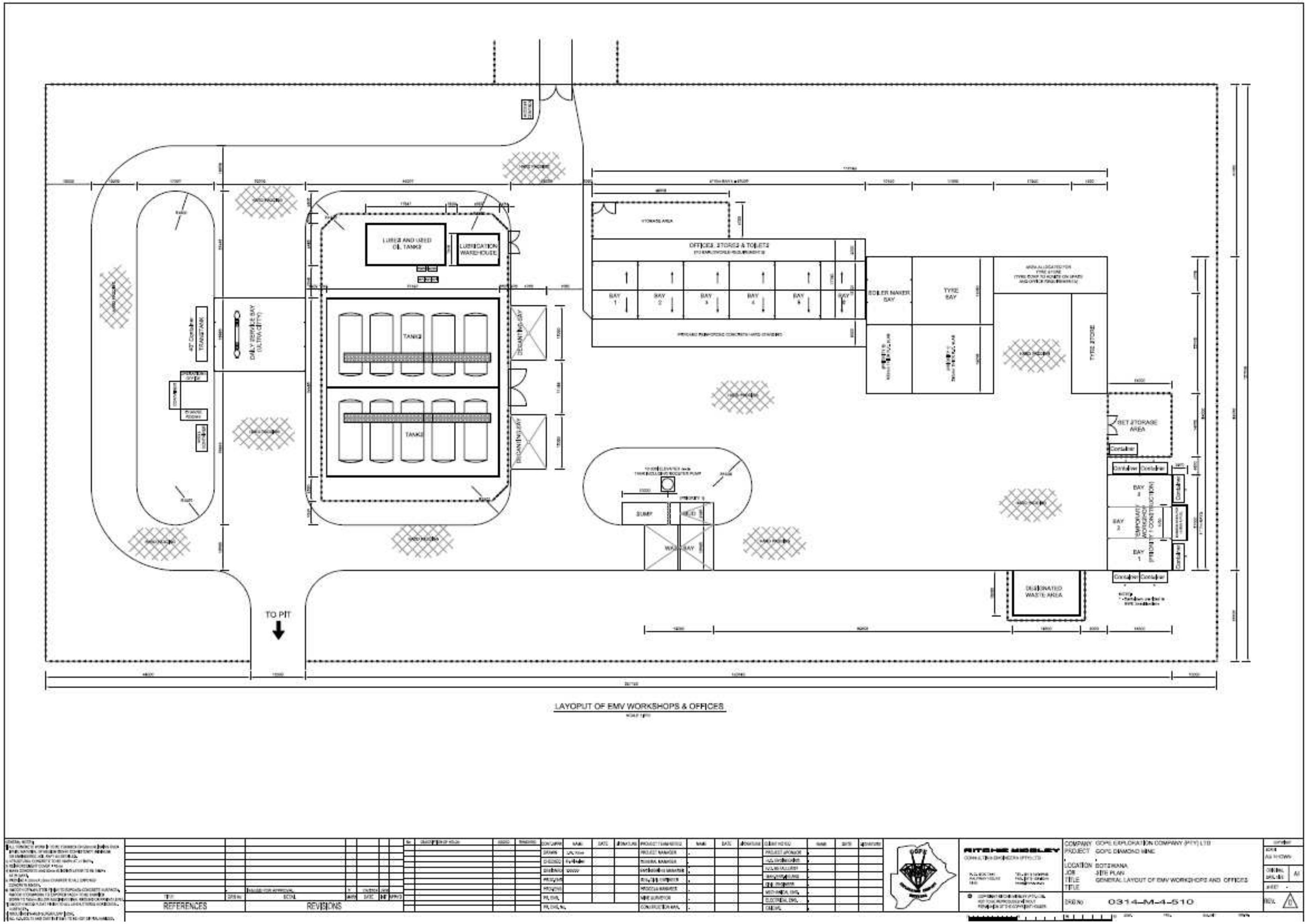


Figure 7: Layout of Workshops

- Prefabricated offices, stores and toilet facilities, and
- Compressed air will be required for tyre inflation.

4.4.1.5.4 Bulk Diesel and Lubricant Storage

A bulk diesel storage facility is required with a capacity of 1,000,000 ℓ based on the mining fleet and diesel generator usage calculations. This will ensure a stock for 16 day's consumption. The anticipated fuel consumption schedule is detailed in Table 18. The storage area is to be bunded in order to contain the tank capacity in case of a major spill.

Table 18: Anticipated Fuel Consumption.

YEAR	LITRES PER MONTH	LITRES PER DAY
2008	375,982	12,327
2009	1,260,653	41,418
2010	2,356,033	77,406
2011	1,480,175	48,630
2012	1,785,467	58,660
2013	1,797,467	59,054
2014	1,958,008	64,329
2015	1,820,675	59,817
2016	1,680,050	55,197
2017	1,680,050	55,197

Storage tanks for new oils are required next to the bulk diesel storage facility. The tanks, pumping equipment, metre, associated valves and hose connections are to be bunded collectively to contain spillage within the bunded area.

Bulk oil storage will be required for three types of new oils (viz. engine oil, hydraulic oil, and transmission oil) and each tank is to have a capacity of 25,000 ℓ. A bulk storage tank of 60,000 ℓ capacity will be required for old/used oil storage prior to the material being removed form the site by a certified contractor for recycling. This storage tank is to be bunded separately from the new oils.

4.4.1.5.5 Wash Bay

The wash bay will be 18 m long by 8 m wide with a reinforced concrete floor sloped towards a mud sump, with a drain leading into the mud sump. The wash bay will be surrounded by a reinforced concrete wall on three sides. The wall will be 750 mm high, 500 mm wide, and the floors capable of supporting a CAT 785 haul truck.

4.4.1.6 *Waste Rock Crusher*

A mobile waste rock crusher will be available on site in order to utilise waste rock as aggregate for construction purposes.

4.4.2 Mineral Processing Plant

The mineral processing flow diagram is presented in Figure 8.

4.4.2.1 *Introduction*

The relation of the mineral processing plant buildings, conveyors and ancillary buildings was determined, in principle, by the process engineers. Conveyor lengths and orientations were modified to suit the overall plant layout and to suit the TMF, slimes dam and recovery dump. Internal roads will provide access to the mineral processing plant and will be located on elevated plant terraces.

The mineral processing plant includes:

- Tipping bin area and primary crushing;
- Ore stockpile;
- Autogenous Milling;
- Classification and screening;
- Dense Medium Separator (DMS);
- Tailings disposal;
- Slimes disposal;
- Process water reticulation, and
- Recovery and sorthouse.

4.4.2.2 *Primary Crushing*

The primary crushing section consists of the following major items of equipment:

- Tipping bin: 300 t capacity;
- Apron feeder;
- Mineral sizer;
- Mineral sizer ore conveyor;
- Stockpile feed conveyor and weightometer, and
- Magnetic tramp material removal system.

Figure 8: Process Flow Diagram

Refer to fold out map.

The primary crushing facility comprises of a structural steel ROM receiving bin and apron feeder, which discharge onto the Mineral Sizer. The facility is approximately 12 m high with footprint area of 30 m by 6.8 m.

4.4.2.3 Autogenous Milling

The Autogenous Milling section will consist of the following major items of equipment:

- Stockpile tunnel;
- Two apron feeders: variable speed;
- Mill feed conveyor and weightometer;
- Metal detection;
- Autogenous mill;
- Trommel screen;
- Spiral classifiers;
- Classifier product screens;
- Pebble discharge conveyors and weightometer, and
- DMS feed conveyor and weightometer.

4.4.2.4 DMS Building

Modular DMS units will be required to process material supplied from the autogenous mill into a DMS Storage Bin Facility. Each DMS plant module will be supported on a bunded concrete raft type foundation with a separate foundation for the DMS Storage Bin. A pipe conveyor will supply concentrate from the DMS plant into the recovery building with tailings being discharged to the tailings dump via a conveyor.

The DMS section consists of the following major items of equipment:

- DMS feed bins;
- Three DMS weighfeeders;
- Three DMS modules, and
- Three concentrate transfer systems.

4.4.2.5 Recovery Building

A 25 m high, multi level structural steel building, will accommodate the diamond recovery equipment. This building will contain the following equipment:

- X-ray machines;
- Magnetic sorting machines;
- Grease tables;
- Sort house, and

- Acidising plant.

4.4.2.6 Recovery Tailings Stockpile

The recovery tailings are waste material emanating from the recovery process. The waste material is transported via conveyor running directly from the recovery building. The recovery stockpile will be included in the red area.

The general characteristics of recovery stockpile are as follows:

Total Volume:	200,000 m^3
Height of Dump:	20 m
Side Slopes:	35º
Density of material:	1.8

4.4.2.7 Tailing Management Facility

The TMF consists of the following major items of equipment:

- DMS tailings conveyor;
- Conveyor;
- Shuttle conveyor, and
- Spreader.

The general characteristics of TMF are as follows:

Surface Area:	72.14 Hectares
Total Volume:	21,227 Million m^3
Height of Dump:	50 metres
Side Slopes:	35º
Progression of tailings:	0.9 m per day
Density of material:	1.8

4.4.2.8 Slimes Dam

The slimes dam will comprise the following items of equipment:

- Slimes dam and slimes dam piping;
- Slimes disposal pumps and piping;
- Penstock system;
- Two return water dams, and
- Slimes dam return water pumps and piping.

The general characteristics of the slimes dam are as follows:

Surface area:	2.88 km^2
Total volume:	51.8 million tonnes
Final anticipated height:	20 m
Side slopes:	1:4, but no more than 18°
Density of material:	1.25 – 1.35
Progression rate:	285 375 tpm

The slimes dam will comprise four compartments, each with its own decant system. The decant systems will comprise of penstock systems, returning supernatant water to the two Return Water Dams (RWDs), located on the north and south of the slimes dam respectively. Returns of approximately 15 – 20% are expected and will be reused in the mineral processing plant.

The RWDs will be constructed below the natural ground level with a 1 m high embankment and depending on the findings of the detailed design phase, the RWDs may be lined with a 1,5 mm HDPE liner in order to minimise seepage, should this be required. The side slopes of the RWDs will be 1:3 with a crest width of 3 m. Each dam will be capable of containing 150,000 m^3 water and will be no deeper than 5 m.

4.4.3 Ancillary Infrastructure

4.4.3.1 Office Blocks

An administration office block has been allowed for, which will accommodate mine management and administrative staff, as well as the mine medical facility. The office complex will consist of offices, a conference room, a meeting room, ablutions and refreshment facilities.

4.4.3.2 Security Infrastructure

Security offices and facilities will be provided in a building adjacent to the recovery building, accommodating the mine security operations room, the surveillance room, and two offices for security supervision.

The main Gope Project Site, a portion of the MLA, will be enclosed with a 2.4 m high demarcation fence including a sterile patrol zone, cleared of vegetation, approximately 5 m wide, on the inside of the fence. A security access control point will be positioned at the entrance to the mine at the demarcation fence. This will prevent *bona fide* game reserve visitors entering the mine.

Botswana has a long history of diamond mining and therefore both local and international illegal diamond trading (IDT) syndicates, along with other criminal elements, have developed and have become increasingly sophisticated during this period. This provides the necessary incentive to develop and incorporate an effective and comprehensive security system at the GDMP in order to ensure that the diamond product will be adequately and economically protected.

The proposed strategy and systems are in accordance with the Botswana Precious and Semi-Precious Stones (Protection) Act (1969; as amended) and are based on the physical and ore processing designs conducted during the feasibility study.

The security philosophy and estimate are based on the following key assumptions:

- The GDMP will operate as an autonomous unit;
- The GDMP will have its own dedicated recovery plant and sorthouse, including an acid cleaning facility for the diamonds;
- All personnel will live on the mine in a single status camp and will be transported to and from the mine site at their relevant shift cycle change;
- All personnel and baggage will be subject to search when leaving the mine site;
- The GDMP personnel will be subjected to X-ray searching;
- The mine will be divided into three main security areas:
  - Green area: Main Access Road inside the fence and the drop of areas;
  - Blue area: complete mine area, excluding the main access road to the mine offices and service areas, airstrip, well field and any other outlying mine service areas, and
  - Red area: downstream from the DMS cyclone spigot boxes, concentrate transfer systems, the recovery plant and the sorthouse.
- Red Area personnel will be subject to search on exit;
- Diamond export will be either by helicopter or road;
- All personnel will carry card identification, and
- Access control to the red area will be via rules based access control system.

4.4.3.3 Roads

Three categories of mine roadway are envisaged:

- *Access Road:* This comprises the route from Lephepe through the CKGR to the Gope Project Site;
- *Haul Roads:* Haul roads carrying CAT 785 dump trucks and CAT 740 ADTs traversing from the open pit to the tipping bin and EMV workshops, and
- *Internal Roads:* General mine maintenance and access roads through the mineral processing plant, TMF and other infrastructure.

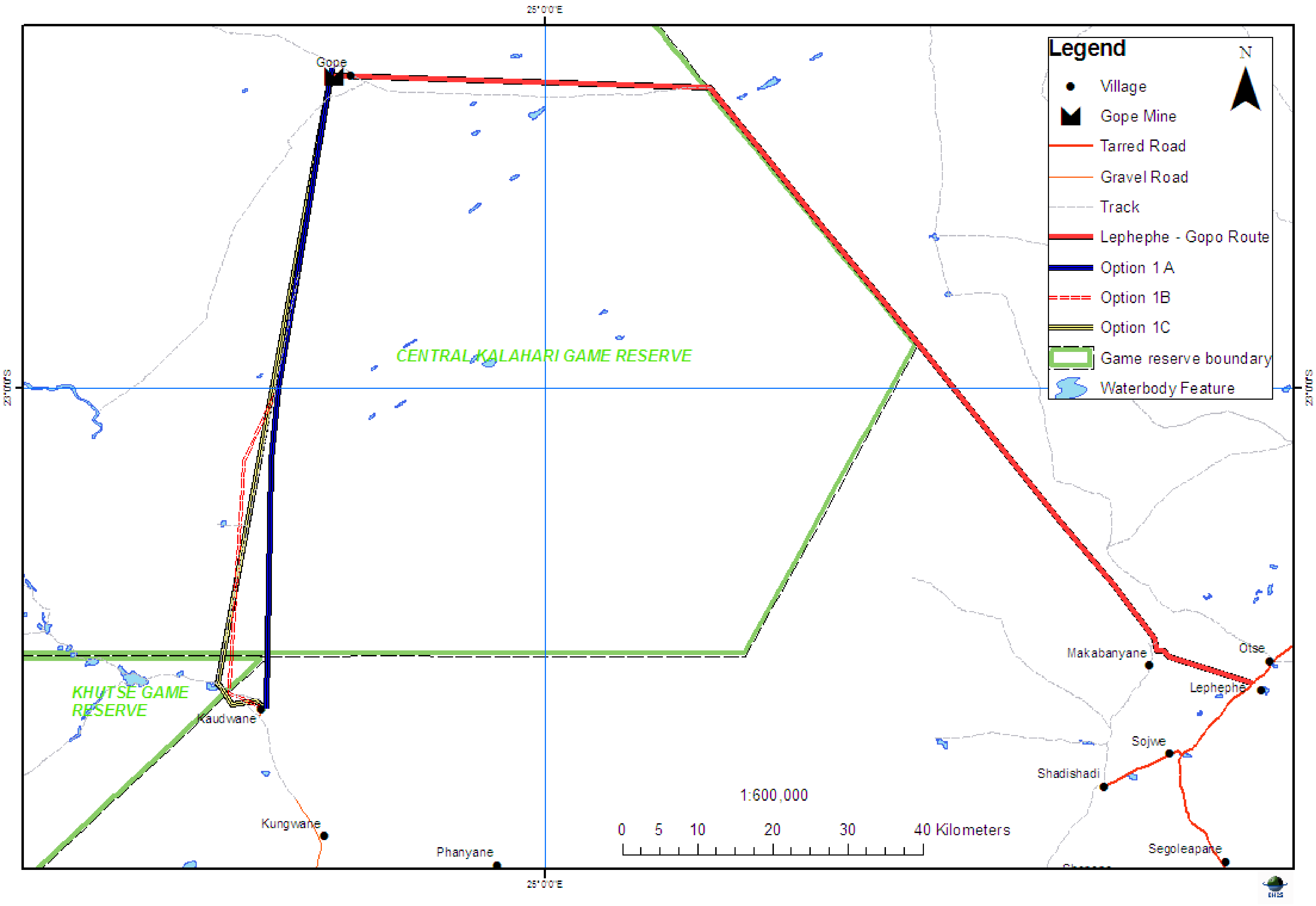
4.4.3.3.1 Access Road

The access road route is outlined in Figure 9, indicated by means of a red line. The route is subject to finalisation of detailed engineering investigations that will form part of the detailed design phase of the overall GDMP. This road runs from an intersection with the existing surfaced road at Lephepe, along the cut line to the start of the CKGR. Thereafter, the road runs along an unfenced edge of the CKGR up to 110 km from Lephepe, before turning west for 45 km into the CKGR.

An access control point will be established where the road turns into the CKGR and will be manned by staff appointed by GEC and provision will be made for staff of the DWNP to be present if required.

During the construction phase of the GDMP, the existing sand track will be widened and upgraded in order to enable the movement of large and often abnormally large vehicles with equipment. The road will be maintained by use of soil binding agents and water suppression for the duration of the construction phase. This will allow for the mining operation to commence as GEC would ideally like to utilise basalt from the open pit as aggregate for construction of the road. It has to be noted that various borrow pits have been preliminarily identified as part of the investigation conducted by EHES (Pty) Ltd.

Figure 9: Proposed Access Road Route



4.4.3.3.2 Haul Roads

Two haul roads will exit the open pit, both at least 28 m in width. The roads are generally to be elevated between 150 and 500 mm above natural ground level with a 2,5% cross grade to facilitate storm water drainage. Storm waterside drains, catch pits and culverts will be provided for storm water management.

4.4.3.3.3 Internal Roads

This includes roads carrying delivery vehicles, fuel bowsers and general traffic from the GDMP entrance gate to delivery destinations at the EMV workshop, mine stores, offices and the mine camp facility.

The internal mine roads have been designed as gravel wearing course roads based upon the available road building material and the soft compressible Kalahari sands, which need to be beneficiated to provide a stable foundation for the heavy equipment and dynamic loading conditions.

The roads will be treated with a combination of water and dust suppressing chemicals as an when needed in order to prevent dust generation.

4.4.3.3.4 Borrow Pits

The volume of Calcrete or other suitable material within the sand overburden to be excavated during the pre-stripping operation, has not been accurately defined. It is envisaged that this source of material, if proven suitable, will be utilised as the primary source of aggregate during the construction phase. In addition, once basalt becomes available from the open pit, this material will be utilised for construction purposes, as it will reduce the environmental footprint associated with the GDMP.

The excavated material will be utilised inter alia, for the following infrastructure:

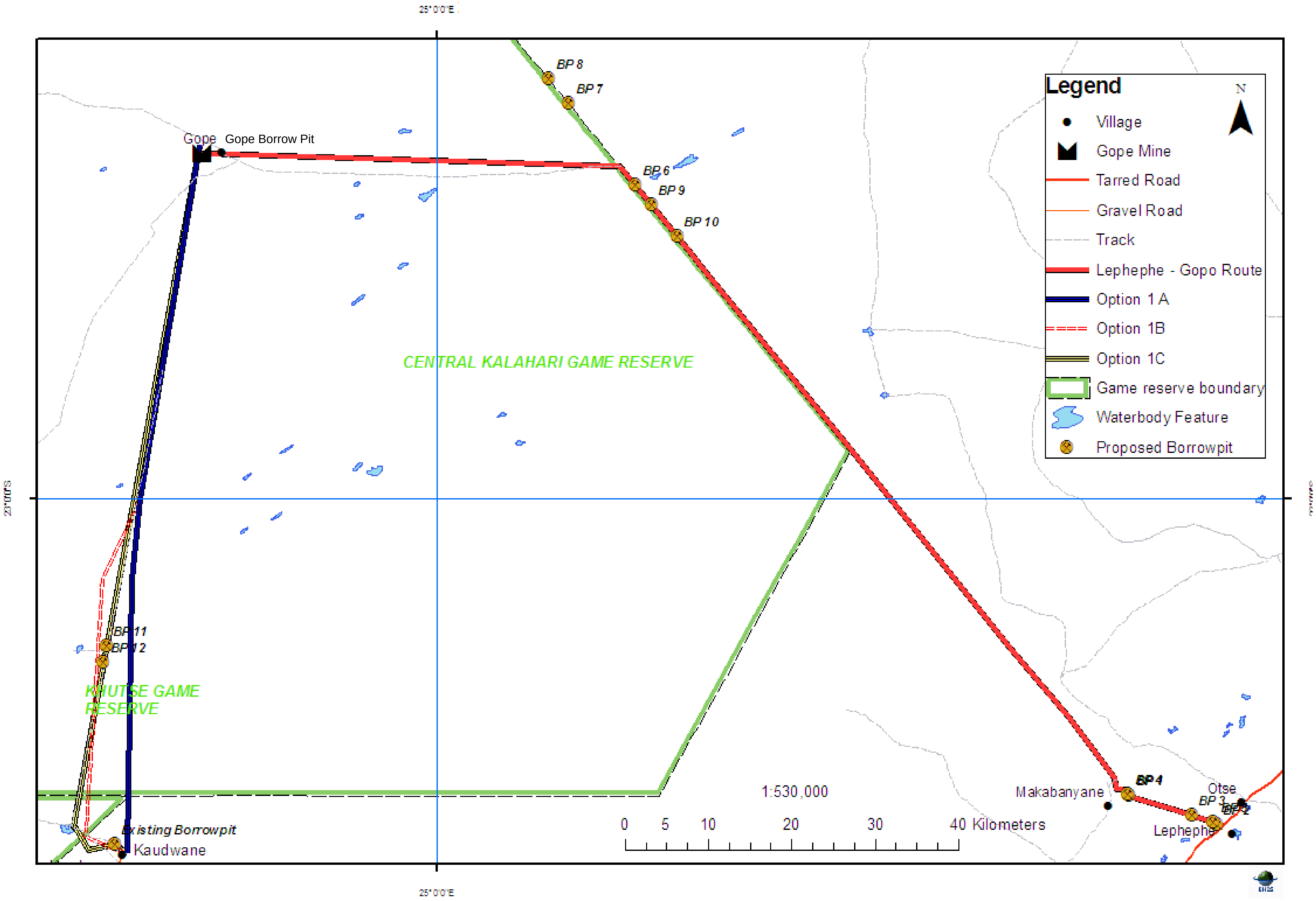
- Hard standing areas within the plant;
- Fill material;
- Air strip, and
- Access, haul and other internal road.

Until the quality and extent of the suitable material within the sand overburden have been proven and/or the basalt reached, some material will be required for the initial construction phase. For this reason, additional / potential borrow pits have been identified (refer to Figure 10):

- An existing borrow pit, previously utilised by DeBeers, is located some 14 km north west of the Gope Project Site;
- Five borrow pits have been identified in the area close to where the proposed access road turns westward into the CKGR. An additional four borrow pits have been identified in the Lephepe / Otse area.
- A further three potential borrow pit sites have been identified along the Kaudwane-Gope route, one of which is an existing facility, located outside both the CKGR and KGR. The remaining two borrow pits are located in close proximity to each other, approximately 15 – 20 km from the CKGR boundary;

Over the number of years that the existing Gope runway have not been utilised, the facility has fallen into disrepair. Therefore, GEC will utilise the surface Calcrete material from the runway as an additional source of Calcrete for the construction of the GDMP. Subsequent to the removal of the Calcrete, the runway will be seeded in order to ensure vegetative cover across the surface.

Figure 10: Location of Potential Borrow Pits along the Access Route



4.4.3.4 Recruitment Centre

Due to the remoteness of the Gope Project Site, GEC is planning to conduct recruitment for the GDMP from outside the CKGR and have selected Lephepe as the preferred location for the construction of this facility.

This decision was taken by GEC following the first round of stakeholder engagement meetings and subsequent to traversing the CKGR, and has also been informed by the decision taken regarding the location of the access road route.

The underlying recruitment philosophy of GEC is to screen candidates where they are. When a large number of applications are received from a specific centre / village, recruitment officers from GEC will screen such candidates at that location. Potential candidates will thereafter be requested to travel to Lephepe for the final interview process and pre-employment medical assessment.

4.4.3.5 Staging Camp

It is envisaged that a staging camp will be established at Lephepe for the main purpose of improving logistical efficiency for the transpiration of a large volume and number of goods to the Gope Project Site.

Scheduled deliveries will take place directly to Lephepe, where stock will be transferred to 6x6 vehicles for delivery to the GDMP. The general approach will be to minimise goods being held at Lephepe. In most instances, goods are to be transferred directly from the inbound vehicle to the 6x6 rigid flat decks.

The requirements for the staging camp design and layout was under assessment at the time of the compilation of this document, but may include, inter alia, the following facilities:

- Hard surface for:
  - Lay down area for sand, stone and other building materials;
  - Lay down area for container warehouse, and
  - Lay down area for break bulk items.
- Containers for the temporary safekeeping of sensitive items;
- Refrigerated containers for perishable goods;
- Office for the site / transport manager and assistant transport manager;
- Forklifts for handling of pallets and containers, and
- Accommodation and ablutions for candidates travelling to Lephepe for the final interview and pre-employment medical assessment and for new employees undergoing induction. In addition, delivery vehicle drivers will also be able to utilise these facilities.

The condition and timing of the construction of the main access road may alter these requirements.

4.4.3.6 Power Supply Infrastructure

4.4.3.6.1 Bulk Power (Power Line)

A new high voltage power line, 132 kV will be constructed to connect the GDMP to the BPC distribution grid in order to provide the project with permanent power supply. Two routes have been investigated; the first from Orapa (from a new substation) to Gope, and the other from Thamaga via Molepolole to Gope. The Orapa-Gope option was selected subsequent to the completion of the feasibility investigation (refer to section 8.3.2).

The total length of the Orapa-Gope power line will be 196 km. The route is outlined in Figure 11.

4.4.3.6.2 Temporary Construction Power (Diesel Generators)

Temporary construction power will be fed from diesel generators that will provide initial site power for site preparation. Thereafter a central generator power plant will be established at the GDMP to cater for the electrical load until bulk power is commissioned.

4.4.3.7 Mine Medical Facility

A mine medical facility has been included in the Gope Project Site, consisting of two consulting rooms, a trauma room, and a two-bed ward with bathroom facilities.

During construction, and prior to completion of the medical facility, a similar facility will be provided in the tented camp.

Figure 11: Orapa-Gope Power Line Route.

4.4.3.8 Mine Camp and Recreational Facilities

4.4.3.8.1 Introduction

The camp layout is depicted in Figure 12 below.

All employees and contractors of the GDMP will be accommodated in a single status camp on the Gope Project Site. At the peak, approximately 1,000 people will be housed at the Gope Project Site.

4.4.3.8.2 Accommodation Facilities

As stated above, the accommodation facilities will comprise a single status camp to those employed by GEC (direct / contractors). The accommodation facilities will accommodate 1,000 people, with approximately 600 housed in permanent structures, while 400 people will be housed in a tented camp. Approximately 800 people will be housed in tents during the phase where the accommodation structures are being built.

The permanent camp was designed based on the following principles:

- All employees will be assigned their own room;
- The camp buildings will be constructed from pre-fabricated building sections, and with a high standard of finish. It has to be noted that these pre-fabricated buildings will be free of asbestos components;
- Bulk services (water, sewage and electricity) will be provided;
- A kitchen and dining facility will service all employees, and
- Leisure facilities, including a wet mess facility, serving malt and wine.

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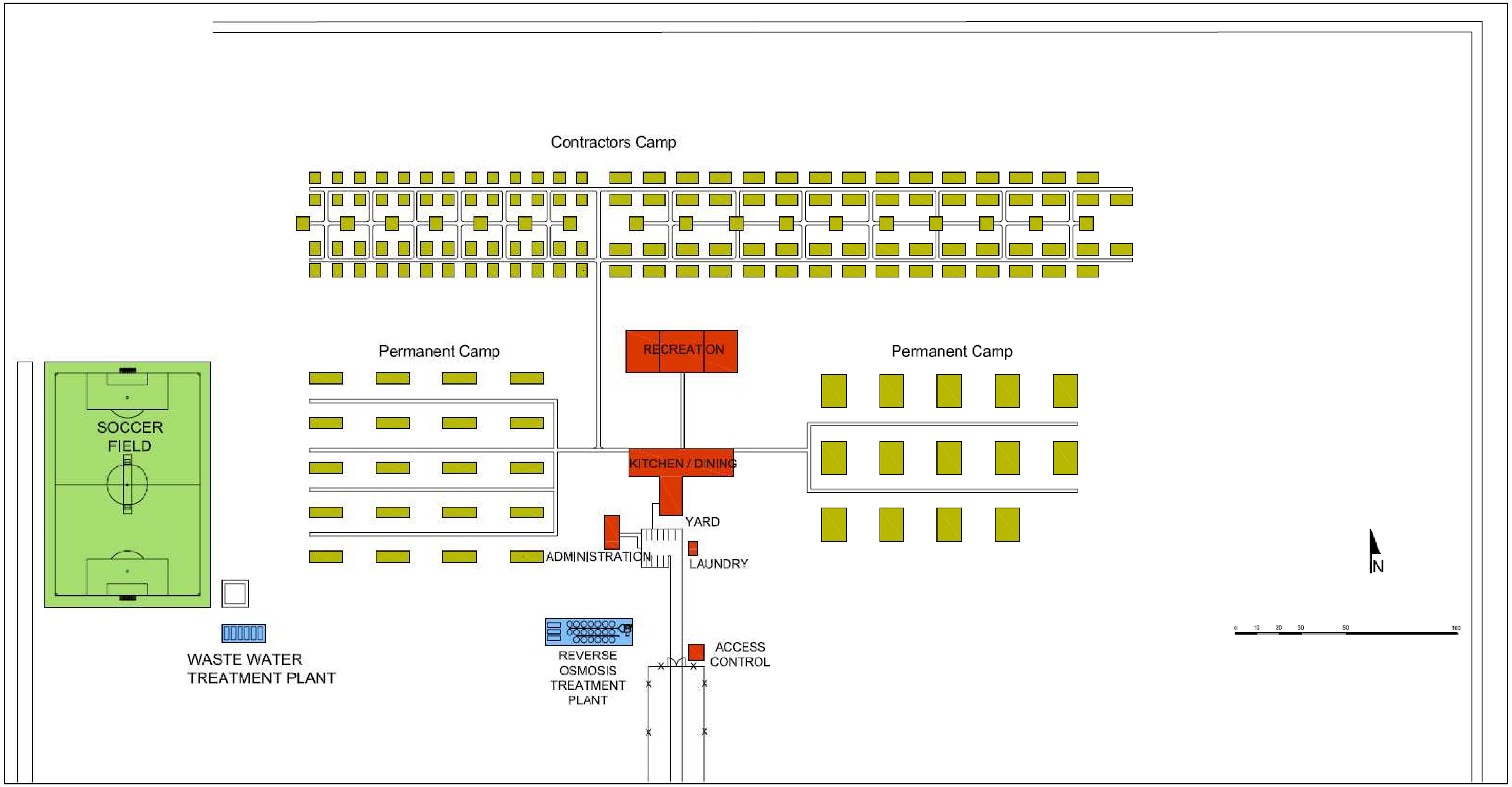
Figure 12: Camp Layout.



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- The camp buildings will be constructed from pre-fabricated building sections, and with a high standard of finish. It has to be noted that these pre-fabricated buildings will be free of asbestos components;
- Bulk services (water, sewage and electricity) will be provided;
- A kitchen (with a on-site bakery and butchery) and dining facility will service all employees, and
- Leisure facilities, including a wet mess facility, serving malt and wine.

Three types of permanent accommodation will be constructed out of pre-fabricated (non-asbestos containing) material, as outlined below:

- *Type 1:* A number of twelve bedroom blocks enclosing a common ablution facility, linked by a covered walkway and leisure area (the details of this configuration is to be confirmed in due course and an investigation is underway to evaluate the option of upgrading these units to shared ablution eight man units;
- *Type 2:* A number of four bedroom blocks, each bedroom having an en-suite bathroom and veranda area, and
- *Type 3:* A number of blocks containing two accommodation units, each consisting of a bedroom, en-suite bathroom, lounge / study and outside veranda area.

During the construction phase, temporary structures (tented type) will be erected to accommodate the estimated 1,000 people on site. These facilities will take the form of tented structures and are intended for early site accommodation, unskilled, semi skilled and artisan accommodation during the construction phase.

4.4.3.8.4 Recreational Facilities

In order to make the living environment as pleasurable for employees as possible, the following recreational infrastructure is planned:

- Recreation building (including DSTV, pool tables, darts and table tennis);
- Swimming pool;
- Gymnasium;
- Soccer field;
- Wet mess, and
- Volleyball court.

4.4.3.9 Sewage Systems

The domestic sewer system was designed as self-contained waterborne system that takes cognisance of the following:

- *Sewage Treatment:*
  - *Main Plant and Accommodation Camp:* To the variable volume and fluctuating load to be treated, a rotating disk package plant was selected.
  - *Secondary Plant:* At remote facilities such as the EVM workshop, mine offices and plant ablution facilities, a prefabricated mini sewage treatment plant, suitable of treating small, steady volumes of effluent is planned.
- *Sewage Pump Stations:* Modular, prefabricated pump stations are available on the market, ensuring fast installations. The pumps stations will have adequate emergency storage capacity and incorporate grinders, which are required to reduce solid waste to a suitable fluid to pump.
- *Sewage Reticulation:* The pipe reticulation system will consists of PVC pipes laid to falls suitable for gravity flow up to the pump station, manholes at junctions or at 80 m intervals and connection points into which the plumbing for each building will be connected.

4.4.3.10 Dewatering Infrastructure and Well Field

Groundwater abstraction during the construction phase will be centred on the proposed open pit with the purpose of lowering the groundwater table to ensure safe and dry mining conditions. Sixteen boreholes around the open pit and eight boreholes around the Kimberlite orebody are recommended for this purpose (refer to Appendix 4 for the full hydrogeological assessment report). The estimated volume to be abstracted is initially 35,000 m^3/day, although the volume drops to 9,000 m^3/day during the first three months.

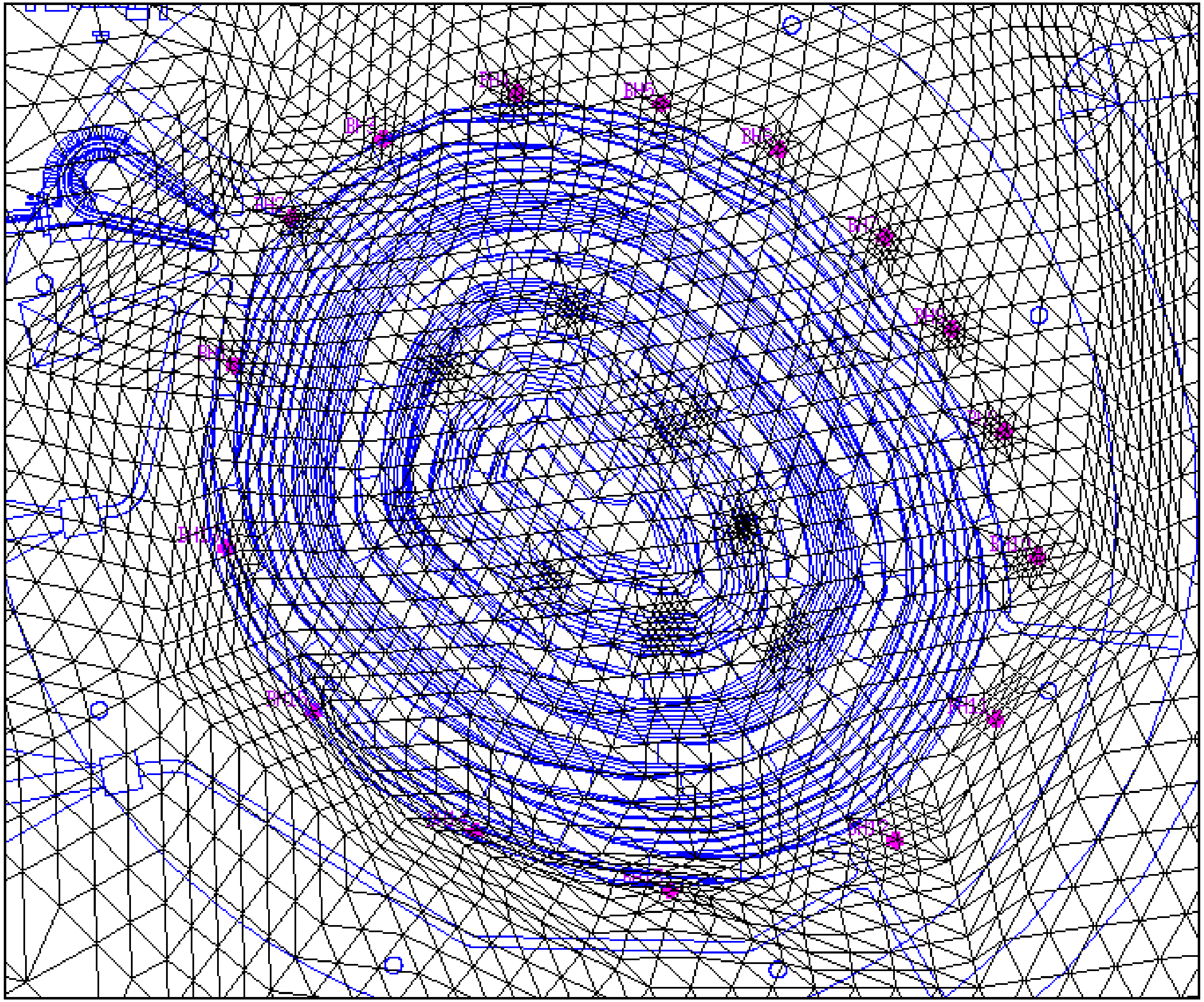


Figure 13: Proposed Placement of Open Pit Dewatering Infrastructure.

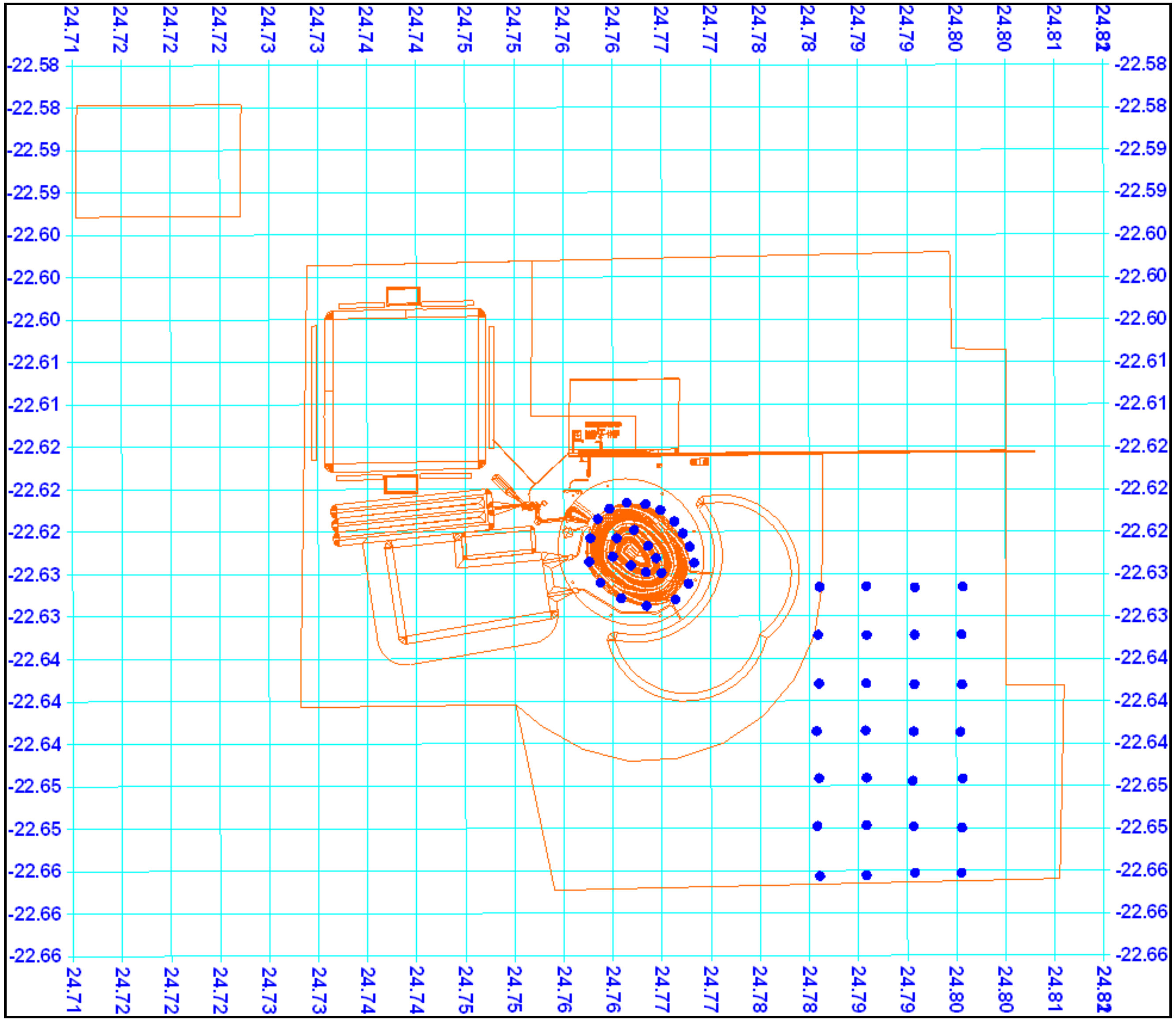


Figure 14: Proposed Well Field Layout.

Groundwater abstraction during the operational phase will be at it peak to ensure that the demand of 12, 584 m^3/day is met. To achieve this, dewatering boreholes will be supplemented with a well field consisting of an additional 28 boreholes. The proposed well field is located to the east and south of the GDMP, the boreholes are spaced 500 m apart and it is estimated that each will yield 250 m^3/day.

4.4.3.11 Water Treatment Facility

Potable water for domestic use (i.e. other than the mining and plant operations) was designed upon the following considerations:

- *Water Treatment Plant:* It is proposed that three, proprietary design, desalination plants using Reverse Osmosis (RO) will process produce potable water. Some water (~ 50 m^3/hr) may be treated for use in the plant (specifically for the X-ray and grease recovery units), but the plant will mainly consume raw water;
- *Water Storage and Booster System:* It is proposed that a 24-hour storage capacity of 150,000 ℓ be provided for in a tank farm comprising of JOJO type tanks to accommodate peak demand during the construction phase. The tank farm facility shall remain for the operational phase. A booster pumping system was designed to provide adequate pressure throughout the reticulation system, and
- *Reticulation:* The potable water reticulation was designed to adequately accommodate the domestic flow and the fire flow. Combining the domestic- with the fire reticulation system was necessary due to the corrosiveness nature of the raw water.

4.4.3.12 Airstrip and Heli-Pad

It is proposed that a new, 2 km long airstrip be constructed to the north east of the open pit within the MLA. The airstrip will have a north-east / south-west orientation and will be located adjacent to the main access road to the mine, away from the waste rock and sand overburden dumps. The original (registered) airstrip will be abandoned due to the encroachment of the sand waste rock dumps over parts of the runway.

A heli-pad will be constructed adjacent to the recovery building and will mainly be utilised for the safe transportation of diamonds from the site.

4.4.3.13 Waste Disposal Infrastructure

Waste material stored at the Gope Project Site as outlined below, will be transported off site at regular intervals, for disposal at an appropriately licensed landfill site, as there will be no landfill constructed at the site.

4.4.3.13.1 Bins, Separation and Internal Collection

Waste streams of different types and disposal destinations are to be separated and containers (bins, skips etc.) provided which shall be appropriately coloured and/or labelled to identify the permitted contents therein.

Each department / area is responsible for ensuring waste is separated and placed in the allocated receptacles.

The waste from the bins is transferred to the appropriate waste receptacle in the designated storage areas (Waste Storage Area of Salvage Yard) for further separation, treating (e.g. compacting) and preparing for on-site use or off site disposal.

4.4.3.13.2 Waste Storage Areas and Salvage Yards

Illustrations for the storage of wastes are included below. These illustrations are intended to guide the design and construction of the stores, and not to prescribe exact layouts. Each store will need to be constructed in such a manner that it will not impact on the environment, and more stringent controls applied to the storage of hazardous wastes (these requirements included below).

4.4.3.13.3 Salvage Yard

The following diagram illustrates the considerations to be taken into account when constructing the salvage yard. An area within the yard will be separated for the storage of hazardous wastes (oils, chemical containers etc.) and is to be sized appropriately to the GDMP's requirements.

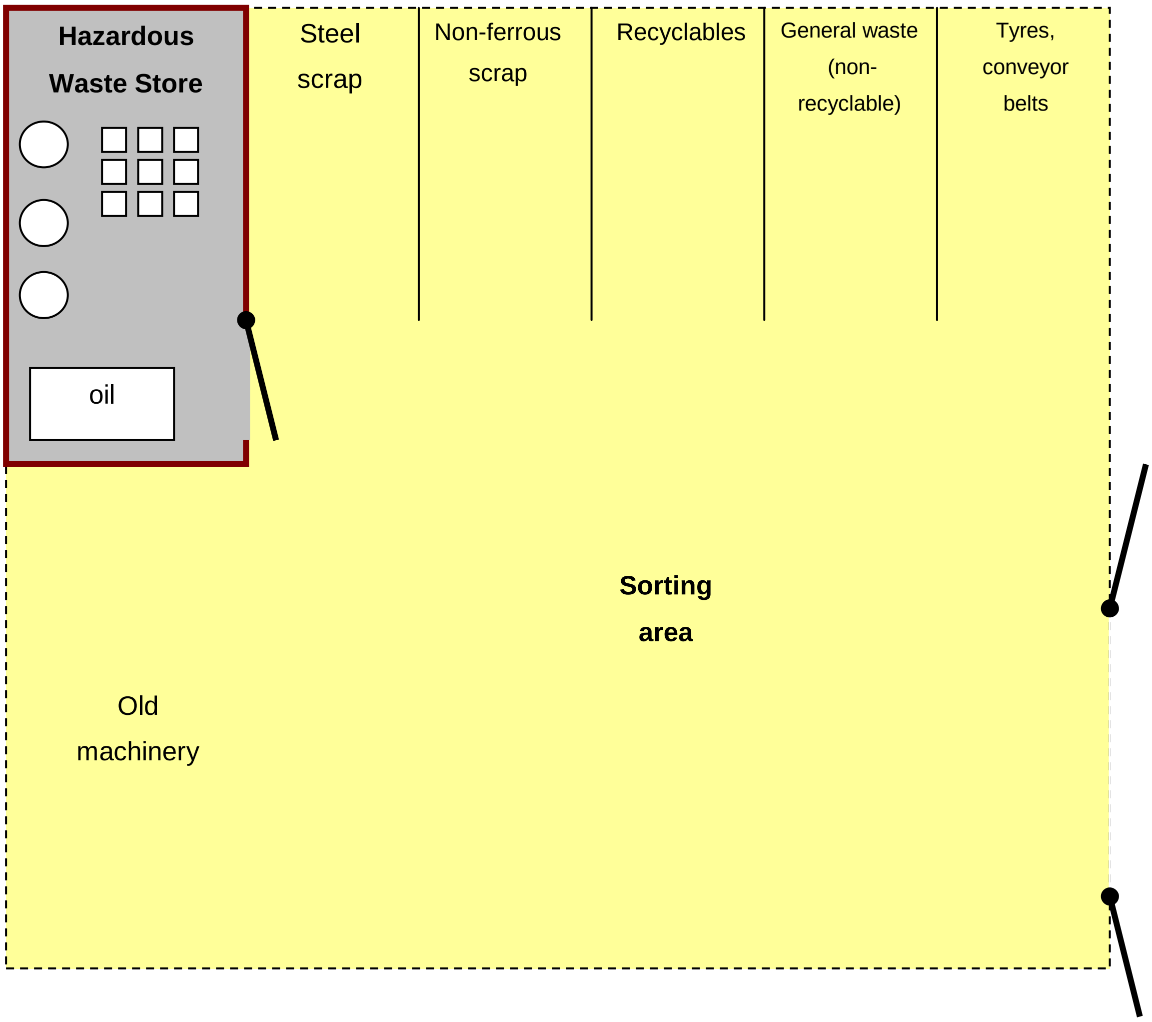


Figure 15: Diagrammatic Representation of Salvage Yard

4.4.3.13.4 Storage of Hazardous Wastes

All hazardous waste must be stored in accordance with the following:

- Wastes must not be mixed with wastes of a different nature or composition. Hazardous waste must be separated from general wastes. If non-compatible wastes are to be stored together, care should be taken to adequately separate them. Flammable or combustible wastes must in any event be stored separately from other waste materials;
- Wastes must be stored separate to process chemicals or products;
- Waste receptacles must be clearly marked to prevent risk of wrong identification on-site and during transportation;
- Waste containers or tanks, whilst on site, must be clearly labelled as marked with the words "Hazardous Waste";
- The migration of leachate or spillage into the ground and groundwater regime around all temporary waste storage areas must be prevented;
- A firm waterproof base that is protected from storm water ingress from surrounding areas is required;

- An effective drainage / collection system (e.g. trenches, bunded areas) to a waterproof spillage collection area is required, where any spillage can be recovered, and
- Waste must be stored in such a manner that no pollution of the environment occurs at any time.

4.4.3.13.5 Storage of General Waste Streams

This includes paper, cardboard, plastic (various types), tins, glass, food and other non- hazardous wastes that are typically recycled by many industrial, commercial and residential sites.

As far as is practicably possible, the waste will be separated so that it can be re-used, or recycled with an underlying objective to minimise waste to landfill. Bins for separate waste streams will be located around the mine. Different coloured bins for different waste streams are therefore required, but the challenge is to not provide too many bins such that the management of waste by the individual (staff/visitor/contractor) becomes too complicated resulting in wastes not being separated.

The following plan is therefore envisaged:

- General Areas: A maximum of four waste bins are provided for staff, contractors and visitors. Wastes may be further separated by trained staff in the waste storage area, depending on the value in separation. Different coloured bins for different waste streams will be located throughout the mine (production, pit, office, outside residences), and all staff required to use the bins. The different waste streams will then transferred to the Waste Storage Area;
- Residences: One bin will be provided for each residence. As the bulk of domestic waste will be generated in the kitchen, dining and recreational areas, a minimal quantity of waste is expected to be generated in the residential complexes. The waste from the bins will be transferred to the Waste Storage Area, separated into the designated bins for recycling or land filling, and
- Offices: Two bins will be provided in the offices – one for paper, and one for other waste streams, to be separated at the Waste Storage Area.

4.4.3.13.6 Waste storage for Construction of Roads and Power Lines

Hazardous wastes generated by the camps from the construction of the roads and power lines into the Gope Project Site must be removed from the construction sites and disposed of in accordance with this Waste Management Programme. This includes the following requirements:

- Waste will be removed from the site;
- There will be no burying, burning or dumping of wastes;
- Hazardous wastes to be separated from general wastes;
- Hazardous wastes to be stored in sealed containers to prevent any spillages (e.g. waste oils);

- Recycling of waste streams to be considered;
- Vegetation cleared can be left to degrade naturally in-situ, and
- Where spillages occur, the contaminated soil must be collected and disposed of as hazardous waste.

4.4.3.14 Communication Infrastructure

A satellite communication system will be made up of equipment suitable to support a bandwidth of up to 1 Mbps, with an additional safety contingency.

Fibre optic cables will be installed on the power line infrastructure in order to enable PABX and IT network systems. The systems will support, voice, data and e-mail transmissions.

Should a suitable service provider be found, the installation of a GSM (cell phone) system may be considered in due course.

4.4.3.15 Mine Stores

During the construction phase of the GDMP, standard containers (6 m long, 2.4 m wide and 2.4 m high) will be used for the separate storage of the following goods:

- Parts;
- Lubricants, and
- Tyre workshop and store, with tyres and spare wheels stored in the open on a levelled surface.

During the construction phase, these stores will be moved to built structures located either at the daily service bay or the main workshop complex.

4.5. DESCRIPTION OF THE PROCESS

4.5.1 Pre-Strip (Sand Stripping Process)

A total of 32 million tons of sand overburden, excluding top soil, is to be removed during the pre-stripping operation.

4.5.1.1 Site Preparation

The site preparation will comprise the following aspects:

- Vegetation clearing, chipping, topsoil removal & dumping (refer to Sections 10.2.1.3 and 10.2.1.6);

- Opening of roads through clearing of vegetation along side the road, and
- Preparation of roads.

4.5.1.2 Load & Haul

During the sand stripping operation, a number of machines will be utilised for the loading and hauling activities, including:

- CAT 385 HEX, and
- ADT 40 tonners.

No blasting is expected during this stage, however hard pockets may require ad hoc blasting.

4.5.1.3 Dump & Convey

During the sand stripping operation, the following equipment will be utilised for the dump and conveying operations:

- ADT;
- Tipping bin, and
- Conveyors.

4.5.2 Mining Process

4.5.2.1 Drilling and Blasting

All of the hard-rock mining will be drilled and blasted using conventional open pit drilling equipment and explosives.

4.5.2.2 Load and Haul

Blasted rock will be loaded by face shovels into dump trucks and transported out of the open pit. The ore will be dumped at the main ore tip and the waste will be dumped on the waste rock and sand overburden dump.

4.5.3 Mineral Processing

4.5.3.1 Primary Crushing

The Mineral Processing Plant layout allows for a strategic stockpile of approximately 350,000 tons at the bottom of the primary crusher tipping bin ramp (refer to section 4.4.1.2). Mine haul trucks, with a maximum capacity of 140 tons (CAT 785), will discharge ROM ore directly into the tipping bin, which has a capacity of approximately 300 tons.

A hydraulically driven apron feeder will withdraw the ROM material from the tipping bin and feed the mineral sizer at a maximum design feed-rate of 1,200 tph. This will allow for replenishing the primary stockpile after any mining delays, breakdowns or maintenance periods.

The design of the primary crusher section allows the mineral sizer to “scroll off” any rock that is larger than the design top size of 1.1 m, via a hydraulically operated gate, which will report to an oversize stockpile. The mineral sizer product will discharge through a chute onto the mineral sizer product conveyor, which will also collect any spillage material from the apron feeder. This conveyor will discharge onto the stockpile feed conveyor which will transport the material to the 7,000 ton live draw down stockpile.

Any tramp metal will be removed by means of an overband magnet, which will discharge the metal into a waste skip. This will be transported to the plant scrap yard as required.

Spillage from the primary crushing area will be collected in a central sump area where it will be filtered through wedge-wire screens with an aperture of approximately 6 mm and then pumped to the spiral classifiers in the milling section. Any oversize spillage will be returned to the tipping bin.

4.5.3.2 Autogenous Milling

The live draw down stockpile (~ 7,000 tonne) will act as a buffer between the primary crushing section and milling section of the Mineral Processing Plant and thereby ensure consistent milling operations. At the design treatment rate of 900 tph for the milling section, this represents approximately 8 hours operating time, operating at approximately 60% solids.

Apron feeders will withdraw material from the stockpile and discharge it onto the mill feed conveyor, which will also collect any spillage from the apron feeders. The mill feed conveyor will transport the material to the autogenous mill.

A tramp metal detector is located on the mill feed conveyor in order to detect significant tramp metal.

An autogenous mill will be used as the main component in the comminution and diamond liberation unit process. The mill, which will be the grate discharge type, will be fitted with an integral discharge trommel in order to remove oversize material larger. The mill will be fitted with a variable speed motor, which will allow the mill to operate between 60 and 80% critical speed.

The mill rotation will be bi-directional and rubber liners will be used in order to minimise the risk of diamond damage.

The mill will operate in open circuit and will generate two products: trommel oversize or “pebbles” and trommel undersize. The pebbles will report to the three pebble conveyors that will transport them to the DMS tailings conveyor for disposal on the tailings dump. The Mineral Processing Plant design will allow for the potential future installation of a pebble crusher, along with the necessary recycle conveyors, if it is found necessary to retreat the pebbles.

The trommel undersize will report to two spiral classifiers that will separate the majority of the slimes, as spiral classifiers overflows, from the DMS feed material that will report to the spiral classifiers underflows. The efficiency of the removal of the slimes material in the spiral classifiers is expected to be in the region of 85%. Due to this, it is necessary to re-screen the spiral classifiers underflows on screens in order to remove the majority of the remaining slimes material prior to DMS treatment. The screens oversize report to the DMS feed conveyor. The screens underflows, along with the spiral classifiers overflows, will report to the slimes disposal sump where the slimes will be pumped to the slimes dam.

This classification circuit is designed to minimise the amount of water required to undertake the separation of the slimes material. The spiral classifiers have been designed to treat the mill product directly and minimal spray water will be used on the spiral classifier product screens in order to ensure a final slimes disposal density of approximately 1.35 g/cc. The water addition to each section will be automatically controlled to maintain this status.

Milling section spillage will be collected in a central sump area where it will be filtered through wedge-wire screens and then pumped to the spiral classifiers. Any oversize spillage will be returned to the primary crushing section tipping bin.

4.5.3.3 Dense Medium Separation

Feed material from the milling section will report to a 300 tonne bin, divided into three sections. Three separate weighfeeders will extract the DMS feed material from each of the bin sections and feed the material, at a controlled rate, to each of the three DMS modules. Each module will use two cyclones in parallel to treat the full size range of fractions at a rate of 150 tph.

The DMS concentrates will be jet pumped to the recovery section. The DMS effluent will be pumped to the dirty process water tank for reuse in the milling section. The DMS tailings will report to the tailings conveyors.

4.5.3.4 Recovery process

The recovery process will receive feed from the DMS sections via jet pumps. The total feed rate will be 6 tph in the size range – 25 mm+1.5 mm.

4.5.3.4.1 X-Ray Recovery

The concentrates will be fed to the primary sizing screen where the material will be screened into five fractions as part of the X-Ray recovery process. All of the X-ray concentrates will report to the concentrate dewatering screen.

4.5.3.4.2 Grease Recovery

All of the X-ray tailings will report to an attritioning scrubber in order to remove any surface coatings from the diamonds prior to grease recovery. The attritioner product is jet pumped to the grease recovery sizing screen where the material will be screened.

All of the grease belt concentrates will report to the concentrate dewatering screen. All of the grease belt tailings will gravitate to the tailings disposal screen. The X-ray and grease belt concentrates will be dried and screened for further processing.

4.5.3.4.3 Magnetic Separation

The sorthouse fines will be fed to a permroll magnetic separator to remove any magnetic material prior to sorting. The non-magnetics, expected to be approximately 20% of the feed material, will report to eight single-handed glove boxes. The magnetic (tailings) fraction will report to the tailings disposal screen.

4.5.3.4.4 Hand Sorting

The glove box tailings will be vacuumed away and report either to the recovery tailings conveyor, which will be fitted with a weight-o-meter for metallurgical accounting purposes, or to two single-handed glove boxes for audit purposes. It will be possible to audit the tailings from all of the primary glove boxes separately.

The glove box concentrates will be vacuumed to the accounting and weighing glove boxes. Once all the necessary metallurgical accounting has been completed, the diamonds will be acidised and cleaned.

4.5.3.5 Cleaning Process

The acid cleaning section has been designed to utilise hydrofluoric, hydrochloric and nitric acid as the main cleaning agents. However, it is anticipated that the system will be commissioned using only hydrochloric and nitric acid in order to assess their effectiveness in cleaning the diamonds. If the final product is considered to be adequate for export and sale, then it will not be necessary to use hydrofluoric acid. The final export diamonds will then be deposited in the export drop safe.

4.5.4 Waste Rock & Sand Overburden Dumps

Construction of the Waste Rock & Sand Overburden Dumps continues over the LOM and sequenced such that the dumps can be effectively rehabilitated to satisfy environmental requirements, taking cognisance of final dump height, access berms for each lift, prevailing wind direction, shape and footprint. The year-by-year dumping progression has been structured to suit both the economics associated with mining of the overburden as well as environmental requirements. Topsoil will be removed for the upcoming years dumping and used to rehabilitate the previous years' dumping so as to minimise double handling of material and sterilisation of the topsoil due to excessive stockpiling.

Phasing / progression of the Waste Rock & Sand Overburden dumps are described as follows:

<u>Phase 1: Sand Stripping</u>

- 32.928 Mt of sand stripping required – Sand is dumped at shortest distance from pit and loaded onto the sand conveyor, forming a 'finger-like' dump extending due west for the pit;
- 1.445 Mt of basalt in initial sand strip, dumped at the shortest distance from the Eastern pit exits, forming a semi-circular dump which radiates outwards towards the East. The rock dump will shield the pit from the prevailing North East wind;
- Sand from the pre-strip will be dumped at a central loading point (located at the Western Pit exit) at the tail end of the sand conveyor, using the sand stripping fleet CAT 740 ADT , and
- Calcrete exposed during the sand strip is to be recovered for construction material.

<u>Phase 2: Mining operation</u>

- 152.32 Mt of basalt will continue to be dumped on the semi-circular rock dump located on the Eastern side of the pit. This rock dump will grow progressively to the east forming a distinct "bean" shape. Dumping will continue from 2010 – 2023;
- 67.48 Mt of Sand will continue to form the "finger-like" dump projecting westwards. The sand dump will use a single sand conveyor, which will be moved to manipulate the final shape and length of sand dump. The sand dump will be rehabilitated immediately from stockpiled topsoil.
- The Basalt rock will be dumped using the hard rock fleet of CAT 785 140 Ton trucks, and
- Calcrete exposed during the mining operation is to be recovered for Construction Material.

4.5.5 Tailings Management Facility

The DMS tailings and the pebbles report to the final TMF conveyors.

The overall dump design is based on the DMS tailings conveyor conveying the material to the top of the dump where it will transfer it to the grasshopper conveyor. This, in turn, deposits the material on the shuttle conveyor that conveys it to the spreader conveyor. The spreader conveyor deposits the material in a 180° arc of approximately 15 m radius.

The shuttle conveyor has sections added into it on a regular basis to cater for the advance of the dump. When this shuttle conveyor reaches its final design length, the grasshopper conveyor is replaced with a fixed conveyor and moved forward to its new position and the process recommences.

4.5.6 Slimes Dam

Catchment paddocks, constructed downstream of the slimes dam impoundment wall, will collect run-off from the outer slope of the impoundment walls. Storm water diversion trenches around the perimeter of the slimes dam, will prevent clean storm water from the external catchments to flow onto the facility.

A penstock decant system for each compartment will return supernatant water to the Return Water Dams (RWDs) from where it will be pumped to the Mineral Processing Plant for use as process water.

The raw water supply for make-up water will be provided from the well field and RWDs. The process water system will consist of two main tanks: the raw water tank and the process water tank.

The raw water tank will receive the make-up water which will be used to supply the following sections:

- Primary crushing section;
- Stockpile section;
- DMS modules, and
- The recovery section.

4.6. SUMMARY OF INPUTS AND OUTPUTS

The primary inputs for the proposed mining process include:

- Electricity from the BPC service provider;

- Raw water from borehole infrastructure surrounding the open pit. Should it become a requirement, additional water supply will be obtained from a well field, located within the MLA;
- Diesel and hydrocarbon products (i.e. oil, grease);
- Explosives;
- Ferrosilicon (FeSi) and water (in the DMS);
- Grease (in the Recovery Plant);
- Mixtures of Hydrochloric, Sulphuric and Hydrofluoric (HF) acids (in the Acidisation / Diamond cleaning process), and
- Human resources / work force.

The lists of outputs (including by-products) include:

- Air emissions (dust and vehicle emissions):
- Grease stored on site for LOM;
- Domestic waste and sewage;
- Waste water / effluent (retained in closed circuit for reuse);
- Mine waste (i.e. tailings, slimes, waste rock, sand overburden), and
- Product / diamonds.

4.6.1 Raw Materials

Table 19 provides a list of chemicals and substances that are likely to be used at the GDMP. This table is based on the materials used at one of GDL's other operations, Letseng, based in Lesotho.

Table 19: Raw Material Expected to be Consumed at GDMP.

RAW MATERIAL	APPLICATION	STOCK BEING HELD ON SITE (APPROXIMATELY)
Air freshener	Housekeeping / Kitchen	70 x 180 ml
Bleach	Housekeeping	60 ℓ
Deo Blocks	Housekeeping	40 kg
Fabric Softener	Housekeeping	80 ℓ
General Purpose Cleaner	Housekeeping / Kitchen	100 ℓ
Handy Andy	Housekeeping	60 ℓ
Dish Washing liquid	Housekeeping / Kitchen	120 ℓ
Tile cleaner	Housekeeping	20 ℓ
Mr Min	Housekeeping / Kitchen	70 x 300 ml
Pine Gel	Housekeeping	40 ℓ
Floor polish	Housekeeping	18 x 400 ml
Bath soap	Housekeeping	1440 x 125g

RAW MATERIAL	APPLICATION	STOCK BEING HELD ON SITE (APPROXIMATELY)
Hand soap	Housekeeping / Kitchen	20 ℓ
Washing powder	Housekeeping	250 kg
Window cleaning agent	Housekeeping / Kitchen	80 x 750 ml
Biocide	Kitchen	10 x 50 x 6g
Chafer Fuel	Kitchen	24 x 50
Jeyes Fluid	Kitchen	10 ℓ
Oven Cleaner	Kitchen	20 ℓ
Base Emulsion	Explosives – mining	130 Tons
Bulk Explosives	Explosives – mining	200 x 25 kg x 3
Gassing Solution	Explosives – mining	2 Tons
Acetylene	Mining	4 x 8 kg
CAT Deo 15W-40 Diesel Engin Oil	Mining	6 x 210 ℓ
CAT Gear Oil GL-5 80W-90	Mining	2 x 210 ℓ
CAT Hydraulic Oil 10W 478909-00	Mining	6 x 210 ℓ
CAT Multipurpose Tractor Oil (MTO)	Mining	2 x 210 ℓ
CAT Trans/Drive TRN 10W 564658-00	Mining	6 x 210 ℓ
CAT Trans/Drive TRN 30 564666-00	Mining	6 x 210 ℓ
CAT Trans/Drive TRN 50 564674-00	Mining	6 x 210 ℓ
Liquefied Petroleum Gas & Propane	Mining	210 ℓ
Nitrogen	Mining	2 x 11 kg
Oxygen	Mining	4 x 11.5 kg
Shielding gasses	Mining	2 x 18.5 kg
Thinner No. 17	Mining	10 ℓ
Acetylene	Plant	5 x 8 kg
Calcium chloride	Plant	400 x 25 kg
Ferrosilicon (FeSi)	Plant	80 Tons
Fuchs M1 AND M2 WP synthetic waterproof EP greases	Plant	10 x 15 kg
Fuchs powergear oils	Plant	20 x 20 ℓ

RAW MATERIAL	APPLICATION	STOCK BEING HELD ON SITE (APPROXIMATELY)
Renep Compound oils	Plant	20 x 20 ℓ
Fuchs renolin HO oils	Plant	20 x 20 ℓ
Multi purpose precision lubricant	Plant	15
Nickel base-aerosol spray	Plant	15
Nordbak Nordwear 8 compound hardener	Plant	5
Nordbak Nordwear 8 compound resin	Plant	5
Oxygen	Plant	15 x 11.5 kg
Plascon super universal enamel	Plant	25 x 25 ℓ
Praestol G 2540	Plant	200 x 25 kg
Stamford transformer	Plant	10 x 20 ℓ
Thinner No. 17	Plant	5 x 5 ℓ
Diesel	Plant / mining	1,000,000 ℓ
Hydrochloric acid (HCl)	Acidisation plant	Unknown
Sulphuric acid (H_2SO_4)	Acidisation plant	Unknown
Hydrofluoric acid (HF)	Acidisation plant	Unknown

4.7. OPERATIONAL ENVIRONMENT

4.7.1 Shift Configuration

The mine will operate on a 24 hour contops (continuous operation) basis. Shift duration will be 12 hours, seven days a week.

Production personnel will work on a three shift systems, with two weeks on site, followed by one week away. There will be various other shift configurations for the other departments. The following are envisaged are designed to be flexible in order to meet the work requirements

- Mining & Plant maintenance – 12 hr shift dayshift only 9 days on 5 off, and
- Management – 12hrs day shift 5 on 2 off.

4.7.2 Employment Philosophy

4.7.2.1 Recruitment Philosophy

GEC's recruitment philosophy is to recruit the best individuals with the potential to achieve extraordinary results for the company that will be of mutual benefit. Therefore, recruitment would aim to attract and retain candidates who are excelling in their current employment and are looking for an employer who can recognise their talent and reward it competitively based on performance and growth for both parties. Thus while qualification and experience are key to the recruitment process, at GEC competence and results will determine the individual employee's value and hence his or her contribution that will be appropriately recognised and rewarded.

The following principles guide the recruitment and selection processes at the GDMP:

- A detailed recruitment plan would be provided to the Ministry of Labour to facilitate an understanding of the GDMP's requirements and to solicit the necessary advice, support and assistance from the ministry with regards to the recruitment of expatriates. This will be crucial at the start of the operation;
- All employees would be engaged on short to medium term contract periods depending on the nature and requirements of specific jobs;
- All vacancies would, subject to the inherent requirements of the job, be open to all eligible applicants;
- For lower level skills requirements, an effort will be made to recruit from the local communities surrounding the Gope Project Site;
- Immediate family members of staff already employed at the mine will be subject to the same recruitment and selection procedures and no special preference would be extended to them. However if they are employed, they would not be allowed to work within the same department or in a situation where one reports to another;
- In all cases, preference will be given to Botswana citizens, where such employees meet the stated educational, experience and competency requirements. However, where it has not been possible to recruit a Botswana citizen, expatriates will be recruited;
- In cases where expatriates are employed, the relevant Government ministry shall be availed all the necessary information e.g. copies of advertisements as per the legal requirements. It will also be important to provide the information on the quality of Botswana citizen employees who applied in particular summary of educational and experience to the department;
- GDMP personnel shall, on behalf of Contractors, negotiate with government on short-term contract labour. To facilitate this, the Contractor shall provide GDMP with all the information required by the department and ensure that reasonable measures be taken to recruit Batswana and where possible impart the necessary skills to citizens. In addition, Contractors shall be required to recruit people who fit the GEC skills profiles;
- GDMP employees with a stake in the recruitment and selection process of any applicant or short-listed candidate would be required to declare this immediately when the recruitment process commences or when he / she becomes aware of such instance. Such an employee would be excluded from the decision making process to ensure fairness and integrity of the process;

- Where a large number of employees are required to be recruited all at once, a reputable and relevant recruitment consultant or agency would be sourced through a tendering / selection process to provide the required services;
- Prospective employees will be subject to the necessary psychometric, behavioural and security related assessments to ensure that the right people are recruited and to safeguard the security of the mine's product, and
- All employees will be expected to go through the induction, detailed medical programme and required security clearance before they commence employment.

4.7.2.2 The Recruitment Process

GEC's Human Resources Manager will be responsible for the facilitation of the end-to-end recruitment and selection process. The summary of the recruitment and selection process is as follows:

- Advertising, source of candidates: Advertisements shall be placed in Botswana papers and simultaneously in any of the following counties' papers; Republic of South Africa, Zambia, Zimbabwe and Namibia where there is a known skill shortage in Botswana;
- Advertising, short-listing and selection: To be fair and consistent, all applicants must be screened and measured against the same and predefined criteria for a specific job;
- Interview: To be fair and consistent, the interview process and the questions shall be consistent for all short-listed candidates. All short-listed candidates shall be interviewed by a panel consisting of at least two members consisting of Human Resources representatives of a designated Manager and/or the subject-matter expert. The interview questionnaires will aim at evaluating the competencies specific to a job, inclusive of relevant knowledge, skill and attributes. The Human Resource representatives will assist with the development of the interview questionnaire;
- Pre-employment screening: All short-listed candidates from the interview process will be subjected to pre-employment screening. Pre-employment screening will be applied with the necessary confidentiality and discretion and not to the disadvantage of any candidate, unless an inherent requirement of the job, and
- Remuneration and benefits: All individuals will be contracted to GEC on a fixed term contract. The philosophy is to provide a total package concept (monetary value that provides for benefits) to enable the employee to structure their benefits as deemed appropriate.

4.7.2.3 Employee Wellness

It has been shown that employees with a good health status are 20% more effective than those with poor health and it is found that typically about 30% of employees could be described as being in poor health suffering from occupational diseases (i.e. stress, lack of sleep, low fitness level and bad diet). This has been exacerbated by the advent of Human Immunodeficiency Virus

(HIV) and Acquired Immune Deficiency Syndrome (AIDS). It is against this background that more and more organisations are moving towards a more comprehensive wellness program, which aims to encourage and empower employees to take charge of all aspects of their health and lifestyles in order to stay healthy and maintain an acceptable level of productive lives.

4.7.2.3.1 Wellness Philosophy

It is the intention of GEC to take a comprehensive, cost effective and sustainable approach to employees' health protection and disease prevention. The wellness program which is an integral part of the Operation's Safety, Health and Environmental program has been aimed at tackling and balancing the physical, social and psychological (and emotional) components of the employees' wellbeing. This will be made possible by collaborating with the employees, the community, professionals, Non-Governmental Organisations (NGOs) and the relevant Government Departments. It is also the intent to outsource some of the programmes because it has been shown, in general, that where services are outsourced, the uptake is usually higher than if they are offered internally.

The main elements of a wellness programme will be:

- Focusing on the individuals and cultural factors that influence risk prone behaviour or an unhealthy life style;
- Monitoring and trending information from various sources, including occupational health statistics, will be used to identify areas where wellness interventions will be required;
- Educating and training employees on wellness matters e.g. formal training, induction;
- Offering support e.g. informal and formal structures such as peer groups, and
- Monitoring compliance to mine policy and other codes such as the Code of Conduct.

Guiding principles for the implementation of a wellness programme includes:

- All services and contracts with individuals shall be treated with the strictest confidence and only information that relate to the individual's ability to do work may be shared with the manager or supervisor to enable him / her to appropriately manage the employee. Therefore, no detail of any illness or nature of such an illness shall be divulged to a third party without the consent of an employee. The above is in line with the core value of Trust that will be cultivated by 'treating all people and partners with respect';
- The mine will play a facilitative role where employees will have the option to consult / see other independent professionals who will be contracted from time to time to assist the mine. This is provided for because of the stigma associated with diseases such as HIV/AIDS and may result in employees feeling discouraged from seeking help;
- The mine will liaise and make most use of the existing Government structures i.e. professionals in the area, local community structures, central structures and other stakeholders to promote constructive interaction in matters of health concern;

- The mine will introduce a robust Occupational Health, Safety and Environmental Management system that will ensure that key performance indicators, set within certain parameters, are monitored, reported and problems identified well in time for appropriate action to be taken;
- All Contractors will be expected to have in place measures and processes that will ensure that their employees are in compliant with both the mines' and legislated requirements relating to employee welfare;
- It will be every employee's responsibility to manage wellness in their work areas; therefore it is a requirement that every manager it to report on defined wellness related indicators, and
- Repeatedly, at agreed intervals, cultural audits or some relevant studies will be carried out in order to help GEC to refocus and improve on likely problematic areas.

4.7.2.3.2 Components of the Wellness Programme

The following structures on educational and continuous support programmes will be introduced to assist in the promotion of good health:

- A Mine Wellness Policy and enabling structures;
- Educational campaigns on chronic diseases such as high blood pressure, diabetes, HIV/AIDS;
- Training and prevention through setting up of peer education structure, multi task teams and/or other structures;
- Care, support and wellness management through the various institutional arrangements with the relevant Government Departments and NGOs. Support programs may include technical support and learning materials to managers, team leaders, peer educators and other structures that maybe developed;
- Medical checkups and treatment services will be provided on site and where necessary through Government facilities such as clinics and referral hospitals;
- Community outreach programs through the various relevant Government Departments where, as part of social responsibility, GEC will partner with them to ensure that employees' home environment (communities) is conducive, and
- Monitoring and evaluation will be as per identified Key Performance Indicators (KPIs). Monitoring will also be done through monthly reports form peer educators and quarterly statistics from within GDMP and the district.

It is important that where possible, the impact of the wellness program should be measured. Some of the anticipated benefits are likely to include:

- Informed and knowledgeable employees;
- Low absenteeism rates;
- Low sick leave days being taken;
- High morale amongst employees because of low anxiety and the knowledge that they can access help if necessary resulting in maintained productivity levels;

- Maintained level of productivity because of skill availability;
- Low incidents of injury;
- High level of compliance, and
- Accreditation.

4.7.3 Mine Staff Complement

The work force requirements for the mine has been derived per function, based on the envisaged shift structure and are indicated in Table 20 below:

Table 20: GDMP Histogram.

Construction

Description	2008		2009				2010				2011		
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
EIA/SIA Team	5	5											
Camp Construction/Buildings	10	180	220	220	150	150	80	80	80	80	40		
Site Preparation	15	35	55	55	20	10							
Civils & Infrastructure	10	80	200	220	250	220	70	50	50	50	50		
Structural & Mechanical	0	5	80	160	180	180	80	70	60	60	40	40	
E&I	0	0	15	15	35	35	35	45	30	30	30	30	
Specialists	0	0	0	15	35	40	35	35	25	10	10	10	
Camp Management	15	35	51	51	51	51	51	51	51	51			
Construction Management	4	8	20	20	26	18	12	12	8	8	8	8	6
Totals	**59**	**348**	**641**	**756**	**747**	**704**	**363**	**343**	**304**	**289**	**178**	**88**	**6**
Sand Stripping and Hard Rock Mining(2008 - 2012)													
Supervision/Support/Engineering	27	27	27	27	27	27	42	42	42	42	42	42	31
Operators	129	129	129	129	129	129	234	234	234	234	234	234	160
Totals	**156**	**156**	**156**	**156**	**156**	**156**	**276**	**276**	**276**	**276**	**276**	**276**	**191**
Production Operations													
Treatment/Engineering						37	55	100	100	100	100	100	100
Security				6	6	25	25	25	25	25	25	25	25
Management/Admin/HR				3	3	8	14	14	14	14	14	14	14
Other Service Providers	15	15	20	25	40	51	51	51	51	51	51	51	51
Village Management											51	51	51
Totals	**15**	**15**	**20**	**34**	**49**	**121**	**145**	**190**	**190**	**190**	**241**	**241**	**241**
Grand Totals	***230***	***519***	***817***	***946***	***952***	***981***	***784***	***809***	***770***	***755***	***695***	***605***	***438***

Source: PPM, 2008

4.7.4 HSSE Policy

It is anticipated that the number of construction personnel will peak at over 644 during the latter part of 2009. Safety becomes a major management concern when a construction site becomes congested, and schedule pressures create an environment where there is the temptation to force the pace of work at the expense of sound management and safety.

It is therefore important that a good safety support and auditing system be developed prior to, and implemented as soon as construction work starts, and that all contracting organisations are made aware of the site safety requirements at the time bids are requested for the execution of work. The Health, Safety, Social and Environment (HSSE) Policies were under development at the time of the compilation of this report and will be finalised as part of the detailed design phase.

A Site Rules and Regulations Document will be developed and issued to all contracting organisations, and supporting policies and procedures will be developed, addressing such aspects as:

- Safety Induction and Site Orientation;
- Safety Reporting;
- Personal Protection Equipment (PPE) Requirements;
- Emergency Procedures;
- Safe Working Practices;
- Housekeeping Standards;
- Vehicle Usage;
- First Aid Training;
- Environmental Awareness Programme, and
- Working Hours and Conditions.

Other more technically oriented procedures will cover requirements for:

- Welding Procedures;
- Working at Height;
- Electrical Safety and Switching Procedures;
- Driver Qualifications and Requirements, and
- Use of Portable Electrical Equipment and Tools.

Construction management will appoint Safety Officers assigned to specific areas of the mineral processing plant, and all Contractors will be expected to have a certain minimum number of employees trained as first aiders. In instances of larger contracts, they will also be required to have Safety Officers within their own site structures.

During the construction phase of the project, the GEC HSSE Superintendent will be responsible for the development and implementation of the Mine Safety framework for operations. The IRCA system has been selected as the risk management and safety framework to be adopted at the GDMP.

4.8. LOGISTICS

4.8.1 People Transport

It is envisaged that all the construction and operational staff will be transported between the Gope Project Site and Lephepe or certain other designated locations, by mine-supplied transport.

The principle of staff transport is as follows:

- People will be transported the night before their cycle commences, in order to ensure that they have a good meal and a nights rest prior to commencement of their cycle;
- The following morning, the crew leaving the site for their time off, will be transported to the designated drop off points, and
- The transport for all of the people will be provided for by the GEC, and these arrangements will be planned in advance in order to minimise the trips and travelling time for the people.

4.8.2 Material

All material will be transported to and from the Gope Project Site in the most appropriate manner. It is envisaged that one service provider will be utilised in order to minimise the number of trips as well as reduce the negative HSSE impacts.

Prior to and during the construction of the permanent surfaced road, 6x6 vehicles will be required. however, there are some abnormal loads that will need to be handled on a case by case basis. Examples of this include the transportation of the mill and hard rock mining fleets.

Once the permanent surfaced road has been installed, it is likely that one service provider will be utilised, using conventional road transport means.

4.8.3 Product

The final mining product will be transported from the Gope Project Site through the use of air transport.

4.8.4 Vehicle Selection

Given the basic road conditions between Lephepe and Gope, the vehicles below were selected to transport people and goods to site:

- 6x6 Rigid flat deck with a carry capacity of 15 tons, 35 cubes;
- 6x6 Rigid tanker with a carry capacity of 25,000 ℓ;
- Low beds will be used to transport abnormal loads to site in convoy with graders, compactors and water tankers;
- 3 – 6 4x4 Bus with carry capacity of 35 seats;
- 6x6 Fridge / freezer vehicle with a carry capacity of nine tons, and
- 4x4 Bakkie for emergency loads.

4.8.5 Fuel Supply

Table 21: Anticipated Fuel Consumption.

YEAR	LITRES PER MONTH	LITRES PER DAY
2008	375,982	12,327
2009	1,260,653	41,418
2010	2,356,033	77,406
2011	1,480,175	48,630
2012	1,785,467	58,660
2013	1,797,467	59,054
2014	1,958,008	64,329
2015	1,820,675	59,817
2016	1,680,050	55,197
2017	1,680,050	55,197

The anticipated fuel consumption figures are presented in Table 21. It is estimated that during 2010, fuel consumption will reach the maximum demand, at approximately 2,360,000 ℓ/month.

It is proposed that the GDMP will hold one month of fuel in stock on site over the LOM, which is estimated at approximately 1,000,000 ℓ.

During the phase before the construction of the permanent road, the fuel supplier will hold buffer stock of 1,000,000 ℓ of fuel in a depot in Lephepe and another 800,000 ℓ on site at the Gope Project Site to ensure reliable supply over this period. The fuel will be transported from Lephepe to the mine site using 6x6 rigid tanker vehicles over this period to support the above strategy.

Once the permanent road has been completed, the fuel supply storage capacity on site will be increased to hold one month's stock and the fuel will be supplied directly from Gaborone instead of Lephepe.

The supplier will supply a full range of fuels and lubricant products, according to the mine's needs. They will provide ongoing maintenance and support, which will be measured using KPIs on a monthly basis. The supplier will provide a team of qualified and experienced engineers who will be responsible for the installation of all equipment as well as providing ongoing cost-saving solutions to meet the GDMP's business requirements.

The supplier will purchase, manage and install storage and dispensing equipment at the Gope Project Site where necessary. The supplier will assist in installing a fully integrated electronic Fuel Management System (FMS) on site to control access, enable pumps and record fuel use for cost allocation and also act as an automatic tank gauging system. This will allow for a greater degree of control and monitoring over one of the operations greatest costs.

4.9. WATER PROVISION, USE AND DEMAND

No surface water features were identified at the Gope Project Site during the SEIA investigations. Groundwater was assessed as part of the hydrogeological investigations. The only borehole infrastructure that existed at the time of the compilation of this report, were three boreholes drilled historically by DeBeers.

4.9.1 Plant Requirements

The plant is estimated to require approximately 700 m^3/h feed water. The DMS and recovery section effluents, along with the slimes dam return water will be pumped back to the process water tank and this water will be used in the milling section.

The raw water make-up requirement from the well field is estimated to be an average of approximately 12,000 m^3/day, peaking at 13,500 m^3/day, assuming an industry average of approximately 20% return of the water pumped to the slimes dam. If the well field is required to pump at a higher rate for pit dewatering, the excess water will overflow to the slimes dam RWD for future recycling. The process water tank will overflow into the raw water tank if required.
Storm water runoff will report to the slimes dam RWD and be recycled.

The processing plant at the GDMP will have a significant water use requirement and is currently estimated at around 12,500 m^3/day. Dewatering around the pit is predicted to provide in the order of 5,000 to 6,000 m^3/day in the longer term, but with short term values of closer to 10,000 m^3/day at the start of dewatering.

4.9.2 Sources of Water

Water for the GDMP will be sourced from the following sources:

- Precipitation;
- Groundwater via the open pit dewatering infrastructure;
- Well field infrastructure, and
- Return water from the slimes dam RWDs.

A description of the open pit dewatering and well field infrastructure is detailed in Section 4.4.3.10.

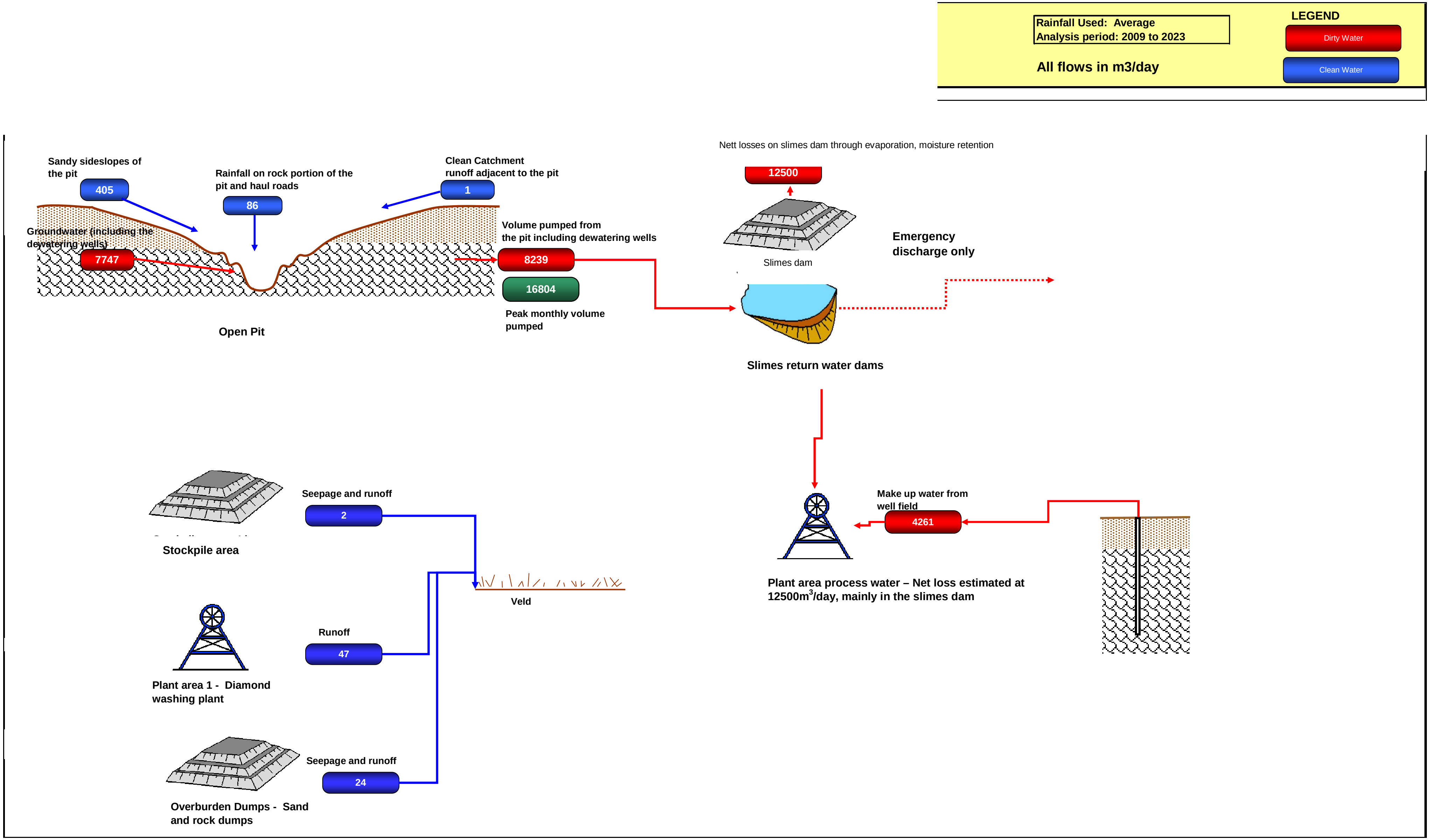
4.9.3 Water Balance

The water balance refers to the relationship between water make and water use; when these are equal, the mine water circuit is in balance, which in practice is seldom the case without engineering interventions. The water balance also refers to all water that will be collected by the mining operation as well as water that is used by the mining operation.

Precipitation data utilised in the calculation of this water balance was obtained from the Mahalapye weather station, which is located some distance from the Gope Project Site. It is estimated that the rainfall at the Gope Project Site, will be approximately 20% less than at this weather station. Extremely wet and dry periods have also been modelled in the compilation of this water balance.

A schematic representation of the water balance diagram is outlined in Figure 16.

Figure 16: Schematic Water Balance – Operational Phase



4.9.3.1 Water Make – Average Rainfall

The water make for average rainfall for the GDMP is given in Figure 17 including the water from the dewatering wells.

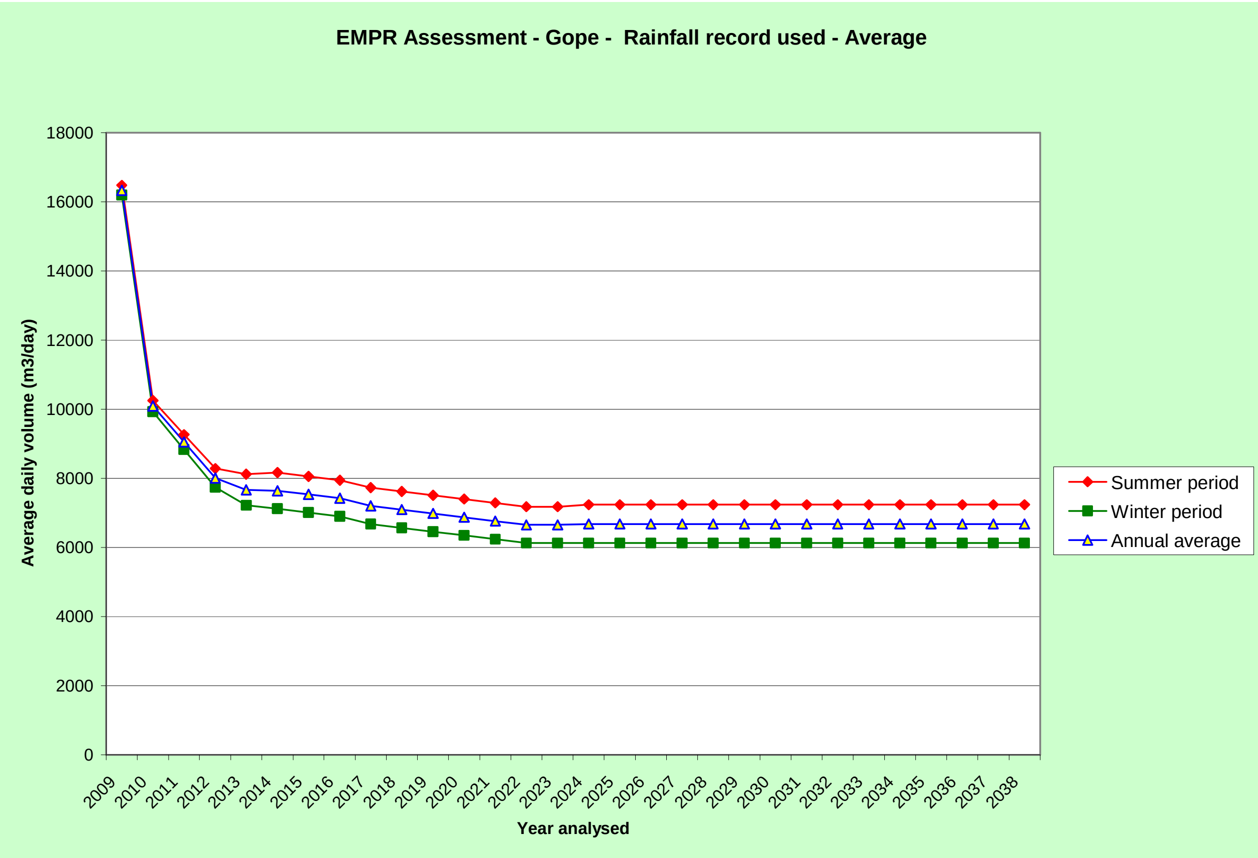


Figure 17: Graphical Water Balance for the Pit for Average Water Make During the Operational and Post Closure Phases of Mining Showing Seasonal Variations but Excluding the Dewatering Boreholes.

The output in Figure 17 should be interpreted as follows:

- The volumes arising from dewatering are far in excess of the water make from direct rainfall and runoff. Thus, the initial dewatering will generate significant volumes of water that will reduce with time, and
- The difference between winter and summer in the figure indicates the difference between the groundwater make and surface water make. To make this clearer, the balance of water make is highlighted in Figure 18, indicating the expected water make excluding the dewatering boreholes.

Note that it expected that the dewatering boreholes will not be 100% efficient, and some residual groundwater is expected to enter the pit, illustrated by the winter period inflows in Figure 18. These are based on a 90% dewatering efficiency. However, the implications of groundwater entering the pit should the collection efficiency vary are not significant for the water balance, the key reason for dewatering being stability of the side slopes.

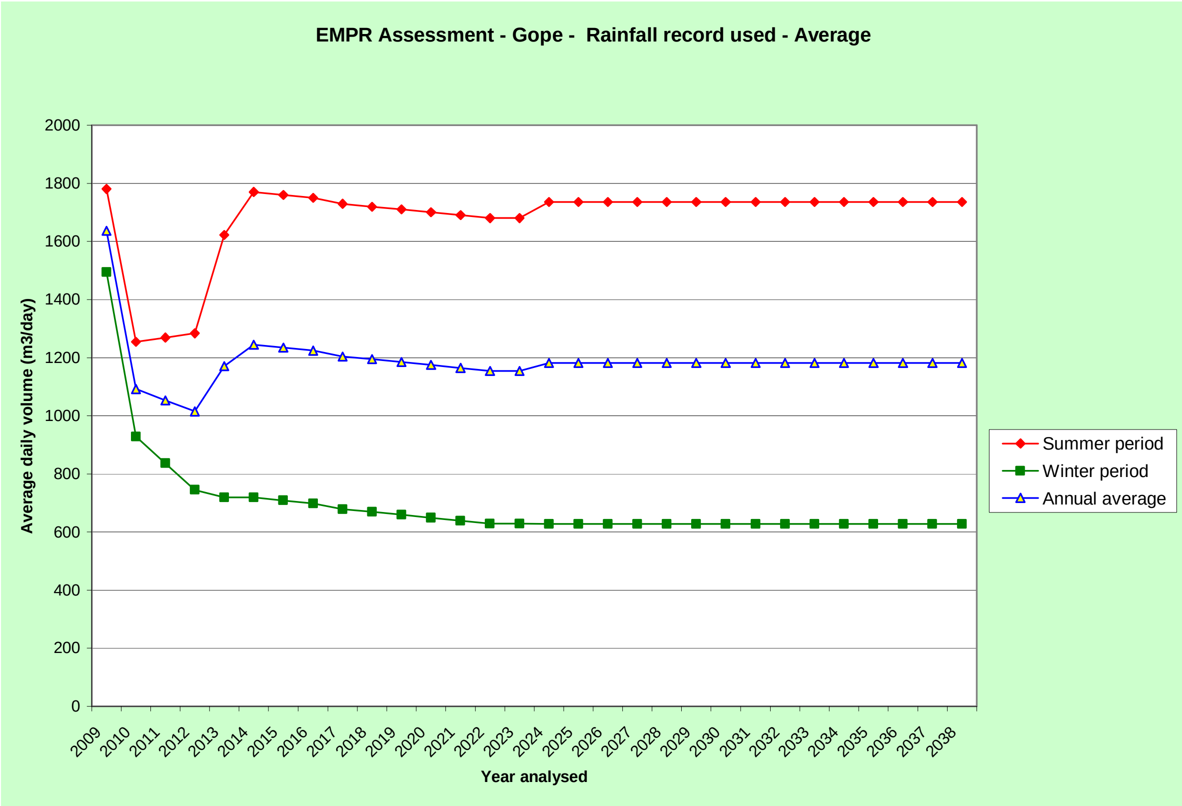


Figure 18: Graphical Water Balance for the Pit for Average Water Make During the Operational and Post Closure Phases of Mining Showing Seasonal Variations; Excludes the Dewatering Boreholes.

The above values are the pit water make and exclude the following:

- Runoff from the various dumps and stockpile areas. These are included in the overall water balance, but runoff is not planned to be collected from areas where deterioration of runoff water quality is not expected, and
- At the workshops contaminated runoff will be contained, but this will be outside of the pit area.

To understand the contributions of the various areas to the water make, the reader is referred to the schematic water make given in Figure 16. This is based on the operational phase for average rainfall.

The net water make apart from the dewatering around the pit is (as may be expected for an arid area) small.

4.9.3.2 Water Make with Dewatering and Storage in the Open Pit

As indicated previously, a ring of boreholes will be installed around the open pit (but outside of the extent of the pit) in order to draw down the groundwater prior to and during mining in order to ensure stability of the sandy sidewalls as well as in the rock excavation. Dewatering will continue throughout the operational phase.

Dewatering may also be required of the old bulk sample mining in the area, the workings having been sealed but not backfilled. Additional ingress is expected from these workings, but the volume is not expected to be significant, roughly estimated at around 20,000m^3, which is equivalent to around 2 to 3 days average extraction from the dewatering boreholes.

During mining, no storage of water will be possible within the workings due to the pit geometry.

4.9.3.3 Water Use

In addition to the use of water in the plant, some water will be used for dust suppression. However, the high evaporation on site makes it problematic to use water for all but the most critical of areas. The use of dirty water is expected to be as follows:

- Water for dust suppression at the processing plant has still to be quantified, but has been provisionally estimated to be around 100 m^3/day based on experience with other processing plants. The actual value may vary slightly from this estimate in practice, but this is not a critical component of the overall water balance.
- The Processing Plant water requirement is around 12,500 m^3/day (as indicated previously).

The net water make after water use is shown in Figure 19.

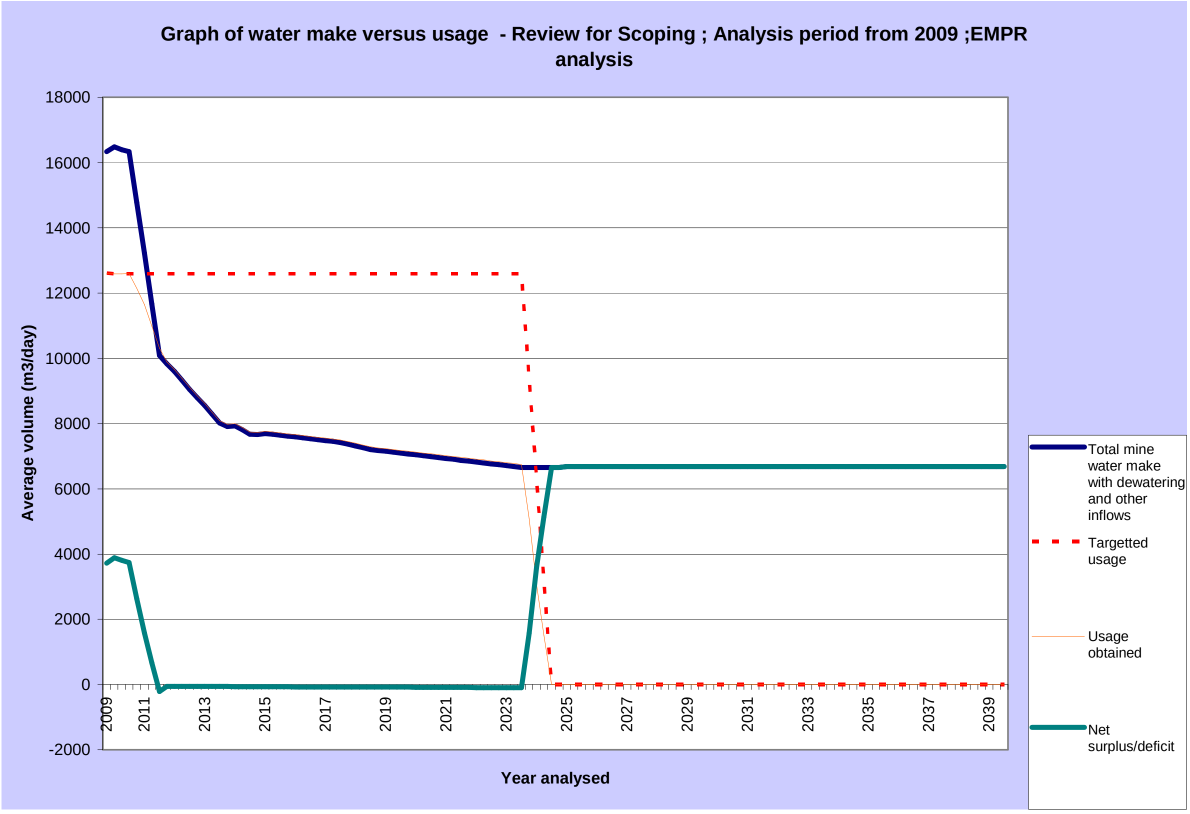


Figure 19: Net Water Make After Water Use (next 30 years) and Including the Water Make From the Dewatering Boreholes.

Important aspects to note are as follows:

- Dewatering is expected to commence prior to the plant being operational, since there will be no ore to process at the start of mining.
- During the operational phase, targeted usage (the dotted line in Figure 19) will exceed the available water, even taking account of the dewatering volumes. The GDMP is expected to have a deficit for the life of the mine, varying from 2,500 m^3/day initially to some 6,000 m^3/day towards the end of the LOM.
- To address this shortfall, a well field is proposed within the MLA to ensure adequate water supply to the process plant. However, the groundwater is presently under review and a decision on the need for a well field will be determined during the detailed design phase.

Water generated at the Gope Project Site from surface components such as direct rainfall into the pit is expected to be only some 8% of the total water make (taking account of the water extracted from the dewatering boreholes) averaged over the LOM. However, not all of this water will be contained, and surface water will only make up around 6% of the total water make to be managed.

4.9.3.4 Management of Water Make

For most mines, a water surplus develops on the mine at some point during the operational phase, normally around 5 years after operations commencing, but varying from site to site. It can thus become difficult to contain all of the water affected by mining, with the risk that affected water could spill to the environment. However, at the Gope Project Site, for average rainfall, the GDMP will have a water deficit for the entire life of mining due primarily to the arid environment, but also to the limited extent of catchments on the site. There is thus little risk of unplanned spillages during normal conditions.

4.9.3.5 Management of Extreme Rainfall Events

Analysis of peak inflows was undertaken by considering some of the historical extremes in the rainfall record. The following should be noted:

- The rainfall record indicates some short periods of high rainfall. The most significant of these was in February 1988 where some 414mm of rainfall occurred over a period of 8 days;
- Storage is required on site to manage significant rainfall events. At this stage a hypothetical dam has been modelled excluding the water supplied from the groundwater well field. If it is assumed that for an extreme event such as that of February 1988 would be allowed to spill, then a storage capacity of around 400 Ml is required for other short and infrequent rainfall events, and
- Inflows from the plant, and dumps area are expected to comprise a very small component of the total water make, currently estimated at less than 2%.

Evaluation of the data indicates that the peak events (as might be expected) all occur in the peak summer months, primarily but not exclusively around December to March.

4.9.3.6 Management of Dry Periods

Analysis of dry period conditions is given in Figure 20 considering the historical rainfall from 1962 onwards. It can be seen that at times there is virtually no summer water make.

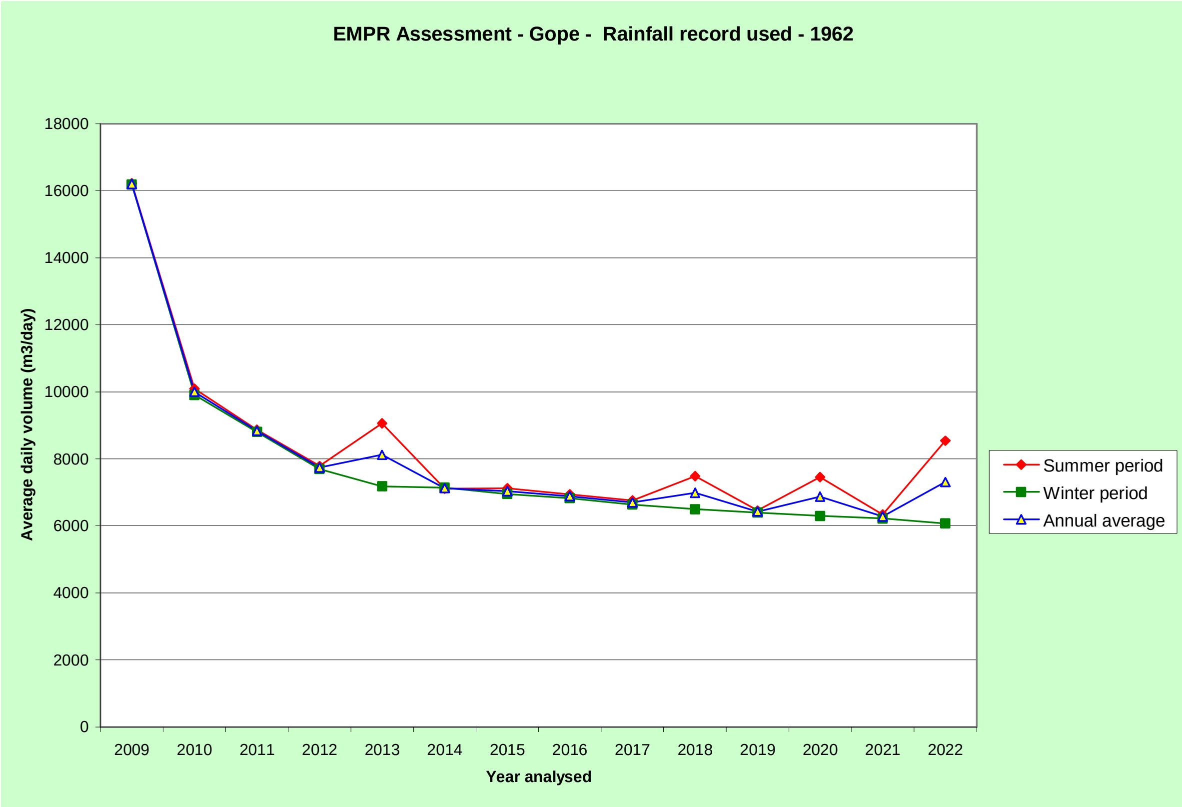


Figure 20: Seasonal Water Make Considering Dry Years (Historical Rainfall from 1962 Onwards).

4.9.3.7 Post Closure

Post closure the mine will no longer be dewatered. Water levels will gradually rise until the surface area is large enough so that the ingress rates equal the evaporation rates.

Modelling of the pit suggests that the balance between evaporation and groundwater recharge will occur approximately 200 m below the pre-mining groundwater level.

By implication, the pit could remain a sink for groundwater post closure, thus limiting the recovery of groundwater around the workings. It is unlikely that this can be overcome unless the pit was to be backfilled to a level equal to the pre-mining groundwater level.

4.10. DESCRIPTION OF PHASES OF THE PROJECT

4.10.1 Construction Phase

The construction phase will progress over a period of 3 years and will include the construction of various facilities at the GDMP, including:

- Mineral processing plant;
- Mine camp containing accommodation units as well as tented facilities, recreational facilities, kitchen and dining room facility;
- Erection of a security perimeter fence around the mining area;
- Drilling and installation of pit dewatering and water supply infrastructure;
- Pre-stripping of 80 meter thick sand overburden;
- Initial construction of the waste rock and sand overburden dump;
- Construction of slimes dam;
- Construction of the TMF;
- Domestic and / or hazardous waste disposal (should the on site disposal option be selected);
- Maintenance of temporary access road;
- Construction of the power supply infrastructure by Botswana Power Corporation (BPC) (but included in this SEIA), and
- Cell phone communication infrastructure.

A workforce of approximately 1,000 people is expected to be on site during this phase of the GDMP.

4.10.2 Operational Phase

The operational phase will commence immediately upon completion of the construction of the mine facilities and infrastructure. The operational life of the mine is estimated to be 15 years.

During this phase of the GDMP the main activities will comprise:

- Continuation of overburden and waste rock material stripping;
- Mining of Kimberlite ore;
- Dewatering activities in order to maintain safe in pit working conditions;
- Abstraction of water from the anticipated well field;
- Hauling of ore and waste material to the product stockpile and waste rock and sand overburden dump;
- Mineral processing;
- Generation of slimes material and hence ongoing expansion of the slimes dam;
- Generation of tailings material and hence ongoing expansion of the TMF;

- Permanent access road construction (both on and off site);
- Domestic and / or hazardous waste disposal, and
- Ongoing environmental remediation.

A workforce of between 400 - 600 people is expected to be on site during this phase of the GDMP.

4.10.3 Decommissioning, Closure & Rehabilitation Phase

End of Life of Mine (LoM) remediation will commence towards the end of the mine operation and will proceed for an estimated 3 year period beyond the life of the mine.

Once a detailed remediation plan has been developed as part of the SEMP during the SEIA phase of the GDMP, activities will be listed. End of LoM remediation will be undertaken for applicable structures during this phase of the GDMP.

SECTION 5. BENEFITS OF THE PROJECT

5.1. RATIONALE FOR THE INVESTOR

GDL is a relatively young company which has embarked upon an aggressive growth strategy and the GDMP fits into this. The diamond industry is currently in quite a unique situation, there has been a steady increase in the demand, whilst the supply has not been able to maintain these growth curves. Mining by its nature depletes the resources daily and there have been precious few new deposits being exploited and hence there is the potential for the demand supply gap to increase without new operations being brought into production.

In terms of GDMP fitting into the GDL growth strategy the first important point is the fact that it is located within Botswana, which as a country is regarded as the centre of diamond mining as well as being regarded as one of the post politically stable countries in the continent. Botswana also has developed experienced significant economic growth as a result of diamond mining and thus the country has vast experience in this sector.

Secondly, the Gope deposit is regarded as being significant and having relatively little risk. The ore body has been the subject of extensive exploration and quantification investigations, and thus the ore body is well documented and understood. The Gope 25 pipe is considered to be a significant Kimberlite pipe with an estimated 100 million tonnes in reserve. This will ensure a reasonable LOM, estimated at approximately 15 years or more. This LOM adequately off sets the capital requirements associated with the remoteness of the Gope Project Site and the pre-strip requirements to ensure a profitable operation.

The GDMP is however not without risk, some of the more significant risks associated with the GDMP, are detailed below;

- It is located inside a Game Reserve;
- There is a historical social issue with respect to the Basarwa people;
- There is a large amount of sand to be mined as the pre-strip prior to accessing the ore body;
- The site is remote and hence additional capital investment required for the access road, bulk power, the single status camp, and the associated logistics to transport all men and material to site and back, and
- The water supply is potentially not sufficient.

GEC, however, believes that despite these risks the GDMP fits into the GDL growth strategy and intends to mitigate these risk in the following manner:

- Conducted a full and comprehensive SEIA, to ensure that the mine is designed with the environmental sensitivities taken into account and the obtaining of the social license to operate;
- Conducting consultations with all stakeholders to ensure that a sustainable project is developed;

- Implementing the GDL operating model to reduce the overall operating cost of the project;
- Implementing GDL marketing arrangements which should improve the revenues by introducing the tender process to the diamond sales;
- Introduction of AG milling as the comminution circuit which should increase liberation and hence improve revenues, and
- The optimisation of the throughput by increasing it to 6 mtpa.

5.2. BENEFITS TO THE GOVERNMENT OF BOTSWANA

The development of a new diamond mine has several benefits to the government of Botswana, which includes the following:

- The project will lead to the expansion of the diamond mining base that underlies the economy of the country;
- The GDMP will lead to an increase in the utilisation of the natural resources of the nation;
- The GDMP will ensure a diversification of the operating diamond mining companies in the country, and
- Additional revenues will be generated through the levying of government royalties, company tax and personal taxes.

5.3. BENEFITS TO THE PROJECT AFFECTED COMMUNITIES

GEC is committed to ensuring the development and operation of a sustainable project. At the time of the compilation of this report, GEC was in the process of developing a Sustainable Development (SD) programme in order to facilitate the long term sustainability of communities directly affected by the GDMP. It is estimated that the first full SD report will be issued prior to the operational phase commencing – a first in the mining industry world wide.

Furthermore, the GDMP will contribute positively to the directly affected communities in the following manner:

- Development and improvement of infrastructure and social amenities;
- Increased work opportunities for skilled, unskilled and semi skilled persons;
- GEC is working closely with the Botswana Tourism Board to explore sustainable tourism opportunities that can be associated with the GDMP as tourism can continue sustainably, long after mining has ceased.

It is anticipated that some 1,000 jobs will be created during the construction phase and 400 to 600 during the operational phase.

5.4. ESTIMATED EXPENDITURE

The following figures are relevant the expenditure on the GDMP:

Table 22: Capital and Operational Expenditure for the GDMP

VARIABLE	COST (BWP)
Capital Expenditure (CAPEX)	
Year 1	581 184 825
Year 2	1 194 718 150.00
Year 3	1 262 461 315.00
Total	3 038 364 290
Operational Revenue (OPEX)	
Year 3	224 880 406.00
Year 4	997 189 518.00
Year 5 to 19 average	3 370 103 439.40

During the construction phase, it is expected that a total of $470 Million (US) (approximately BWP 3 billion). GEC is committed to localisation of services where possible to increase the impact of this financial injection into the economy of Botswana.

The impact upon the regional socio-economic environment was assessed and has proven significant (refer to Appendix 11 for the full report).

SECTION 6. DESCRIPTION OF THE EXISTING ENVIRONMENT

6.1. INTRODUCTION

6.2. CLIMATE

6.2.1 Introduction

Meteorological data was obtained from the MM5 Satellite Database[19] from the United States Environmental Protection Agency (USEPA), which was modelled for the Gope Project Site. The coordinates that were used as the modal point are:

Latitude: 22°34.4'S

Longitude: 24°48.07'E

Baseline data was recorded into the MM5 database from 2002 to 2006 and is depicted graphically in the sections below.

6.2.2 Temperature and Relative Humidity

6.2.2.1 Average Monthly Temperature

The summer season stretches from November to March and daily summer temperatures range between 24°C and 27°C. The winter season is from May to August, and temperatures range between 14°C and 17°C.

Figure 21 indicates that temperature and relative humidity are indirectly proportional, i.e. as the temperature increases the relative humidity usually decreases or vice versa. It is noted that the humidity is higher during the winter months (average of approximately 62%) and lower during the summer months (average of approximately 52%). Relative humidity throughout the year ranges between 48% and 68%.

[19] Modeled MM5 Meteorological Data sourced from Lakes Environmental Software, Canada

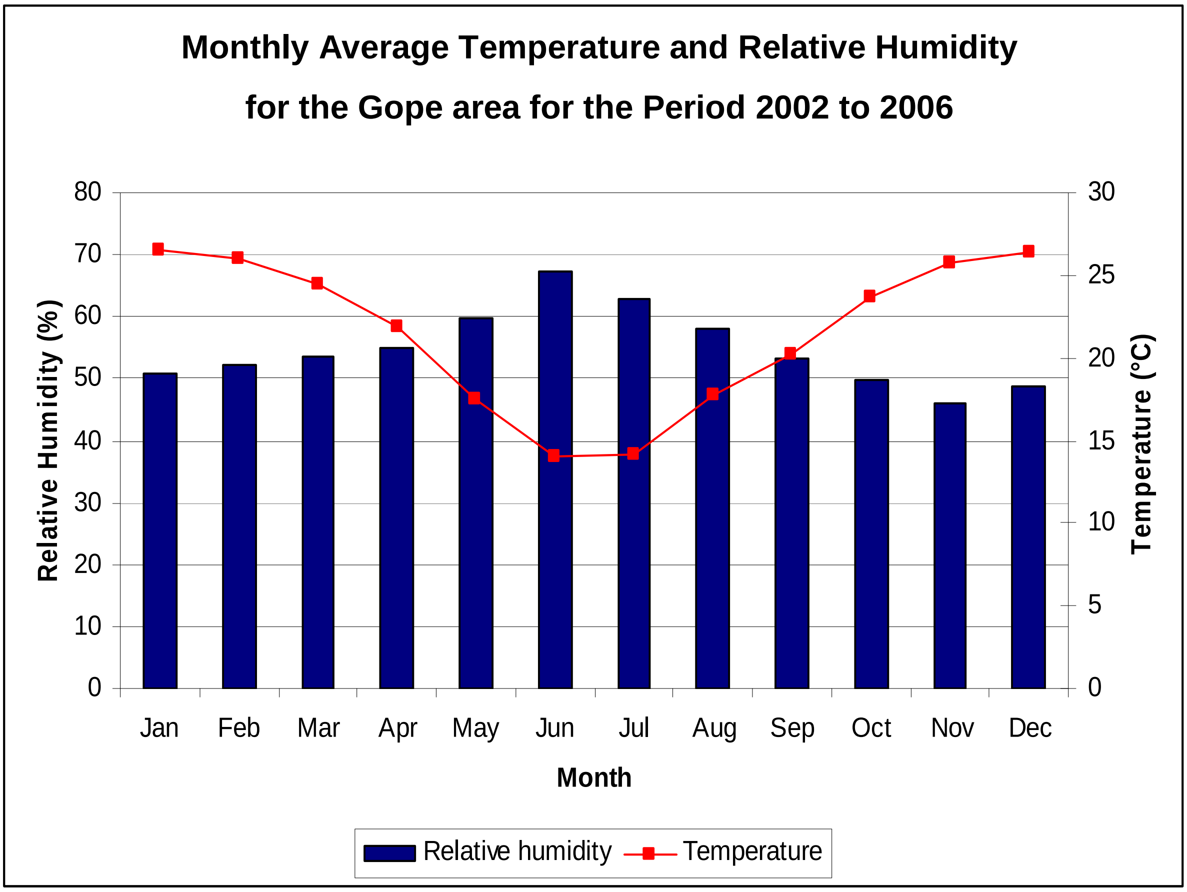


Figure 21: Monthly Average Temperature and Relative Humidity for the Gope Project Site for the Period 2002 to 2006 (MM5, 2007).

6.2.2.2 Monthly Minimum and Maximum Temperatures

Monthly maximum temperatures range between 26°C during the winter months and 36°C during the summer months. Monthly minimum temperatures range between 2°C and 17°C for the winter and summer months respectively. The temperature range between minimum and maximum daily temperatures is therefore 24°C for the summer months and 19°C for the winter months. It is noted that summer month temperatures during October - March, can exceed 40°C, and winter temperatures frequently fall below 0º (Bhalotra, 1987). Monthly minimum and maximum temperatures for the period 2002 - 2006 for the area in which the Gope Project Site is located are given in Figure 21.

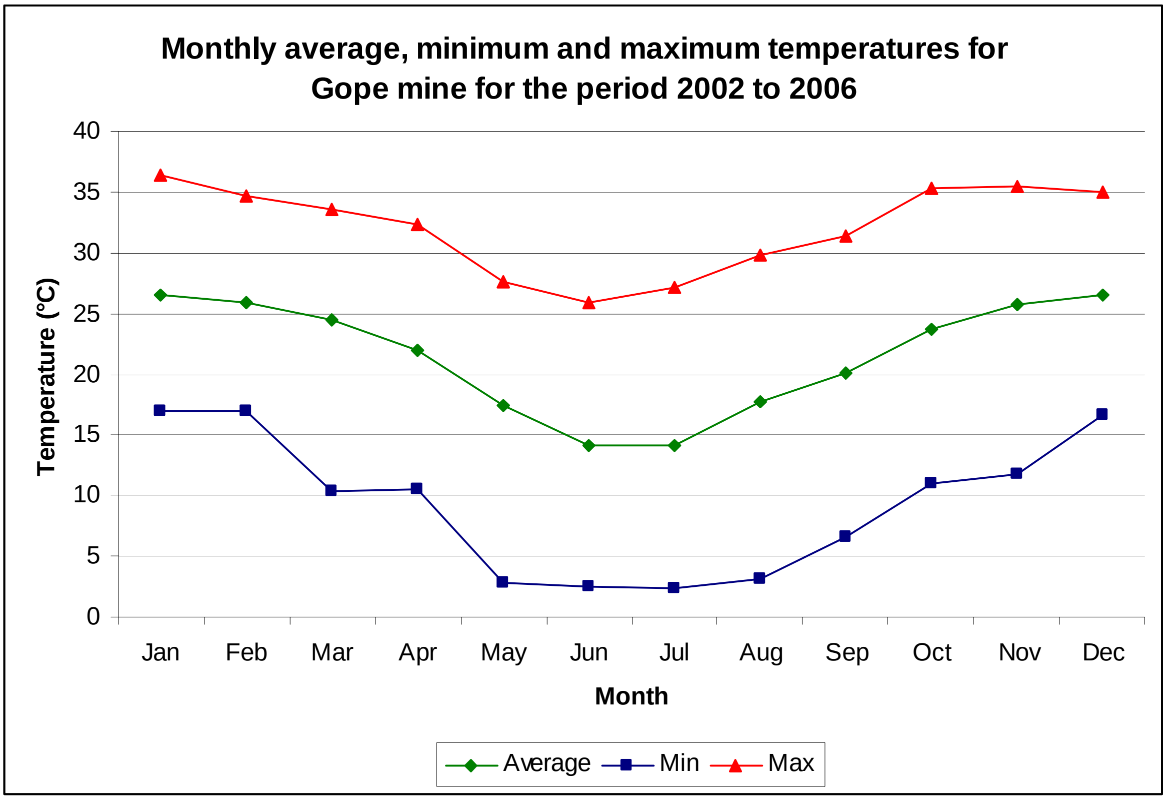


Figure 22: Monthly Average, Minimum and Maximum Temperatures for the Gope Project Site for the Period 2002 to 2006 (USEPA-MM5, 2007).

6.2.2.3 Monthly Average Hourly Temperature and Relative Humidity

Average hourly temperature and relative humidity for the Gope area are shown for a 12 month period in Figure 23. The average diurnal variations in temperature are clearly noticeable. The relationship between temperature and relative humidity is also clearly visible, where an increase in temperature decreases the relative humidity and vice versa.

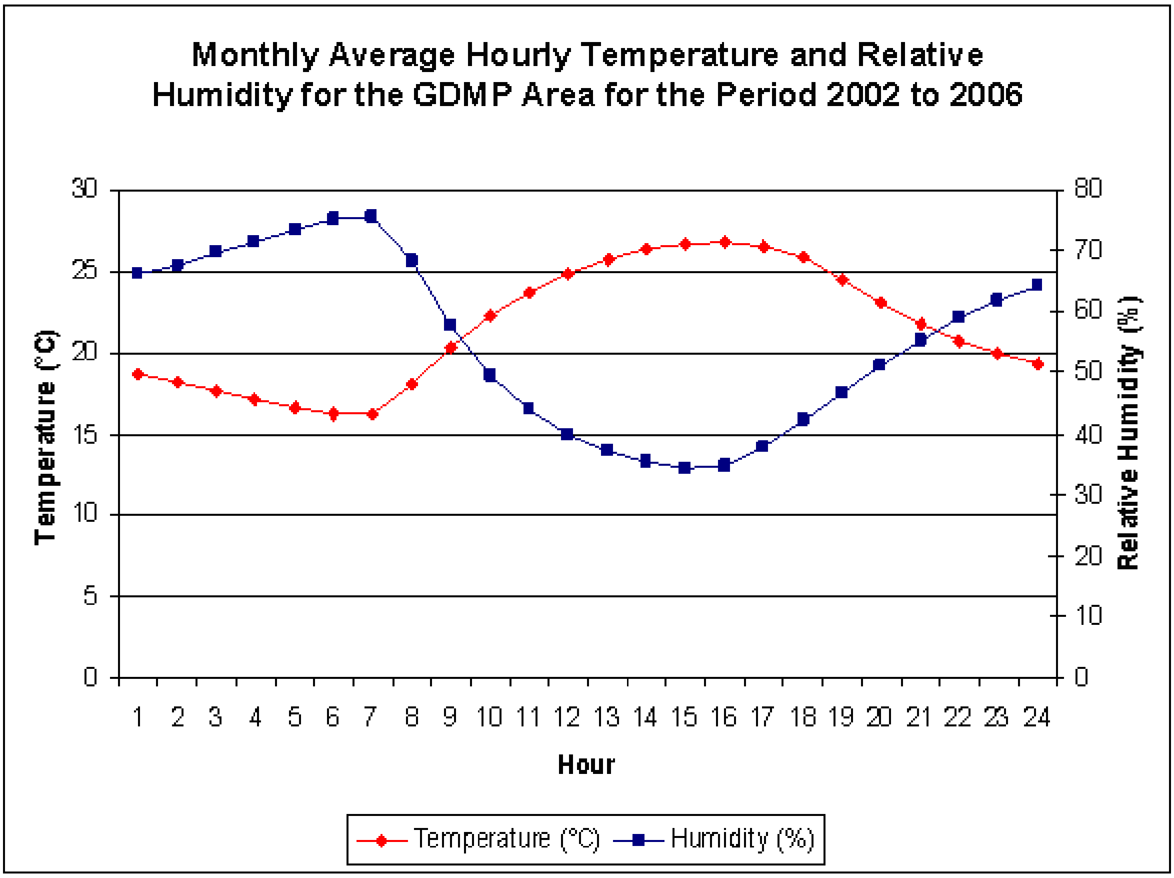


Figure 23: Monthly Average Hourly Temperature and Relative Humidity for the GDMP Area for the Period 2002 to 2006 (USEPA-MM5, 2007).

6.2.3 Rainfall

Most of the rainfall in Botswana occurs during summer from November until March. The rain occurs in the form of scattered and localised convective thunderstorms. These showers tend to result in flash flood conditions in areas of preferential water movement. Due to the high daytime temperatures, rainfall may not infiltrate the ground due to loss through evaporation and transpiration. Drought is endemic to the region due to the interior's peripheral and topographically remote location in respect to the region's rain bearing air masses (Bhalotra, 1987). Annual rainfall distribution (in mm) for Botswana is depicted in Figure 24. The majority of the country receives between 250 and 500 mm rainfall per annum, classifying the area as semi-arid. Some areas in the northern and south eastern part of the country receive greater than 500 mm per annum and an area in the south western part of the country receives up to 300 mm. According to Figure 24, the Gope Project Site falls in an area where the annual rainfall distribution is between 300 to 350 mm with a variation coefficient of 35%.

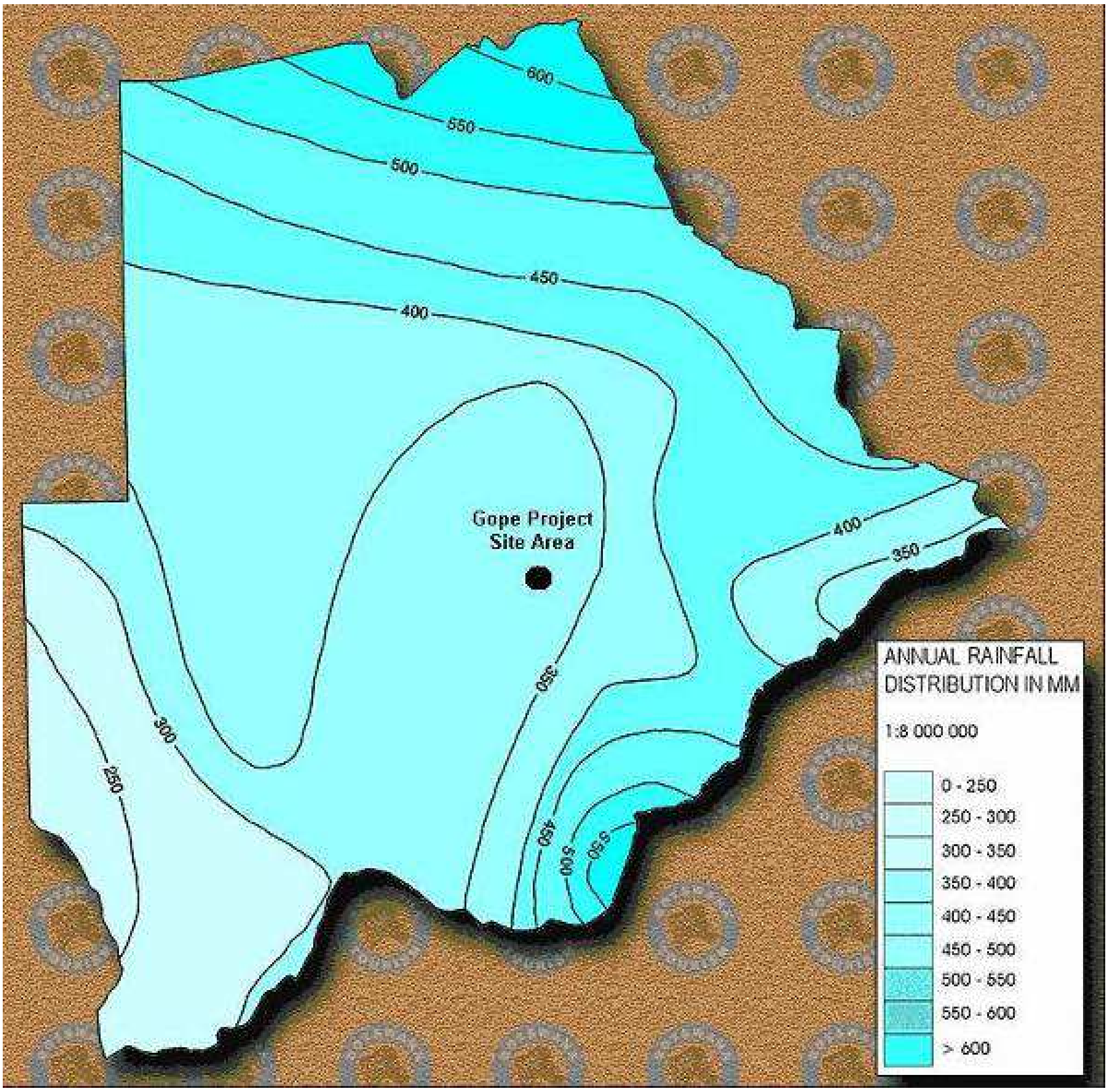


Figure 24: Annual Rainfall Distribution (mm) for Botswana (Botswana Tourism, 2007).

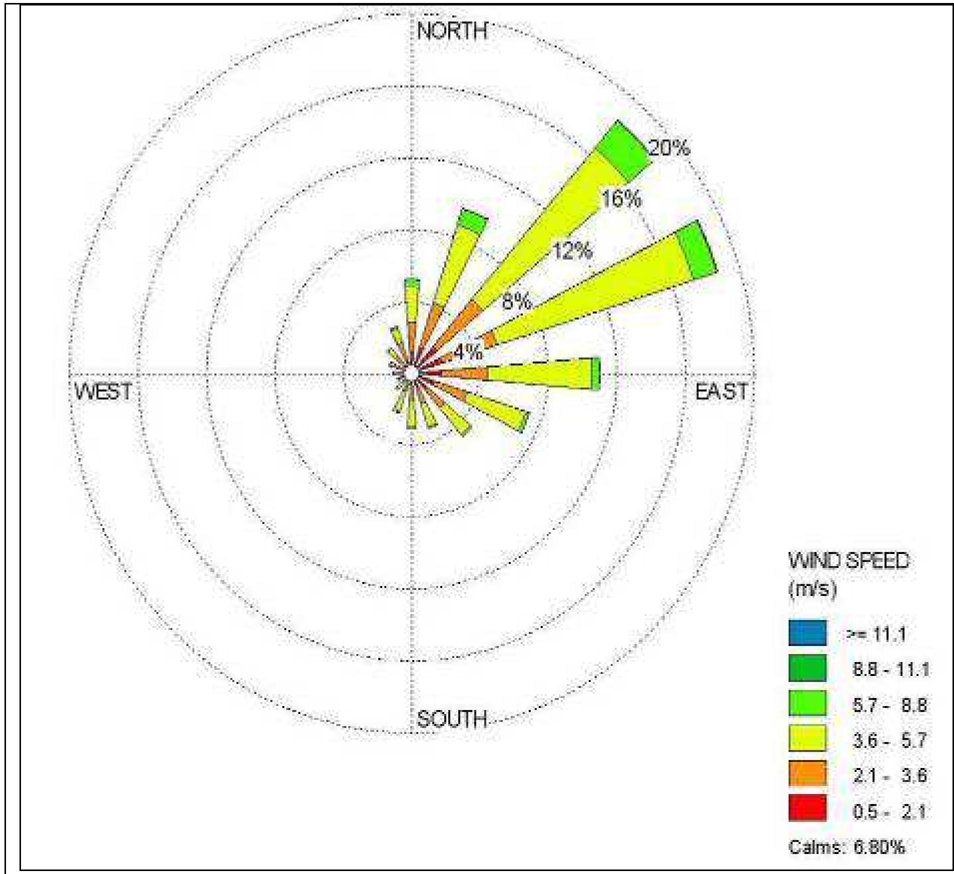
6.2.4 Evaporation

As would be expected in a desert area, evaporation levels are high. At Mahalapye (0713757 P), the closest weather station to the Gope Project Site, the Open Water Evaporation (OWE) rate is higher than rainfall by some margin, with an OWE of 1,825mm. Note that this rate is evaporation after adjustment from the S-Pan factor.

6.2.5 Wind

Figure 25 represents a wind rose for the Gope Project Site area for the period 2002 - 2006, and Figure 26 represents the wind class frequency distribution. In Figure 25, it is important to note the following:

- The 16 spokes of the wind rose represents the wind directions for the recording period;
- Wind speeds are categorised by different colours, and
- Concentric dotted lines indicate the frequency of occurrence of wind speed.



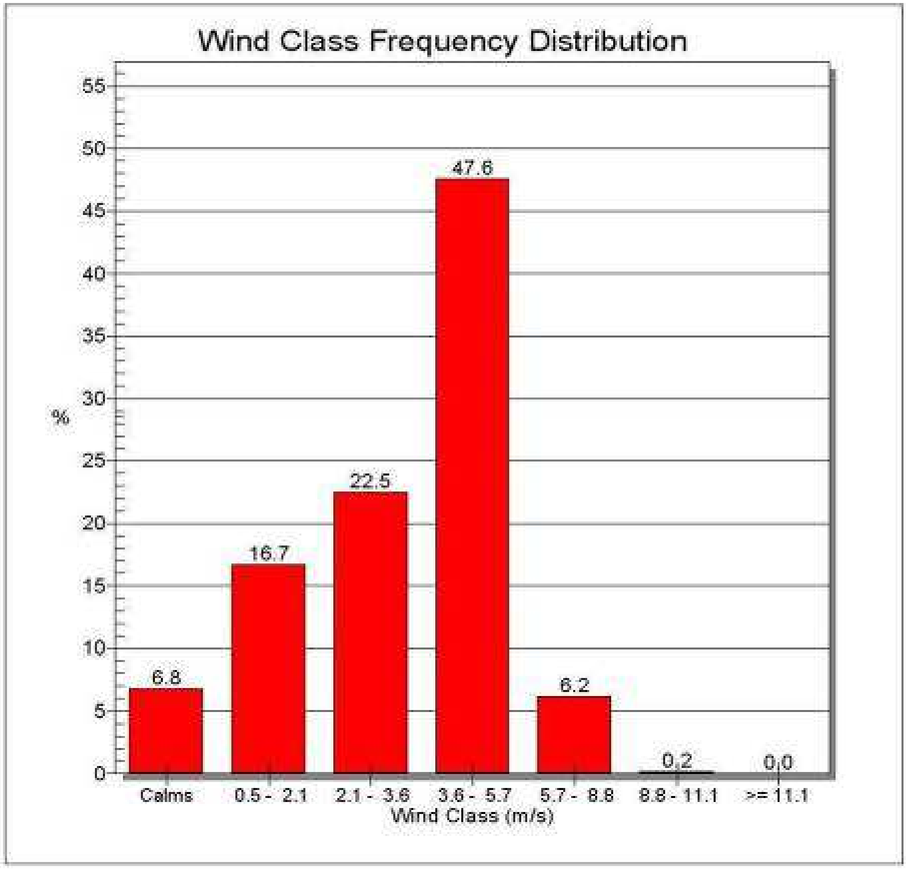


Figure 25: Wind Rose for the Gope Project Site Area for the Period 2002 to 2006 (USEPA-MM5, 2007).

Figure 26: Wind Class Frequency Distribution for the Gope Project Site Area for the Period 2002 to 2006 (USEPA-MM5, 2007).

Figure 25 indicates that the dominate wind direction is from the north east. Calm conditions, as well as wind speeds reaching up to 8.8m/s have been recorded in the area. As indicated in red in Figure 25 and in Figure 26, the dominant wind speed is between 3.6 and 5.7 m/s. The frequency of wind speed which occurs in this wind class accounts for almost 50% of recorded measurements.

Figure 26 further indicates that there is an increase in frequency with increasing wind speeds up to 5.7 m/s. Wind speeds within the 5.7 and 8.8 m/s class only account for 6.2% of the values recorded.

6.3. GEOLOGY

Please refer to Appendix 1 for the full Geology and Soils Report.

6.3.1 Regional Geology

The Central Kalahari region is covered by the vast expanse of unconsolidated to semi-consolidated Kalahari Bed sediments. The bedrock in the area of concern / interest (Gope) lies approximately 75 m below the topographic surface, and comprises a suite of rocks belonging to the Karoo Supergroup. The lithostratigraphy of the Karoo is complex but well known in Botswana (Smith, 1986), with the specifics of the lithologies underlying the site being no exception. The entire Karoo sedimentary sequence, inclusive of the basaltic lava cap is known to occur in the Central Kalahari region.

6.3.1.1 Karoo Supergroup

The Karoo Supergroup has been divided into several lithostratigraphic groups, including (in decreasing age) the Dwyka Group, the Ecca Group, Lebung and Stormberg Groups. For the GDMP only the Lebung and Stormberg Groups need to be considered. The Lebung Group comprises two lithostratigraphic units, referred to as the Mosolotshane and the Ntane Sandstone Formations, comprising intercalated reddish medium to fine grained sandstones, siltstone and mudstone (Mosolotshane Formation) having been laid down in a terrestrial fluvitile environment, while the Ntane Sandstone, which overlies the Mosolotshane Formation, comprises medium to fine grained Aeolian sandstones (wind derived).

Both of these formations are essentially sandstone units, although the transitional member is more silty, and has layers and streaks of mudstone and siltstone as distinguishing marker horizons.

The Stormberg lava that overlies the Ntane Formation is the top most unit of the Karoo Supergroup, and comprises tholeiitic basalt lava that has extruded over an undulating (disconformities) Ntane weathered surface.

6.3.1.2 Kalahari Beds

The Kalahari Beds that occur in the vicinity of Gope Project Site are between 75 m and 80 m thick and overlie Karoo bedrock. Two broad units are recognised in the area, including the upper fine grained, unconsolidated Aeolian sand unit, and the lower, partially consolidated unit that is often calcified and/or silicified.

6.3.1.3 Kimberlites

A total of five Kimberlite facies have been identified during the exploration undertaken at the Gope Project Site. These four facies make up the Kimberlite pipe that is proposed to be exploited at the GDMP.

The five facies include a tuffisitic Kimberlite, a hypabyssal Kimberlite, a basaltic breccia with tuffisitic Kimberlite, and a basaltic breccia hypabyssal Kimberlite.

In turn, the Gope pipe is one of pipes that make up the Kimberlite field in the Central Kalahari area.

6.3.1.4 Regional Structure

Of significance to the area of concern is the abundance of large faults that transect the area. These are not apparent at surface due to the extremely thick sand cover. However, the exploration drilling has exposed a strong West-north-west—East-south-east and North-north-east—South-south-west trend to the dominant fault zones. These are significant features in that the Kimberlite intrusions have taken advantage of these zones of weakness. The area is understood to be tectonically stable now, but would have shown movement along the fault and fracture zones in geological history.

6.4. SOILS

Please refer to Appendix 1 for the full Geology and Soils Report.

6.4.1 Data Collection

6.4.1.1 Review of Published Reports and Maps

The area proposed for development is totally isolated from any other development, and has to date been protected as a Game Reserve. The only other disturbance that has had any impact on the area to date is the nomadic bushmen, (evidence of which is noted in the cleared areas with evidence of stone tools etc.), and the exploration that has been periodically conducted since the late 1960's.

Extensive geological information of the immediate site is available from the exploration work undertaken on the geophysical anomaly that was originally sighted as the target. This information has been well documented in both the Exploration Activities documents, as well as in the numerous Geotechnical Studies undertaken.

The DEA has voiced its concerns regarding the impact of mining activities on the sensitive landscape and the soils in the area. The geotechnical studies are the only specialist studies that have assessed the cover materials in any detail. This has been used in the evaluation as a baseline from which the overall soils could be mapped and the subtle differences understood.

In undertaking soil studies of this kind, it is often very useful to understand the geology of the area as the parent materials are often the source of the soil in-situ. This is not necessarily the case at the GDMP, where the cover material is of Aeolian derivative and has been transported over great distances before coming to rest. The sedimentary lithologies and hard rock igneous formations that underlie the site, and that are to be mined, are too deep to have had any significant influence on the physical or chemical make up of the cover soils. In addition, the lack of structure and very limited pedogenic processes evident in most of the soils is indicative of young wind blown sands.

However, it is of paramount importance to the success of the sustainability of materials and vegetative cover, that the presence of a topsoil is recognised. This layer is the zone of sustenance for the highly sensitive vegetative cover that holds the desert in place. These conditions will need to be emulated as part of the storage and rehabilitation processes that are to be undertaken for the sustainable development and success of the GDMP as a mining venture

As a simplified section of the geology that underlies the site, the following lithologies are present:

0.00m - 0.30m	Pale yellow brown to brown topsoil
0.30m - 0.70m	Pale orange brown to yellow red subsoil
0.70m - 0.90m	Hard Pan layer – generally pale yellow to white/grey
0.90m - > 2.00m	White to grey subsoil
2.00m - 3.00m	Dry to slightly moist reddish to yellow brown loose to medium dense fine grained sand
3.00m - 6.00m	Dry, pale yellow and white medium dense to dense fine grained sand with occasional $CaCO_3$ concretions
6.00m - 30.00m	Dry, pale yellow to white dense to very dense fine grained sand with occasional $CaCO_3$ concretions.
30.00m – 75.00m	Dry, very dense white to grey calcareous sands and sandstone
>75.00m	Basalt and/or Kimberlite

6.4.1.2 Field Work

The reconnaissance pedological study of the site was performed based on a grid overlay of 300 m x 300 m. This was achieved wherever it was possible to gain access (old tracks and roads) or where the existing infrastructure allowed. A walk over survey was not possible (for reasons of dangerous wildlife), and un-controlled traversing of the veld was prohibited, as per the CKGR access permit conditions.

The initial site survey was undertaken between October and November of 2007, with a second site evaluation visit in January of 2008. This allowed for possible changes in climatic conditions, and gave the survey team the advantage of planning the classification and mapping exercise. In addition, the commissioning of the Power Line Route Study was only tabled in mid December of 2007.

In addition to the grid point observations, a representative selection of the soil Forms mapped was sampled for representative chemistry of the soils. A representative suite of core samples was taken from the recent exploration drilling and analysed for both physical and chemical constituents. The core was crushed to the size fractions that are going to be produced during the beneficiation process to determine the utilization potential of the various mineralogical waste by-products. The soil characterization and mapping was undertaken on a 1:20,000 scale (orthophotographic base).

A total area of approximately 5,120 ha was covered on the MLA, with a further 560 ha being mapped as part of the Power Line Route study.

The majority of observations used to classify the soils were made using a hand operated Bucket Auger. In all cases, the observation points were excavated to a depth of 1,500mm or until refusal was obtained. Immediately after completing the classification of the profiles, the excavations were backfilled for safety and conservation reasons.

Standard mapping procedures and field equipment were used throughout the survey. Initially, the “Google Earth” colour imagery was used as an orientation tool and a base onto which the field information could be mapped. This was not a satisfactory scale however, and the more accurate and better quality orthophotographs where purchased by Marsh for use as the base plan. All subsequent mapping was undertaken onto the 1:20,000 orthophotographic maps.

The fieldwork comprised a site visit during which profiles of the soil were examined and observations made of the differing soil extremes. Relevant information relating to the climate, geology, wetlands and terrain morphology were also considered at this stage. This information was obtained from the client or from other consultants involved in these areas of speciality. Information pertaining to the dust and air quality variables was also requested and used as a basis for the motivation on the stabilization and rehabilitation of the sand dump and the soil / mining waste material stockpiles.

The pedological study was aimed at investigating / logging and classifying the soil profiles. Terrain information, topography and any other infield data of significance was also recorded, with the objective of identifying and classifying the area in terms of:

- The soil types to be disturbed / rehabilitated;
- The soil physical and chemical properties;
- The soil depth;
- The erodibility of the soils;
- Pre-construction soil utilisation potential, and
- The soil nutrient status.

6.4.2 Soil Profile Identification and Description Procedure

The identification and classification of soil profiles were carried out using the Taxonomic Soil Classification System (Mac Vicar et al, 2nd edition 1991).

The Taxonomic Soil Classification System is, in essence a very simple system that employs two main categories or levels of classes, an upper level or general level containing Soil Forms, and a lower, more specific level containing Soil Families. Each of the soil Forms in the classification is a class at the upper level, defined by a unique vertical sequence of diagnostic horizons and materials.

All Forms are subdivided into two or more families, which have in common the properties of the Form, but are differentiated within the Form on the basis of their defined properties.

In this way, standardised soil identification and communication is allowed by use of the names and numbers given to both Form and Family. The procedure adopted in field when classifying the soil profiles is as follows:

i) Demarcate master horizons (Refer to Figure 27 - Figure 28 Soil Polygon Map below);

ii) Identify applicable diagnostic horizons by visually noting the physical properties such as:
   - Depth (below surface);
   - Texture (Grain size, roundness etc.);
   - Structure (Controlling clay types);
   - Mottling (Alterations due to continued exposure to wetness);
   - Visible pores (Spacing and packing of peds);
   - Concretions (cohesion of minerals and/or peds);
   - Compaction (from surface).

iii) Determine from i) and ii) the appropriate Soil Form, and

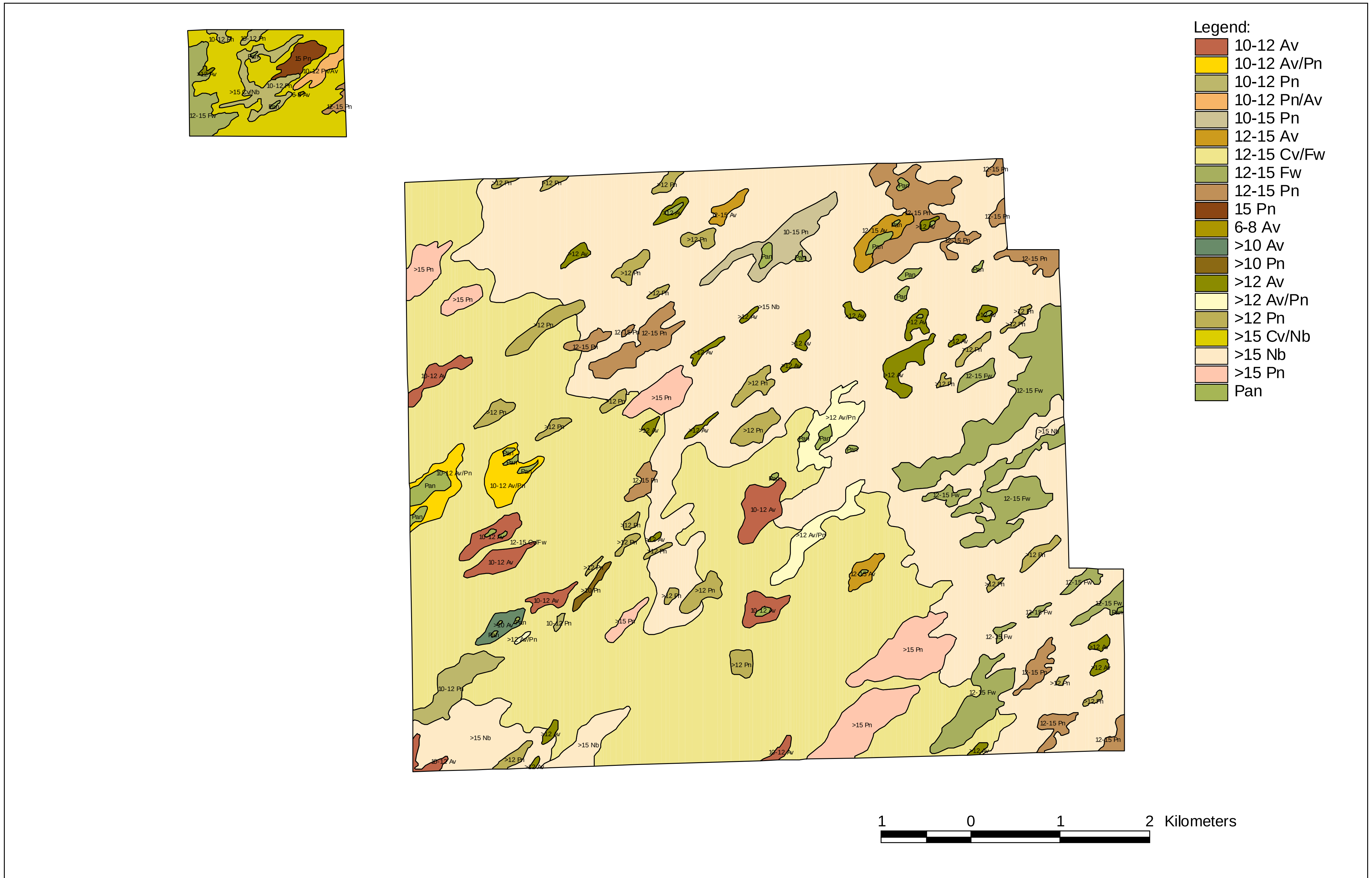
iv) Establishing provisionally the most likely Soil Family.

Table 23: Typical Arrangement of Master Horizons in Soil Profile.

SOLUM

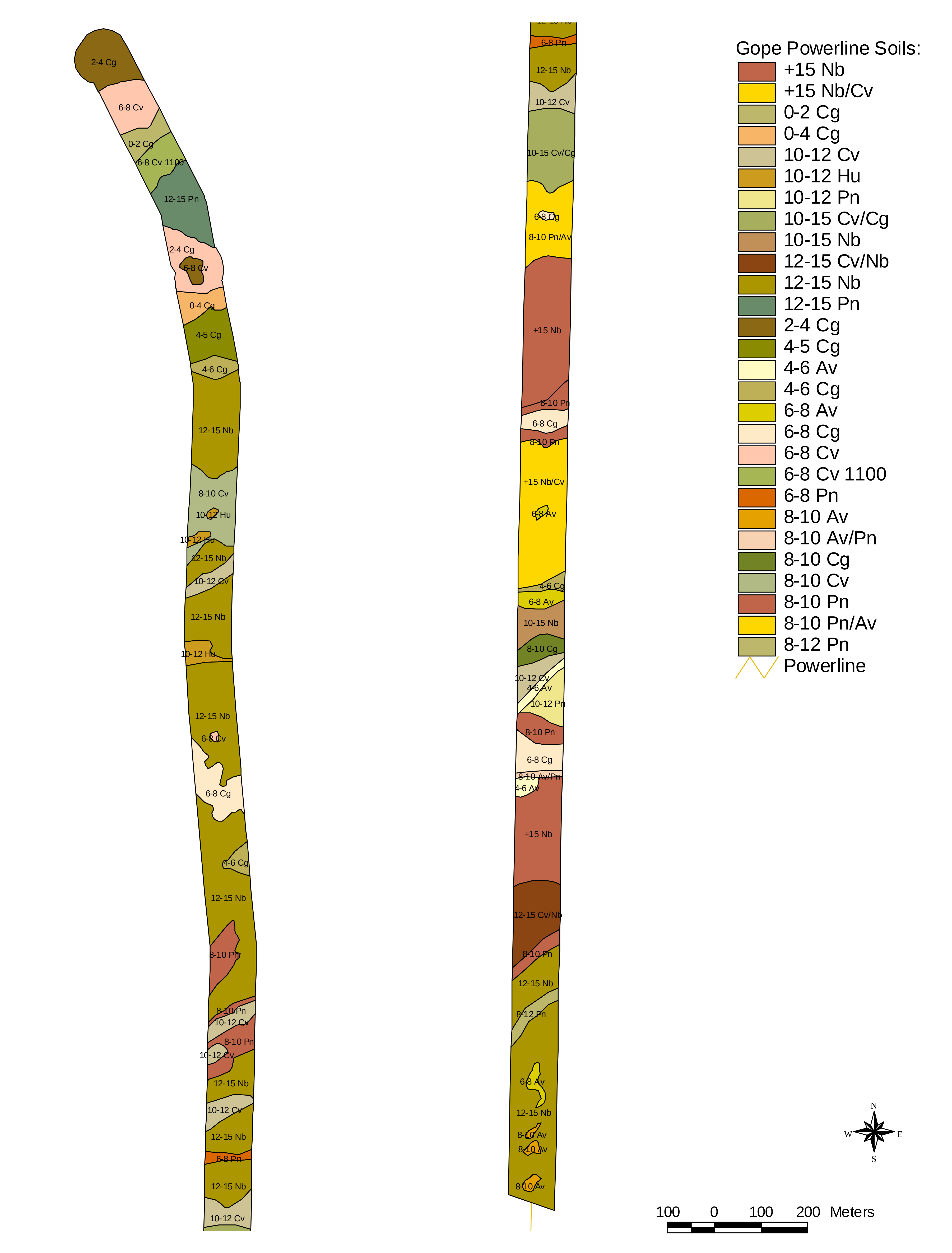
(Zone in which the soil forming processes are maximally expressed)

O		O1	Loose leaves and organic debris, largely undecomposed
		O2	Organic debris, partially decomposed or matted
A		A1	Dark coloured due to admixture of humified organic matter with the mineral fraction
		A2 or E	Light coloured mineral horizon
		A3	Transitional to B but more like A than B
G	B	B1	Transitional to A but more like B than A
		B2	Maximum expression of B-horizon character
		B3	Transitional to C
	C		Unconsolidated material
R			Hard rock



ESS (Pty) Ltd. P. O. Box 26264 Steiltes, Nelspruit 1200 Tel: 013-753 2746 Fax: 013-752 2565 E-mail: ess@earthscience.co.za	CLIENT: Marsh Environmental Services PROJECT NAME: Gope Diamond Mine FIGURE NAME: Mining Rights Area Soil Map	FIGURE NUMBER: 8.4.5a PROJECT NUMBER: MARSH.GOPE.S.07.05.056 DATE: April 2008

Figure 27: Soil Polygon Map - MLA.



ESS (Pty) Ltd. P. O. Box 26264 Steiltes, Nelspruit 1200 Tel: 013-753 2746 Fax: 013-752 2565 E-mail: ess@earthscience.co.za	CLIENT: Marsh Environmental Services PROJECT NAME: Gope Diamond Mine FIGURE NAME: Powerline Soil Polygon Map	FIGURE NUMBER: 8.4.5b PROJECT NUMBER: MARSH.GOPE.S.07.05.056 DATE: April 2008

Figure 28: Soil Polygon Map – Power Line Route.

6.4.2.1 Soil Forms Identified

The major soil types mapped for the MLA include those of the orthic phase Namib (Nb), Clovelly (Cv), Fernwood (Fw), and Coega (Cg) along with the hydromorphic forms, including the Pinedene (Pn), Tukulu (Tk) and Avalon (Av) Forms predominating.

The areas mapped have been captured in a Geographical Information System (GIS) format, and the differing soil forms have been ranked according to soil classification nomenclature and soil depth. The polygon areas for the differing soil forms and depths are tabled below (Table 24, and in Figure 27 and Figure 28).

Table 24: Soil Coverage – MLA.

POLYGON LAYER	SOIL FORM	SOIL DEPTH	AREA (HA)
>10 Av	Avalon	>10	9.97
>10 Pn	Pinedene	>10	4.60
>12 Av	Avalon	>12	61.48
>12 Av/Pn	Avalon/Pinedene	>12	54.91
>12 Pn	Pinedene	>12	122.95
>15 Cv/Nb	Clovelly/Namib	>15	126.56
>15 Nb	Namib	>15	2043.20
>15 Pn	Pinedene	>15	153.47
10-12 Av	Avalon	10 - 12	87.77
10-12 Av/Pn	Avalon/Pinedene	10 - 12	41.85
10-12 Pn	Pinedene	10 - 12	60.57
10-12 Pn/Av	Pinedene/Avalon	10 - 12	8.57
10-15 Pn	Pinedene	10 - 15	38.56
12-15 Av	Avalon	12 - 15	28.82
12-15 Cv/Fw	Clovelly/Fernwood	12 - 15	1831.58
12-15 Fw	Fernwood	12 - 15	244.73
12-15 Pn	Pinedene	12 - 15	148.73
15 Pn	Pinedene	>15	11.49
6-8 Av	Avalon	6-8	0.20
Pan	Pan		40.57
Total Area (ha)			**5120.58**

Table 25: Soil Coverage – Power Line Route.

SUMMARY OF SOILS AS % OF TOTAL			
SOIL DEPTH & FORM	**SOIL FORM**	**SOIL DEPTH (DM)**	**POLYGON AREA (HA)**
4 - 6 Av	Avalon	40 - 60	4.07
6 - 8 Av	Avalon	60 - 80	5.39
8 - 10 Av	Avalon	80 - 100	3.26
6 - 8 Cv	Clovelly	60 - 80	27.94
8 - 10 Cv	Clovelly	80 - 100	14.75
10 - 12 Cv	Clovelly	100 - 120	22.3
12 - 15 Cv/Nb	Clovelly/Namib	120 - 150	29.97
2 - 4 Cg	Coega	20 - 40	14.71
4 - 6 Cg	Coega	40 - 60	17.47
6 - 8 Cg	Coega	60 - 80	20.88
8 - 10 Cg	Coega	80 - 100	4.48
0 - 4 Cg	Coega	0 - 40	9.94
10 - 12 Hu	Hutton	100 - 120	4.56
15 Nb	Namib	>150	50.5
12 - 15 Nb	Namib	120 - 150	169.13
15 Nb/Cv	Namib/Clovelly	>150	29.58
6 - 8 Pn	Pinedene	60 - 80	1.89
8 - 10 Pn	Pinedene	80 - 100	30.58
10 - 12 Pn	Pinedene	100 - 120	5.97
12 - 15 Pn	Pinedene	120 - 150	13.98
8 - 10 Pn/Av	Pinedene/Avalon	80 - 100	15.29
Totals			**496.64**

6.4.2.1.1 Namib (Nb)

The Namib Form soils mapped make up a significantly large portion of the cover materials that could be impacted by the mining operation and the power line route, and represent the typical Aeolian sands. By definition, the Namib Form soils comprise an orthic “A” horizon on a subsoil that is greater than 500 mm deep, is a recent deposit that shows a colour change in the top horizon. The material is usually Aeolian and shows very little pedogenic processes. The texture can vary, but is normally medium to coarse grained with little to no macroscopically visible structure. The colour can vary from dark yellows and reds to grey white and often exhibits pale grey and typical “E” horizon (leached and washed out), and exhibits consistency that is loose, friable or soft. The term Regic or *rhegos* means = blanket.

The difference between these wind blown sands and the Clovelly, Fernwood and other orthic soils noted in the area is that the Namib show little to no pedogenic features (have had no time – recently deposited – to show distinctive ped formation etc.)

The Namib Form soils mapped in the area vary from those with medium to coarse grained well sorted yellow to yellow grey and brown sands and clear indications of some cross bedding or stratification, to those with no structure at all and grey to white horizons at depth.

The Namib comprise predominantly medium grained sands with little (less than 4% clay and or silt) to no clay, and generally exhibit a single grained structure. These soils generally returned pale red /

brown to yellow red colours in the topsoils and medium grained sands with pale yellow brown to grey and white colours in the subsoil horizons. The mineralogy of these sands is predominantly silica with varying amounts of calcium (as $CaCO_3$), magnesium and sodium.

In the topographically lower lying areas, the slightly higher clay contents (7% max) are associated with the occurrence of smectite as adhered particles to the quartz grains. These additions extend to a point where (in places) the soils show distinct signs of both structure as well as pedogenic processes. The difference is subtle and difficult to distinguish in an auger core.

In almost all cases mapped, these soils classify as having a dystrophic leaching status (marked leaching) based on their well sorted nature. The affects of water leaching will be high even though the rainfall is relatively low (300 mm/yr). Moderately high leaching will take place based primarily on the extremely low clay contents and the in-ability of the materials to retain water.

The Namib Form soil is, as already stated, the most common soil form in the area, forming the deep wind-blown sands and low dunes that characterise the area.

Variation occurs within the inter-dunes, where soils with slightly higher clay content and some evidence of calcification (very light cementing of the sand grains) are noted. There are areas where these features are linked to a hard pan or compacted layer (700 mm to 900 mm) that shows evidence of very weak pedocutanic structure.

Physically, these soils (dune ridges) are noted to support the larger species of trees and shrubs / bushes, with a distinct botanical change within the valleys and inter-dunes. Reasons for the larger vegetation being restricted to the dunes is not well understood, but is probably associated with the ability of certain plants to root deeper for their water than others.

The chemical analysis undertaken on the composite samples returned only moderate reserves of Ca and Mg, with lower than required reserves of P, Zn and K. Supplements of these nutrients will be needed if the soils are to be utilized for rehabilitation and or the stabilization of the sand stockpile dump. These soils will not (under the conditions - <300 mm of rain) sustain any form of arable crop production. At best, very low intensity grazing / browsing of the natural wildlife will be sustainable.

6.4.2.1.2 Clovelly (Cv) and Etosha (Et)

The Clovelly and Etosha Form soils mapped in the area comprise predominantly fine to medium grained sands with subtle, but distinctive signs of calcium carbonate within the profile. The presence of $CaCO_3$ is significant, and imparts a light structure to the subsoils.
Pedogenic process are slight but present if observed critically. The Etosha Form soil is not very common in the vicinity of the MLA, but is very evident, and forms a significant part of the Power Line

Route in the northern extremes close to Orapa, where the presence of Coega (Cg) Forms are dominant.

These soils differ from the Namib Form only in the degree of texture and structure (Pedogenesis) that they exhibit, and the slight increase in $CaCO_3$ and clay mineralization that is present. The colours range from pale yellow and red / brown topsoil to yellow grey and white in the subsoil. The extremely well sorted nature and high leaching status of these soils renders them low in the required nutrients required for sustainable growth of vegetation.

The texture is dominated by fine to medium grained sands, with clay contents varying from as low as 1% to a maximum of 7%.

In the topographically lower lying areas, the slightly higher clay contents are associated with the accumulation of smectite on the quartz grains and the concentration of sodium salts at moderately shallow depths.

In almost all cases mapped, the soils classify as having a dystrophic leaching status (highly leached) and are non-luvic in character. These soil forms generally occupy the crest and midslopes of the dunes, and returned Effective Rooting Depths (ERD) that vary from as shallow as 200 mm where the clays and organic carbon is restrictive to greater than 1,500 mm where the water holding capability of the sands is sufficient to sustain root growth.

Chemically, these soils are similar to the Namib Form described above, the variation being noted in the percentage of calcium and possible magnesium where the accumulation of $CaCO_3$ has occurred within the rooting zone.

Supplements in the form of fertilizers/nutrients will be needed if the soils are to be utilized for anything other than natural low intensity grazing of wildlife. Additions of fertilizers are required if economically sustainable farming is to be undertaken on a long-term and sustainable basis.

6.4.2.1.3 Pinedene (Pn), Avalon (Av) and Fernwood (Fw)

The Pinedene, Avalon and Fernwood Forms mapped fall within the “hydromorphic” category of soils as classified. These soils are generally found in the inter-dunes associated with and down slope of the dry sandy loams and sandy clay loams (Clovelly Form) and form the transition zone to the moist grasslands.

Chemically, these soils (characteristics are similar within these same forms) are highly leached returning significantly lower amounts of Ca and Mg and Na in the topsoils, with accumulations of these nutrients at depth (on hard pan). The leaching of the nutrients down the profile is significant, particularly with regards to the finally balanced need for water and accumulations of the life sustaining minerals and salts needed by the animal population. Evidence of diggings for water and salts associated with the Pan depressions show a definite correlation between the concentration of sodium salts and the "hard pan" barrier to the water infiltration in the pans.

By definition, these soils vary in the degrees of wetness at the base of their profile. i.e. The soils are influenced by a rising and falling water table, hence the mottling within the lower portion of the profile and the pale background colours.

Depths of utilizable soil (to top of mottled horizon) vary from 500 mm to 1,000 mm. The deeper rooting depths (>600 mm) are considered potentially utilizable soils, with those less than 400 mm being considered to have a wilderness capability. In general, these soils are high in transported clay in the lower "B" horizon with highly leached topsoils and pale denuded horizons at shallow depths.

These soils will be slightly more susceptible to compaction when wet, and will potentially be more difficult to work due to the wetness factor.

However, these soils will be of use in the rehabilitation and stabilization of the sand berm as they have a slightly higher water holding capability than the single grained, clay poor materials. Stockpiling of these soils should be done separately from the dry soils where possible, as they will be important as cover material.

6.4.2.1.4 Westleigh (We) - Pans

The Westleigh soil form is exclusively associated with the Pan features. This soil form is by definition a soil with hydromorphic characteristics. It exhibits strong indications of wetness at shallow depths in the form of strong red to yellow / red mottling on a leached pale grey background.

In general, these soils are high in transported clay in the lower "B" horizon with highly leached topsoils and pale denuded horizons at shallow depths. The nutrient status is generally low.
These soils will be more difficult to work due to the wetness factor, both during the mining operation, as well as on rehabilitation, and compaction is a problem to contend with if these soils are to be worked during the wet months of the year.

Stockpiling of these soils should be done separately from the dry soils and greater care is needed with the management of erosion problems during storage.

6.4.2.2 Soil Physical Characterisitcs

A suite of representative samples from the differing soil forms / types were taken and sent for analyses for both chemical as well as physical parameters. A select number of samples were submitted, each sample containing a number of sub samples from a particular soil polygon / type, which is representative of the area in question, thus forming a composite sample, which in turn is representative of the soil polygon rather than just the point sampled. In addition, a suite of samples of the mining waste / by-products that will be produced from the mining and processing operations (waste rock, tailings material and slimes) where tested for their physical and chemical attributes. This was deemed important as these materials and the variation in grain size could be extremely important in the stabilization of the highly erodible sand dump. The size distributions of the sand (primary cover) and the related by-products (waste rock, tailings material and slimes) are tabulated below (Refer to Table 26).

The majority of the soils mapped exhibit weak to very weak structure, low to extremely low clay contents and dystrophic leaching status. The resultant workability of these materials will be moderately easy, with little to no problems with structural integrity of the materials or adverse compactability. However, in contrast to very structured and heavy soils, the sands that will need to be handled will erode with ease, and have little to no cohesive properties that will hold either water or nutrients in place.

These facts make for difficulties in the rehabilitation and stabilization of the materials, and will be a test for the construction team who will need to stockpile the sands as a berm around the workings before there is any clay rich or rock material that can be used to clad the berm. Mitigation of these impacts will need to be investigated in depth, and an interim answer found to the stabilization of materials.

Table 26: Soil Physical Properties.

GDMP - Soil Physical Properties

Sample	Location	Depth	Particle size (mm) % Passing									Atterburg Limits (%)				MDD	OMC	CBR @ % Compaction					Material Description	TRH20 Class	Properties/Applications
No.		(m)	19	13.2	4.75	2	0.425	0.25	0.15	0.075	0.002	LL	PI	LS	GM	kg/m³	%	100	97	95	93	90		(refer diagram)	
TP1	PLANT A	1.0	100	100	100	100	98	79	34	9	1	22	1	0	0.94	1696	12.9	19	15	12	10	8	Fine grained sand - Aeolian	N/A	High collapse potential
	(Preferred	3.0	100	100	100	100	99	86	38	8	1	21	1	0	0.94	1783	11.5	27	23	20	18	15	Fine grained sand - Aeolian	N/A	High collapse potential
	Site)	1.0+3.0	100	100	100	100	98	73	36	8	1	22	1	0	0.94	1826	9.0	125	100	87	75	60	Stabilized fine grained sand (3% OPC)	N/A	Stiff soil raft
		1.0+3.0	100	100	100	100	98	73	36	8	1	22	1	0	0.94	1848	10.4	150	140	134	129	121	Stabilized fine grained sand (5% OPC)	N/A	Stiff soil raft
TP2	EMV	1.0	100	100	100	100	97	84	30	3	0	23	2	0	0.99	1656	13.2	22	10	6	3	2	Fine grained sand - Aeolian	N/A	High collapse potential
		3.0	100	100	100	100	99	82	36	7	1	24	1	0	0.95	1678	14.6	31	20	15	12	8	Fine grained sand - Aeolian	N/A	High collapse potential
TP3	HOUSES	1.0	100	100	100	100	98	84	40	6	1	21.5	0.6	0	0.96	1686	13.2	28	13	8	5	3	Fine grained sand - Aeolian	N/A	High collapse potential
		3.0	100	100	100	100	99	88	25	7	1	20.5	0.9	0	0.95	1710	12.4	28	19	15	12	8	Fine grained sand - Aeolian	N/A	High collapse potential
TP4	PLANT B	1.0	100	100	100	100	99	82	34	9	1	38.5	0.6	0	0.93	1898	10.5	65	36	25	17	10	Fine grained sand - altered Aeolian	N/A	Collapse potential - Sub-grade
	(Alt. Site)	1.6	100	97	91	86	77	63	35	16	1	27.6	1.9	0	1.2	1696	16.5	43	37	34	31	27	Calcified sand - pedogenic	B	Sub-base
GB1	West of Gope Camp	2.5	100	77	56	44	30	24	15	9	1	36.4	1.2	0	2.18	1821	10.9	77	62	53	46	37	Calcified sand - nodular pedogenic	B	Base coarse

Source: ESS, 2008

6.4.2.2.1 Soil Distribution

The distribution of the soils (Figure 27 and Figure 28) is closely linked to the subtle topography and climatic variables that occur in the area, with distinctive dune ridges and inter-dune valleys that control the pedogenic process that are taking place. The prevailing wind direction is an extremely strong influence on the forms and distribution of the soils.

The better drained soils are generally associated with the dune ridges and upper slopes, while the hydromorphic and more clay rich soils (only very slightly) are confined to the inter-dune valleys.

6.4.2.2.2 Soil Erosion and Compaction

The erosion potential of a soil is expressed by an erodibility factor ("K"), which is determined from soil texture, permeability, organic matter content and soil structure. The Soil Erodibility Nomograph of (Wischmeier et al, 1971) was used to calculate the "K" value. An index of erosion (I.O.E.) for soils is then determined by multiplying the "K" value by the slope percentage. Erosion problems may be experienced when the Index of Erosion is greater than 2.

The "K" value is used to express the "erodibility" of a particular soil form. Erodibility is defined as the vulnerability or susceptibility of a soil to erosion. It is a function of both the physical characteristics of the soil, as well as the treatment of the soil. Erodibility ratings are expressed as:

- Resistant "K" factor = <0.15
- Moderate "K" factor = 0.15-0.35
- Erodible "K" factor = 0.35-0.45
- Highly erodible "K" factor = >0.45

The average "Erosion Indices" for the dominant soil forms on the study site are shown in Table 27. The majority of the soils mapped can be classified as having a moderate to low erodibility index based on the topography of the site, but classify as moderate or even high based on the low clay content and well sorted texture and low organic carbon content. These factors combine to produce highly mobile materials if exposed to strong winds.
Overall, the index is rated at moderate to high.

The relatively wetter and slightly more clay rich soils are susceptible to compaction. These soils will need to be managed extremely well, both, during the stripping operation, as well as during the stockpiling/storage and rehabilitation stages.

The concerns around erosion and compaction are directly related to the fact that the protective vegetation cover and topsoil will be disturbed during any mining or construction operation. Once disturbed, the impacts from wind and water are increased. Loss of soil (topsoil and subsoil) is extremely costly to any operation, and is generally only evident at closure or when rehabilitation operations are compromised. Well planned management actions during the construction and operational phases will save time and money in the long run, and will have an impact on the ability to successfully "close" an operation once completed.

Table 27: Erodibility of Differing Soil Forms.

SOIL FORM	ERODIBILITY INDEX	I.O.E.
Namib	High	1.40 – 2.50
Clovelly/Etosha	Moderate to High	1.40 – 1.85
Coega	Moderate to Low	0.90 – 1.25
Tukulu/Avalon/Pinedene	Moderate	1.35 – 1.45
Westleigh	Moderate	1.35 – 1.45

6.4.2.2.3 Soil Utilisation Potential

In general, the soils that will be disturbed and that will require rehabilitation are deep sandy loams and sands, well drained, with a susceptibility to erosion and compaction and in places show some signs of wetness at depth (shallow or perched water table).

The wet based and slightly structured soils will be slightly more difficult to work, both from a trafficability and workability point of view, but will aid in the stabilization of the sand berm and stockpiles if used surreptitiously.

6.4.2.3 Soil Chemical Characteristics

Sampling of the soils for nutrient status was confined where possible to areas of undisturbed land where there was little chance of there having been any influence imposed by man. These results will be useful in understanding the pre mining conditions, and will give a baseline from which to compare the soils when deciding on the need or lack thereof of fertilizers on rehabilitation at closure. However, due to the possible loss of nutrients from the soils during stockpiling, additional sampling and analysis of the soils will be needed prior to their use for rehabilitation.

The mineralogical waste materials (by-products) derived from the volcanic and intrusive basalts will have a significantly different nutrient base once decomposed, and will be somewhat different from the well sorted and nutrient poor sands that are to be stockpiled prior to the mining of the Kimberlite. The clay content of the Kimberlite derived by-product is more than four times that of the Kalahari sands that form the capping to the ore-body. This is of great significance as the clay rich materials (tailings and slimes) can be used to enhance the water holding capability of the soils to be used for the top-dressing of the dumps once mixed.

The results of the chemical analysis for the mineralogical waste materials indicate that for both the slimes as well as the coarser grained tailings material that will be produced, there is significant amounts of nutrient available that can be used for the enhancement of the growth medium proposed for the top dressing of the Consolidated Sand Dump. The detailed results of these analyses are contained in Appendix 1.

Similar studies undertaken on the Kimberlite tailings and slurry produced on a similar diamond mining venture (all be it in a very different climatic zone) have returned encouraging results, with both “clay” and “silt” contents as well as nutrient levels contributing positively to the improvement of the stabilization of the sands that will need to be stockpiled and vegetated.

The soil chemistry returned from the agricultural laboratory (refer to Appendix 1) indicates that the sandy soils are extremely low in clay (between 3% and 10% maximum), with a highly leached profile of moderate to low nutrient content and poor water holding capabilities. These topsoils are however significantly better than the underlying subsoils, with proportionately more organic carbon and significant amounts of calcium, and adequate amounts of magnesium, sodium and potassium, but lower than required zinc and phosphorous.

The tailings and slimes (mineralogical waste material / by-products to be dumped) on the other hand have significantly larger quantities of all of the useful nutrients, as well as having the clay fraction that is needed.

The results of the analysis returned extremely light textured soils (single grained to slightly pedocutanic) with an acid to slightly neutral pH of between 4.4 and 7.9, a base status ranging from 0.7me% to 3.7me%, and nutrient levels reflecting generally moderate levels of calcium, magnesium, potassium and sodium, but deficiencies in the levels of phosphorous, zinc and organic carbon matter.

The variations are associated with the presence of clay in the profile, the additional samples taken during the January 2008 study showing the change in status down the profile.

The nutrient status (as returned from the limited sampling undertaken) indicates a need for fertiliser applications of “Zn” “P” and “organic matter”.

It should be noted that the addition of nutrients in the form of commercial fertilisers are potential pollutants to the groundwater environment if added in excess. This must be taken into account when applying these additives. Small amounts of fertilizer should be added on a regular / more frequent basis, rather than adding large quantities in one application.

6.4.2.3.1 Soil Acidity / Alkalinity

In general, it is accepted that the pH of a soil has a direct influence on plant growth. This may occur in a number of different ways, which include:

- The direct effect of the hydrogen ion concentration on nutrient uptake;
- Indirectly through the effect on major trace nutrient availability; and by
- Mobilising toxic ions such as aluminium and manganese, which restrict plant growth.

A pH range of between 6 and 7 most readily promotes the availability of plant nutrients to the vegetation. However, pH values below 3 or above 9, will seriously affect, and reduce the nutrient uptake by a plant.

The dominant soils mapped in this area are neutral to slightly acid (4.40 to 7.80), within the accepted range for moderate to good nutrient mobility. However, some of the soils are verging on the acidic boundary, and will exacerbate the mobilization of nutrients.

The increase in the base status will have the affect of potentially buffering the capacity of the moderately soils to mobilize nutrients, a good situation to have in these soils (additions of basaltic tailings and/or slurry will enhance the growing medium)

6.4.2.3.2 Soil Salinity / Sodicity

In addition, to the acidity / alkalinity of a soil, the salinity and/or sodicity are of importance in a soils potential to sustain growth.

Highly saline soils will result in the reduction of plant growth caused by the diversion of plant energy from normal physiological processes, to those involved in the acquisition of water under highly stressed conditions. Salinity levels of <60 mS/m will have no effect on plant growth. From 60 – 120 mS/m salt sensitive plants are affected, and above 120 mS/m growth of all plants is severely affected.

In addition soil salinity may directly influence the effects of particular ions on soil properties. The SAR is an indication of the effect of sodium on the soils. At high levels of exchangeable sodium, certain clay minerals, when saturated with sodium, swell markedly. With the swelling and dispersion of a sodic soil, pore spaces become blocked and infiltration rates and permeability are greatly reduced. The critical SAR for poorly drained (grey coloured) soils is 6, for slowly draining (black swelling as found in this site) clays it is 10 and for well drained, (red and yellow) soils and recent sands, 15. The soils mapped in this area are all non saline and extremely low in clays.

6.4.2.3.3 Soil Fertility

The soils mapped in this area returned moderate to low levels of most of the nutrients required for good plant growth, although Zn, P and organic carbon are generally lower than the optimum required.

Significantly large areas of soil with an acceptable level of plant nutrition where mapped, all be it that the soil water, and water holding capabilities are low, (thus lowering the ability of the soils to hold nutrients within the rooting zone, and increase the susceptibility of the vegetation to drought) and the structure and texture is loose and highly permeable.

There are no indications of any toxic elements that are likely to limit natural plant growth in the soils mapped within the study area. Fairly standard fertiliser treatments will be needed for optimum agricultural production of crops on areas that have previously been planted, with exceptionally good water management being of paramount importance on both dryland as well as irrigated lands.

6.4.2.3.4 Nutrient Storage and Cation Exchange Capacity

The potential for a soil to retain and supply nutrients can be assessed by measuring the Cation Exchange Capacity (CEC) of the soils.

The low organic carbon content is balanced to some extent by the relatively high clay content which naturally provide exchange sites that serve as nutrient stores. These conditions will result in a low retention and supply of nutrients for plant growth.

Low CEC values are an indication of soils lacking organic matter and clay minerals. Typically a soil rich in humus will have a CEC of 300 me/100g (>30 me/%), while a soil low in organic matter and clay may have a CEC of 1-5 me/100g (<5 me/%).

Generally, the CEC values for the soils mapped in the area are moderate to low due to the low clay contents.

6.5. LAND CAPABILITY

Please refer to Appendix 1 for the full Geology and Soils Report.

6.5.1 Data Collection

The land capability of the study area was classified into four classes (wetland, arable land, grazing land and wilderness) according to the South African Chamber of Mines Guidelines, 1991 and the Canadian Land Inventory System. The criteria for this classification are set out in below:

Criteria for Wetland

- Land with organic soils or supporting hygrophilous vegetation where soil and vegetation processes are water determined.

Criteria for Arable land

- Land, which does not qualify as a wetland.
- The soil is readily permeable to a depth of 750mm.
- The soil has a pH value of between 4.0 and 8.4.
- The soil has a low salinity and SAR
- The soil has less than 10% (by volume) rocks or pedocrete fragments larger than 100mm in the upper 750mm.
- Has a slope (in %) and erodibility factor ("K") such that their product is <2.0
- Occurs under a climate of crop yields that are at least equal to the current national average for these crops.

Criteria for Grazing land

- Land, which does not qualify as wetland or arable land.
- Has soil, or soil-like material, permeable to roots of native plants, that is more than 250mm thick and contains less than 50% by volume of rocks or pedocrete fragments larger than 100mm.
- Supports, or is capable of supporting, a stand of native or introduced grass species, or other forage plants utilisable by domesticated livestock or game animals on a commercial basis.

Criteria for Wilderness land

- Land, which does not qualify as wetland, arable land or grazing land.

6.5.2 Description

The "land capability classification" as described above was used to classify the land units identified during the pedological survey. It should be noted however at the outset, that the absence of permanent surface water in the area reduces the ability of all but water independent species and arid-adapted migratory species that can take advantage of periodic availability of ephemeral water during episodic rainfall events. Consequently the land capability is limited to a wilderness rating at best, with the inter-dunes producing isolated wetland environs.

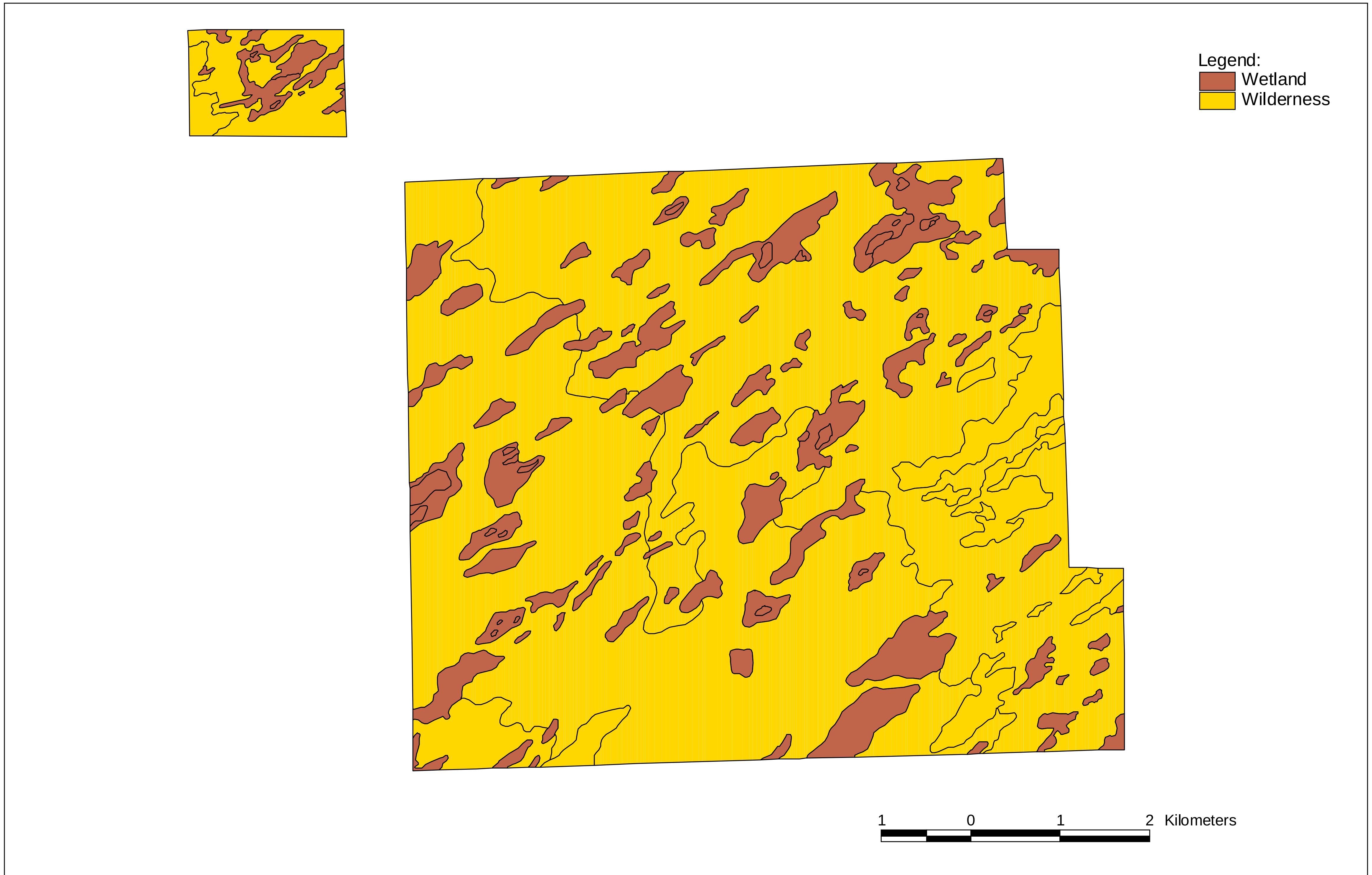
Table 28 and Table 29 list the Land Capability for the GDMP area, whilst Figure 29 and Figure 30 illustrate this information for the MLA and Power Line Route respectively.

Table 28: Land Capability – MLA.

LAND CAPABILITY	HECTARES	AREA %
Conservation	4246.075	82.92
Wetland	874.500	17.08
Total Area (ha)	5120.575	100.00

Table 29: Land Capability – Power Line Route.

SUMMARY OF LAND CAPABILITY			
Arable	Grazing	Conservation	Wetland
450.45	17.47	24.65	4.07
90.70%	3.52%	4.96%	0.82%



ESS (Pty) Ltd. P. O. Box 26264 Steiltes, Nelspruit 1200 Tel: 013-753 2746 Fax: 013-752 2565 E-mail: ess@earthscience.co.za	CLIENT: Marsh Environmental Services PROJECT NAME: Gope Diamond Mine FIGURE NAME: Mining Rights Area Land Capability Map	FIGURE NUMBER: 8.5.1a PROJECT NUMBER: MARSH.GOPE.S.07.05.056 DATE: April 2008

Figure 29: Land Capability Plan – MLA.

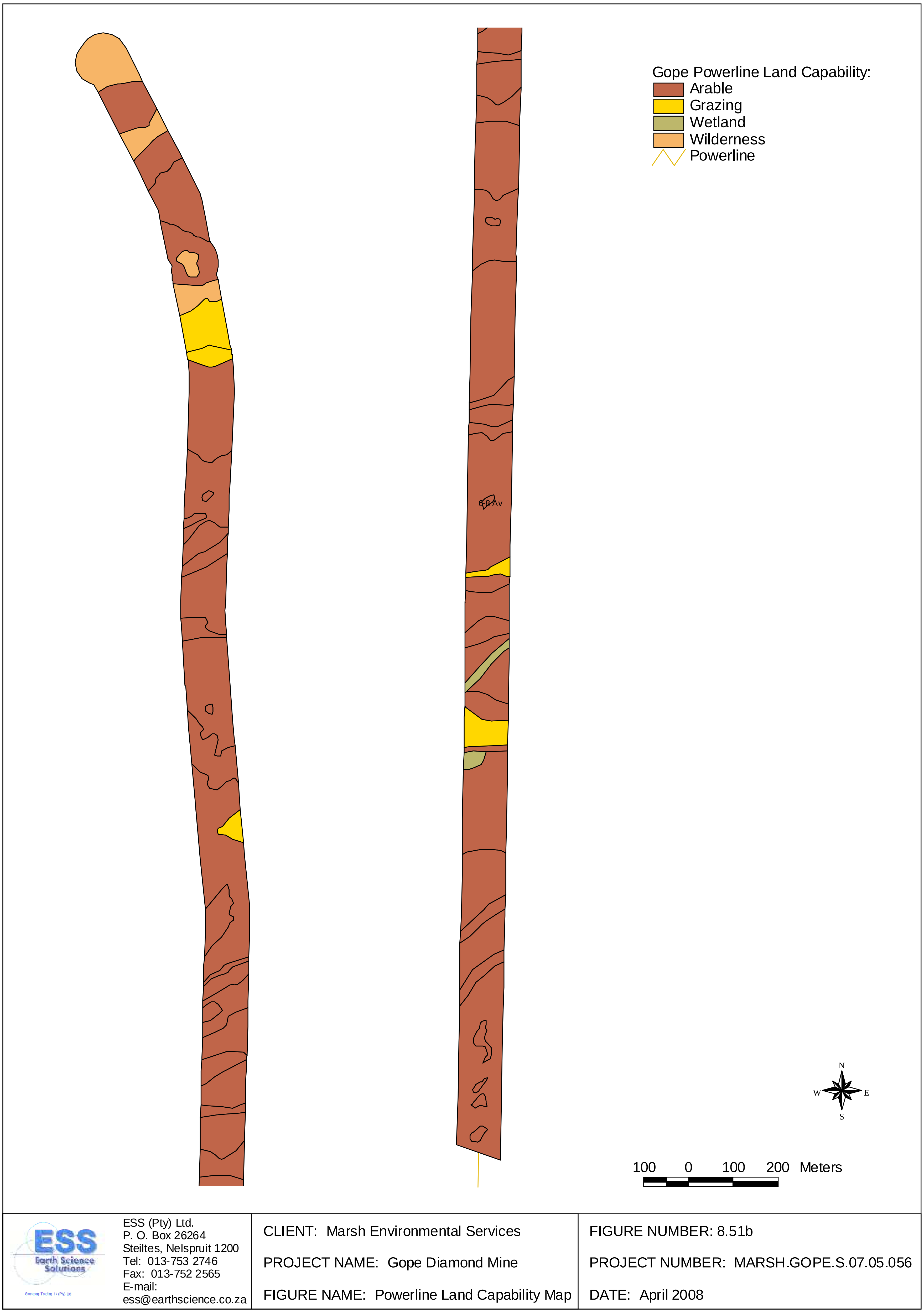


Figure 30: Land Capability Plan – Power Line Route.

6.6. LAND USE

Please refer to Appendix 1 for the full Geology and Soils Report.

The land use for the MLA is, and has been confined to wilderness or conservation land (Protected Game Reserve) with only the nomadic Bushmen having lived in the area from time to time. Evidence of human habitation is noted in the detailed study undertaken by the Archaeologists and Ecologists, with areas of cultivation (all be they very small) having been undertaken around the more permanent dwelling site. Gemsbok Water Melons are still evident in small patches close to the now dilapidated dwelling sites, with some evidence of both maize and vegetables having been grown. Please refer to the detailed studies undertaken by the specialists dealing with the socio economics, archaeological and ecological aspects of this assessment for more details.

6.7. TOPOGRAPHY

6.7.1 General

The Kalahari Desert, situated in the southwest and dominating most of Botswana, is a sand-filled basin approximately 1,100m above sea level (Figure 31). The north-eastern region of this basin comprises the Makgadikgadi Pans, which is a vast network of saltpans and ephemeral lakes. The northwest of the country contains the Okavango Delta, which is the world's largest inland delta. Botswana’s topography is characterised by a predominantly flat terrain. Occasionally, however, the almost uniformly flat terrain is interrupted by gently descending valleys, sand dunes, pans and isolated hills. Many of the pans are associated with dune systems, which vary in size and complexity.

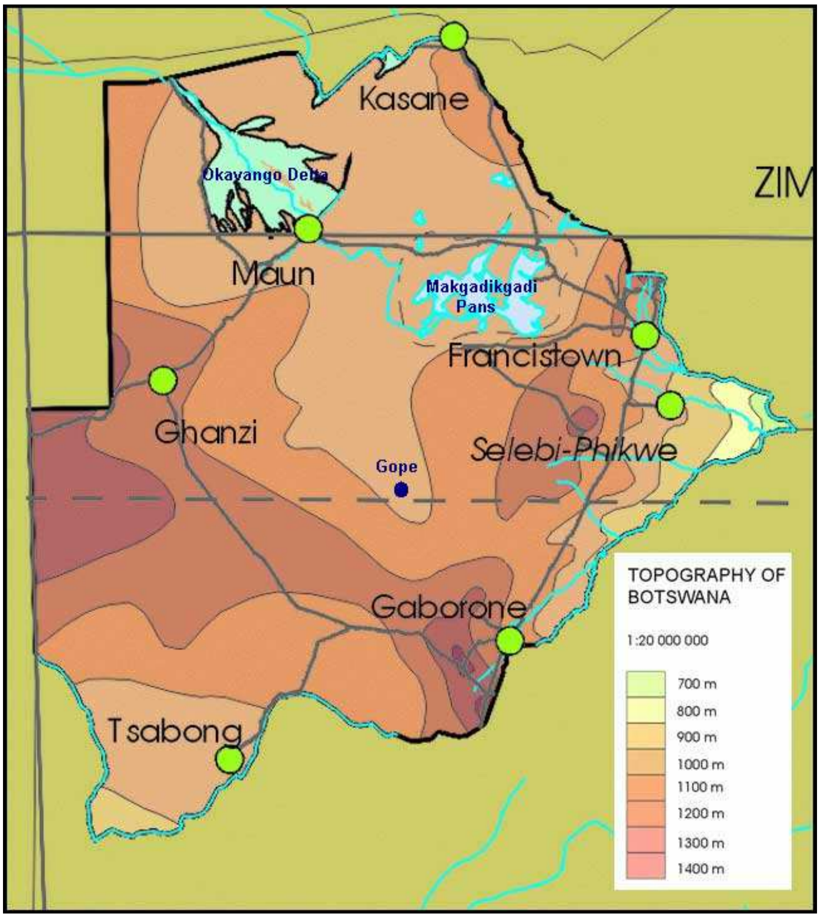


Figure 31: Topography of Botswana (Botswana Tourism, *2007).*

6.7.1.1 GDMP Site and Surrounding Area

The landscape elevation within this area decreases in a westerly direction and with few hills evident within the area. The average site elevation is 988 mamsl and ranges between a maximum of 1,033 mamsl and with a minimum of 985 mamsl.

Throughout the region a diverse array of fossil dune systems and sand-choked drainage networks are present. This area, although locally diverse, display a remarkable homogeneity on a large scale.

6.7.1.2 Proposed Power Line Routing and Surrounding Area

The topography along the proposed power line route is relatively flat and unifier, with gently undulations and occasional saltpans and rocky outcrops. The landscape elevation along the proposed power line route decreases in a North-easterly direction towards the Makgadikgadi Pans. The average route elevation is 1,014 mamsl and ranges between a maximum of 1,033 mamsl and with a minimum of 940 mamsl.

6.8. BIODIVERSITY

Please refer to Appendix 2 for the full Flora and Fauna Reports.

Botswana is rich in faunal biodiversity, while the flora, in terms of numbers of known species, is quite low in comparison with other countries in the region. The number of known species per group of organisms is summarized in Table 30 together with the number of endemic species and Red Data (RD), or rare and endangered, species in Botswana.

Table 30: Summary of Species Inventory.

Organism	No Species	Endemic	*RD species*
Mammals	150	3	*112*
Birds	570	11 (near endemic)	*151*
Fish	8	1	*0*
Reptiles	131	Not known	*2*
Insects	Not known	Not known	*N/A*
Other invertebrates	Not known	Not known	*N/A*
Vascular Plants Est.	*2,150 – 3,000*	*15*	*43*

Source: BSAP Stocktake Report. 2004

The ecosystems of Botswana can be classified into two main biogeographical zones: the Zambezian zone in the north and the Kalahari–Highveld zone in the drier central-to-southern part of the country. The Zambezian zone contains a greater species diversity than the drier south including the dry deciduous woodlands, dominated by *Baikiaea* and *Colophospermum mopane*; the aquatic and swamp vegetation of the Okavango Delta; and the halophytic vegetation of Makgadikgadi salt pans surrounded by treeless grass savanna.

The Kalahari–Highveld zone is characterised by *Acacia* bush, wooded grassland and arid shrub savanna. Within these broad zones, large areas of land have had little disturbance from human activities and are consequently of national and global ecological importance. These include wetland ecosystems such as the Makgadikgadi pans, the Okavango–Kwando, and the Linyanti–Chobe systems, as well as the surrounding terrestrial ecosystems.

For more detail the reader is referred to 'Botswana Biodiversity Strategy and Action Plan, 2004'.

Botswana possesses a wide diversity of wild fauna and flora, with at least 150 species of mammals, over 570 species of birds, 131 species of reptiles, over 82 species of fish. Very few of the species that have been identified are endemic to Botswana. The country supports healthy populations of globally endangered species such as Wild Dog (*Lycaon pictus)*, cheetah (*Acinonyx jubatus*), Wattled Crane *(Grus carunculatus)* and Cape Vulture *(Gyps coprotheres)*. There are also rare species such as sable (*Hippotragus niger)*, roan *(Hippotragus equinus)*, puku *(Kobus* *vardonii*), Chobe Bushbuck *(Tragelaphus scriptus)*, Red Lechwe (*Kobus leche*), sitatunga (*Tragelaphus spekei*) and reedbuck *(Redunca arundinum)* which occur in localized habitats.

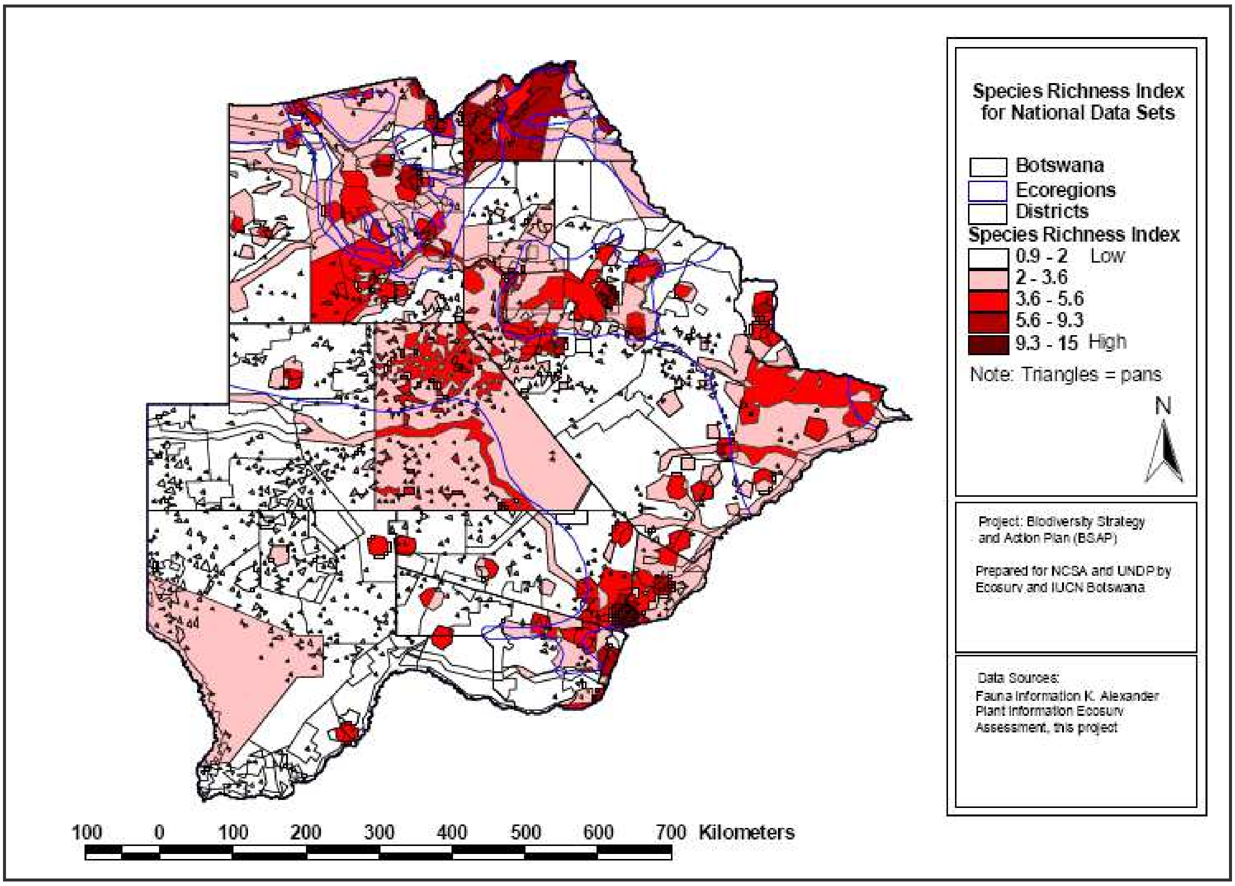


Figure 32: Botswana Species Richness Index for National Datasets.

Despite this diversity, wildlife numbers have been declining over several decades due to illegal hunting, drought and the degradation of habitat. The causes of habitat destruction include the construction of infrastructure, unsustainable rangeland management and excessive water abstraction. The Black (*Diceros bicornis*) and White (*Ceratotherium simum*) Rhino appear to have been poached to extinction. However, a small population of White Rhino has been re-established in the Khama Rhino Sanctuary. A notable exception to the overall decline has been with regard to elephants and which has created pressure on its habitat.

Biodiversity contributes to livelihoods through cash incomes as well as through the use of products derived from it for building, food and medicines. The over harvesting of some veld products, e.g. devil's claw *(Harpagophytum procumbens*), damages their regenerative capacity, thus jeopardising their ability to provide future subsistence and commercial needs (Country Environmental Profile of the Republic of Botswana, 2006).

6.9. FLORA

Please refer to Appendix 2 for the full Flora Report.

A total of 141 plant species were identified during the site investigations. A total of 46 plant families are represented in the study area. Families that include a high number of species include Poaceae (grasses, 16.3%) and Fabaceae (legumes, 12.8%). Investigations were conducted during a dry period (November 2007) as well as subsequent to significant rains (January 2008). This diversity is relative high taking the homogeneity of the study area into consideration. Previous studies and available information frequently refer to the poor floristic diversity of the region and attribute this poor diversity to low rainfall and extreme growing conditions.

A total of 51 sample plots (relevè) were compiled and subjected to the **TWINSPAN** classification program. Results yielded an average of 34 species per sample plot with the highest being 45 and the lowest 22.

6.9.1 Flora Species of Conservation Importance

No Red Data flora species were observed within the study area. Previous investigations also revealed the absence of threatened flora species from the region. This does not indicate that Red Data flora species don't occur in the study area. Considering the homogeneity of the study area, as well as the comprehensive surveys undertaken, the likelihood of encountering Red Data flora species within the study area is regarded low. Red Data flora species are generally associated with topographically unique or atypical habitat types, which is absent from the study area (Southern African Plant Red Data List, 2002).

The following flora species are protected in Botswana (Biodiversity Guide to Botswana, 1991):

- Pod mahogany (*Afzelia quanzensis*);
- Rhodesian teak (*Baikiaea plurijunga*);
- Tsaudi (*Guibourtia coleosperma*);
- Mukwa (*Pterocarpus angolesis*);
- Brown mahogany (*Entandophragma caudatum*);
- Baobab (moana) (*Adansonia digitata*);
- Mozinzila (*Berchemia discolor*), and
- African ebony (*Diospyros mespiliformis*).

These species do not appear on the national RDL because they are currently not a problem and, at this stage are viewed as inappropriate for a national threatened list. In the future, however, these species may become candidates for a national RDL.

The following species of concern was also highlighted:

- *Amaranthus dinteri;*
- *Grielum cuneifolium;*
- *Thesium dissitum;*
- *Panicum coloratum* subsp *makarikariense;*
- *Panicum pilgerianum;*
- *Rennera laxa;*
- *Ipomoea fanshawei,* and
- *Neuradopsis bechuanensis.*

Neuradopsis austro-africana was observed in several localities in the study area is regarded endemic to the south-western Kalahari (van Rooyen, 2001). Since habitat across the region is extremely homogenous, it is highly likely that this species is distributed across the entire region.

Little information is available for medicinal plants, except for *Harpagophytum* species. Even for these highly exploited species, there is no reliable data for the entire populations of the species in the country (for example, rates of exploitation and rate of recruitment), because most studies are site-specific. However, should these species be encountered at the Gope Project Site, they are to be removed and preserved in the on-site nursery until they can be replanted on permanently rehabilitated areas.

6.9.2 Floristic Communities found within the Gope Project Site

The uniformity of the biophysical attributes of the region in which the study area is situated is strongly reflected in the extremely low level of variation in species composition across the area. Floristic communities and variations that have been identified during this assessment is mostly a factor of indiscriminate and indeterminable environmental factors, particularly fire.

The topography of the study area varies between open plains and slightly undulating low dunes. Water is the main driving force behind floristic development and coupled with the sandy nature of soils across the study area, makes for a vegetation type that is extremely hardy, consisting of woody species with root systems that penetrate deep into the substrate in search of available moisture. The herbaceous stratum is adopted to survive dry spells by means of seasonality.

Fire plays a determinate role in the structure of the vegetation. The frequency of fires within this area is random and is usually started by lightning. Evidence indicates that time intervals within the sample plots varied from less than one year to more than 3 years.

6.9.3 Mining Site

The following communities and variations were recognised:

- *Grewia flava – Urochloa mosambicensis* Habitat Type;
- *Philenoptera nelsii – Acanthosicyos naudinianus* Woodland Community - *Commiphora glandulosa* Woodland Variation, and
- *Stipagrostis obtusa – Rhigozum trichotomum* Depression Community.

6.9.3.1 Grewia Flava – Urochloa Mosambicensis Habitat Type

Minor variations can be delineated from the **TWINSPAN** table, but these are more frequently a reflection of general sampling error and sampling limitations than a true reflection of ecological communities and variations. The study area comprises a fairly high number of flora and fauna species that occurs throughout the area, including the woody species *Grewia flava, Acacia erioloba, Boscia albitrunca,* the forbs *Indigofera hilaris, Talinum crispalatum, Ornithogalum seineri* and the grasses *Urochloa mosambicensis* and *Schmidtia pappophoroides.* Invertebrate species that occur in throughout the study area include Tenebrionidae 1, Formicidae 2, Solifugae 1, Mutillidae 1, Formicidae 3, Formicidae 4, Formicidae 5 and Formicidae 1.

A number of other species occur frequently throughout the study area, but without high fidelity and is regarded a reflection of the growing patterns of the species and not of the biophysical attributes of the region. The major difference in ecology of the study area was found to be permanent pans and terrestrial habitat, resulting in the differentiation of the *Philenoptera nelsii – Acanthosicyos naudinianus* Woodland and *Stipagrostis obtusa – Rhigozum trichotomum* Depression Community.

6.9.3.2 Philenoptera Nelsii – Acanthosicyos Naudinianus Woodland Community

This community is differentiated from the *Stipagrostis obtusa – Rhigozum trichotomum* Depression Community by the dominant presence of the woody species *Philenoptera nelsii, Acacia luederitzii, Terminalia sericea, Bauhinia petersiana, Grewia retinervis, Ochna pulchra,* the grasses *Digitaria milanjiana, Stipagrostis uniplumis, Anthephora pubescens* and the forbs *Acanthosicyos naudinianus, Oxygonum delagoense, Citrullus lanatus, Heliotropium ciliatum, Indigofera filipes, Requienia sphaerosperma, Sesamum triphyllum, Xenostegia tridentata, Chamaecrista mimosoides* and *Hoffmannseggia burchellii* subsp. *burchellii.*

Invertebrate species that are associated with this community include Carabidae 1, Mutillidae 2, Lepismatidae 1, Parabuthus 1 and Solifugae 2.

The most significant environmental attribute contributing to the physiognomy of the vegetation is fire. The occurrence of fire in the region is highly random and contributes to a homogenous effect on the vegetation of the area. The effect on the species composition is minimal since most of the species are well adapted to the effects of fire by means of bark protection or underground storage organs from where regeneration occurs.

6.9.3.3 Commiphora Glandulosa Variation

Based on estimations in the time lapse since the last fire occurrence, a single variation is identified within the *Philenoptera nelsii – Acanthosicyos naudinianus* Woodland Community, namely the *Commiphora glandulosa* variation. Within this variation the woody species *Commiphora glandulosa*, the shrub *Hermannia tomentosa* and the grasses *Aristida meridionalis, A. stipitata* and *Eragrostis lehmanniana* occur frequently. These species are generally absent from areas that were recently burnt (app. 1 year ago). Other species that occur frequently in the *Philenoptera nelsii – Acanthosicyos naudinianus* Woodland Community appears to be less affected by fire than these species. Invertebrate species that occur in areas that were not subjected to recent burns include Meloidae 2 and Araneae 10.

Fire has a significant effect on the physiognomy of the vegetation in the region; while all moribund grass material is removed the shrub and tree layers are severely affected, in spite of the species being adapted to the effects of fire. The average crown cover in fire affected areas is approximately 32%, compared to the 48% of areas not recently subjected to burning.

6.9.3.4 Stipagrostis Obtusa – Rhigozum Trichotomum Depression Community

This community is characterised by the absence of species from the *Philenoptera nelsii – Acanthosicyos naudinianus* Woodland Community and *Commiphora glandulosa* variation as well as the dominant presence of the woody shrubs *Rhigozum trichotomum, Acacia hebaclada, Monechma incanum, Catophractes alexandri* and the grass *Stipagrostis obtusa.* Invertebrate species that occur in the depression areas are Sphecidae and Diplopoda 1.

Soils in these areas are atypical to the general region, being slightly higher in clay and nutrient content. Situated in slight depressions, the effects of seasonal rain are significantly increased, compared to surrounding sandy areas where moisture readily drains away.

6.9.4 Power Line

The part of the alignment that is common to both the proposed routes is from Orapa to the CKGR boundary. Route 1 is aligned from this point south-east along the CKGR cut line to the main entrance road and then east to the mining site. Route 2 is aligned from the common point directly south-west to the mining site.

6.9.4.1 CKGR Area

Floristic variations within the CKGR are representative of the habitat types, communities and variations described in Appendix 2. Both the variants of the proposed power line from Orapa are situated within the CKGR.

6.9.4.2 CKGR to Orapa

The following floristic variations recognised in this section of the proposed power line included:
a) Degraded natural woodland;
b) *Colophospermum mopane* Woodland; and
c) *Philenoptera nelsii – Acacia* Shrubveld.

a) Degraded Natural Woodland

Extensive grazing by cattle in areas outside the CKGR has resulted in slight degradation of the natural woodland. This is markedly noted in a gradient away from cattle posts that can be noted from aerial photography.

Daily travelling to and from available water for cattle results in vegetation in proximity to the cattle posts to be severely overgrazed. Bush encroachment is evident throughout the study area. Species that characterise areas of encroachment and that have known invasive characteristics include *Dichrostachys cinerea, Grewia flava, Acacia tortilis, Combretum apiculatum, Acacia erubescens, Acacia mellifera* and *Terminalia sericea.* Although these species occur naturally in the region, the increase in density and prominence of these species (particularly in the lower 1.5 – 3 m stratums), to the exclusion of other woody species indicates the advanced state of encroachment.

A particular dense layer of the invasive shrub *Dichrostachys cinerea* is noted in the immediate vicinity of cattle posts. This shrub is a particular aggressive encroacher. Properties that contribute to the aggressive nature include highly palatable seed pods with a high distribution success through cattle digestive systems.

Areas farther away from the cattle posts are characterised by a woody layer of which the species composition is similar to that encountered in the CKGR. However, significant structural differences are noted, mainly as a result of the lower incidence of fire (or lower fire temperatures as a result of lower biomass). The main structural difference between natural vegetation within and outside the CKGR is the higher structural appearance of woody species outside the CKGR.

The grass sward is dominated by a few species, including *Urochloa mosambicensis*, *Digitaria milanjiana, Eragrostis pallens, Aristida stipitata, Eragrostis lehmanniana, Pogonarthria squarrosa, Schmidtia pappophoroides* and *Stipagrostis uniplumis.*

b) *Colophospermum Mopane* Woodland

Localised areas of Mopane woodland is encountered along the proposed power line from Orapa further south to approximately halfway to the CKGR border. These areas are dominated by the presence of the shrub/ tree *Colophospermum mopane*. As a result of high grazing pressure within some parts, smaller variations are also encountered, but are not regarded significant in terms of this project.

Other woody species that were encountered within these parts include *Terminalia prunioides, Combretum apiculatum, Grewia flava, Croton gratissimus, Acacia nigrescens, Commiphora neglecta, Boscia foetida, Acacia senegal* and *Aloe* species. The herbaceous layer are similar to the other variations encountered and is regarded to be reflective of the grazing pressure within the particular area, more than any other environmental attribute.

A moderate-low floristic sensitivity is attributed to this variation as a result of the absence of any particular species of significance and the low probability of encountering any of Threatened species within these areas, as well as the moderate level of degradation that is noted in some parts.

c) *Philenoptera Nelsii – Acacia* Shrubveld

Localised areas where Acacia trees dominate are encountered along the proposed line. These areas are normally not extensive and the origin of the physiognomy and species composition is unknown, probably anthropogenic. A medium floristic sensitivity is attributed to these areas, mainly as a result of the localised distribution pattern and atypical species composition.

The dominant woody species is *Acacia luederitzii*. Other prominent species include *Philenoptera nelsii, Terminalia sericea, Boscia albitrunca, Grewia flava, Acacia erioloba* and *A. mellifera.* The herbaceous layer is generally poor in species as well as cover, assumed to be a result of the high shade cover of the dominant woody layer as well as the lower moisture content of the topsoil.

6.9.4.3 Landing Strip

The landing strip will have negligible impact on the flora of the area other than the vegetation that is removed for construction purposes.

6.10. FAUNA

Please refer to Appendix 2 for the full Fauna Report.

A total of 212 animal species were identified during the site investigations (including the proposed power line alternatives). These included:

- 4 scorpions;
- 17 insects (excluding morpho-species listed for the sweep - and pitfall samples);
- 1 frog;
- 19 reptiles;
- 143 birds, and
- 28 mammals.

The 113 morpho-species identified in the pitfall samples included:

- 2 scorpions;
- 2 sun-spiders;
- 22 spiders;
- 1 tick;
- 1 centipede;
- 2 millipedes, and
- 82 insects.

For the sweep samples 75 species were identified, namely 12 spiders and 63 insects.

6.10.1 Fauna species of Conservation Importance

Probability of Occurrence for Red Data species were attributed as follows (Table 31):

- 17 Red Data species were attributed a low Probability of Occurrence;
- Seven Red Data species were attributed a moderate Probability of Occurrence;
- Six Red Data species were attributed a high Probability of Occurrence, and
- Five species are confirmed for the Gope Project Site.

A total of 18 of the species are listed as Near Threatened (NT), 14 as Vulnerable (VU), 1 as Endangered (EN) and 1 as Critically Endangered (CR).

Table 31: Listed Red Data Fauna Species for the Gope Project Site.

SPECIES DETAILS			RESULT
Biological Name	**English Name**	**RD**	**Probability**
BIRDS			
Aegypius occipitalis	White-headed Vulture	VU	Confirmed
Aegypius tracheliotos	Lappet-faced Vulture	VU	Confirmed
Agapornis nigrigenis	Black-cheeked Lovebird	VU	Low
Bugeranus carunculatus	Wattled Crane	VU	Low
Charadrius pallidus	Chestnut-banded Plover	NT	Low
Circus macrourus	Pallid Harrier	NT	Moderate
Circus maurus	Black Harrier	VU	Low
Coracias garrulus	European Roller	NT	High
Egretta vinaceigula	Slaty Egret	VU	Low
Falco fasciinucha	Taita Falcon	NT	Low
Falco naumanni	Lesser Kestrel	VU	Confirmed
Falco vespertinus	Red-footed Falcon	NT	High
Glareola nordmanni	Black-winged Pratincole	NT	High
Gyps africanus	White-backed Vulture	NT	Confirmed
Gyps coprotheres	Cape Vulture	VU	High
Limosa limosa	Black-tailed Godwit	NT	Low
Mirafra cheniana	Melodious Lark	NT	Low
Neotis denhami	Denham's Bustard	NT	low
Oxyura maccoa	Maccoa Duck	NT	low
Phoenicopterus minor	Lesser Flamingo	NT	moderate
Rynchops flavirostris	African Skimmer	NT	moderate
MAMMALS			
Acinonyx jubatus	Cheetah	VU	high
Ceratotherium simum	White Rhinoceros	NT	very low
Chaerephon shortridgei	Shortridge's Free-tailed Bat	NT	low
Cloeotis percivali	Short-eared Trident Bat	VU	low
Dasymys nudipes	Angolan Marsh Rat	NT	low
Diceros bicornis	Black Rhinoceros	CR	low
Felis nigripes	Black-footed Cat	VU	very low
Hippopotamus amphibius	Hippopotamus	VU	low
Loxodonta africana	African Elephant	VU	moderate
Lycaon pictus	African Wild Dog	EN	moderate
Miniopterus natalensis	Natal Long-fingered Bat	NT	low
Panthera leo	Lion	VU	confirmed
Rhinolophus blasii	Peak-saddle Horseshoe Bat	NT	low

6.10.2 Mining Site and Power Line Route

The GDMP site represents untransformed habitat for a variety of faunal species and does not vary significantly in terms of faunal habitat characteristics from the surrounding habitat provided by the CKGR. It can therefore be expected with a reasonable level of confidence that faunal communities and assemblages observed in the GDMP will closely resemble those found in the rest of the CKGR. No pans, rivers or landscape features (such as outcrops) were observed within the study area.

Of the 212 animals identified within the Gope Project Site (including the proposed power line alternatives), five species are listed as red data species in Botswana (IUCN red data list). Most of the other species are widespread and found through most of Botswana – species linked to the habitat types available in the Gope Project Site are unlikely to be restricted in range of habitat preferences since there are no significantly restricted habitat characteristics found within the Gope Project Site.

The low level of habitat variation of the GDMP site is further supported by results obtained from the surveys. Of the 51 sample plots surveyed, none were distinctly different in terms of assemblage structure, species richness or species diversity. There also no significant differences between experimental plots (within the GDMP site) and control plots (in neighbouring areas) which supports the statement that the habitat within the GDMP site is similar to that of large neighbouring regions. Invertebrates collected in both sweep- and pitfall samples are therefore expected to be found in most of the CKGR; this also holds true for the 212 animals that were encountered during the survey periods.

Taking the availability of surrounding habitat into consideration, the loss of habitat present within the Gope Project Site could be deemed insignificant since no areas of unique habitat characteristics or restricted faunal communities, assemblages or species are to be affected in the course of the construction or operation of the proposed project. Please note that this statement is based solely on viewpoint of available habitat and does not reflect the sensitivity of the CKGR as a national reserve. When this is also taken into account the loss of any habitat within the CKGR is regarded a significant impact.

Although the communities currently found in the Gope Project Site would be disrupted on a permanent basis, similar communities and assemblages would continue to thrive outside of the Gope Project Site in the remaining untransformed parts of the CKGR.

It should, however, be stated that the main concern involves cumulative impacts. This would be the first main disturbance in a currently pristine area; the creation of infrastructure such as roads and power lines into an area where, currently, it is very difficult to gain access or start any operation that would significantly influence the environment, is likely to provide a strong foothold for future operations (mining and otherwise) in the CKGR. This phenomenon has been observed throughout the world and is likely to follow suit in the CKGR. And although the impacts of the

GDMP on the fauna of the area can be argued to be insignificant it is the responsibility of the author to advise caution when considering the bigger picture.

6.11. Surface Water

Please refer to Appendix 3 for the full Surface Water Report.

6.11.1 Baseline Data Collection Methodology

The following actions were undertaken as part of the surface water study:

- The groundwater team were on site in November 2007 and January 2008. They were asked to look for surface water and sample where possible, but none was found;
- In February 2008 the site was visited by the surface water team. A rainfall sample was obtained, together with a sample from a localised area of ponding close to the site;
- Climate data was obtained from the Mahalapye rainfall station, and
- The overall water balance for the proposed mining activities was compiled, and the impacts and mitigations evaluated.

6.11.2 Limitations and Assumptions

Surface water collection from site has been generally problematic. During visits in November and early January assessing groundwater, no surface water was available for sampling. There are also no streams or dams that can be sampled. As discussed in the report, a low-lying area was identified in the vicinity of the proposed mining area. During a rainfall event on site in February rainfall and runoff samples were taken, although the runoff was from an area where concrete slabs had been left by previous exploration activities and it is not certain that the sample is fully representative of natural runoff. The low rainfall and high ingress makes collecting surface water samples problematic; tracking rainfall clouds and trying to obtain surface runoff samples proved fruitless due to the rapid dissipation of water into the soils.

As a result, the data presented in the baseline section does not contain information that would normally be found here such as flood lines, flood peaks, and information on the water resource, but rather indicates the general nature of surface water in Botswana. Information on rainfall and evaporation for the area is also presented.

6.11.3 Catchment description

Botswana has six river basins; five of which are shared with neighbouring countries. These basins are as follows:

- The Molopo / Nossop River, which forms the southern border between Botswana and South Africa, and flows into Orange River. However, due to the low rainfall in the basin the river has negligible flows for most of the time;
- The Limpopo River Basin forms the eastern border between Botswana and South Africa. Most rivers in eastern Botswana drain into the Limpopo River, including the Notwane, the Bonwapitse, the Mahalapye, the Lotsane, the Motloutse and Shashe Rivers. The basin constitutes a drainage area if some 80,000 km^2;
- Makgadikgadi drainage basin to the west of the Limpopo basin. On the eastern side of the pans, the Mosope, Mosetse and the Nata Rivers all drain into the Makgadikgadi pan. The pan has a catchment of some 21,216km^2, with most of the catchment being in Zimbabwe;
- Kwando/Linyanti/Chobe Rivers in the north of the country. The Kwando originates in Angola and enters Botswana after crossing through the Caprivi Strip in Namibia. In Botswana, it spreads out into the Linyanti swamps, which drains into the Savuti and Linyanti swamps eventually reaching the Chobe River;
- Okavango River drainage and basin and Delta system in the northwest. This comprises the Okavango River, the Okavango Delta and its outlets. The Okavango system also extends down the Boteti River to the Makgadikgadi pans. The river and delta provide life sustenance for the local population and tourism in an otherwise dry sandy region (e.g. fishing and flood recession or molapo farming), and
- Internal drainage system. The remaining part of the country is the uncoordinated internal drainage system. All runoff is lost through evaporation and seepage. In the central Kgalagadi, some fossil river channels run in an easterly direction, but those rarely carry any significant runoff.

The basins are shown in Figure 33. The proposed mining site falls into the internal drainage system.

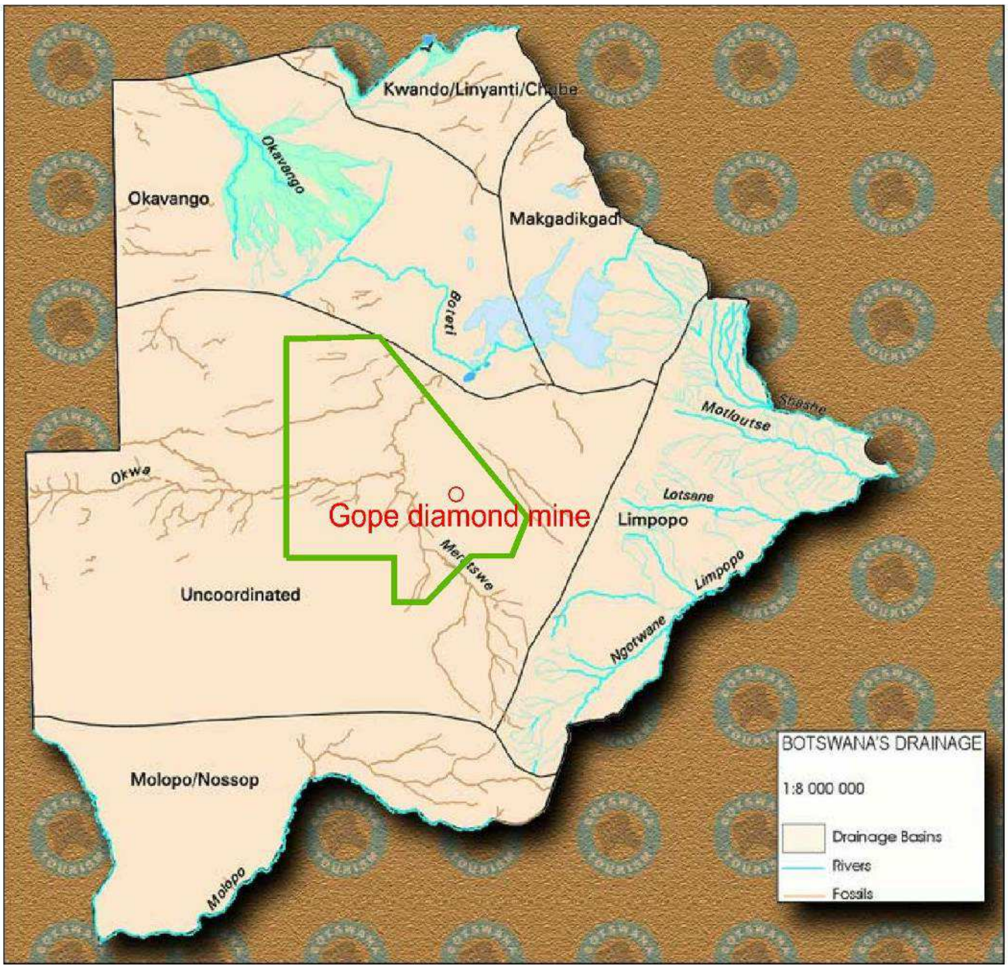


Figure 33: Major Rivers in Botswana (courtesy Botswana Tourism)

6.11.4 Receiving Water Body

The mine is located away from any of the receiving water bodies (Figure 33), and is also a considerable distance from the fossil drainage lines.

It is apparent that:

- The actual mining infrastructure is remote from any water system or drainage lines. Only localised areas of ponding exist in the general area, and
- The power lines system will not cross any major drainage line. The original power line route was indicated to cross two pan areas, and it is currently proposed by the project team to modify the route to avoid these pans. Consequently, the power line is also not expected to cross any drainage lines or pans.

6.11.5 Rainfall

Most of the rainfall in Botswana occurs during summer from November until March. The rain occurs in the form of scattered and localised convective thunderstorms. The annual rainfall distribution for Botswana is shown in Figure 34.

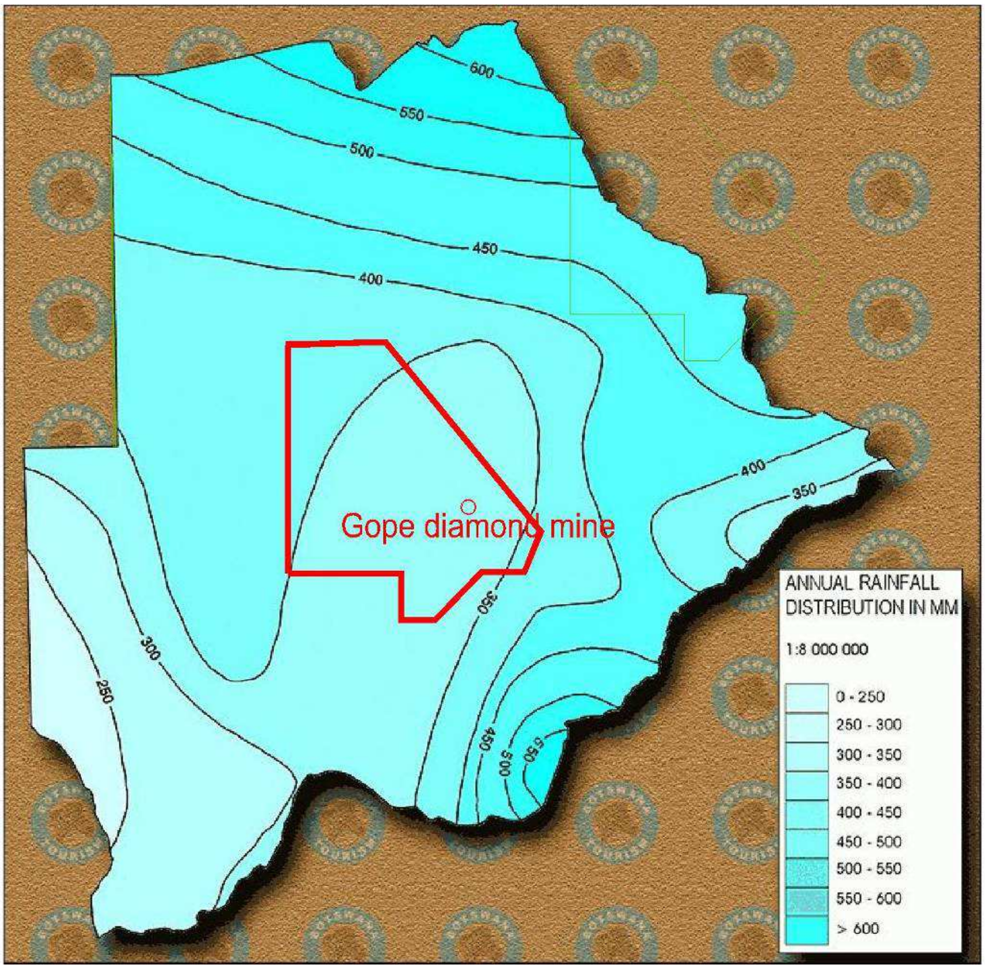


Figure 34: Rainfall Map of Botswana (courtesy Botswana Tourism)

Data has not been obtained from the site itself, but the closest rainfall station for which reliable data could be obtained was Mahalapye (0713757 P), Lat 23° 07', Long 25° 26'. This site is located some distance from the proposed mining site, but is the closest rainfall station to the site. The station has rainfall data from 1911, yet, it is apparent from Figure 34 that the rainfall at Mahalapye (467 mm/annum) is probably higher than would be expected at the site, which is located further west. A mass plot for Mahalapye is given in Figure 35.

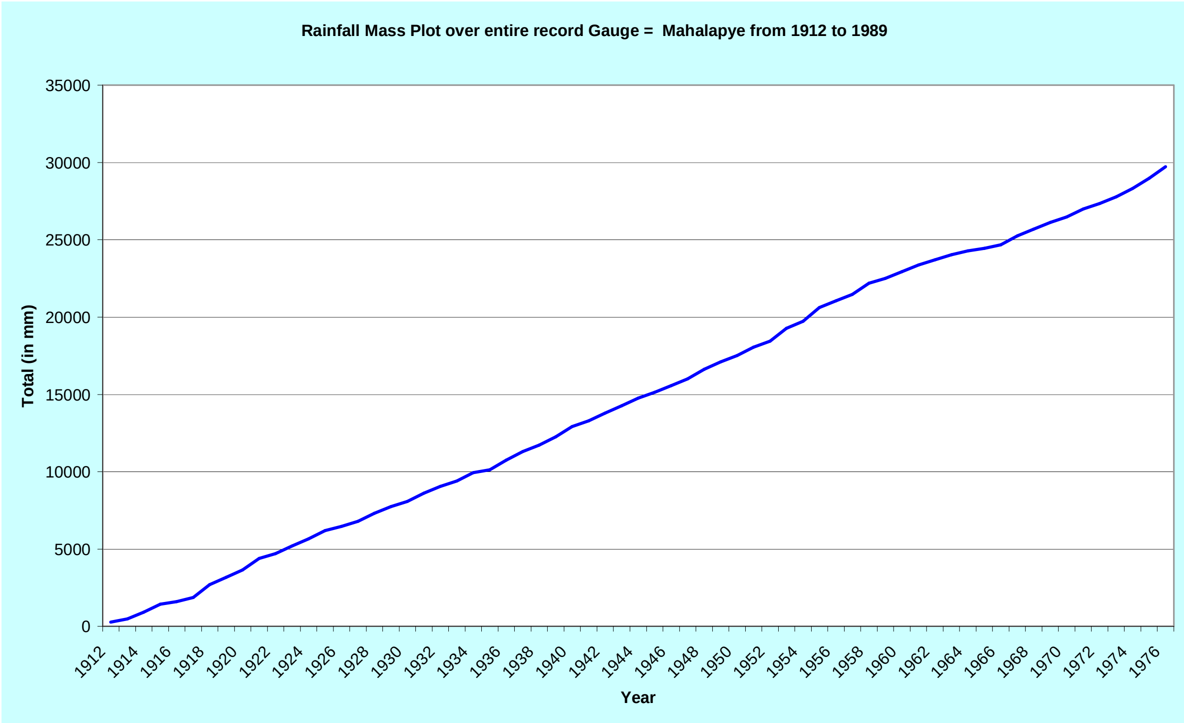


Figure 35: Mass Plot for Mahalapye.

The mass plot indicates that the data is reliable with no long term changes observed (the plot is largely linear).

A map of the rainfall stations identified during the study is given in Figure 36.

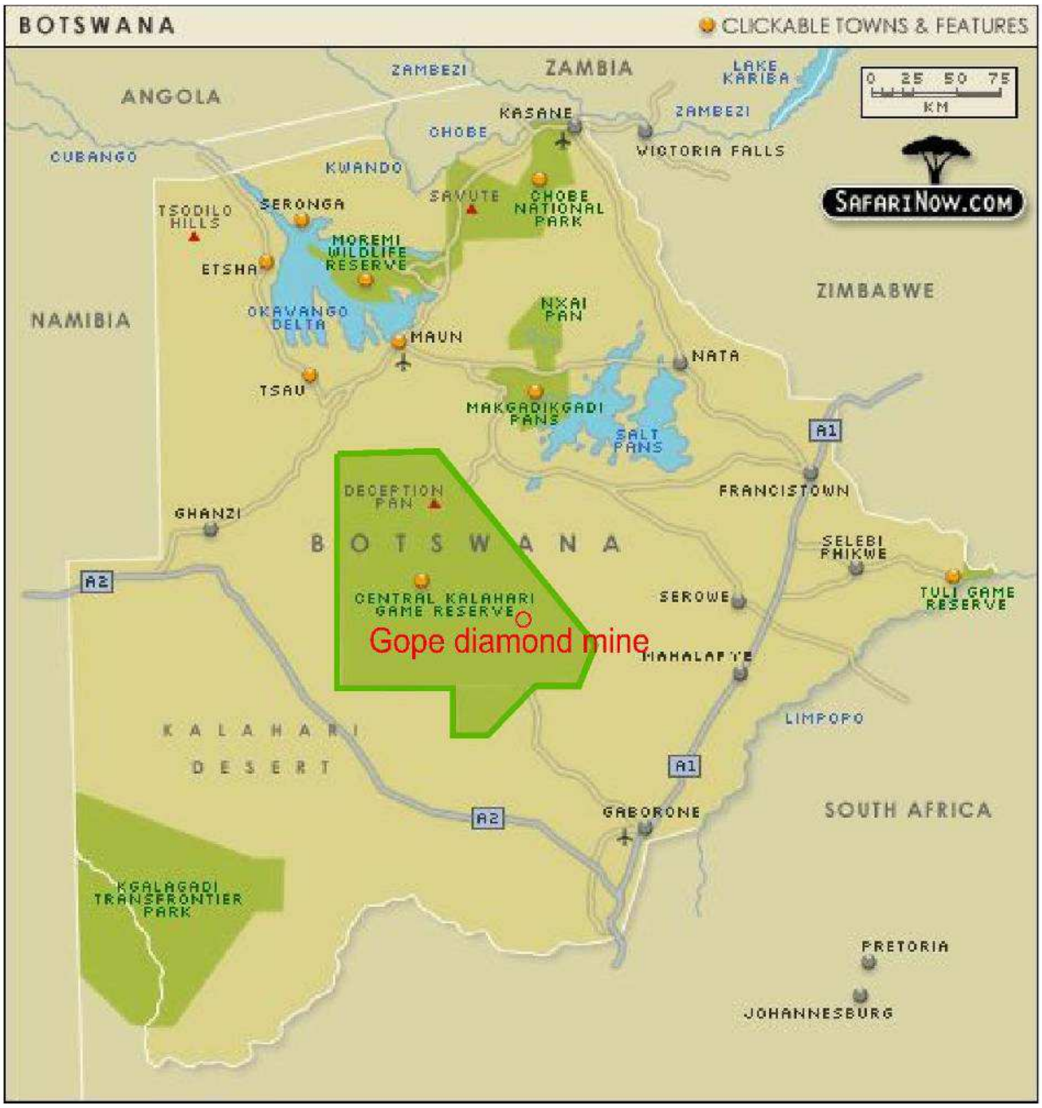


Figure 36: Rainfall Station Locations.

6.11.6 Evaporation

As would be expected in a desert area, evaporation levels are high. At Mahalapye (0713757 P), the Open Water Evaporation (OWE) rate is higher than rainfall by some margin, with an OWE of 1,825mm. OWE refers to the evaporation rate computed for open water, but derived from measurements taken in pans (the so-called S-pan or A-pan evaporation) and adjusted empirically to arrive at the expected evaporation from a large water body.

6.11.7 Surface Water Users

Water stress is said to occur when there is less than 1,700 m^3 of water available per person per annum. Absolute scarcity is found when water cannot meet all demands. This occurs when there is less than 1,000 m^3 of water per person per year. Finally, acute water shortage exists when there is less than 500 m^3 per person per annum available. Botswana as a whole is considered to have adequate resources (Botswana Water Accounts Report).

However, the fact that these resources are shared with neighbouring countries and due to high variability in rainfall results in much of the country being under water stress, and in the dry interior there is generally an acute water shortage. Thus, water is generally a constraining factor for the development of much of Botswana, and there is also a high level of awareness of the need to preserve the water quality and quantity available.

The consequence of the above for the Gope Project Site is that both fauna and flora are dependant on alternative water sources such a groundwater, or water obtained from various plants. Even local communities that may choose to re-establish close to the proposed mining areas would not be able to rely on surface water as their primary source of water.
Consequently, no “receiving water body” has been identified for the proposed mine area and surface water runoff does not a key component of any of the ecosystems in the area. When runoff does occur (and only several mm of runoff is predicted for the site), the water is expected to pond locally before recharging to the groundwater system, or evaporating.

6.11.8 Water Quality

As indicated previously, surface water collection from site has been generally problematic. During visits in November and early January assessing groundwater, no surface water was available for sampling. Three water samples where however taken in February 2008 from the following sources:

- Rainwater. It rained during the site visit, and water was collected off the tarpaulins of the tent camp;
- Runoff was found in the localised low area at the decommissioned De Beers processing area (within the area identified by the biodiversity specialist as a habitat for bull frogs). However, the only available water for sampling was found on a concrete slab. The proportion of runoff versus direct rainfall was therefore somewhat uncertain. The quality appears to indicate that it does include a significant proportion of runoff, since it has a higher TDS than the rainfall, and
- A sample was taken from the surface water dam at Lephepe.

The water quality results are given in Table 32.

Table 32: Water Quality Results.

ANALYSIS IN mg/ℓ	SAMPLE IDENTIFICATION		
	DAM AT LEPHEPE	LOW LYING AREA AT SITE	RAIN WATER
pH Value at 25°C	7.8	7.5	5.6
EC in mS/m at 25°C	27.9	34.6	3.0
Total Dissolved Solids at 180°C	212	248	20
Total Alkalinity as $CaCO_3$	148	80	8
Chloride as Cl	<5	39	<5
Sulphate as SO_4	<5	11	<5
Nitrate as N	<0.2	0.3	<0.2
Fluoride as F	<0.2	<0.2	<0.2
Sodium as Na	17	11	<2
Potassium as K	5.7	3.5	1.0
Calcium as Ca	21	38	<2
Magnesium as Mg	7	<2	<2
Iron as Fe	2.10	4.02	0.095
Manganese as Mn	0.099	0.285	0.025
Aluminium as Al	1.11	1.60	0.154
Zinc as Zn	<0.025	<0.025	0.175

All three samples would comply with the water quality objectives for discharge off site to an ephemeral stream. With the exception that all three samples have iron outside of the guidelines. Drinking water standards in Botswana for iron (class III) is 2 mg/l, although the target levels (ideal) are 0,03 mg/l. It has to be noted though that none of the samples taken can be considered to be unaffected / clean water.

6.11.9 Surface Water Quantity

The runoff in the area is of the order of 1% of rainfall. It is thus likely that runoff during an average year will be around 3 to 4mm only.

6.12. GROUNDWATER

Please refer to Appendix 4 for the full Groundwater Report.

6.12.1 Baseline Data Collection Methodology

The primary aim of this study was to assess the availability of groundwater in the region and to determine the interaction between the proposed mining and the aquifer/s. The following investigations were undertaken:

- Assessment of the available geological and geohydrological data. Anglo American Corporation (AAC) investigated the deposit in 1998 during which time thirteen boreholes were drilled and pump tested. This information formed the basis for the current study;
- Performed analytical assessments to recommend abstraction rates from the present borehole infrastructure;
- Constructed a conceptual groundwater flow model for the aquifer/s at the mine site and the current water supply well field;
- Construct and calibrate a detailed numerical groundwater flow model to assist with aquifer management and mine planning. Calibration of the model was done for both steady and transient state conditions, and
- Provide pit inflow rates and dewatering impacts based on the current mine plans.

The field data collected by AAC was re-evaluated and a more detailed numerical groundwater flow model was developed to simulate the groundwater management options relevant to the current project requirements. The fieldwork undertaken by AAC in 1998 was very comprehensive and the raw data was made available for the current study. Aquifer parameters were calculated through the re-interpretation of the raw AAC pump test data. Dr. Hugo Janse Van Rensburg (Aquisim Consulting) undertook the groundwater modelling using **FEFLOW** and the calibrated groundwater model was used to:

- Determine the required dewatering rates and the number of dewatering boreholes to ensure dry mining conditions;
- Determine the abstraction rates and number of boreholes required to supply sufficient water to the plant, and
- Simulate the dewatering and water supply impacts on the regional aquifers.

The modelling area was selected to include both the mine site and the existing AAC well field and based on the current understanding of the site the initial finite element mesh includes the following:

- Geological formations;
- Geological structures such as dykes and faults. These structures can either act as groundwater conduits or groundwater barriers;

- The proposed open pit, and
- All available boreholes.

Compilation of the finite element grid using the **FEFLOW** pre-processing software facilitated the requisite construction of 6-noded triangular prism elements over the study area. The triangular grid consists of 388 348 elements and 244 105 nodes. The positions of the geological structures (faults) are incorporated in the modelling grid. The faults (fold zone) were incorporated such as to conceptually reflect more permeable zones or barriers. Small cell sizes were specified in the mining area and around boreholes where a more accurate solution of the groundwater flow is required. Larger cell sizes were specified in other areas.

The model consists of four layers, with a total thickness of 500 m. The model layers include the average regional thickness of the geological formations:

- Kalahari Sand (79 m);
- Stormberg Basalt (206 m);
- Ntane Sandstone (70 m), and
- Mosolatsane Mudstone (145 m).

For this study it is estimated that recharge to the aquifer is less than 1% of the Mean Annual Precipitation (MAP). This amounts to 0.05 mm/annum.

Steady state calibration of the model was accomplished when a reasonable resemblance between the measured piezometric levels and the simulated piezometric levels were obtained, as well as between the calculated and simulated transmissivity values. The steady state calibrated groundwater flow model was further refined using transient abstraction and water level data obtained from the aquifer testing. This was conducted in order to ensure that the model is sufficiently calibrated on a small scale.

Two approaches were followed to determine the groundwater inflow into the pit:

- Using the model in the confined mode simulation (worst-case scenario), and
- Using the model in the confined - unconfined mode.

For model forecast simulations the model was run in the confined/unconfined mode. As a result of the fact that the static water level (swl) is below or at the contact between the Kalahari Sand and Stormberg Basalt, numerical instabilities necessitated that the first two modelling layers had to be combined into a single layer. Stable numerical solutions were then obtained. For forecast purposes the following scope of work was adopted:

- Detailed mine plans were provided on an annual (snap shot) basis over the period 2008-2023, and
- The plant water demand was supplied for the same period.

Using the mine plan and the water requirements the following was simulated with the aid of the groundwater flow model:

- Required dewatering rates and number of dewatering boreholes to dewater the pit ahead of mining;
- Water excess / shortfall based on plant water demand;
- Should water shortfall occur the recommend additional water supply was calculated, and
- Simulate dewatering / water supply impacts on regional aquifer.

6.12.2 Limitations and Assumptions

The groundwater modelling was based on the available groundwater data and certain data gaps have been identified. Cognisance should be taken of these data gaps when viewing the results and estimates. The data gaps include the following:

- The model is based on only three boreholes at the pit. This is in statistical norms a very small sample;
- From the three boreholes an indication was obtained with regards to the transmissivity of the Stormberg basalt and the permeable part of the Ntane sandstone;
- For the deeper less permeable portions of the sandstone and deeper mudstone and Kimberlite the permeability is unknown and should be obtained in order to refine the model predictions, and
- The current groundwater model should be seen as a first step in managing the groundwater resource. It is recommended that once drilling commences and more information becomes available the model be continually updated.

6.12.3 Aquifer Description

The following aquifers were identified:

6.12.3.1 Ntane Sandstone Aquifer

The Ntane Sandstone Formation is the principle aquifer in the project area. Although this unit varies in thickness between 40 m and 130 m the majority of the water strikes occurred on the alternating lava / sandstone contact with the overlying Stormberg Basalt.

6.12.3.2 Mosolotsane Sandstone Aquifer

Individual sandstone units within the Mosolotsane Formation may attain a thickness of 10 m and water intersections are known to occur in some of these units. No water intersections were, however, reported in these units in the boreholes drilled by AAC and the presence of this aquifer cannot be confirmed.

6.12.3.3 Kimberlite Aquitard

The Kimberlite pipe that will be mined cannot be classified as an aquifer, but rather an aquitard. Water passes through an aquitard, but at an extremely slow rate and water cannot be abstracted from such formations at any significant rate. Although no site-specific data on the "aquifer" parameters of the Kimberlite is available, it is expected to be very low.

6.12.3.4 Fractured Aquifer

Occasional water strikes were recorded in the fractured lava of the Stormberg Basalt. This represents a minor aquifer in which fracture flow is prominent. WNW – ESE trending faults dominate the region although NNW – SSE and NNE – SSW trending faults also occur. The major faults and associated splays act as groundwater conduits and when intersected in a borehole manifests as a water strike, not bound to any particular stratigraphic unit. Although very limited information on the age of the faults is available it is assumed that the majority are younger or the same age as the Stormberg Basalt, in other words they cut through the entire stratigraphic sequence with the exception of the Kalahari Sand. The faulting has created graben and horst structures, which in terms of the geohydrology provides variable intersections of the Ntane / Stormberg contact and therefore variable groundwater intersections and groundwater levels. Based on the measured groundwater levels the boreholes can be divided into various structurally controlled groundwater compartments (Table 33).

Table 33: Measured Actual Groundwater Levels and Groundwater Compartments.

BOREHOLE	GROUNDWATER LEVEL mbgl	DATA SOURCE	AQUIFER	COMPARTMENT
WS 1	88.79	Measured	Ntane Sandstone / Fractured Basalt	A
WS 2	88.21	Measured	Ntane Sandstone	A
WS 3	85.88	Measured	Ntane Sandstone	A
WF 4	91.33	Measured	Ntane Sandstone	B
WF 5	93.00	AAC	Ntane Sandstone	B
WF 6	97.00	AAC	Ntane Sandstone	B
WF 1	110.81	Measured	Ntane Sandstone	C
WF 2	107.20	Measured	Ntane Sandstone	C
WF 7	108.44	Measured	Ntane Sandstone	C
WF 8	136.30	AAC	Ntane Sandstone	D
WF 9	133.50	AAC	Ntane Sandstone (Fractured)	D
WF 10	134.00	AAC	Ntane Sandstone (Fractured)	D
WF 3	116.00	AAC	Ntane Sandstone	E

6.12.4 Depth to Groundwater

The static water level (swl) at the GDMP is situated just below the Kalahari Sand at approximately 90 mbgl. Some statistics with regard to water strikes and water levels are shown as Figure 37 and Figure 38.

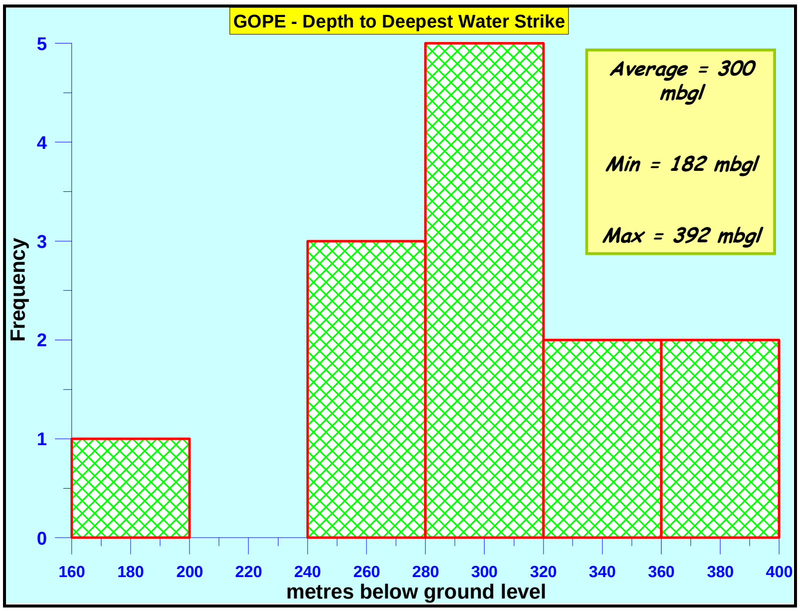


Figure 37: Water Strike Depths.

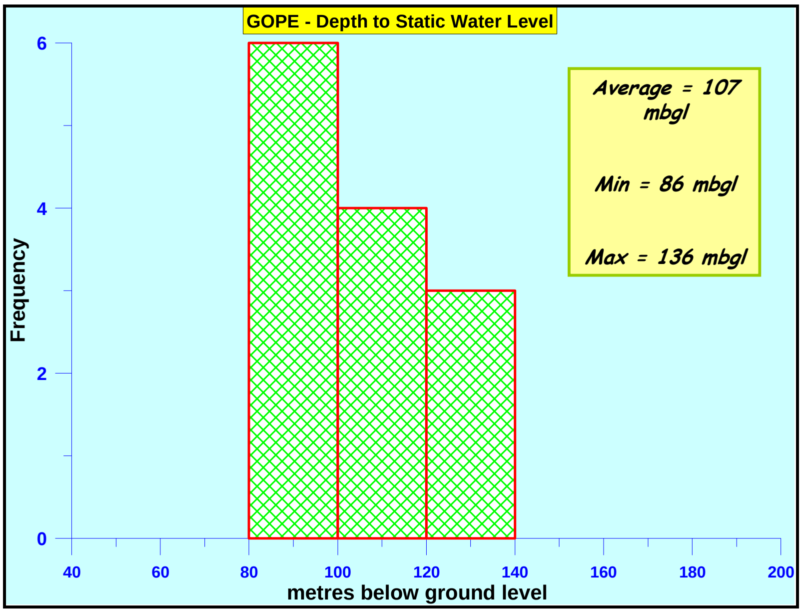


Figure 38: Depth to Water Level.

The available drawdown within the 13 boreholes is shown in Figure 39.

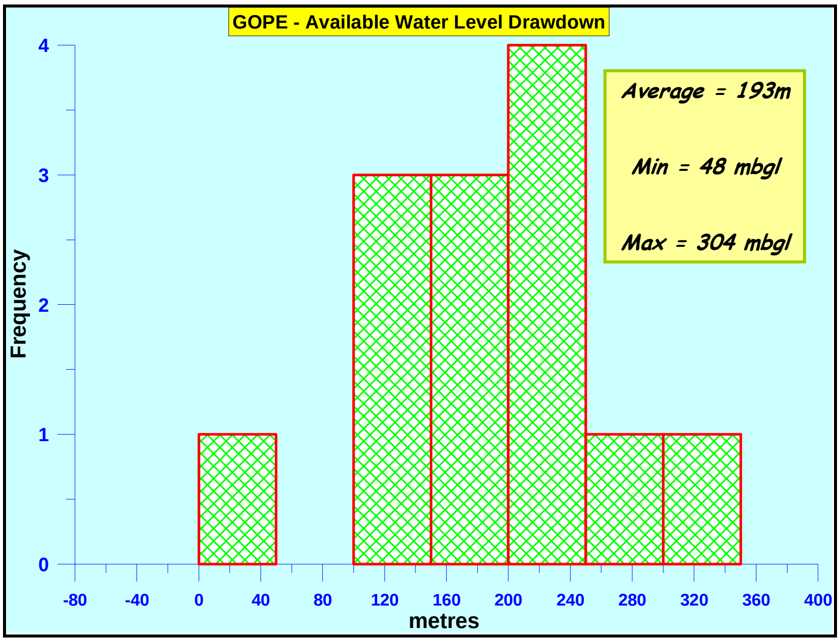


Figure 39: Available Groundwater Level Drawdown.

6.12.5 Groundwater Quality

This section describes the current or pre-mining groundwater quality in the immediate vicinity of the GDMP. During the 1998 study all available boreholes were sampled and analysed for the major cations and anions. A hydro census was conducted in 2007, during which time the accessible AAC boreholes as well as new farmer's boreholes were sampled and analysed. This allowed for a comparative analysis of groundwater quality between 1998 and 2007. All available groundwater quality analysis results are presented in Table 34.

With reference to Table 34, the following parameters occur in very high concentrations and exceed the Botswana Groundwater Quality Standards (BOS 93:2004).

Table 34: Groundwater Quality.

SAMPLE ID	DATE	pH	CONDUCTIVITY	TOTAL DISSOLVED SOLIDS	TOTAL ALKALINITY	CALCIUM	MAGNESIUM	SODIUM	POTASSIUM	MANGANESE	IRON	CHLORIDE	SULPHATE	NITRATE	FLUORIDE
UNITS		@25ºC	mS/m @25ºC	mg/l @180ºC	mg/l CaCO3	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l N	mg/l
BOS 93:2004		6-9	-	2000	-	500	-	400	100	-	0.05	600	400	22	1.5
WS1	1998	7.82	804	6570	56	432.0	13.6	2000	9.2	-	-	2983	1179	<0.1	0.4
	2007	9.30	824	4800	103	13.0	2.1	1830	29.0	<0.1	<0.1	2890	134	0.6	0.3
WS2	1998	7.38	890	7810	64	663.0	26.0	2060	10.1	-	-	3057	1948	<0.1	0.2
	2007	7.40	1238	7030	6.0	450.0	30.0	1663	8.9	0.09	0.1	2890	1420	<0.5	0.8
WS3	1998	7.20	854	6510	104	350.0	52.0	2160	13.5	-	-	3130	1121	<0.1	0.2
	2007	5.50	902	6070	107	339.0	73.0	1856	25.0	<0.1	<0.1	2760	655	8.9	0.8
WF1	1998	7.90	786	5400	292	120.0	56.0	2110	14.0	-	-	2740	914	18.6	0.5
	2007	8.10	878	5610	239	111.0	64.0	1652	18.0	<0.1	0.1	2650	608	1.6	0.8
WF2	1998	7.89	742	4670	240	62.0	13.5	2070	5.3	-	-	2677	473	31	0.2
	2007	9.10	772	4500	143	7.2	6.6	1843	8.3	<0.1	<0.1	2380	190	0.6	0.3
WF3	1998	7.89	852	5820	256	120.0	36.0	2020	8.8	-	-	2830	787	12.0	0.4
WF4	1998	7.60	274	1780	288	13.8	2.1	632	1.5	-	-	738	146	12	0.4
	2007	5.10	305	1710	<2.0	43.0	2.2	534	3.1	6.4	127	1150	<50	<0.5	0.1
WF5	1998	7.70	625	4420	312	96.0	63.0	1400	13.8	-	-	2136	339	22.0	0.1
WF6	1998	7.70	658	4590	332	90.0	56.0	1550	15.9	-	-	2287	378	14.3	0.2
WF7	1998	8.16	820	6140	184	188.0	41.0	2060	14.9	-	-	2909	877	<0.1	0.3
	2007	8.80	848	5010	21	39.0	12.0	1907	14.0	<0.1	0.1	2930	155	<0.5	0.5
WF8	1998	8.00	834	6260	248	194.0	48.0	2030	9.1	-	-	2877	966	34.0	0.5
WF9	1998	7.67	838	6380	180	322.0	43.0	2020	11.9	-	-	2951	965	31.0	0.3
WF10	1998	8.03	427	2900	304	136.0	46.0	831	13.0	-	-	1275	258	33.0	0.3
HC1	2007	6.80	1344	9070	10	672.0	2.1	2739	26.0	<0.1	<0.1	4390	1200	<0.5	0.7
Domestic	2007	7.50	1263	6600	119	204.0	26.0	1978	9.7	0.07	0.2	3142	780	<0.5	0.9

The effects of the parameters that exceed the standards on individuals and the environment are described (South African Department of Water Affairs and Forestry (DWAF), 1996), particularly as it relates to the GDMP.

6.12.5.1 Electrical Conductivity and Total Dissolved Solids

Electrical Conductivity (EC) and Total Dissolved Solids (TDS) are very high in all the boreholes, although WF4 and WF10 have slightly lower concentrations. The TDS is a measure of the amount of various inorganic salts dissolved in water. The TDS concentration is directly proportional to the EC of water. Since EC is much easier to measure than TDS, it is routinely used as an estimate of the TDS concentration. EC is a measure of the ability of water to conduct an electrical current. This ability is a result of the presence of ions in water such as carbonate, bicarbonate, chloride, sulphate, nitrate, sodium, potassium, calcium and magnesium, all of which carry an electrical charge. Most organic compounds dissolved in water do not dissociate into ions, consequently they do not affect the EC. Low concentrations of particularly calcium and magnesium salts have nutritional value, although water with an extremely low TDS concentration may be objectionable because of its flat, insipid taste. Health effects related to TDS are minimal at concentrations below 2,000 – 3,000 mg/ℓ TDS. In contrast, high concentrations of salts impart an unpleasant taste to water and may also adversely affect the kidneys (TDS >3,000 mg/ ℓ).

The TDS concentrations at GDMP is in excess of 3,000 mg/l and if left untreated the physiological effects, which may be experienced by some employees directly related to high concentrations of dissolved salts include:

- Laxative effects, mainly from sodium sulphate and magnesium sulphate:
- Adverse effects of sodium on certain cardiac patients and hypertension sufferers;
- Effects of sodium on women with toxaemia associated with pregnancy, and
- Some effects on kidney function.

Bathing and washing in water with excessively high concentrations of TDS may give rise to excessive skin dryness and hence discomfort. Soap may lather poorly or with difficulty. Chemical corrosion may occur when the alkalinity, i.e. the concentrations of carbonate, bicarbonate and hydroxide are low, the TDS concentration is high, particularly the concentrations of chloride and sulphate, and the pH is low, which may have an impact upon the operational effectiveness of the plant. Scaling may also occur. Excessively high concentrations of TDS may adversely affect plumbing and appliances and hence the maintenance and replacement requirements. If not treated the ambient groundwater quality will cause excessive corrosion in the plant and equipment.

6.12.5.2 Calcium

Calcium occurs naturally in varying concentrations in most waters and, together with magnesium, is one of the main components of water hardness. Soft waters contain low, while hard waters contain high concentrations of calcium. Calcium is an essential element for all living organisms and is an important constituent of the bony skeleton of mammals, which consists of phosphates of calcium. Mineral deposits of calcium are common, usually as calcium carbonate, phosphate or sulphate. Calcium bicarbonate, chloride and nitrate are very soluble in water, calcium sulphate is moderately soluble and calcium carbonate and phosphate are insoluble.

Typically, the concentration of calcium in:

- Fresh water is 15 mg/l, and
- Seawater is approximately 400 mg/l.

On heating water containing calcium bicarbonate, carbon dioxide is lost and calcium carbonate precipitates; this causes scaling in hot water systems. The norm used in the guideline for calcium is based on aesthetic effects, particularly the undesirability of scaling in domestic appliances and the impairment of soap lathering.

Calcium is an important mineral element in the human diet, the total daily dietary intake being in the range of 500 - 1400 mg/day. Calcium has been reported as exerting a protective action against cardiovascular disease. However, the available data purporting to show an inverse relationship between hardness or the calcium concentration of water, and the occurrence of cardiovascular disease do not demonstrate an unequivocal causal relationship. There is no conclusive evidence to support claims for the increased incidence of human kidney and urinary tract stones (urolithiasis) resulting from the long-term consumption of water with high concentrations of calcium. Calcium is known to mitigate against the toxicity of certain heavy metals.

Scaling, the principal undesirable effect which occurs in water heating appliances such as kettles, urns, geysers, boilers and certain pipes, results in less efficient use of electrical power and any other fuel used for heating purposes, and the partial obstruction of pipes. High concentrations of calcium (>80 mg/l) impair the lathering of soap by the formation of insoluble calcium salts of long chain fatty acids that precipitate as scums. This results in excessive soap consumption used in personal hygiene and, in rare cases, household cleaning operations. In addition the scums are anaesthetic, leading in the long-term to the marking of enamelled surfaces such as baths and hand basins.

The ambient groundwater quality at GDMP in terms of calcium is generally below the Botswana Standards and does not pose any risk to the employees or equipment.

6.12.5.3 Sodium

With the exception of borehole WF4, all the boreholes have very high sodium concentrations. Sodium is an alkali metal that reacts with water to form highly soluble, positively- charged sodium ions. It is an essential dietary element important for the electrolyte balance and the maintenance of many essential physiological functions. Sodium is present in all food to varying degrees.

Sodium is ubiquitous in the environment and usually occurs as sodium chloride, but sometimes as sodium sulphate, bicarbonate or even nitrate. Sodium is found as solid sodium chloride (rock salt) in areas where geological deposits occur. The levels of sodium in surface waters are generally low in areas of high rainfall and high in arid areas with low mean annual precipitation. Sodium is highly soluble in water and does not precipitate when water evaporates, unless saturation occurs. Hence, water in arid areas often contains elevated concentrations of sodium. High concentrations also occur in sea water, at approximately 11 g/l.

Industrial wastes, especially processes that give rise to brines, contain elevated concentrations of sodium. Sodium is also present at high concentrations in domestic waste water; this is in part due to the addition of table salt (sodium chloride) to foods. Furthermore, with re-use or recycling of water, the sodium concentration will tend to increase with each cycle or addition of sodium to the water. For this reason, sodium concentrations are elevated in runoffs or leachates from irrigated soils.

The taste threshold for sodium in water varies from 135 - 200 mg/l, depending on the associated anion. The common ones include chloride, sulphate, nitrate, bicarbonate and carbonate. Sodium intake can exacerbate certain disease conditions. Persons suffering from hypertension, cardiovascular or renal diseases, should restrict their sodium intake. In the case of bottle-fed infants, sodium intake should also be restricted.

The sodium concentrations at GDMP are in the order of 2,000 mg/l. At these high concentrations the health of some employees will be adversely affected (as described above) and the corrosion of the plant and equipment will be enhanced.

6.12.5.4 Chloride

With the exception of borehole WF4, all the boreholes have very high chloride concentrations. Chloride is the anion of the element chlorine. Chorine does not occur in nature, but is found only as chloride. The chlorides of sodium, potassium, calcium and magnesium are all highly soluble in water. Chloride is of concern in domestic water supplies because elevated concentrations impart a salty taste to water and accelerate the corrosion rate of metals.

Chloride is only detectable by taste at concentrations exceeding approximately 200 mg/l. A salty taste becomes quite distinctive at 400 mg/l and objectionable at greater than 600 mg/l. At chloride concentrations greater than 2,000 mg/l nausea may occur, while at 10,000 mg/l vomiting and dehydration may be induced. Chloride accelerates the corrosion rate of iron and certain other metals well below the concentration at which it is detectable by taste. The threshold for an increased corrosion rate is approximately 50 mg/l. At chloride concentrations greater than 200 mg/l, there is likely to be a significant shortening of the lifetime of domestic appliances as a result of corrosion.

The chloride concentrations at GDMP are in the order of 3,000 mg/l, which far exceeds the Botswana Standards. At these high concentrations the taste will be extremely salty and the corrosion of the plant and equipment will be a major problem. The life of the equipment will be significantly reduced if the water is not treated.

6.12.5.5 Sulphate

Sulphate is a common constituent of water and arises from the dissolution of mineral sulphates in soil and rock, particularly calcium sulphate (gypsum) and other partially soluble sulphate minerals. Since most sulphates are soluble in water it tend to accumulate to progressively increasing concentrations.

Typically, the concentration of sulphate in:

- Surface water is 5 mg/l, although concentrations of several 100 mg/l may occur where dissolution of sulphate minerals or discharge of sulphate rich effluents from acid mine drainage takes place, and
- Seawater is just over 900 mg/l.

Sulphates are discharged from acid mine wastes and many other industrial processes such as tanneries, textile mills and processes using sulphuric acid or sulphates. Sulphates can be removed or added to water by ion exchange processes, and microbiological reduction or oxidation can interconvert sulphur and sulphate. The microbiological processes tend to be slow and require anaerobic conditions usually only found in sediments and soils. Atmospheric sulphur dioxide, discharged on combustion of fossil fuels, can give rise to sulphuric acid in rainwater (acid-rain) and as such, this results in the return of sulphate to surface waters in the environment.

The norms used in the guideline for sulphate are based on human health and aesthetic effects. High concentrations of sulphate exert predominantly acute health effects (diarrhoea). These are temporary and reversible since sulphate is rapidly excreted in the urine. Individuals exposed to elevated sulphate concentrations in their drinking water for long periods, usually become adapted and cease to experience these effects. Sulphate concentrations of 600 mg/l and more cause diarrhoea in most individuals and adaptation may not occur. Sulphate imparts a salty or bitter taste to water. The taste threshold for sulphate falls in the range of 200 - 400 mg/l and depends on whether the sulphate is predominantly associated with either sodium, potassium, calcium or magnesium, or mixtures thereof. Elevated sulphate concentrations also increase the erosion rate of metal fittings in distribution systems.

The sulphate concentrations at GDMP are in the order of 1,200 mg/l. At these concentrations individuals will experience health effects such as diarrhoea.

6.12.6 Groundwater Characterisation

The chemical character of the groundwater samples is determined and compared with the aid of the Piper diagram. The Piper diagram, introduced by Arthur Piper in 1944, is one of the most commonly used techniques to interpret groundwater chemistry data. This method proposed the plotting of cations and anions on adjacent trilinear fields with these points then being extrapolated to a central diamond field. Here the chemical character of water, in relation to its environment, could be observed and changes in the quality interpreted. The cation and anion plotting points are derived by computing the percentage equivalents per million for the main diagnostic cations of Ca, Mg and Na, and anions Cl, SO_4 and HCO_3.

Different waters from different environments always plot in diagnostic areas. The upper half of the diamond normally contains water of static and disordinate regimes, while the middle area normally indicates an area of dissolution and mixing. The lower triangle of this diamond shape indicates an area of dynamic and co-ordinated regimes. Sodium chloride brines normally plot on the right hand corner of the diamond shape while recently recharge water plots on the left-hand corner of the diamond plot. The top corner normally indicates water contaminated with gypsum (often related to coal and gold mining activities).

In general the top half of the diamond contains static waters and other unusual waters high in Mg/Ca Cl_2 and Ca/Mg SO_4. The lower half contains those waters normally found in a dynamic basin environment. Mixtures of any two waters in any proportion plot along a line joining their respective points in each of these diagrams. Water therefore being invaded by an industrial effluent will plot as a vector towards the analysis of the invading fluid.

The Piper Diagram for all the samples collected at the Gope Project Site is shown as Figure 40.

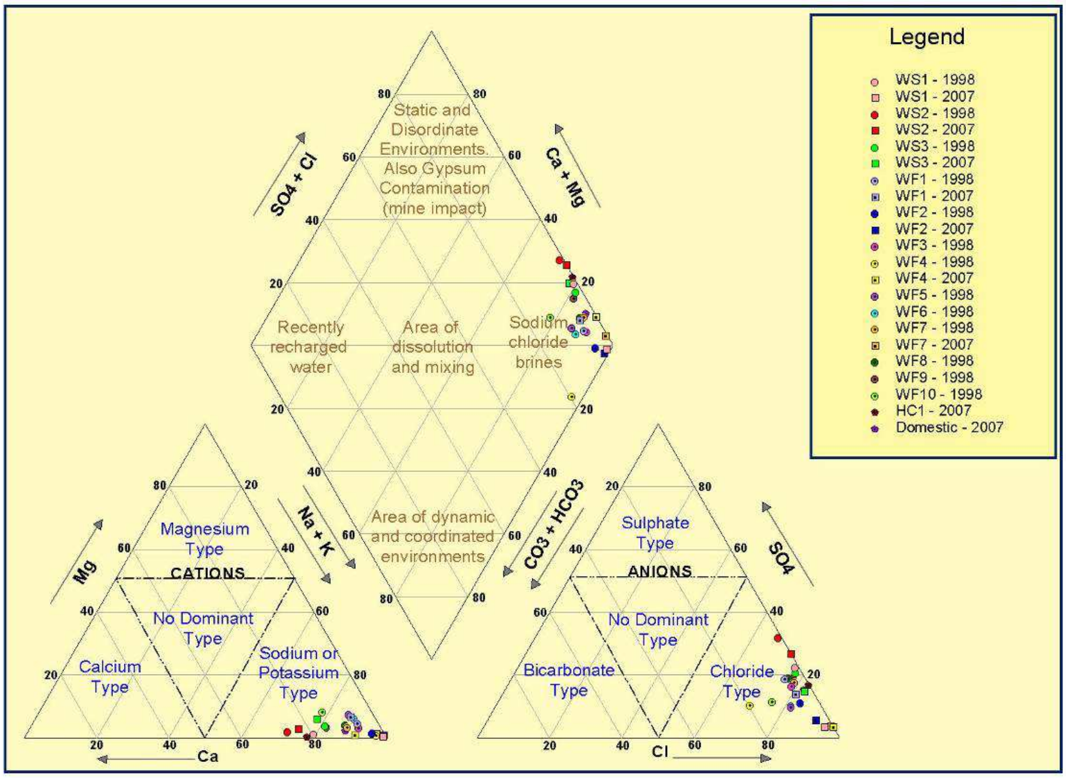


Figure 40: GDMP Piper Diagram.

With reference to Figure 40, the groundwater samples at GDMP are all similar and are characterized as sodium-chloride brine, similar to seawater. The groundwater at the GDMP is not potable, it will have an adverse influence on the health of the employees and it will significantly shorten the life of the plant and equipment that comes into contact with the untreated groundwater. The major salts that contribute to the high TDS are sodium and chloride. Treating the water with one of the following processes can reduce the TDS concentrations (DWAF, 1996):

- Demineralisation in a mixed-bed ion exchange column, usually where the feed TDS concentration is approximately 2,000 mg/l. Disposable ion exchange canisters can be used to produce potable water for domestic consumption whereas large banks of ion exchange filter beds, which are capable of being regenerated, are used on an industrial scale. Ion exchange processes are also used for the production of ultra pure water;
- Treatment by membrane processes such as RO or electrodialysis where the TDS concentration is in the range of 2,000 – 3,500 mg/l. Small low-pressure RO modules fed from a domestic supply line reliably produce potable water for household consumption and are easily replaced after one to three years if the membrane becomes fouled through scaling. Large-scale treatment is achieved with banks of RO modules in parallel, and
- Distillation, in cases where the TDS concentration is approximately 10,000 mg/l.

The above description indicates that the ambient groundwater quality at the GDMP is poor and that the water cannot be used for domestic or industrial purposes without treatment.

6.13. AIR QUALITY

6.13.1 Meso-scale meteorology and site-specific dispersion potential

The information presented in the subsections, which follow, detail of the dispersion potential of the area under investigation. Meteorological data for the period January to December 2002 to 2006 were obtained from the MM5 model data run by Lakes Environmental in Canada

A period wind rose for the Gope Project Site is presented in Figure 41. Wind roses comprise of 16 spokes, which represent the directions from which winds blew during the period. The colours reflect the different categories of wind speeds. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories.

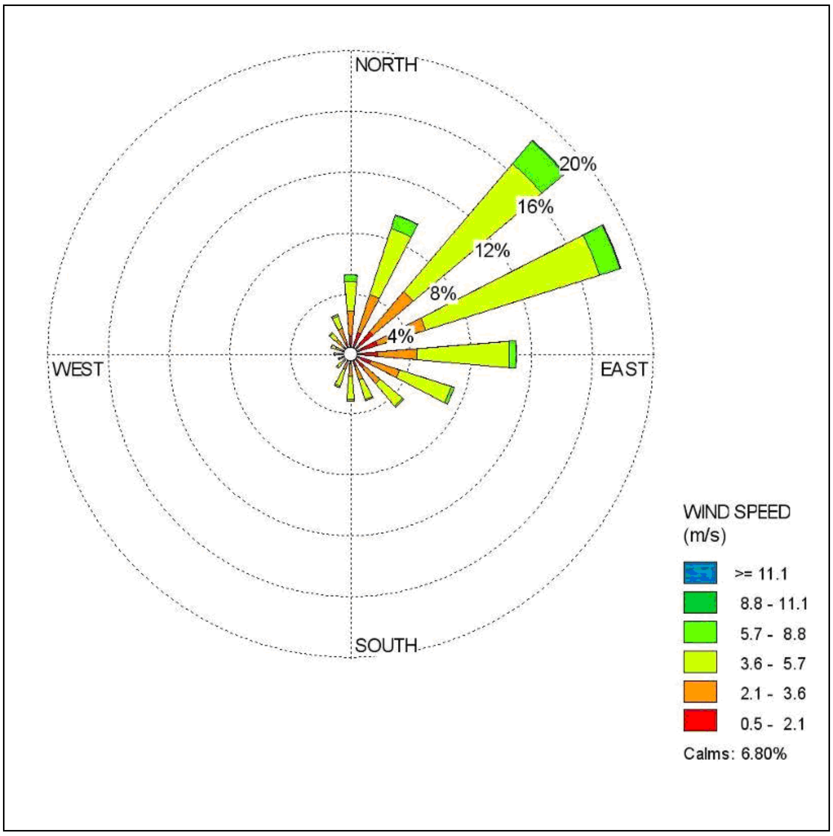


Figure 41: Period Wind Rose for the Gope Project Site for the Period 2002 to 2006.

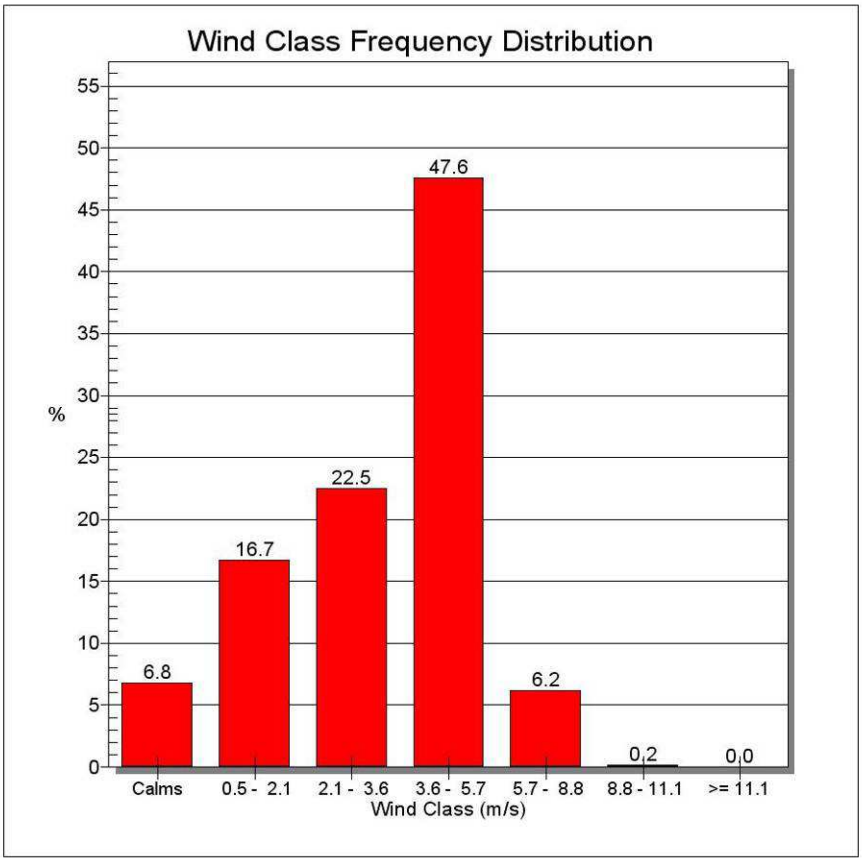


Figure 42: Wind Class Frequency Distribution for the Gope Project Site for the Period 2002 to 2006.

Looking at Figure 41 and Figure 42 respectively, it can be seen that the Gope Project Site is not an area of high wind speeds on average. At the Gope Project Site, 6.8% of the time, calm conditions existed over the area. The highest frequency of wind speeds lie between 3.6 to 5.7 m/s which occurred for 47.6% of the time. The second highest wind class (2.1 – 3.6 m/s) occurs 22.5% of the time. The winds dominate from the north-easterly sector and easterly sector.

6.13.2 Atmospheric Stability

Atmospheric stability is commonly categorised into six stability classes. These are briefly described in Table 35. The atmospheric boundary layer is usually unstable during the day due to turbulence caused by the sun's heating effect on the earth's surface. The depth of this mixing layer depends mainly on the amount of solar radiation, increasing in size gradually from sunrise to reach a maximum at about 5-6 hours after sunrise. The degree of thermal turbulence is increased on clear warm days with light winds. During the nighttimes, a stable layer, with limited vertical mixing, exists. During windy and/or cloudy conditions, the atmosphere is normally neutral.

Table 35: Atmospheric Stability Classes.

A	Very unstable	Calm wind, clear skies, hot daytime conditions
B	Moderately unstable	Clear skies, daytime conditions
C	Unstable	Moderate wind, slightly overcast daytime conditions
D	Neutral	High winds or cloudy days and nights
E	Stable	Moderate wind, slightly overcast night-time conditions
F	Very stable	Low winds, clear skies, cold night-time conditions

6.13.3 Temperature and Humidity

Temperature affects the formation, action, and interactions of pollutants in various ways (Kupchella & Hyland, 1993). Chemical reaction rates tend to increase with temperature and the warmer the air, the more water it can hold and hence the higher the humidity. When relative humidity exceeds 70%, light scattering by suspended particles begins to increase, as a function of increased water uptake by the particles (CEPA/FPAC Working Group, 1999). This results in decreased visibility due to the resultant haze. Many pollutants may also dissolve in water to form acids. Temperature also provides an indication of the rate of development and dissipation of the mixing layer as well as determining the effect of plume buoyancy; the larger the temperature difference between the plume and ambient air, the higher the plume is able to rise.

The long-term average monthly temperature for the Gope Project Site is depicted in Figure 43. Daily summer temperatures range between 25 °C and 32 °C. Winter temperatures range between 2 °C and 17 °C. From Figure 43 it is noted that the humidity is higher during the winter months, ranging between an average of 48% during November and 77% during June. These are however low relative humidity values. Monthly minimum and maximum temperatures for the period 2002 to 2006 for Gope are given in Figure 44. Monthly maximum temperatures range between 26 °C during the winter months and 36 °C during the summer months. The minimum monthly temperatures at Gope vary between 2 °C and 17 °C respectively. There exists therefore a big range between minimum and maximum daily temperatures at Gope, indicative of a semi-arid region.

Hourly average temperatures for Gope are shown for a 12 month period in Figure 45. The average diurnal variations in temperature are clearly evident. The same is said for the relative humidity, which is indirectly proportional to the temperature.

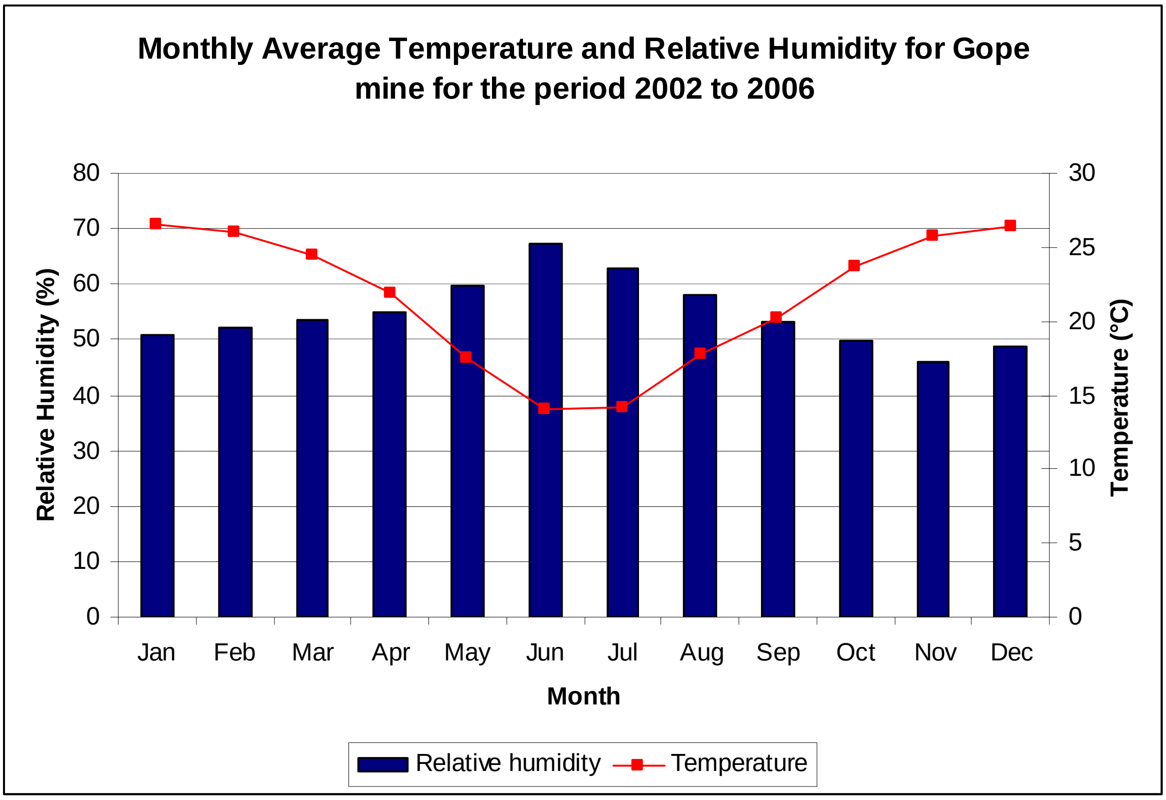


Figure 43: Monthly Average Temperature and Relative Humidity for GDMP for the Period 2002 to 2006.

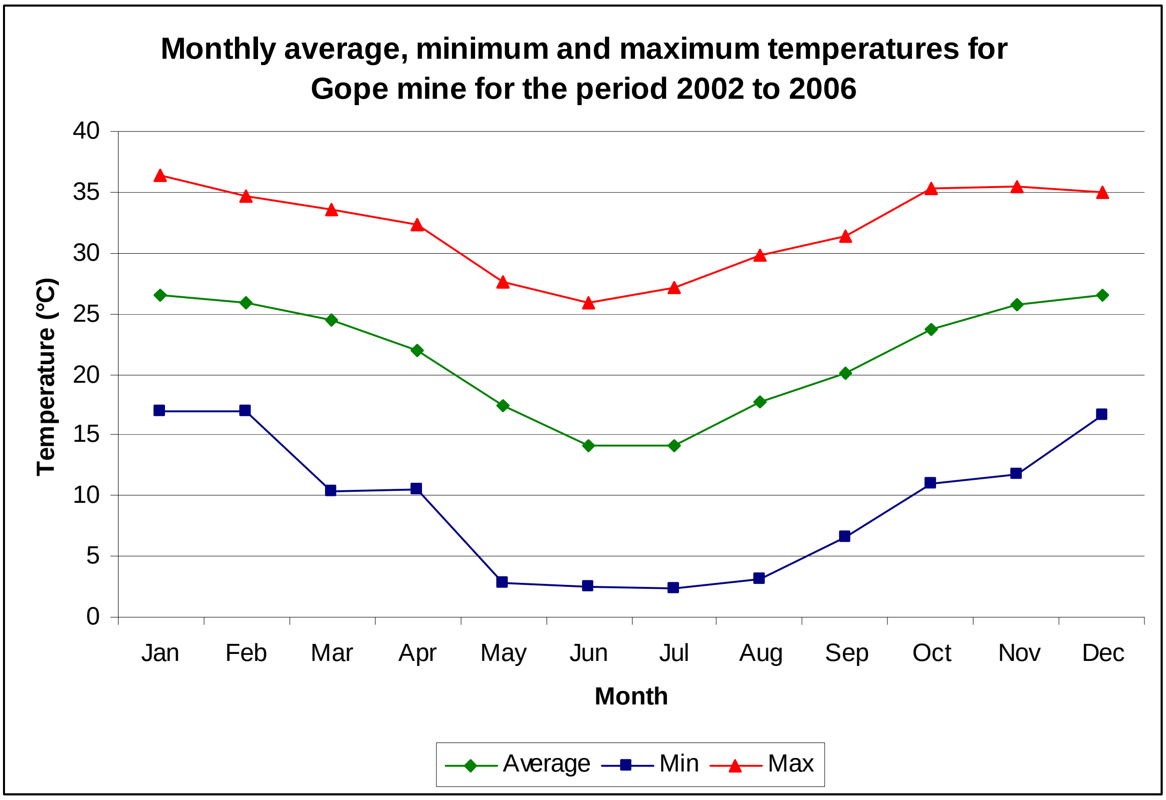


Figure 44: Monthly Average, Minimum and Maximum Temperatures for GDMP for the Period 2002 to 2006.

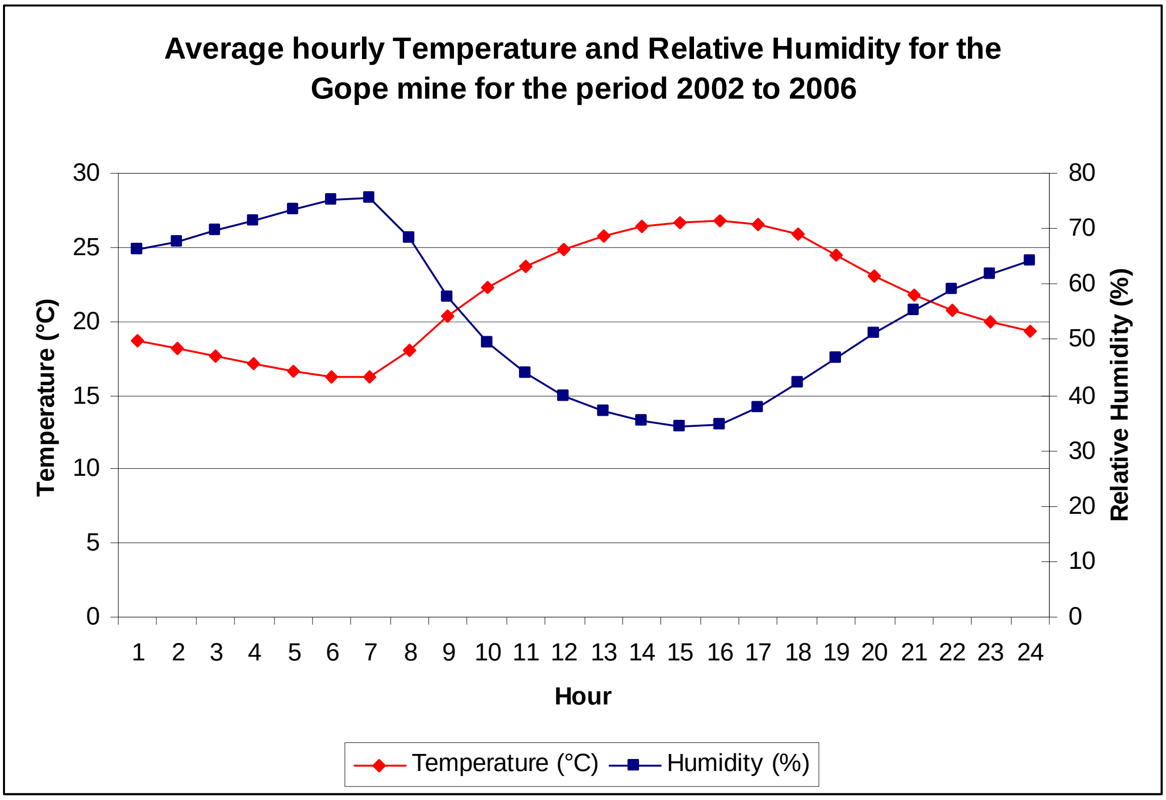


Figure 45: Monthly Average Hourly Temperature and Relative Humidity for the GDMP for the Period 2002 to 2006.

6.14. NOISE

Please refer to Appendix 6 for the full Noise Report.

6.14.1 Baseline Data Collection Methodology

Evaluation of potential noise impacts from the GDMP Project included reviewing Best Practice Standards and characterising the existing noise environment. The Best Practice Standards include:

- The South African Bureau of Standards (SANS[20]) code of practice (10103:2003), and
- The IFC EHS Guidelines (World Health Organisation (WHO), 2007).

Noise measurements were taken selected locations at the GDMP, and at 30 km intervals and / or sensitive receptors along the proposed Orapa-Gope Power Line Route. Environmental limits for noise were established to minimise effects such as nuisance, disturbance to wildlife, disruption of sleep and concentration, and interference with normal daily activities such as speech and telephone communication. The SANS has published limits for ambient noise in different types of districts (Table 36).

[20] No such standards currently exist in Botswana

Table 36: Typical Rating Levels for Ambient Noise in Districts.

TYPE OF DISTRICT	EQUIVALENT CONTINUOUS RATING LEVEL, $L_{REQ.T}$ FOR NOISE					
	OUTDOORS			INDOORS, WITH OPEN WINDOWS		
	DAY-NIGHT	DAY-TIME	NIGHT-TIME	DAY-NIGHT	DAY-TIME	NIGHT-TIME
Residential Districts						
Rural districts	45	45	35	35	35	25
Suburban districts with little road traffic	50	50	40	40	40	30
Urban districts	55	55	45	45	45	35
Non-Residential Districts						
Urban districts with some workshops, with business premises and with main roads	60	60	50	50	50	40
Central business districts	65	65	55	55	55	45
Industrial districts	70	70	60	60	60	50
IFC EHS GUIDELINES	**DAY-TIME**			**NIGHT-TIME**		
Residential; Institutional; Educational	55			45		
Industrial; Commercial	70			70		

On comparing the SANS code of practice (10103:2003) with the maximum allowable noise levels, as stipulated in the EHS Guidelines, the suburban and urban districts in the SANS COP are associated with the residential, institutional, and educational category in the EHS Guidelines. The daytime maximum allowable limit is 55 Decibel Audible (dB(A)) and the night time is 45 dB(A). The industrial category in the EHS Guidelines stipulates 70 dB(A) both for day and night.

It should be noted the SANS code of practise (10103:2003) stipulates the probable environmental response related to the degree of difference in levels between the ambient (intrusive) noise and the residual noise. This is shown in Table 37. Furthermore, that the EHS Guidelines stipulates that either noise generated by an activity (i.e. daytime and / or nighttimes) needs to comply with the stipulated limits, or increase no more than 3 Decibel (dB) from the background / ambient level.

Table 37: Categories of Environmental / Group Response (SANS Code of Practise 10103:2003).

EXCESS Lr dB(A)	ESTIMATED COMMUNITY/GROUP RESPONSE	
	CATEGORY	DESCRIPTION
0 -10	Little	Sporadic complaints
5 -15	Medium	Widespread complaints
10 – 20	Strong	Threats of community/group action
> 15	Very Strong	Vigorous community/group action

6.14.2 Limitations and Assumptions

Due to accessibility and for safety reasons only three noise measurements were taken at night at the GDMP site and along the proposed Power Line Route.

6.14.3 Results of Site Analysis

Ambient noise levels at the GDMP and along the proposed Power Line Route are currently very low (Table 38 and Table 39). Mine traffic, power line construction, road construction, plant operation and periodic blasting will contribute significantly to increasing the current noise levels.

Table 38: Noise Levels Measured within the GDMP Area.

GDMP	CO-ORDINATES DEGREES MINUTES SECONDS		UTMWGS85		READING (dB(A))
	SOUTH	EAST	SOUTH	EAST	
NL01 – Slimes Dam	22° 36' 32.71''	24° 44' 45.44''	7497998.115	268301.95	28.9
NL02 – Road / Sub station	22° 36' 32.54''	24° 47' 5.03''	7498068.07	272288.08	31.7
NL03 – Waste Rock Dump	22° 37' 44.34''	24° 47' 28.10''	7495884.22	272980.41	33.7
NL04 – Old Airstrip	22° 38' 38.99''	24° 45' 51.03''	7494152.8	270219.97	20.4
NL05 – Opencast Area	22° 37' 33.13''	24° 46' 9.61''	7496177.85	270733.93	38.2
NL06 – Night Reading	22° 37' 09.8''	24° 45' 38.0''	7496882.16	269816.68	17.6

Table 39: Noise Levels Measured along the Orapa-Gope Power Line Route.

ORAPA-GOPE POWER LINE ROUTE	CO-ORDINATES DEGREES MINUTES SECONDS		UTMWGS85		READING (dB(A))
	SOUTH	EAST	SOUTH	EAST	
PL01 – Night Reading	21° 22' 46.4''	25° 28' 10.4''	7635197.15	341414.35	34.8
PL02 – Power Line Route	21° 22' 22.2''	25° 27' 31.4''	7636020.69	340161.53	37.4
PL03 – Settlements	21° 24' 34.9''	25° 26' 16.9''	7631827.5	337947.73	33.2
PL04 – Pan	21° 29' 28.9''	25° 24' 57.5''	7622991.5	335721.26	22.4
PL05 – Power Line Route	21° 34' 45.9''	25° 27' 07.9''	7613838.78	339758.35	19.6
PL06 – Settlement	21° 49' 06.1''	25° 18' 22.9''	7586526.99	311159.91	35.2
PL07 – Power Line Route	21° 49' 44.8''	25° 14' 29.9''	7585242.57	318229.01	30.5
PL08 – Settlement	21° 57' 02.6''	25° 10' 17.5''	7571884.38	311159.91	38.9
PL09 – Power Line Route	22° 20' 00.5''	25° 05' 58.8''	7529239.03	304328.6	33.2
PL10 – Power Line Route (CKGR Boundary)	22° 19' 09.1''	24° 57' 09.8''	7530761.44	289121.84	21.0
PL11 – Night reading	22° 37' 09.8''	24° 45' 38.0''	7496882.16	269816.68	17.6

An ambient noise monitoring survey was conducted during the period 05 November 2007 to 09 November 2007, and the period 09 April to 10 April 2008. Five noise dosimeters readings were taken around the proposed mine foot area during daylight hours and one reading was taken at night (Figure 46). 10 noise dosimeters readings were taken along the proposed power line route during daylight hours and two readings were taken at night (Figure 47 & Figure 48).

The respective readings obtained are detailed in Table 38 and Table 39 in dB(A). Threshold levels of 0 dB and 70 dB were set, along with a criterion level of 85 dB. The daily personal exposure level for noise monitoring locations NL01 to NL06 were measured between 17.6 dB and 38.3 dB, while the daily personal exposure level for noise monitoring locations PL01 to PL11 were measured between 17.6 dB and 38.9 dB. NL05, PL02 and PL08 were recorded as being higher than the stipulated 35 dB(A) for rural districts. The higher measurement at NL05 was due to the recording being made in close proximity to the exploration drill site, where at the time, various activities were being undertaken. The location of the sampling location PL02 in relation to the existing road may have influenced the measurements obtained, as the movement of traffic would have contributed to the slightly higher than normal levels. The activities of people and domestic animals (cattle and dogs) contributed to the higher than stipulated rural district limit at PL08.

The noise levels readings were all within the day and nighttimes maximum allowable levels, as stipulated in the EHS Guidelines. As the site comprises an industrial activity within a rural setting, the more stringent criteria (viz. rural districts) will be applied until otherwise negotiated with the DEA.

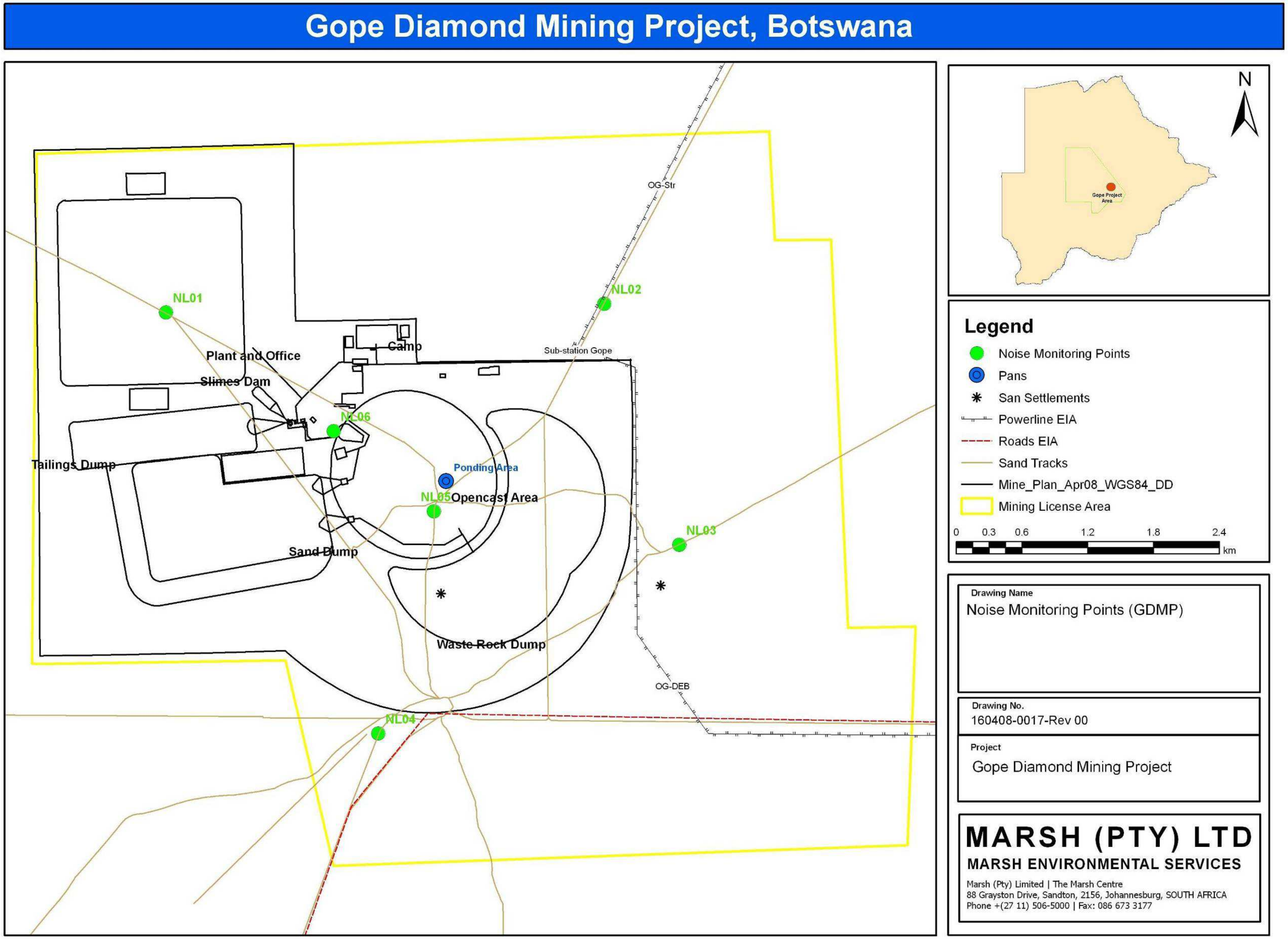


Figure 46: Noise Monitoring Points within the GDMP Area.

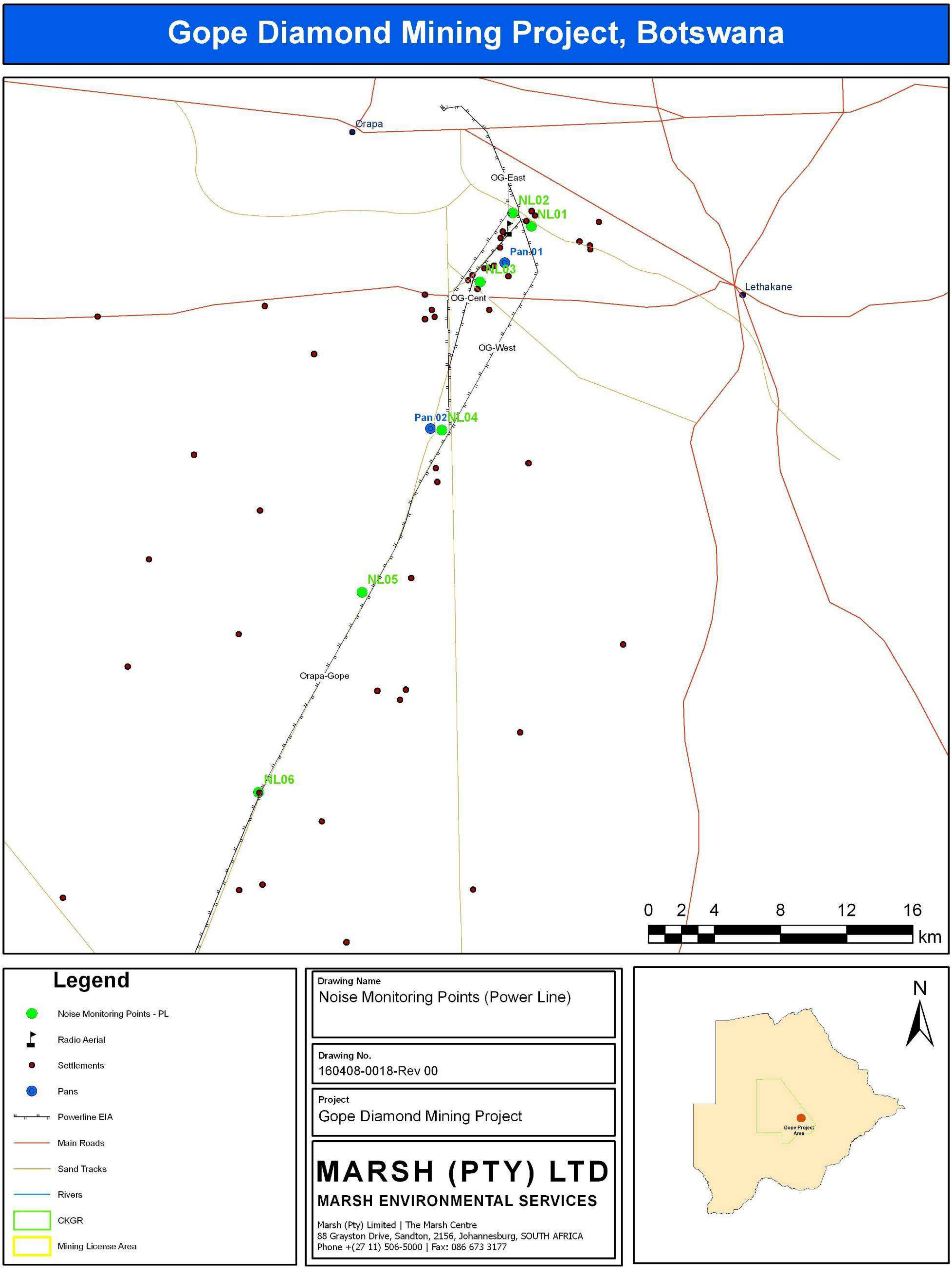


Figure 47: Noise Monitoring Points positioned along the Orapa-Gope Power Line Route (Map 1).

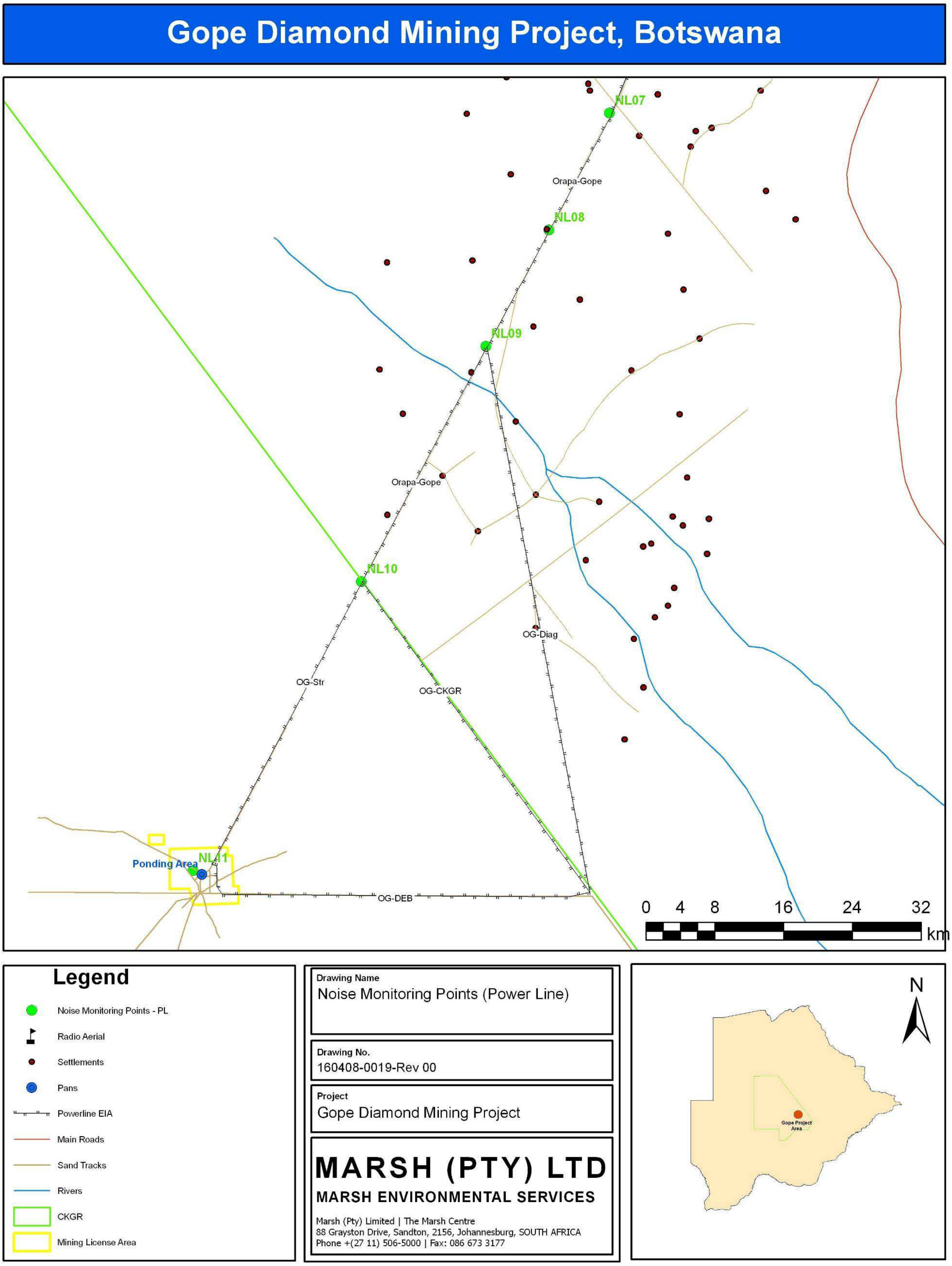


Figure 48: Noise Monitoring Points positioned along the Orapa-Gope Power Line Route (Map 2).

6.14.4 Sensitive Receptors Analysis

Sensitive receptors include within the Gope Project Site, include pan and wetland areas, rural residences (settlements) and the camp facilities within the GDMP. These areas will be avoided where feasible.

6.14.5 Vibration and Blasting

6.14.5.1 Background and Introduction

Vibration and blasting are measured on two levels, namely particle velocity and noise. Ground vibration, in the form of Peak Particle Velocity (PPV) is generally measured along the radial, vertical, and transverse plains in millimetres per second (mm/s) whilst air blast is recorded as acoustic noise levels and is measured in dB. Air blast is also measured as pressure in kilopascal (kPa). Frequency measurements are also obtained in conjunction with the blast vibration readings. The blast vibration frequency is measured in Hertz (Hz) and, when plotted graphically against the PPV, allows one to evaluate whether a blast was perceptible, disturbing or intolerable (Figure 49).

Although there are no formalised limits to vibration in Botswana, the US Bureau of Mines limits are commonly applied in Southern Africa. The limiting curve, developed from empirical studies by Siskind (1980), is detailed in Figure 49. Figure 49 represents the limit for cosmetic damage to a house, as well as damage to drywall and plaster. The maximum ground vibration amplitudes are frequency dependent, with higher frequencies allowing higher peak amplitudes. In general, at lower frequencies, the ground vibration should not exceed 12.7 mm/s, but at higher frequencies, the limit increases to 50 mm/s. Generally, the ground vibration should not be allowed to exceed 12.7 mm/s at any building in order to limit the risk of cosmetic or other serious damage to the building.

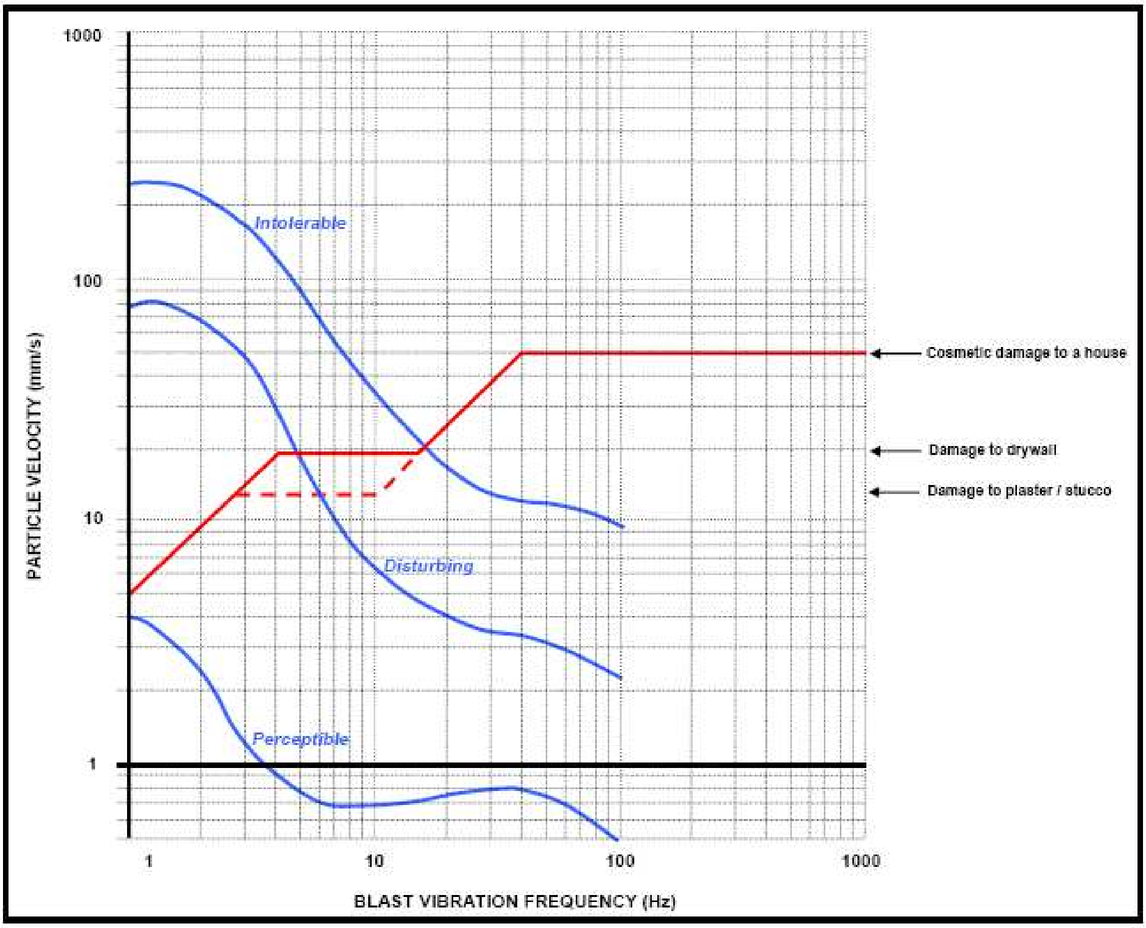


Figure 49: Safe Level Blasting Criteria according to the US Bureau of Mines Standards (USBM RI 8507, 1980).

The magnitude of ground vibrations depend on various aspects, including the following:

- The maximum mass of explosives used within a particular time interval;
- The distance between the blast and the blast monitoring point;
- The direction for direct energy propagation;
- The blast hole pattern;
- The timing and sequence of the blast, and
- The geological structure of the rock mass.

Air blast amplitudes up to 135 dB are deemed safe (Siskind, 1980), provided the monitoring instrumentation is sensitive to low frequencies (i.e. down to 1 Hz). Table 40 details the estimated threshold values for damage as a function of air blast.

Table 40: Damage Threshold Values for Air Blast Activities.

ACOUSTIC NOISE (dB)	COMMENT
100	Barely noticeable (0.002 kPa).
110	Readily acceptable (0.006 kPa). Loose windows, doors and ceiling panels will rattle.
120	Threshold of pain for continuous sound.
128	Reasonable level for public concern (0.050 kPa). Complaints likely to start. No more than 10% of measurements should exceed this value.
134	Equivalent to a large thunderstorm (0.1000 kPa). Poorly mounted pictures will fall and objects on shelves will rattle. No measurements outside a mine boundary should exceed this value.
150	Some windows may break.
170	Well-mounted windows will break (6.3 kPa).
180	Structural damage will occur.

6.14.5.2 Vibration and Blast Specific Data

Limited blasting is expected to occur during the sand stripping operations due to the poor physical structure of the Kalahari sand overburden. Only the occasional hard calcrete layer may require blasting, but these activities will be conducted on an *ad hoc* basis. However, during the operational phase blasting will be conducted on a regular basis.

6.14.5.3 Potential Impacts / Pollution Sources

Potential impacts on the GDMP as a result of blasting activities may be expected. The greatest impact would be related to the impact on foundation stability as a result of associated vibrations experienced. Excessive or high vibration levels could result in cracking of foundations and building exteriors. The potential for projectiles being dispersed into the Gope Project Site is possible and therefore a 100m blast zone around the open pit has been established.

Cloudy and partly cloudy conditions can amplify the effects of blasting activities. Thus, the potential noise related impacts associated with blasting activities might be amplified if blasting by GEC is undertaken on cloudy or partly cloudy days.

The impact of blasting and vibration during the construction and operation phases will be brief nature, but continuing for the life of the mine.

6.15. SITES OF ARCHAEOLOGICAL AND CULTURAL INTEREST

Please refer to Appendix 7 for the full AIA Report.

6.15.1 The Archaeological Environment

The southern African archaeological environment is divided into the Stone Age, the Iron Age and the Historical Period. The Stone Age is identified in the archaeological record through stone being the primary raw material used to produce tools and is associated with hunter-gatherer lifestyles. Iron Age people, known for their skill to manufacture ceramics, work iron and other metals, and also practiced agriculture and animal husbandry, formed kingships and civilizations. The Historical Period is marked by the advent of writing, in southern Africa primarily associated with the first European travellers (Mitchell 2002). During the latter part of the Later Stone Age (LSA) hunter-gatherers shared the landscape with both pastoralists and Early Iron Age people, while the advent of the Historical period in southern Africa is marked by a complex association of people, including LSA hunter-gatherers, Late Iron Age (LIA) people and colonial occupation (Lane & Reid 1998).

6.15.1.1 Botswana's Historical Period

The Historical Period is characteristically marked by the advent of writing and almost by default became associated with the sixteenth century AD European settlement and colonization of southern Africa. Under this definition many European sites, including trading posts, mission stations and shipwrecks were researched, furthering the understanding of everyday life of the early European traders, settlers and colonists (Lane & Reid 1998). However, as Posnansky and DeCorse (1986) and Rubertone (1989) have pointed out, the focus on European settlement and colonialism and the associated issue of acculturation have more than often led to the neglect of African indigenous responses to colonization. As a result Historical Period archaeology in southern Africa today are increasingly identified with an emphasis on the cultural association such as indigenous, contact period, or colonial, describing the particular research group or site.

A number of Historical Period research studies in southern Africa include early colonialism in Cape Town, South Africa (Hall 1991, 1993). Garlake (1969) and Pikirayi (1993) investigated pre-nineteenth century AD African – Portuguese contact in Zimbabwe while studies on European influence on Namibia's eighteenth century AD pastoralist communities were conducted by Kinahan (1996).

Historical Period archaeological studies in Botswana are still very limited. Studies done to date include, to name a few, the early work of Pahl (1971) at Motsenekatse Hill south of Kanye;

Van Waarden's (1980) research at the eighteenth and twentieth century AD settlement at Leeukop, north-eastern Botswana; Ramsay's (1991) investigation on Livingston's first school and church at Kolobeng; the 1863-1930's Ntsweng Kwena site near Molepolole (Ndobochani 1997, Sekgarametso 1995, Thebe 1996) and the nineteenth century AD Bangwato settlement at Old Palapye (Mathibidi 1996, Segadika 1997).

The need to further Historical Period archaeological research in Botswana has been realized. Lane and Reid (1998) emphasize the need for research to be done in association with indigenous perceptions of history and the past. They explain that many archaeological sites in Botswana are used by contemporary people for varying ritual and religious purposes. Many sites are associated with myths, legends and behavioural taboos. The discovery of concepts of historical value will greatly assist with the interpretation of sites and by implication the writing of a justly indigenous history of Botswana.

6.15.2 Brief Overview of the San

The San (also referred to as Basarwa or Bushmen) is defined by Lee (2002) as a "*cluster of indigenous peoples in southern Africa who speak a click language and who have a tradition of living by hunting and gathering.*" Although a vast array of different languages and dialects are spoken by the San, these can be grouped into a northern (such as the !Kung), central (i.e. the G/wi and G//ana) and southern (such as the !Xo) linguistic families. In pre-colonial days a fourth even more southernmost linguistic family referred to as the Xam existed across southernmost Africa. As can be seen from these linguistic divisions, the San can be found across southern Africa in countries such as South Africa, Namibia, Botswana, Angola and Zambia. In Botswana some figures are available to show the demographic history of the San in that country. In 1965 the population was estimated by George Silberbauer at 24,652 individuals (Wily, 1979). In 1979 the San population of Botswana was 25,000 individuals. The national census undertaken in 2001 has shown the San population to be at 50, 426 individuals.

The CKGR (formally proclaimed in 1961) has for a very long time been resided in by San groups. Some estimate the San to have stayed there for at least 30,000 years. Two groups belonging to the central linguistic family, namely the G/wi and the G//ana are strongly associated with the game reserve area. In 1965 the San population of the CKGR was estimated by George Silberbauer to be between 3,000 and 5,000 individuals (Wily, 1979).

6.15.3 The Permanent Settlement of Gope by the San

As indicated above the San is estimated to have stayed in the CKGR for at least 30,000 years. As will be outlined in more detail below, this would have consisted of groups of hunter-gatherers following a settlement system of congregation and dispersal aligned to seasonal changes.

In 1982 a borehole was drilled at Gope. This led to various San families (including the Balang, Segampe, Kepese and Mosode families) to settle permanently in the area. The Mosode family had been staying in the area before the drilling of the first borehole.

With their more permanent way of settling (as well as the availability of water) the people started livestock farming (especially goats) and established agricultural gardens where water melons, beans and mealies were grown. Domestic animals such as horses and donkeys were also kept. Some residents were also employed by the prospecting and mining operations which followed.

Politically, the residents of Gope had from the start an elected *Kgosi*. Before his death in 1989 this leader was Mr. Mosode Segampe. After his death Mr. Loma Goitoma Kepese was elected as leader. All important social and political discussions and events in the community centred around the *kgotla*, which is located a short distance to the south of the present mining license area.

6.15.4 Site Significance Assessment

Site significance assessment was based on the five-tier system (1-5) prescribed by the BNMMAG. Associated mitigation recommendations were done according to the system prescribed by the BNMMAG (Table 41).

Table 41: BNMMAG Mitigation Requirements.

BNMMAG SITE SIGNIFICANCE	MITIGATION RECOMMENDATION
1	Preserve at all costs
2	Preserve if possible, otherwise extensive salvage work
3	Test excavation to determine whether further work is necessary
4	Systematic representative sampling necessary
5	No further archaeological work required

6.15.5 MLA Findings

During the AIA a total of 38 abandoned San settlements as well as 12 San graves were identified in and around the MLA (Figure 50).

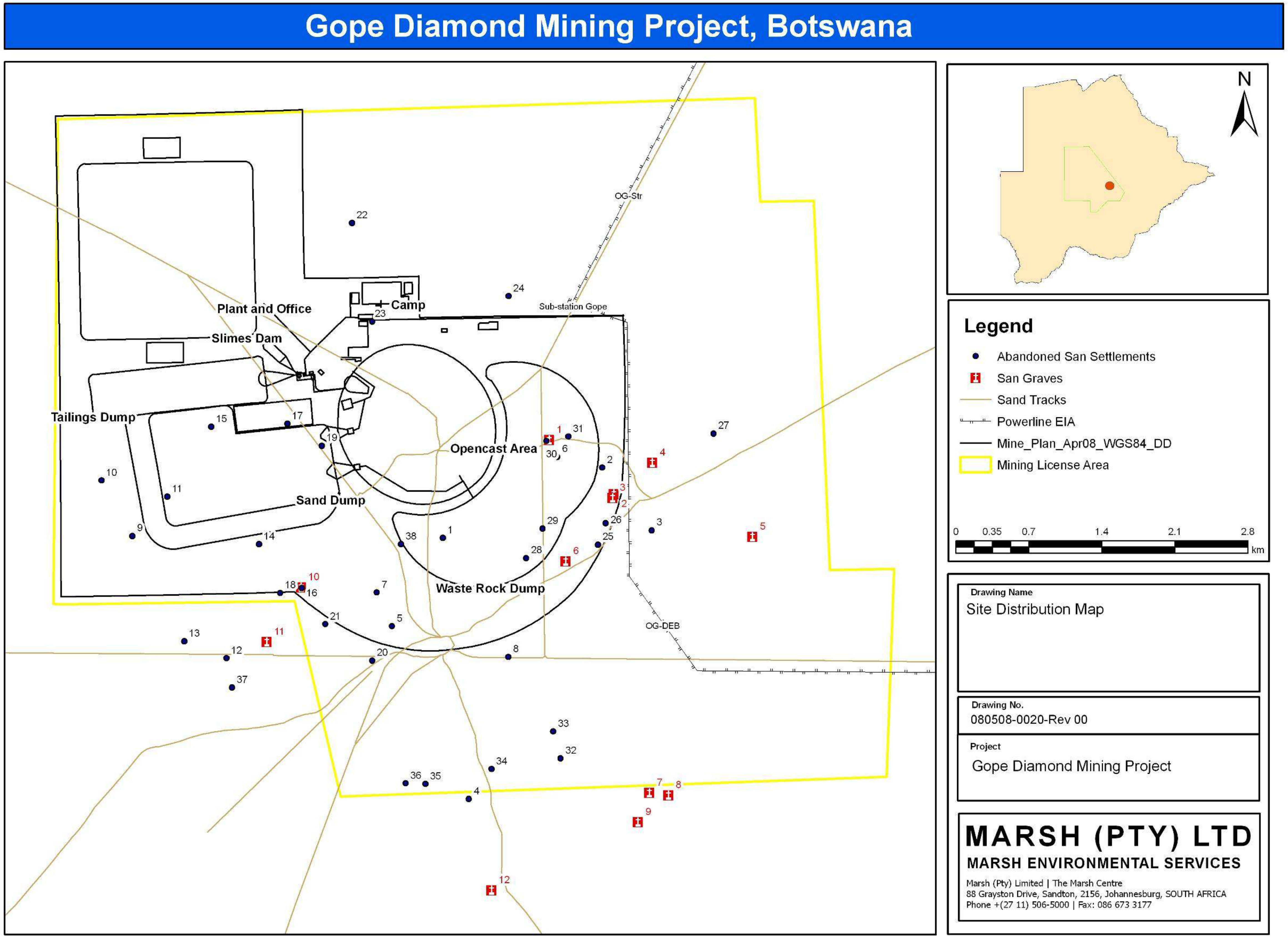


Figure 50: Map Depicting Distribution of Abandoned San Settlements and Graves.

6.15.6 Abandoned Settlements (*Aya*)

The following table depicts the findings of the investigations into the Aya's. Full details pertaining to each settlement is contained in Appendix 7. A total of 13 sites will be impacted directly by the mining operations.

Table 42: Summary of Findings – Aya's

AYA NUMBER	LOCATION IN RELATION TO PLANNED INFRASTRUCTURE	DIRECTLY IMPACTED / NOT	PROTECTED UNDER MRA 2001?	SOCIAL & HISTORICAL SIGNIFICANCE (BNMMAG)	CATAGORY
Aya 1	Located within footprint of WRD.	✓	✗	✓	4
Aya 2	Located in very close proximity to the WRD.	✗	✗	✓	4
Aya 3	Located in vicinity to the access road.	✗	✗	✓	4
Aya 4	Located outside MLA.	✗	N/A	N/A	N/A
Aya 5	Located inside the Gope Project Area.	✗	✗	✓	S
Aya 6	Located within footprint of WRD.	✓	✗	✓	4
Aya 7	Located inside the Gope Project Area.	✗	✗	✓	S
Aya 8	Located outside the Gope Project Area, but inside the MLA.	✗	✗	✓	S
Aya 9	Located in close proximity to the sand dump.	✗	✗	✓	4
Aya 10	Located within the Gope Project Site.	✗	✗	✓	S
Aya 11	Located within the footprint of the sand dump.	✓	✗	✓	S
Aya 12	Located outside the MLA.	✗	N/A	N/A	N/A
Aya 13	Located outside the MLA.	✗	N/A	N/A	N/A
Aya 14	Located in close proximity to the sand dump.	✓	✗	✓	S
Aya 15	Located within the footprint of the sand dump.	✓	✗	✓	S

AYA NUMBER	LOCATION IN RELATION TO PLANNED INFRASTRUCTURE	DIRECTLY IMPACTED / NOT	PROTECTED UNDER MRA 2001?	SOCIAL & HISTORICAL SIGNIFICANCE (BNMMAG)	CATAGORY
Aya 16	Located within the Gope Project Site.	✘	✘	✓	S
Aya 17	Located in the crater stockpile / sand dump footprint.	✓	✘	✓	S
Aya 18	Located on the fence of the Gope Project Site.	✘	✘	✓	S
Aya 19	Located within the footprint of the sand dump.	✓	✘	✓	S
Aya 20	Located outside the Gope Project Area, but inside the MLA.	✘	✘	✓	S
Aya 21	Located outside the Gope Project Area, but inside the MLA.	✘	✘	✓	S
Aya 22	Located outside the Gope Project Area, but inside the MLA.	✘	✘	✓	S
Aya 23	Located within the footprint of the accommodation camp.	✓	✘	✓	S
Aya 24	Located outside the Gope Project Area, but inside the MLA.	✘	✘	✓	S
Aya 25	Located in close proximity to the WRD.	✘	✘	✓	S
Aya 26	Located in close proximity to the WRD.	✘	✘	✓	S
Aya 27	Located outside the Gope Project Area, but inside the MLA.	✘	✘	✓	S
Aya 28	Located within footprint of WRD.	✓	✘	✓	S
Aya 29	Located within footprint of WRD.	✓	✘	✓	S
Aya 30	Located within footprint of WRD.	✓	✘	✓	S
Aya 31	Located within footprint of WRD.	✓	✘	✓	S

AYA NUMBER	LOCATION IN RELATION TO PLANNED INFRASTRUCTURE	DIRECTLY IMPACTED / NOT	PROTECTED UNDER MRA 2001?	SOCIAL & HISTORICAL SIGNIFICANCE (BNMMAG)	CATAGORY
Aya 32	Located outside the Gope Project Area, but inside the MLA.	✘	✘	✓	S
Aya 33	Located outside the Gope Project Area, but inside the MLA.	✘	✘	✓	S
Aya 34	Located outside the Gope Project Area, but inside the MLA.	✘	✘	✓	S
Aya 35	Located outside the Gope Project Area, but inside the MLA.	✘	✘	✓	S
Aya 36	Located outside the Gope Project Area, but inside the MLA.	✘	✘	✓	S
Aya 37	Located outside MLA.	✘	N/A	N/A	N/A
Aya 38	Located in close proximity to the WRD.	✓	✘	✓	S

6.15.7 Graves (*Tcamm*)

The following table depicts the findings of the investigations into the graves sites located at the Gope Project Site. Full details pertaining to each grave site is contained in Appendix 7. A total of 12 grave sites were located with the assistance of former residents of Gope who assisted the Archaeology team in the field investigations.

Table 43: Summary of Findings – Grave Sites

GRAVE NUMBER	NAME OF DECEASED	DATE OF DEATH	NEXT OF KIN & CONTACT DETAILS	LOCATION IN RELATION TO PLANNED INFRASTRUCTURE	DIRECTLY IMPACTED / NOT	PROTECTED UNDER MRA 2001?	SOCIAL & HISTORICAL SIGNIFICANCE (BNMMAG)	CATAGORY
Tcamm 01	Mr. Mpotsang Balang	1995	Mr. Moloreng Balang (Brother) Resident in Kaudwane	Located within footprint of WRD.	✓	✘	✓	S
Tcamm 02	Mr. Mosode Segampe	1989	Mses. Xama, Kwena, Yama Mosodo (Daughters) Resident in Kaudwane	Located in close proximity to the WRD and inside the Gope Project Site.	✘	✘	✓	S
Tcamm 03	Neo Mosodo	1989	Ms. Xama Mosodo (Grandmother) Resident in Kaudwane	Located in close proximity to the WRD and inside the Gope Project Site.	✘	✘	✓	S
Tcamm 04	Ms. Makgosi Cxommhe	1990	Ms. Xama Mosodo (Daughter) Resident in Kaudwane	Located in the vicinity of the access road.	✘	✘	✓	S
Tcamm 05	Ms. Tsabang Segampe	~1960	Ms. Moloreng Balang (Daughter) Resident in Kaudwane	Located outside the Gope Project Area, but inside the MLA.	✘	✘	✓	S
Tcamm 06	Ms. Khataga Maholo	1984	Mr. Kepese Moitsana (Son) Resident at Gope	Located in close proximity to the WRD and inside the Gope Project Site.	✘	✘	✓	S
Tcamm 07	Ms. Maditseko Molatege	1997	Kgosi Loma Goitoma Kepese (Husband) Resident at Gope	Located outside both the Gope Project Site and MLA.	✘	✘	✓	S
Tcamm 08	Oto Treedubble (sic)	1991	Father stays in the Moraka of Namane close to Shoshong	Located outside both the Gope Project Site and MLA.	✘	✘	✓	S

GRAVE NUMBER	NAME OF DECEASED	DATE OF DEATH	NEXT OF KIN & CONTACT DETAILS	LOCATION IN RELATION TO PLANNED INFRASTRUCTURE	DIRECTLY IMPACTED / NOT	PROTECTED UNDER MRA 2001?	SOCIAL & HISTORICAL SIGNIFICANCE (BNMMAG)	CATAGORY
Tcamm 09	Ms. Monalesi Gambe	1992	Mr. Kepese Moitsana (Son) Resident at Gope	Located outside both the Gope Project Site and MLA.	✘	✘	✓	S
Tcamm 10	Mr. Nxoqoo Pororo	1997	Mr. Kepese Moitsana (Cousin) Resident at Gope	Located within the fenced area of the Gope Project Site.	✘	✘	✓	S
Tcamm 11	Mr. Mototselo Mosode	1997	Mr. Dingo Moloreng (Nephew) Resident at Kaudwane	Located outside both the Gope Project Site and MLA.	✘	✘	✓	S
Tcamm 12	Ms. Tuela Moitsana	1995	Mr. Kepese Moitsana (Brother) Resident at Gope	Located outside both the Gope Project Site and MLA.	✘	✘	✓	S

6.15.8 Ethnographic Evidence for San Settlement[21]

6.15.8.1 Prerequisites for Settlement

Looking at the G/wi hunter-gatherer prerequisites for settlement Silberbauer (1981:191) lists a number of points which he describes as the essential resources which had to be situated in reasonable close proximity to one another to allow for settlement:

1. "*An adequate, variety, number, and density of food plants to provide for their needs in all seasons and over a wide range of variation of annual rainfall and other climatic factors.*
2. *A sufficiency of grazing and browsing to attract and sustain antelope and other herbivorous prey animals.*
3. *Trees to provide shade and to furnish firewood and timber for constructing shelters and making artefacts.*
4. *Pans or other impervious drainages in which rainwater gathers in the wet season to provide a supply of drinking water for man and animal.*
5. *Sufficient space to contain these thinly distributed resources in adequate quantity.*"

Although the appropriateness of at least some of these points for the Gope area can not be denied, the presence of boreholes has changed them. Here almost all of the settlements are situated within reasonable distances from the boreholes with no presence of visible settlements further away. As such boreholes and proximity to boreholes can be considered to be the primary settlement prerequisite. As almost all of the sites located in the Gope area has trees associated with it, the presence of trees can be seen as the second-most important settlement prerequisite at Gope. The availability of grazing and browsing more for the domestic livestock (goats) and to a lesser degree for antelope would still be valid, as would the availability for plant foods. As some of the located sites are congregated together the assumption can be made that the significance of the availability of sufficient space must have become less important than being close to permanent sources of water (boreholes).

6.15.8.2 Seasonal Changes and Settlement

The Central Kalahari is characterised by a significant seasonal variation in the amount and variety of food plants with which a hunter-gatherer group can sustain themselves. Silberbauer (1981) illustrates this by stating that a square kilometre in the Central Kalahari that has enough esculent plants to feed 50 people for 20 days in May would only feed two people for the same period in September. As a result the G/wi has a settlement system of congregation and dispersal aligned to seasonal changes. During the good period which lasts from midsummer to late autumn/early

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[21] The work of George B. Silberbauer was used as the basis of this discussion as he worked on the one of the groups of San who lived in the Gope area, namely the G/wi. However, one observation which needs to be noted right from the start is that in his research he focused on purely hunter-gatherer groups, whereas the settlements found at Gope clearly included kraals for livestock purposes as well.

winter, the band congregates together into a joint campsite. Due to the strain this places on the local esculent plant populations as well as subsequent pollution of the area from waste and faeces the band moves the joint campsite between 6 and 15 times in one season, with the distances between these campsites being more than 15 kilometres' apart. When drought and winter frosts start to limit the amount and variety of esculent plant and also force the large herds of antelope to move north-westward out of the Central Kalahari, the congregated bands disperse into individual households. Each of these households (consisting of between three to six individuals) then moves to a previously defined location and remain there until midsummer when they regroup into the original bands again. Through this system the G/wi achieve the benefits of a reasonably large band membership (through temporary separation and isolation) while at the same time having a sustainable livelihood in an environment which would not be able to support such a larger band permanently.

Based on the results of the consultation undertaken with erstwhile residents it can be surmised that the introduction of permanent water sources at Gope had changed the settlement system of congregation and dispersal to one of permanent settlement in a specific area.

6.15.9 Ethnographic Evidence for San Burial Practices

George B. Silberbauer has undertaken comprehensive research on the G/wi of the Central Kalahari. In his *Hunter and habitat in the central Kalahari Desert* Silberbauer (1981) states that in the G/wi belief system graves are associated with post-mortem spirits (known as g/amadzi). The g/amadzi are hostile to living persons and will attack them if given the chance to do so. Their mobility is however restricted to a couple of hundred meters surrounding a recent grave. Although these spirits are not believed to kill their victims, they may leave them blind and witless. Because of this belief graves are always given a wide berth once the funeral ceremonies are over. These ceremonies last for three days. It is also indicated that graves are marked by breaking the possessions of the deceased and placing them on the grave mound. In his Report to the *Government of Bechuanaland on the Bushman Survey* Silberbauer (1965) also states that the deceased is always "…*wrapped in a cloak and bound in a squatting or foetal position, upright in a grave about five feet deep*". He adds that if a person dies in or near a village the deceased is buried in the floor of his/her hut. After burial this and all other huts from the settlement are broken down and the settlement is abandoned and never used again. The weapons and implements of the deceased are broken and placed on the grave to warn others of the presence of a grave. This is the only form of marking of the grave that is made. The mourning of the deceased lasts three days after which the whole band moves away never to return again.

Mathias Guenther's research on the Naron (Nharo) San of Botswana has also revealed some indication of burial ritual and tradition amongst the San. It is important to note however that the Naron are a settled group characterised by living on farms and cattle posts. As a result this group has undergone considerable acculturation of western and Christian traditions and customs. Guenther (1986) shows that during pre-farm days the Naron paid almost no ritual attention to death. If a person died he/she was quickly buried in a bent position, knees up to the chest and lying on his/her side. The deceased was buried with his/her clothes and any movable possessions were always placed in the grave. While some Naron destroyed the deceased's hut others would leave it intact. The site of a grave was never revisited for fear of the spirits associated with them. Based on this one can clearly see a strong similarity between the burial customs of the G/wi and pre-farm Naron. The contemporary farm Naron has more elaborate burial customs and ritual. This is as a result of acculturation from especially European farmers as well as a result of their more permanent settlements. As a result graves are buried in a fixed cemetery approximately 500 meters from each village. The cemetery is surrounded by thorn bushes to protect it from goats and donkeys. It is also stated that although the Naron still has a vague fear of a grave site (and stay away from them unless burying a corpse) a number of individuals have revealed an emotional link to the place where their family lie buried. In the words of Guenther (1986:282) "…*it is the location of their relatives' graves, rather than where they work or live, that defines //ai (home) for quite a few Nharo.*" In terms of mortuary practice, a person who dies in the morning may be buried the same afternoon, though usually it is undertaken the following day. The task of the immediate family members is to lay out the body of the deceased, wash it, wrap it in a blanket and place the body inside the deceased's hut. Other family members and neighbours will dig the grave. It is usually about two meters deep and excavated along the east-west axis. A narrow chamber is dug into the side of the bottom wall. This custom was adopted from the Tswana who dug a chamber to keep the deceased from "suffocating" when the grave is filled. Throughout the day all residents of the village as well as friends and family from nearby villages would arrive to pay respects to the deceased and his/her immediate family. During this time the immediate family of the deceased remain in the hut with the deceased. In the late afternoon the visitors will go back to their villages for their evening meals and later return for the wake. The wake takes the form of the things which were done throughout the day namely chatting, tea drinking and smoking. The burial takes place during the next morning. It is attended by everyone in the village and sometimes also by the farmer who owns the farm on which the deceased has stayed or worked. The wrapped body is placed in the chamber with the head facing the west. No goods are placed in the grave. The grave is filled swiftly by a number of men and no prayers are said at the burial. No ritual takes place during or after the burial, nor is the grave marked or adorned in any fashion. The last person to leave the burial ground replaces the thorn branches at the entrance of the burial ground.

The consultation undertaken with erstwhile residents of the Gope area has revealed that 11 of the 12 grave sites are associated with abandoned settlements. Two of these graves (*Tcamm* 1 & 2) are buried inside goat enclosures while the remainder (*Tcamm* 3, 4, 5, 6, 7, 9, 10, 11 & 12) are buried inside settlements without any physically identifiable component thereof (i.e. huts, enclosures or middens) visible. Only one grave (*Tcamm* 8) is situated in a locality not associated with any abandoned settlements. Eleven of the identified graves are buried in close proximity to a tree, with *Tcamm* 1 being the exception. In terms of the burial itself, three of the 12 graves (*Tcamm* 1, 2 & 10) were buried in a coffin, eight (*Tcamm* 3, 4, 5, 6, 7, 8, 11 & 12) in blankets and animal skin and the remaining one (*Tcamm* 9) in only a blanket. Most of the graves were buried at a depth of approximately two meters.

6.15.10 Power Line Findings

A total of 14 sites were identified along the proposed transmission line, namely two Later Stone Age sites, two Late Iron Age sites, two Abandoned *Moraka* sites and eight Contemporary *Moraka* (Figure 51 and Figure 52).

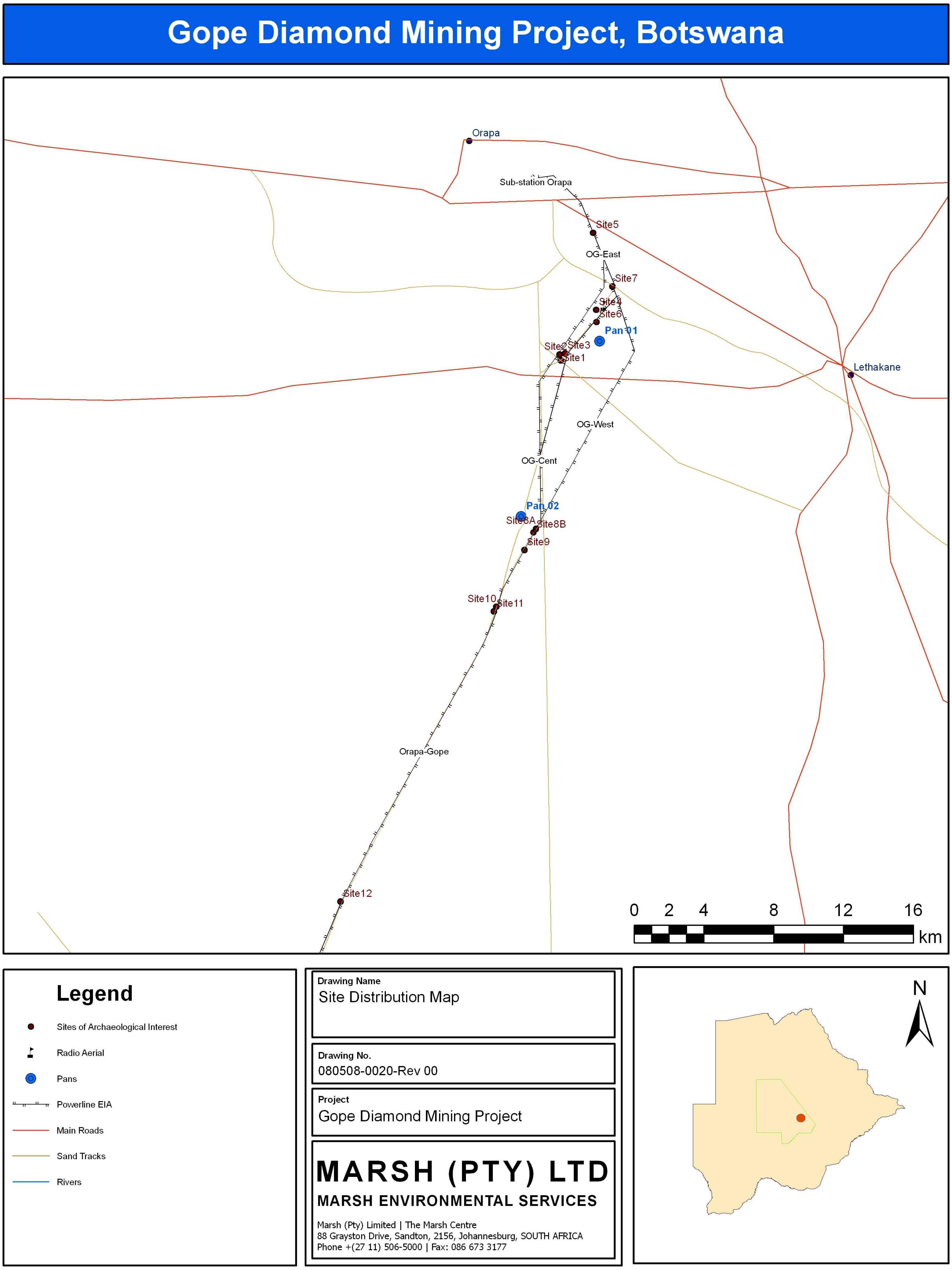


Figure 51: Sites Located Along the Proposed Power Line and Alternate Routes in the North.

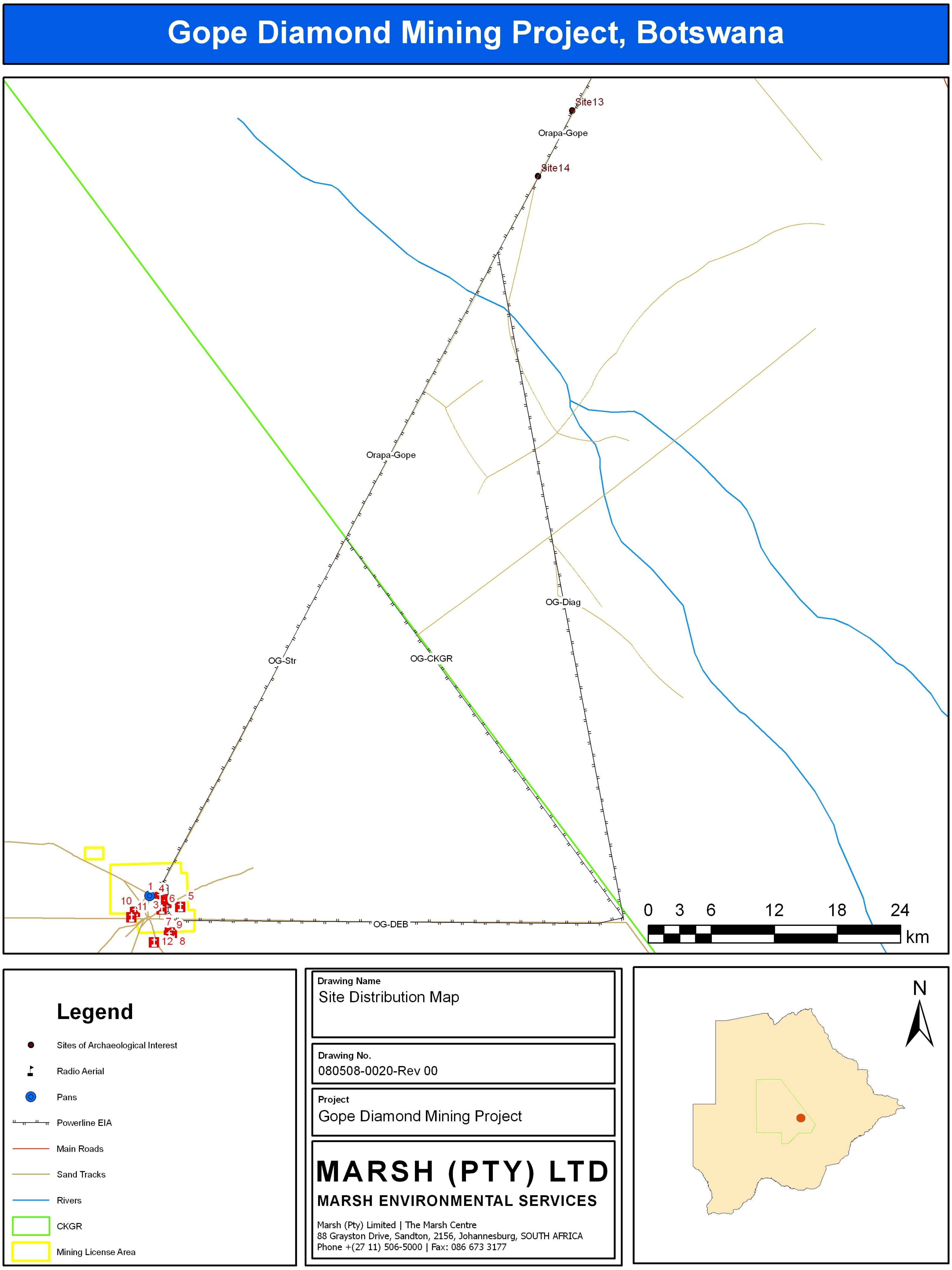


Figure 52: Sites Located Along the Proposed Power Line in the South.

6.15.11 Later Stone and Iron Age Sites and Contemporary *Moraka's*

Table 44 summarises the findings of the investigations into Moraka's along the power line route. Full details pertaining to each Moraka is contained in Appendix 7. A total of 13 sites will be impacted directly by the mining operations.

Table 44: Summary of Findings – Moraka's

MORAKA NUMBER	LOCATION IN RELATION TO PLANNED INFRASTRUCTURE	DIRECTLY IMPACTED / NOT	PROTECTED UNDER MRA 2001?	SOCIAL & HISTORICAL SIGNIFICANCE (BNMMAG)	CATAGORY
Moraka 1	Located outside of the footprint of the power line infrastructure.	✗	✓	✓	4
Moraka 2	Located outside of the footprint of the power line infrastructure.	✗	✗	✓	S
Moraka 3	Located outside of the footprint of the power line infrastructure.	✗	✗	✓	S
Moraka 4	Located outside of the footprint of the power line infrastructure.	✗	✗	✓	S
Moraka 5	Located within the footprint of the proposed power line infrastructure.	✓	✓	✓	5
Moraka 6	Located in close proximity to the proposed power line infrastructure.	Possible	✗	✓	S
Moraka 7	Located in close proximity to the proposed power line infrastructure.	Possible	✗	✓	S
Moraka 8	Located within the footprint of the proposed power line infrastructure.	✓	✗	✓	S
Moraka 9	Located within the footprint of the proposed power line infrastructure.	✓	✗	✓	S

MORAKA NUMBER	LOCATION IN RELATION TO PLANNED INFRASTRUCTURE	DIRECTLY IMPACTED / NOT	PROTECTED UNDER MRA 2001?	SOCIAL & HISTORICAL SIGNIFICANCE (BNMMAG)	CATAGORY
Moraka 10	Located in close proximity to the proposed power line infrastructure.	Possible	✓	✓	5
Moraka 11	Located outside of the footprint of the power line infrastructure.	✗	✗	✓	5
Moraka 12	Located within the footprint of the proposed power line infrastructure.	✓	✗	✓	S
Moraka 13	Located within the footprint of the proposed power line infrastructure.	✓	✗	✓	S
Moraka 14	Located within the footprint of the proposed power line infrastructure.	✓	✗	✓	S

6.16. VISUAL

Please refer to Appendix 8 for the full Landscape and Visual Impact Assessment Report.

6.16.1 Baseline Data Collection Methodology

Visual Landscape Value is usually established through an analysis of sensitive receptors (people who will see the mining operation) as well as the value attached by these people to the available view. It is imperative to note that sensitive receptors are limited to visitors in this section of the game reserve and the local residents at Gope. During the Public Participation Process undertaken by Marsh in January 2008 Interested and Affected Parties (I&APs) did not comment on the potential visual landscape alteration or impacts associated with the proposed mining activities.

This assessment is therefore based on an analysis of the Landscape & Visual Sensitivity and Landscape Capacity. This methodology is proposed by a paper published by the Countryside Agency[22] and provides a guideline for assessing landscape and visual capacity and sensitivity.

[22] The Countryside Agency, 2008, Topic Paper 6: Techniques and Criteria for Judging Capacity and Sensitivity.

Landscape and Visual Sensitivity refers to the general visibility of the proposed activity and the scope to mitigate the visual effect. Visibility will be a function of the landform, the presence of screening land cover and the number of people who are likely to perceive the landscape. Landscape Capacity refers to the amount of change of a particular type that can be accommodated within the change in land-use having an adverse effect of on the character of the landscape and without compromising the value attached to the particular landscape.

6.16.2 Limitations and Assumptions

6.16.2.1 Assumptions

- The landscape value estimation has been based on available information regarding tourist activities in the GDMP section of the game reserve. This information indicated that there limited tourist activities in the GDMP area, and
- The impact analysis is based on the extent of the proposed mining operation as included in this report.

6.16.2.2 Limitations

- The baseline environment analysis and landscape character analysis was undertaken during November 2007, seasonal variation in the landscape character has not been considered though limited variation is expected, and
- Visual simulations undertaken should be regarded as an estimated representation of the actual visual impact.

6.16.3 Landscape & Visual Character Analysis

The Landscape Character Analysis is based on the concepts of character assessment and includes proposed indicators as set out in the literature by Ode, Ase, Tveit, Mari S, and Fry, Gary (2008)23. The character analysis can be summarised as follows (Table 45):

Table 45: Visual Landscape Character Analysis.

INDICATOR	LANDSCAPE CHARACTER / DESCRIPTION	
Spectacular, unique and/or Ironic landscapes	The general landscape is homogeneous with no specific unique views	
Viewpoints	None identified	
Presence of disturbing elements.	None	
Visual impact of the disturbance.	N/A	
The distribution of landscape	Landform,	Low topographic relief with relatively

23 Ode, Ase, Tveit, Mari S, and Fry, Gary. 200823. Capturing Landscape Visual Character Using Indicators: Touching Base with Landscape Aesthetic Theory, Landscape Research, 33:1, 89-117.

INDICATOR	LANDSCAPE CHARACTER / DESCRIPTION	
attributes.	shape and scale (openness/ enclosure)	low vegetation cover enabling vast views
	Landscape pattern and foci	The vegetation type presents a relatively homogeneous landscape character to the observer.
	Character of the built environment	The built environment is represented by abandoned villages which is generally not visible due to it locality and contraction methods and materials used. Access routes and roads are regarded as part of the built environment for the purposes of this assessment. Roads are considered as tracks are usually limited to the general width of 3-4 meters.
	Landscape features	Untransformed natural veld areas are regarded as a landscape features though no other significant landscape features are noted in the area.
	Sense of remoteness/wildness	A highs sense of remoteness is noted due to the general absence of human alterations of the landscape.
	Inter-visibility with adjacent landscapes	Inter-visibility is limited due to the low topographical relief of the area.
	Experience of landscape	The landscape is generally pleasing with the absence of any spectacular features and a high sense of remoteness.
The spatial organisation of these attributes	The landscape attributes are spatially homogeneous.	
The variation and contrast between landscape character.	There is no variation in the landscape character.	
The spatial arrangement of water.	N/A	
The spatial arrangement of vegetation.	Homogeneous	
Topographical nature.	Low relief	
Level of management of vegetation.	Vegetation is pristine with limited disturbances by settlements and roads. Maintenance of these transformed areas is not required.	
The status and conditions of man-made structures (including infrastructure).	N/A	
Open area.	Vast views	
Obstruction of the View.	Limited	
Landscape attributes with seasonal change, landscape attributes with weather characteristics and season bound change.	Seasonal differences are noticeable though does not present spectacular changes due to the vegetation type.	
Water in the landscape.	N/A	
Vegetation with continuity.	The vegetation type is perceived as continuous and homogeneous. The floral landscape character is well represented over a large area.	

INDICATOR	LANDSCAPE CHARACTER / DESCRIPTION
Landscape Elements.	Flat topographic relief with low level vegetation cover.
Naturalness of vegetation.	High

6.16.4 Estimation of the value of the Landscape and Visual Resources

As part of the assessment, the value of the visual and landscape resources was established. The wildlife and safari experience is greatly valued by international visitors with specific focus on the national parks in the northern areas of the reserve including the Moremi and Savute National Parks. The CKGR is internationally recognised as a tourist destination and is often described in this context as the world's second largest protected area and as vast, captivating and with a wild rugged beauty, that visitors feel a sense of remoteness as the suns sets on the horizon. (http://www.drivebotswana.com/whybotswana.htm). The CKGR is valued for its untransformed character and abundance of wildlife though, as previously mentioned, the northern extent of the reserve holds the prevailing interest due to the higher occurrence of surface water features which attracts wildlife.

However, the reserve extends over approximately 52,800 km^2. Specific attractions within the CKGR include Pipers Pan, Tau Pan and Deception Pan and Dry Valley, these tourist attractions (landscapes of special interest) are all situated within the northern regions of the CKGR. Tourists travelling through the game reserve from the Khutse Camp, situated along the southern boundary of the CKGR, are popular and routes through the game reserve are mostly aligned with the river courses. Tourist routes are located approximately 70 km from the proposed mine site in all instances where tourist are not travelling on the route directly to Gope.

As part of the Public Participation Process undertaken by Marsh, the potential for visual impact has been presented to I&APs. However, no comments from the public were received with regard to this issue. It is assumed, at this stage, that due the high significance of other issues (such as social, biodiversity and heritage concerns) landscape and visual impacts are not a primary concern.

6.16.5 Landscape and Visual Sensitivity

To enable an understanding of the visibility of the proposed mining operations, visual simulations have been undertaken. Visual simulations was undertaken through the overlaying of a perspective of the proposed mine operation on photographs taken of the site. Photos were taken 5 km, 10 km and 15 km from the site to enable an understanding of the actual visual impact that could be expected over distance.

The first simulation is an image of the mine site from view approximately 15 km towards the east of the proposed development area. The second simulation illustrates a view of the mine site from a point 5 km east of the site. Visual simulations includes representative stockpile material colour and texture in order to provide a realistic idea with regard to the potential visual impacts posed by texture and colour different to the natural environment.

6.16.6 General Visibility (Landscape and Visual Sensitivity)

Based on the visual simulation undertaken it is can concluded that the visual visibility of the proposed mining activity is low at a distance of 15 km and further, but could be regarded as a high impact when the proposed mine site is viewed from 10 km and closer.

Based on the baseline analysis undertaken during the ESS report, limited visual preceptors are present in the area and the general distance from the route tourist route from Khutse Game Reserve (KGR) to the northern extent of the game reserve is too great to cause significant visual impact.

6.16.7 Landscape Capacity

Based on the baseline assessment, the landscape character of the CKGR is homogeneous and thus the character is represented well. The character is, in the absence of stakeholder comments, regarded as high as the proposed mine will be situated in a game reserve. As previously stated, this section of the game reserve is not regularly visited by tourists thereby rendering the value less that that of the northern sector of the game reserve.

Tourist travelling through the game reserve will not necessarily notice the mining operation as the route from Khutse to the northern sector is more that 15 km from Gope.

6.16.8 Landscape Value

Although the proposed GDMP is located within a game reserve, few visitors travel to this section of the game reserve. However, the landscape value may be high as it has the potential to develop as a tourist destination.

Figure 53: Photograph Showing a View Towards the Undeveloped Gope Project Site from 15km.

Figure 54: Photograph Showing a View Towards the Gope Project Site Showing the Sand Dump, WRD as well as the TMF from 15km (the Simulation Assumes a Recommended 60% Vegetation Cover on the Mine Residue Dumps).

Figure 55: Photograph Showing a View Towards the Undeveloped Gope Project Site from 5km.

Figure 56: Photograph Showing a View Towards the Gope Project Site Showing the Sand Dump, WRD as well as the TMF from 5km (the Simulation Assumes NO Vegetation Cover on the Mine Residue Dumps).

6.16.9 Cumulative Landscape Sensitivity

Based on the above, the following proposed methodology, as published by the Countryside Agency is implemented to assess the landscape sensitivity cumulatively.

Landscape and Visual Sensitivity refers to the general visibility of the proposed activity and the scope to mitigate the visual effect. Based on the visual simulations, is can be concluded that the mining operations loose its significant visibility at 15 km. Sensitive receptors located within this radius may include, tourists (regarded as a low probability) and people who may choose the relocate to the mine site. It is further concluded that the landscape has a high capacity due to the broad extent of the landscape type.

Measures to mitigate the potential impact of the mining operation are limited to the restriction of mine residue dumps and measures to re-vegetate the final slopes.

6.17. WASTE MANAGEMENT

Please refer to Appendix 9 for the full Waste Management Report.

6.17.1 Baseline Data Collection Methodology

Information regarding the status of waste facilities (in terms of registered and authorised facilities) in Botswana was generally collected through discussions with the following organisations:

- Department of Waste Management and Pollution Control, Waste Contractors (in Gaborone);
- Skip Hire (waste contractor);
- Somarela Tikologo (operates drop-off recycling station in Gaborone);
- Tsholo Trust (drop-off recycling station waste oils), and
- Information from the Central Statistics Office (CSO) (survey conducted 1996).

Information regarding the leachability of the geological waste streams was obtained through the sampling of different rock groups (including the Kimberlite and Basalt from different facies) at various depths obtained from the target ore body occurring at the Gope Project Site. The rock samples were obtained from the drilling conducted on site and logged in December 2007 by Venmyn Rand (Pty) Ltd. The samples were submitted to Inspectorate M&L laboratory (a SANAS (South African National Accreditation System) accredited Laboratory) for ICP scans of various elements based on an acid rain extract.

6.17.2 Limitations and Assumptions

The available disposal methods and waste facilities are based on information received from discussions with personnel as indicated above. These options and status of the disposal sites may change during the construction and operation of the mine.

It is assumed that the elements within the rock samples analysed are representative of the waste rock, tailings and slimes to be stockpiled on site.

6.17.3 Existing Disposal and Recycling Facilities

6.17.3.1 General Landfills

There were approximately 127 general landfills located in Botswana when last recorded in a 1996 census (by the CSO), although only a handful had been permitted or suitably managed. There are many sites in which waste is indiscriminately dumped. The cities and towns that possess landfills that are currently permitted include the following:

- Gaborone;
- Pilane;
- Ramotswa;
- Serowe;
- Francistown;
- Maun;
- Orapa, and
- Lobatsi.

The existing landfill in Gaborone has been due for closure for a number of years, but is currently operational until the construction of the new general waste landfill in Gaborone has been completed. This landfill is being constructed in a phased approach, with the first four cells expected to be operational in early 2009.

6.17.3.2 Hazardous Landfills and Incinerators

There are currently no hazardous waste landfills in Botswana although a facility has been established at the landfill in Ramotswa whereby hazardous waste may be temporarily stored in a lined area, before being transported to South Africa, for disposal at a permitted hazardous landfill. However, waste has reported to have been in temporary storage for over a year at this storage site. The new landfill to be constructed in or at Molepolole may be able to receive the hazardous wastes streams generated by the mine.

Medical waste incinerators have been installed and are operating at the following landfills:

- Gaborone;
- Ramotswa;
- Serowe;
- Francistown;
- Maun; and
- Lobatsi.

6.17.3.3 Recycling Facilities

Recycling centres have been established in Gaborone by the NGO Somarelang Tikologo whereby waste such as paper, cardboard, plastic glass and tins is delivered to the centre, and collected by local companies who transport to South Africa for recycling. A small quantity is used in art by the community.

A trust (The Tshole Trust) has been established in Botswana that deals with the responsible management and recovery of waste oil in Botswana. It is a collaborative programme between the oil industry, Government, NGO (Somarelang Tikologo), and is overseen by an Executive Committee made up of representatives from these bodies. Recovery, collection and recycling of oil has therefore been established in Botswana, with the used oil being refined into lubricating oil or blended as a fuel.

6.17.4 Existing Transportation and Collection Facilities

Although there are waste contractors that offer waste collection services in Botswana, the access routes to the Gope Project Site will not be suitable for waste vehicles. Transportation of waste from the Gope Project Site to the staging camp planned to be located at Lephepe will be necessary until the road to the site has been adequately improved to provide a better quality road surface. The waste contractors may then collect from the staging camp and transport waste to the waste facilities.

6.18. SOCIAL ASPECTS

Please refer to Appendix 10 for the full Social Impact Assessment Report.

The Social Impact Assessment (SIA) was specifically focused on the mine itself, Kaudwane in Kweneng District through the CKGR to Gope, a power line from the mine into Central District to Orapa. To collect the necessary information, the SIA included implementation of a rapid quantitative questionnaire in most directly affected communities, Focus Group Discussions (FGD) in these same communities, and national, district and local level key informants with various informed parties and stakeholders. No interviews were conducted at Gope itself, as the population had been resettled to Kaudwane. However, interviews were conducted with former Gope residents at Kaudwane, included an extended FGD with poorer households. For the power line, a rapid appraisal was conducted. Overall, the SIA team consulted with over 400 persons. In addition to these field activities, an extended review of the literature took place.

In this section, findings from the field investigations are presented. This includes findings from national, district, and local level key informant interviews, FGDs, and rapid appraisals. In addition, findings are presented from a quantitative questionnaire administered to 210 households in Kweneng and Ghanzi districts. For Ghanzi District, this included the settlement of New Xade outside the CKGR, and Molapo, Metsimanong and Kugama inside the CKGR. In Kweneng District, sampled communities comprised Kaudwane, Salajwe, Khudumelapye, Lephepe and Letlhakeng.

6.18.1 Awareness of the Proposed Mine at Gope

Respondents to the quantitative questionnaire, as well as participants in all qualitative field consultations, were asked whether they were aware of the proposed GDMP and, if so, what they knew. It should be noted that public participation exercises had taken place in some, but not all, of the locations visited in the month prior to the survey.

For the quantitative questionnaire, 80% of the respondents had heard about the proposed mine. Awareness was higher in Ghanzi District than in Kweneng District, at 89.7% versus 78.8%, respectively (chi-square significant at the .1 level; 17.045, p=.000; but it should be noted that public participation exercises took place in all Ghanzi District locations, and only some of the Kweneng District locations). When asked what they had heard, 97.9% of the respondents who had heard of the mine noted that they had heard that a mine would be opening in the CKGR, 53.6% noted that 'skilled people would be employed', and 50% noted that the mine was a diamond mine. Almost one-third (30.5%) noted the possibility of a road through their community associated with the mine. In Ghanzi District, 29.5% noted that 'people were moved out of the area to make way for mining'. Of interest, Sesarwa-speakers were more likely to have heard of the mine that non-Sesarwa speakers.

Of the key informants, virtually all were aware of the mine, and a number had extensive knowledge of changes in the situation over time, including comments about the historical non-viability of the site and, in some cases, changes in mine plans from the initial feasibility study to the operations noted in the public participation exercise. Some of the national level key informants raised a query about how the mine could now be viable, given earlier findings from the de Beers investigation. While many of the national and district key informants had attended meetings at some point in the public participation process, a number noted that they had followed the situation for some time.

Much of the commentary about the mine itself was tied in with the CKGR resettlement issue and the court case for the return, with the two regularly connected by key informants. Therefore, as with the 29.5% in Ghanzi District who noted that 'people were moved out of the area to make way for mining', a number of key informants drew a connection between the two.

Local level key informant interviews were conducted in Kweneng District in directly-affected communities, as well as within the CKGR and in New Xade in Ghanzi District. All of the local level key informants had heard that there were minerals in the CKGR (sometimes noted as discoveries at Gope, but other times described more generally), but there were more mixed responses in terms of pending mining operations. Only those who had participated in the recent public participation exercise were well informed about the proposed mine itself. Local level key informants within the CKGR noted that they often heard 'third hand' about minerals and the possibility of mining in the CKGR, and thereafter quickly moved into a discussion of a perceived lack of consultation around any mining activities.

FGDs with poorer households in directly-affected communities all highlighted that they learned about the proposed mine itself through the recent public participation exercise. In further discussions, a few noted that they had heard rumours about the possibility of mining in the CKGR, and some CKGR residents had gone to Gope for various reasons and found people camped at the area. One group, from Molapo in the CKGR, noted that Debswana had previously contacted them to inform them about the diamonds found at Gope.

In the rapid appraisal of the area northeast from the Gope Project Site along the power line route, none of the interviewees had heard about the mine, nor had any been informed about the mine but, as one man at a cattle post some 70 km from the Gope Project Site noted, 'there has been frequent vehicle traffic, we assumed that something regarding development must be happening'. None had heard about the power line.

6.18.2 Perceived Benefits of the Mine

Respondents to the quantitative questionnaire who were aware of the proposed mine were asked whether there were any likely benefits from the mine for people in their area and, if so, what these benefits might be. Only 2.2% of the respondents felt that there would be no benefits, all of whom were living in the CKGR or in New Xade. For these Ghanzi District residents, 18.5% felt that there were no benefits from the mine. The remainder noted an average of 2.7 benefits, indicating that most respondents who felt that there would be benefits felt that there would be a number of benefits. Most common benefits included jobs (96.3%), improved services for their community (78.6%), the improved road (56.2%), and 'more economic activity in the area' (26.6%). Respondents in Ghanzi District were less likely to note benefits in terms of jobs, improved roads, or more economic activity, and instead noted 'improved services' as the most likely benefit. Those whose main language was one of the Sesarwa languages were more likely to believe that the mine would yield some benefits, and were more likely to mention benefits that those who spoke Setswana of Sekgalagadi or other language to mention jobs and the improved road. Non-Sesarwa speakers were more likely to mention improved services.

In discussing the possible benefits of the mine, a number of national level key informants noted that, without a specific focus on skills development and job preferences for directly-affected communities, few benefits would accrue to these communities. Jobs were felt to be the main potential benefit, but again the discussion sometimes turned to concern about the employability of people in directly-affected communities, and the need for alternative income generation opportunities. There was greater hope for construction-related employment benefits, at the mine site itself, and with regard to other infrastructure needing to be provided (or upgraded) by the mine.

It is interesting to note that some national key informants argued that there would be site-specific benefits associated with community access to mine health services, informal employment around the mine (selling products to mine employees), and similar economic opportunities that assumed access to the mine and mine employees by CKGR residents during construction and operation.

In discussions about benefits accruing from the mine with local level key informants, many key informants noted employment benefits, especially during construction, as *the* main benefit. There was a persistent concern, however, that unless provision was made for hiring locally, the benefits would not accrue to local communities. Key informants in Kaudwane and Lephepe were especially hopeful that the road would come through their community, and perceived the road as having a number of social and economic benefits. For key informants in the CKGR, the issue of benefits from the mine repeatedly got mixed with issues around the return to the CKGR, being allowed to bring animals into the reserve, receive services in their CKGR settlements, and being able to gather veld products and be issued with hunting permits. Without these other benefits, there were repeated concerns about any mine benefits not 'integrating' well with their desired re-established livelihoods.

CKGR FGD participants were less certain about any local benefits accruing from the mine, and contextualised their responses in light of broader development issues. There was a particular concern that jobs would not go to any CKGR residents 'because we are not educated nor skilled in working in the mines', and that other Batswana would instead secure the jobs during construction and operation. Indeed, even when discussing very specific employment opportunities following training for local residents, doubts remained. A number of the groups reverted back to initial comments that they did not feel consulted about mining activities, and noted that they might be left out when it came time for jobs as well. FGD participants repeatedly noted the need for open discussions and joint decision-making so that some benefits might accrue to CKGR residents. In discussing possible benefits with former residents of Gope (consistently referred to during the discussions as Gaagoo), FGD participants again noted a lack of consultation with them as 'most affected', complaining that they had only heard about the mine with people who did not come from Gope. In such a situation, they did not feel that, unless there was regular consultation and dialogue, they would benefit at all from the mine. There was a perception that, because they were from the mine site, they should receive priority attention for training and jobs.

However, in further discussions, it became evident that former Gope residents felt that benefits would be possible for those who would return to Gope that did not work on the mine. Access to water was noted, but more importantly there was an interest in integrating the mine into the livelihood strategies of CKGR residents like themselves, including tourism opportunities, sales to mine personnel, local trade, etc. During construction, they felt that they should be given priority over all others 'because this is our place'. Thereafter, priority should be given to other CKGR residents (in particular Metsimanong and Molapo 'because they helped us with our situation').

For cattle post residents along the power line route, none of those interviewed felt that the mine would have anything to do with them. However, all were pleased that the mine might result in an upgraded road to improve their access to Letlhakane. Even residents well south of Letlhakane noted regular travel to Letlhakane, mostly associated with securing Government services (destitute support packages, orphans support packages, accessing health services, visiting children in boarding school, etc.) and shopping.

6.18.3 Relevant Experience

Respondents to the quantitative questionnaire were asked a series of questions about skills and employment status. Skills questions were specifically associated with potential skills of relevant to construction and operation. Findings for unskilled construction or mining experience are summarised in the following figure:

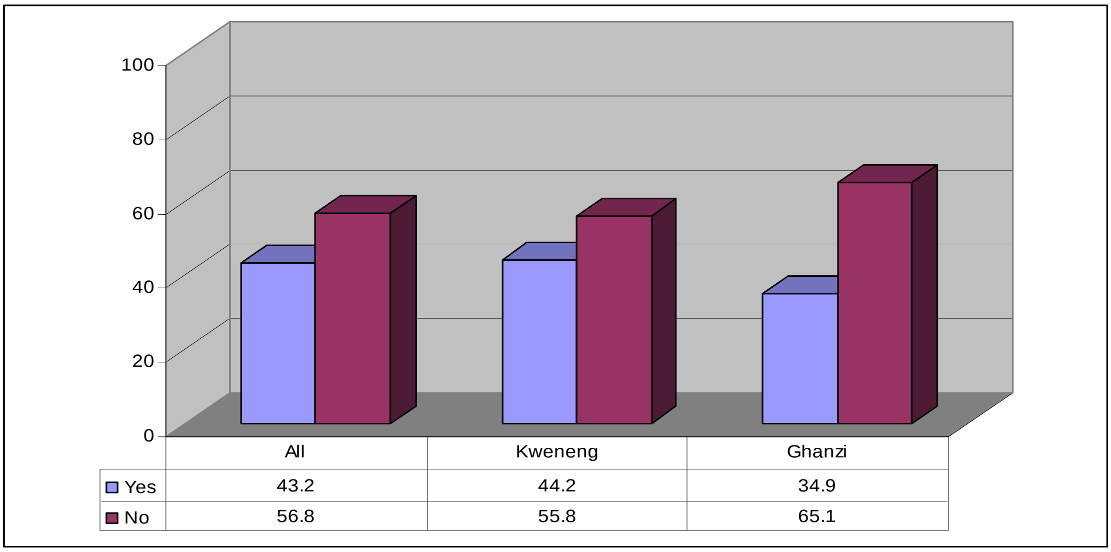
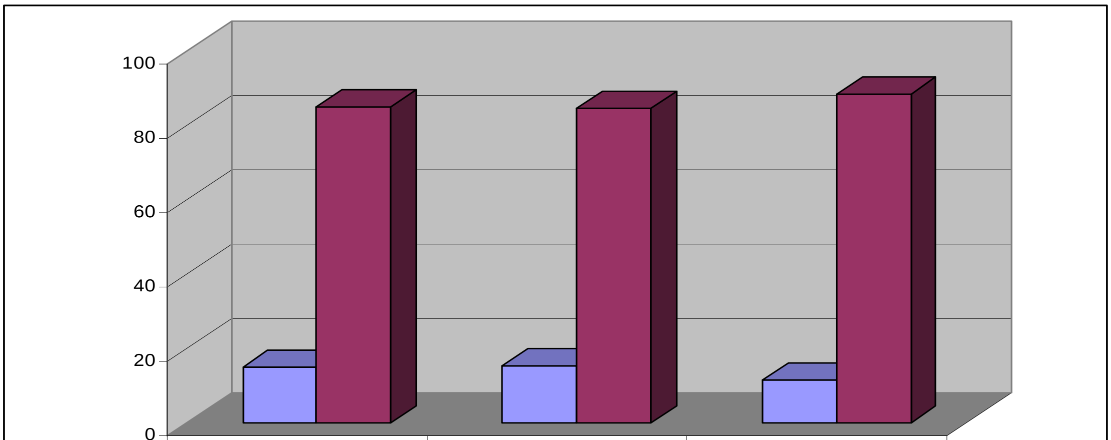


Figure 57: Unskilled Construction or Mining Experience.

Over 40% of households in directly affected locations had at least one member with unskilled construction- or mine-related experience. In exploring this, it appears that much of this relates to labour-based public works programmes providing labour for local road upgrading, and related activities, as well as short-term employment associated with local infrastructure development (water resources, buildings), rather than mine experience. Unskilled experience was more common in Kweneng District than in Ghanzi District (chi-square significant at the .1 level; 64.474, p=.000).

Skilled labour experience was significantly less common, as indicated in the following figure:



	All	Kweneng	Ghanzi
Yes	14.9	15.4	11.5
No	85.1	84.6	88.5

Figure 58: Skilled Construction or Mining Experience.

One-in-seven households in directly-affected communities had at least one member who had previously worked in a skilled position in the construction or mining section. As with unskilled labour, such experience was more common in Kweneng District than Ghanzi District (chi-square significant at the .1 level; 43.724, p=.000).

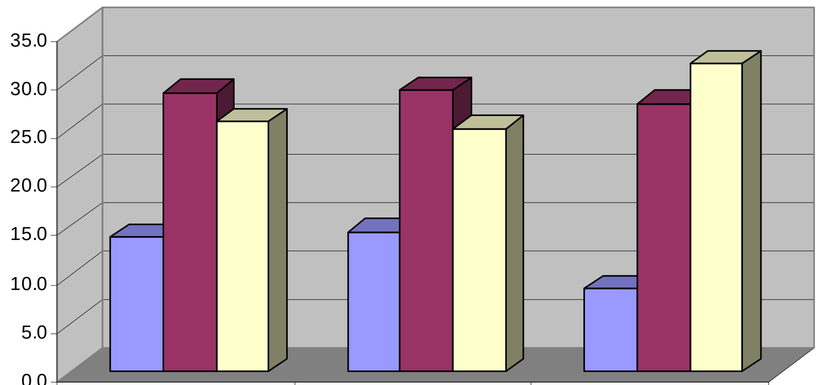
Of interest, households where at least one member spoke a Sesarwa language were *more* likely to have had at least one member with skilled construction or mine experience (16.4% versus 7.8%, respectively; chi-square significant at the .1 level; 22.440, p=.000). In exploring the issue further, most of these households were confirmed to have at least one member with specific formal mining sector experience, rather than just (for example) small scale mining. For a minority, it appears that some of this experience is associated with on-farm employment where skills have been learned on-the-job, associated with fencing, borehole maintenance, vehicle maintenance and repair, and related skills, gained largely on commercial farms in the Ghanzi area (for Ghanzi District) and in eastern Central District and north-eastern Kweneng District (for those now resident in Kweneng District). In FGDs, it was often noted that such employment 'came and went' based on financial need and other circumstances.

In local level key informant interviews, respondents consistently noted concerns about the skills and experience with *long-term* employment necessary to successfully compete for mine-related employment. Often the discussion would revert to comments about short-term employment possibilities associated with construction, and the desire for skills development and opportunities to 'test' long-term employment. However, low levels of education were also noted.

Local level key informants as well as FGD participants regularly put mine employment in the context of the re-establishment of rural livelihoods, highlighting the broader challenges noted earlier in the SIA. While the questions were approached in terms of the relevance of mine employment for their lives in a situation where there were few formal employment opportunities, respondents viewed such employment instead as one element in a 'patchwork' of livelihood strategies that all needed attention. Without attention to this broader framework of needs, many respondents felt that mine employment would not have the desired impacts on livelihoods. Simply put, it was difficult for many respondents to disentangle mine employment from the uncertainty they felt they faced in their lives.

Having said this, there was a clear fear of being 'left behind' by events and, without clear alternatives on the horizon, many key informants as well as FGD participants were quick to welcome the mine, presumably positioning themselves in relation to the project.

Respondents to the quantitative questionnaire were also asked about other *professional* skills that may be of relevance to construction or operations, covering services, carpentry/brick making/ iron mongering/ or baking/sewing. The term 'professional' was included to ensure that the skills were associated with a saleable skill that would be of relevance outside the home. Findings are summarised in the following figure:



	All	Kweneng	Ghanzi
Services	13.8	14.4	8.5
Carpentry/Brick/Iron	28.7	28.9	27.5
Baking/Sewing	25.7	25.0	31.6

Figure 59: Other Skills.

One-quarter of surveyed communities had at least one member with carpentry, brick making, iron mongering, baking, or sewing skills. These technical skills were most common among those who spoke Setswana or Sekgalagadi rather than a Sesarwa language (for carpentry/brick making/iron mongering, chi-square significant at the .1 level; 46.662, p=.000; for baking/sewing, chi-square significant at the .1 level; 14.965, p=.000).

Quantitative questionnaire respondents were also asked whether any member had a valid driver's license. One-seventh (16.4%) had a valid drivers licenses, of which two-thirds had a commercial drivers license. Overall, at least 393 persons in surveyed communities had a driver's license, of which 264 had a commercial license. Access to driving licenses was far more common in Kweneng District (17.5%) than Ghanzi District (7.7%), and was far more common among Sesarwa language speakers than among those who spoke Setswana or Sekgalagadi as the main language (18.3% versus 7%, respectively). Commercial licenses, however, were more common in Ghanzi District among those who held drivers licenses than in Kweneng District (88.2% versus 70.5%, respectively), while commercial licenses were far more common among Setswana or Sekgalagadi speakers than those who spoke a Sesarwa language.

6.18.4 Shift Work

Quantitative questionnaire respondents who indicated skilled experience were asked whether they had shift work experience, with the example of two weeks on and one week off given as an example of such shift work. Bearing in mind that only 14.6% of households had at least one member with skilled employment experience (estimated at 362 persons across the communities covered by the survey), of these, 75.5% (271) had shift work experience. Shift work experience was more common in households where a language other than a Sesarwa language was spoken (93.3% for those who spoke Setswana or Sekgalagadi as the main language, compared to 73.9% for those who spoke a Sesarwa language; chi-square significant at the .1 level; 5.634, p=.018). Virtually all of those who had previous shift work experience felt that it was an excellent system (96.4% rated the system as 'very good').

Nevertheless, when asked to note any concerns about shift work, virtually all of those who had experience with the system noted problems of homesickness, concern about the long working hours, disturbed sleep routines, and 'sexual temptation' in being away from home; almost no one mentioned problems of alcohol abuse. These are, of course, also problems with different work shift configurations when workers lived away from their families, but were felt to still be less of a problem in the case of shift work.

When asked about particular problems associated with home life, conflicts around 'other sexual partners' and the lack of 'family quality time' were most commonly noted, while the inability to provide sufficient labour at home (including on-farm) was also mentioned. When asked about conflicts between cultural norms and shift work, virtually all respondents noted growing more distant from their children, and difficulties in transferring 'life skills' to their children. When presented with the statement "A shift work schedule, with two weeks on and one week off, would allow us to take care of our homes, and is a good way forward", 81.7% 'strongly agreed' with the statement, and over half the remainder 'agreed'.

6.18.5 Perceived Constraints to Employment

Qualitative respondents were asked to discuss non-skills barriers to employment, both during construction and during operation. Among most of those who spoke a Sesarwa language, there were repeated comments about discrimination against them by other ethnic groups. As one respondent in Metsimanong (CKGR) noted, 'Here there are no employment opportunities … there are no past experiences associated with employment as there are no developments that can offer the community employment opportunities. Our residential area is remote from where there are developments. Even when our children go out to look for jobs they mostly come back empty handed due to discrimination of our tribe'. Others noted the practical constraints associated with remoteness, poor communications, lack of transport, and related constraints that they felt affected their ability to compete for wage employment. Low levels of education and lack of skills were also highlighted. A number of them concluded that, overall, 'our interests are not considered, we have no influence', and noted various situations where they felt helpless in the face of factors they could not control. Indeed, 86.8% agreed with the statement "Really, we have little say over how things develop in this area, we are just affected by decisions made outside of the area".

FGD participants gave similar responses, highlighting the lack of jobs in their communities and poor prospects for those who seek work elsewhere. Concluding comments from focus groups with poorer households highlighted a common belief that, as one group put it, 'our community will not be considered for employment opportunities'. Almost 90% of respondents 'strongly agreed' or 'agreed' with the statement "If word gets out that a mine is going to be built in the CKGR, too many job seekers will come in to communities near the area and take the jobs away from the locals". One focus group, in Molapo in the CKGR, raised the interesting issue of lack of social networks in areas where formal jobs might be secured. Without sufficient funds, and in the face of perceived discrimination, these social networks were especially important. Both Sekgalagadi and Sesarwa language speakers were concerned about such discrimination, with some 60% agreeing with the statement "Out culture would likely not be well respected at the mine site if there are many other cultures as well".

In the quantitative questionnaire, respondents were presented with a series of problems, and asked to indicate the extent to which these problems were felt to affect the communities. Findings are presented in the following table:

Table 46: Social Problems Facing the Community.

PROBLEM	NONE	¼	½	¾	ALL
Not really being treated as part of the community	30.8	14.9	11.8	14.7	27.8
Some household's interests not being represented by local leaders because they are seen to be different	19.7	8.3	10.1	28.9	33.0
Households that can no longer practice their livelihoods	36.7	25.8	12.8	11.2	13.5

Over two-thirds of respondents felt that there were community members who were not treated as part of the community, with most of these noting that it affected a portion of the community. There was widespread concern that local leaders did not represent all interests. Two-thirds also felt that some households were no longer able to practice their livelihood strategies. FGD participants in the CKGR and in Kaudwane all raised this as an important concern, noting in particular: 1) not being able to keep domestic animals in the CKGR; and 2) not being able to hunt on a regular basis. Relocated residents in Kaudwane were especially concerned about being able to return to Gope with their domestic animals. Most local level key informants and a number of FGD participants from poorer households highlighted a concern that, in resettlement locations, they were not well represented by local leaders, and that their interests were not being adequately represented. Some used the term 'discrimination', and noted a lack of respect for those living in remote areas by others in Botswana. This held true for those who spoke Sekgalagadi as well as those who spoke a Sesarwa language.

6.18.6 Employment Attitudes

Qualitative findings highlighted ambivalent attitudes about employment. Despite vociferous comments from virtually all key informants and FGD participants that formal employment during construction and operation was highly desired, there was acknowledgement that most did not have the right skills and experience to be competitive, concern about discrimination against those who spoke Sekgalagadi and Sesarwa languages, and a fatalism that others would get the jobs instead. In the quantitative questionnaire, for example, most agreed that the construction of the mine and related infrastructure would encourage rapid in-migration of those more likely to secure employment, but they also agreed that there would be enough jobs to go around during construction, and therefore that "Many of the unemployed here would get work on the mine and related infrastructure during construction" (87.2% agreed with the statement). Respondents were ambivalent about whether people would commit to long-term employment, with half agreeing with the statement "People from here would just work until they saved a bit of money, then they would come home" (those who spoke a Sesarwa language were more likely to agree with the statement). Overall, in key informant interviews and FGDs, it became clear that few people had experience of relevance for the operations of the mine, nor a clear sense of how much training would be required to secure such employment.

Qualitative findings highlight a desire for the mine to be one element in the re-establishment of livelihoods in the CKGR. In the quantitative questionnaire, questions were asked about the coming of mining to the CKGR and its perceived relationship with other economic opportunities. Over 90%, for example, agreed with the statement "Economic activity such as mining in the CKGR would give us more opportunities for things like ecotourism", with those who spoke a Sesarwa language especially optimistic in this regard.

6.18.7 Gope Residents

Following the completion of fieldwork, some former Gope residents returned to Gope. Upon learning this, the team remobilised and travelled to Gope to interview these residents. During the three days that the team was at the site, there were a total of 18 persons, comprising three youth aged 14-16, five aged 17 and older, and 10 children across five households. All five households contained male heads, all five of whom had never been to school. The households reported that, while they had only just recently returned to Gope to settle, in fact they had been back and forth to the area since winning the right to access the area. None of the households had any members in employment, although some had relatives working on ranches east of Gope. All five households used Kua as their main language of communication, and in two of the five households at least one member could also speak Setswana; none could speak or understand English.

There was an unknown number of additional men (those interviewed would not give a specific number) who were reported to be 'out looking for livestock', and none returned in the three days the field team was on site. Further, on the way out of Gope, the team encountered two more families returning to Gope.

The FGD was held with the five adults (3 men and 2 women), and these same five adults were also involved in the natural resource utilisation survey (the field walk of which also included the youth and a number of children). In addition, a key informant interview was held with the senior male in the household[24]. Each adult was also interviewed using the quantitative questionnaire. These quantitative findings have been analysed on a case by case based, and presented as part of the qualitative findings in this section.

All of the residents were reported that they had returned from Kaudwane, and as far as they knew, no one from Gope was living in any other resettlement area such as New Xade. The only other former Gope residents were reported to be living at Kaudwane, working on some ranches, or attending school.

The Gope residents were quite reluctant to discuss issues openly, in particular areas of cultural or spiritual importance in the MLA, but also with specific regard to the proposed GDMP. The reader is therefore cautioned that some of the findings reflect the 'positioning' of the residents around the questions, rather than an open response. As one key informant noted, they did not mind being consulted, but that 'it is a waste of time, no one will consider what we say'. Indeed, all five interviewees were reported to be 'moderately co-operative' in the quantitative interview, while the vast majority of such interviewees are usually 'highly co-operative'.

Bearing in mind that there was a reluctance on the part of the interviewees, the reader should consider the following as indicative of what the residents might know and feel. Also as noted above, consultations with Gope residents needs considerably more attention as part of the EMP through the actions of an anthropologist.

6.18.7.1 Knowledge and Attitudes about the Mine

In the FGD, all five adults argued that they were largely ignorant of what was going on in terms of the proposed GDMP. Two of the men noted that they had heard about something called a 'mine', but did not know what the concept represented. At this juncture, the residents had a number of questions from the field team about what the mine was about. The team therefore used the publicly-available information to explain the proposed mine as best as possible under the circumstances. Upon completion, one participant noted that they had understood that they had to move in 2002 because they were not going to be allowed to live near the mine (and also mentioned that they were not allowed to hunt in the area). In the key informant interview, the respondent noted that a discussion with someone at the Gope Project Site indicated that only people from Kaudwane would be employed at the GDMP, not people living at Gope.

[24] Practically speaking, the non-hierarchical nature of the Kua clan at Gope meant that the 'senior male' was not a 'household head' in the traditional sense of the term. The interview was conducted with his individual because he was noted as the most informed member because of his age and role in the clan's homestead. Further, the household noted herein is, in fact, more of a homestead, comprising multiple households within a single social framework that is akin to the concept of a homestead. For those who had returned to Gope, there were three such households in the homestead.

In lamenting the lack of formal knowledge about the proposed mine, the participants raised objections that the Gope Project Site itself was ‘part of our heritage, or ancestral land’, and that they should have been extensively consulted beforehand. (The participants indicated that they had not been involved in public consultations at Kaudwane, although this could not be verified.) One participant argued that ‘if the presence of the mine could have been explained formally to them rather than what is happening, just seeing people coming in and out of the area, excavating without our consent’, it would have been better. Two participants noted that ‘the mining company came to dig big holes around where our natural resources are, and through this practice our natural resources are perishing’. The group thereafter raised a concern that the mine would result in a further dislocation of their community, and argued if they had to be moved, they should not be moved far. ‘Just 5 to 10 kilometres away, not further, we want to stay in this area’. At the end of this discussion, the group eventually concluded that the mine itself would bring development ‘like water and schools’ to the area, but that if they did not benefit from the mine ‘it would be a fraud’.

In discussing natural resources, the key informant noted that ‘there are many wild animals at Gaagoo (Gope), and these animals may relocate due to a lot of traffic and from both air and noise pollution’. The key informant went on to note that ‘the vegetation [and other things like graves] will be cleared to make way for the mine. The people will lose their natural resources and nothing will replace them. If we must be moved, we must be moved somewhere where we can still access these natural resources, but we know of no such place that is as good as Gope’.

At the end of the discussion, the participants all concluded that they wanted to be part of the decision-making about the mine, they wanted to be consulted, and they wanted to have influence, as those directly-affected by the mine. ‘As long as we are respected, consulted and involved in the process, we will welcome those who come to Gope. While we are uneducated, this does not mean we are stupid’. The key informant noted that ‘this is our area, the mine should give back to the community’.

6.18.7.2 Livelihoods

All five adults noted that their livelihoods in the area revolved around harvesting natural resources for food and medicines. They used grass and wood to build shelters, but these were temporary structures (‘Government will not allow us to build permanent structures’). All argued that none of them hunted ‘because Government does not allow us to hunt freely’, and would not discuss hunting any further.

The movement of the Gope residents to Kaudwane was uniformly noted as undermining livelihoods, while at the same time access to income expected from the move reportedly not forthcoming. The participants noted that they were not able to find any employment in Kaudwane 'because the residents accused us of trying to take their jobs'. Two of the five FGD participants noted that they understood that, under a Government programme, they were eligible for old age pensions. While both tried to register for the pension at Kaudwane, they were denied the service. When asked why, one noted that it was 'political', while the other noted that he was informed that it was because he was not a long-term resident of Kaudwane. All the participants lamented the relocation to Kaudwane, arguing that they would never go back. 'If we have to move far from here, we will relocate to some other place in the CKGR', noting that 'it was so difficult to adjust to the place. We like living where we are now, we like who we are here, and this is the life we want to live'. None of the five households reported any support from any Government package, or from any other organisation.

Some households had members who were working on commercialised ranches east of Gope, but that they were very poorly treated, and that this work did not contribute enough to their livelihoods. They reported that they held some livestock outside of the CKGR (they were not allowed to bring cattle into the reserve with them), and had horses and donkeys with them.

When asked about the main development problems facing Gope, three of the five participants noted that settlement at Gope, and movement from Kaudwane, meant that they could get access to the natural resources they needed to survive, but that they were restricted in which resources they could use and how they could use them. They also argued that a key development challenge to Gope was that 'the place we reside in appears to be of high value to outsiders, and this threatens us here', as their land use and this outside pressure seemed to be in conflict. Returning to a concern about dislocation, one participate noted 'whenever there are good things of high value available in the area, we are moved. As we are seen as nothing, we can be moved easily'.

6.18.7.3 Development Opportunities in the Area

When asked about opportunities for development in the area, the group noted that they needed to establish themselves as a viable community, and this mean water, roads, health and education facilities, electricity, access to transport, income-generation projects, and eco-tourism initiatives. However, they quickly moved to a concern that 'we fear to hear about developments as, at the end of it all, we will be forced to relocate'. They again argued that they should only be moved to a location nearby, now out of the CKGR or other 'far away' point. If they were relocated to a nearby location, 'we could access water from the mine and could be offered employment at the mine'. In the quantitative questionnaire, it was found that none of the members from any of the five households had ever held any job in construction or mining, even in an unskilled position. None of the household members across the five households had any skills or experience in any area that might relate to mine employment, or other benefits from local development. None of the households had any members with a driver's license.

Two of the participants also noted that the proposed GDMP should do what it could to improve employment opportunities for Gope residents through supporting tourism initiatives, and assisting with projects such as livestock development, poultry production, gardens and fields to plough and plant. As one stated, 'as we cannot hunt, at least we can benefit from tourists coming to see our wildlife'. In further discussion, the respondents raised their concerns that, because none of them had formal education, their chances of employment were low, and that this required that the mine give them special attention. The purpose was not, however, employment per se, but a way to improve livelihoods. As one stated, 'if I do not know how to read, it does not mean that I do not want to eat, have shelter and other things. Working means food and a better life'. The other four participants agreed, noting a desire for employment so that they could purchase food. The key informant noted that 'we are not lazy, we work hard to feed or families and our animals', and that this hard work could be translated into employment if their was training.

When presented with the statement "if would be difficult for us to compete with other Batswana for the jobs on the mines, even during construction", all five agreed, noting that they were not used to formal employment, and did not have any employable skills. Further, they were concerned that, because they were not educated and could not count or read, they could be cheated and exploited. One concluded, on behalf of the group, that 'our own people can deceive us, we are afraid of other Batswana'.

In responding to the statement 'with the arrival of the mine, new economic opportunities would arise in the whole area', all agreed that there would certainly be developments in the area, but that it would be unlikely to benefit them as residents 'because we will be moved again'. In following-up on this comment, one participant argued that this having to be moved for the mine confused them, because 'at Letlhakane, people were not moved out to make way for the mine, why should we be moved?' The key informant argued that 'in other places, when a mine is constructed in an area, that community will have life in terms of development and job opportunities, the mine gives back to the community. In those areas, people are moved nearby the mine, but not out of the area. In this area, we were relocated out of the area to make may for the mine, yet we are not allowed employment, which will be given to people from Kaudwane instead'. The key informant noted that the community was hopeful that developments would indeed come to their community, but that 'as we are denied to drink from the mine temporary camp as they said that Government does not allow that', there were concerns that they would not benefit. The key informant went on to note that 'we are only consulted as a matter of formality, we know that decisions have been made that we should not benefit from the mine. The fact that we cannot get access to water at the mine site shows this'.

When presented with the statement "overall, even with the arrival of the mine, the lives of people in this area would not change", none agreed with the statement. One participant noted that the mine would 'distract' their lives, and that they would have trouble with the workforce. He argued that it should be the responsibility of the mine to help act in their interests in this regard. The remaining participants agreed with him, with one arguing that 'there should be a written agreement between the mine and the community regarding all issues as the mine proceeds, otherwise we will not move out of the way come hell or high water'. This agreement was needed before any activities being at the site, failure in so doing would highlight that they were not meant to benefit from the mine, and this will be done to them 'as usual'. The key informant also disagreed with the statement, noting that residents of Gope must be given first preference for employment, and this meant first preference for training. 'Hiring should not be done first in Kaudwane, or anywhere else'. The key informant lamented that they were not given water by those at the mine site (the Marsh camp) 'because they say that Government does not want the team from Marsh to assist the locals because they are back at the site illegally'. The key informant went on to raise concerns about the clearance of vegetation in the area, and what they perceived to be the disregarding of the interests of the Gope residents. It has to be borne in mind that all local communities will receive the same preferential treatment in order to ensure fairness, not just the Gope residents.

Following up on this issue, in the Story With A Gap section of the FGD instruments, participants were asked to consider what Gope would ideally look like in ten years. For each issue, findings are summarised as follows:

- Employment on the mine - all agreed that, in ten years, with the mine in operation for some time, their lives will have been improved in a win-win situation where both they and the mine would be satisfied, because they would have directly benefited from employment on the mine, and in related economic activities;
- Communications with the mine and yourselves - the participants noted that they felt that the First People of the Kalahari would help represent their interests, and that they would seek such assistance in relations with the mine communications / liaison officer;
- Corporate social responsibility initiatives - the participants were unanimous in agreeing that, if the mine extracts minerals from their area, the mine must give something back to the community. This included various development activities, getting their children into school

and giving their children opportunities for tertiary education, and helping them to establish businesses that would benefit from tourism in the area;

- Strengthening your culture and your society - of interest, none of the participants noted that their culture could be strengthened by the arrival of the mine. Instead, they focused on how their culture could avoid be damaged by the mine workforce 'and other people who would come to our area'. The issue of lack of respect for their culture was again raised, with one participant concluding that 'outsiders should listen to our views, and show respect for our presence in this area. Our elders should be listened to and respected';
- Social capital - this was not felt to need any consideration, as they were a strong group, but they were concerned that outsiders might undermine their culture. Further, they felt that it was important for the mine to remember that, even after the mine leaves the area, they will remain, and that the mine needed to leave a strong, positive legacy;
- Integrating your community better with Botswana overall - the participants suggested that past attempts to 'mingle' with other Batswana had failed. As one lamented, 'we respect and see others as human beings, but others seem to have a different perspective towards us'. They therefore felt that their future was at Gope, and that they needed to be in charge of their own lives. This last of respect was felt to be the central problem they faced, and it was reflected in lack of consultation, lack of control over decision-making, and making decisions that did not benefit them. The solution was to allow them to re-establish their livelihoods at Gope 'and not put tough regulations on us', further noting that 'we should be listened to and considered and respected as a group, and as human beings', and
- Other - all participants noted that no alcohol should be allowed at the mine, 'as it is a source of many social ills'.

In the Venn Diagram exercise asking to identify key actors, only a single organisation was noted outside of their own households: First People of the Kalahari. No one else was currently involved in their community, and there were no services.

The key informant raised concerns about problems arising in relations between community members and those working at the mine. In discussions on these issues, there was a concern about the following:

- HIV&AIDS (condoms can protect, but it makes people careless about their sexual relations);
- Casual sexual relationships and the exploitation of women at Gaagoo (Gope) (workers should bring their spouses to the mine);
- Accidents (there should be a clinic at the mine to treat these emergencies);
- Informal settlements (the community must be able to determine who can live in their area, the head of the community can do this);
- Violence (a police officer is needed and perpetrators should be punished);

- Poaching (people will come into the reserve to say they want to work at the mine, but they will poach instead, and they must be caught), and
- Drugs and alcohol (we do not want alcohol allowed in this area, the workers can drink when they go home).

Of particular concern, of the five adults interviewed with the quantitative questionnaire, while add knew that there were diseases that could be transmitted sexually, only two had ever heard of HIV&AIDS. Of these two, neither had any substantive knowledge about HIV&AIDS.

The key informant also noted that Gope residents should be given first preference for jobs, both in construction and in mine operations, and should be first to benefit from programmes offered by the mine. Training and central to being able to benefit from employment. A school was needed for the children, as well as pension support from a fund for the elderly. When the mine was decommissioned, it should restore the area as it was before, including closing the open pit, cleaning out any dangerous chemicals, and leave being social services and other infrastructure, as well as income-generation projects. If the key informant was in charge of the mine and wanted to best help people at Gope, they would prioritise the following:

- Respect and liaise with the locals and consult them as the mine proceeds;
- Drill a borehole to provide water for the residents;
- Make projects that will generate money for the community;
- Provide a development fund;
- Build a health facility, or let residents have access to the mine health facility;
- Build a school for the children in the area, and transport those from more remote locations to the school;
- Build houses for the residents, and
- Provide transport around the area.

Respondents to the quantitative questionnaire were so uncertain about the mine, and its potential impacts, that they could not clearly specify what the impacts might be on their community. Nevertheless, in those cases where they did not indicate ‘do not know’ to the various attitudinal statements, respondents raised concerns that the impacts would be largely negative, and that they felt that they had little power to influence things.

6.18.7.4 Resource Use

In the natural resource utilisation FGD, held with the five adult community members present during the field visit. Resources used were first discussed, and therefore a field visit was made to see the various resources themselves. As noted earlier, because hunting was illegal without a permit, the discussion focused on vegetation, with respondents simply noting that the following animals were found in the area: giraffe, eland, gemsbok, steenbok, springbok, kudu, hartebeest, kori bustard, ostrich, foxes, jackals, porcupines, various cats, tortoises, and other small reptiles (including snakes), and that many of these animals had 'many uses' for the local community (food, clothing, medicinal, etc.). Further reference was given to various insects that had uses, including some that gave a poison for use when hunting. It should be highlighted that the only other reference to animals highlighted the fact that many had moved away 'because of the noise and disturbances caused by the mine'.

Participants listed twenty-one major veld products they used that came from the mine footprint area, and noted that there were many more. They noted that, without Government services in the area, they were especially reliant on veld products. Melons were important for nutrition as well as water, and various veld products had medicinal uses and provided protein. Participants noted that the veld products around Kaudwane were largely unfamiliar to them, and that this was one of the reasons they moved back to Gope. The range of veld products, and the shortages in veld products near Kaudwane, were also reported to be problems. A 'Bie' which, when scraped, can be squeezed for juice (this was demonstrated) and can be used to wash hands and wipe after going to the toilet. It was also used to neutralised any poisons in the body. An '//aa' can be used to treat diarrhoea by boiling the roots and drinking the product. A plant know as 'Nquant''e', which yields beans that be eaten.

A plant known locally as 'mosimega' is used mainly by teenage girls who are starting to menstruate to protect the sick person from the 'ill effects' of the menstruation. The young girl will chew the root and spit the residue on a sick person, and this will protect the sick person from the menstrual blood.

A root known locally as 'kobo xlaa' is used primarily by mothers who are breastfeeding, as this is meant to protect them from any diseases that might be in the breast milk.

When asked whether there were any places of cultural or spiritual significant in the mine footprint area, the participants noted that this was no longer the case, 'it happened when we were children, but we do not do this any more'[25].

[25] It became clear to the field officers that the group was hiding something from them, possibly because of a concern that the identification of these things might lead to their destruction. Indeed, in one case one of the participants began to explain an area of particular spiritual important, but was interrupted by the other group members as 'not really something important anymore', and the team was moved away from the area.

6.19. REGIONAL SOCIO-ECONOMIC STRUCTURE

Please refer to Appendix 11 for the full Socio-Economic Report.

6.19.1 Economic Structure and Performance

Botswana has transformed its economy to a middle-income country since independence. Main economic indicators reflected positive growth trends over the past few years. Economic production increased, and was supported by positive growth in exports and a decline in imports.

Botswana reflects a relatively concentrated economy with mining as the dominant pillar. This dominance of the mining sector reflects a certain level of economic vulnerability – the performance of the national economy is reliant on the performance of the mining industry which is directly impacted on by global changes and mineral prices.

Government however are pursuing the diversification of the national economy as reflected in its national policies focused on enhancing the overall competitiveness of the economy and incentives focused on attracting foreign investment.
The economic performance of the national economy is dependent on the performance of the various sectors and underlying operational establishments. The highest concentration of economic activity is located within the Capital City of the Country – Gaborone, followed by Francistown, Kweneng, Southern District, Serowe, Maun and Selebi-Phikwe.

Botswana has a high Gross Domestic Profit (GDP) per capita rating – ranking third of all Sub-Saharan Africa countries, as well as a high Human Development Index (HDI) – ranking sixth of all Sub-Saharan Africa countries. This reflects positively towards the economic performance of the country in general.

Based on the performance of the various economic sectors it is anticipated that future growth will continue sideways in most of the sectors. In terms of the focused growth sectors it is anticipated that the manufacturing sector will benefit from downward linkages of the mining industry with emphasis on the new diamond cutting and polishing ventures. Growth in the services sector is likely to remain robust and the tourism sector is experiencing positive growth in terms of total number of visitors and income generation.

The external sector also benefits from the openness of the Botswana economy, and its membership of:

- Southern African Customs Union (SACU);

- African, Caribbean and Pacific (ACP);
- Southern African Development Community (SADC);
- World Trade Organisation (WTO);
- African Union (AU), and
- African Growth and Opportunity Act (AGOA), as well as special trade links under the Contonou Convention. Dominant exports are represented by diamonds, copper nickel matte, textiles, vehicle and parts, meat and meat products, soda ash, hides and skins and live animals. Exports are also anticipated to continue its upward growth trend with emphasis on minerals and meat.

Botswana also has to import most of its consumer goods for consumption needs. The dominant import categories include machinery and electrical equipment, food, beverages and tobacco, vehicles and transport equipment, chemical s and rubber products and fuels. It is anticipated that import demand will rebound, due to the higher capital expenditure of government and mining firms.

In terms of the infrastructure of the country it is evident that the country is served by road, rail and air. The telecommunication system is fully digital and internet users are increasing. Energy sources are represented by coal, petrol, fuel, electricity and solar energy. Botswana is also reliant on South Africa for a large segment of its electricity. Water represents one of the scarcest resources in the country and a number of dam projects are undertaken to support ground water levels and borehole facilities.

6.19.1.1 Implications for Gope

It is therefore evident that Botswana's economy is experiencing a positive trajectory – driven by the performance of the mining industry and government's sound economic policy. It is anticipated that the current macro economic conditions will prevail and the country's economy will continue sideways while political stability adds to the positive sentiment in the national economy. These conditions provide a positive climate for new investment such as a new diamond mine.

The GDMP will contribute the following:

- Contribute to the strengthening of the dominant national economic pillar (viz. mining and minerals);
- Extend the diamond production base of the country and contribute to mineral revenue growth;
- Contribute to the creation of additional forward and backward linkages on a national as well as district scale (supply chain, local beneficiation and increased consumer demand);

- Increase the trade exports and export revenue, it will also contribute to the strengthening of Botswana's position as diamond producer in the world;
- Contribute to enhance the GDP per Capita and HDI ratios, strengthening its position within Sub-Saharan Africa;
- Strengthen and diversify the economic base of region, positively adding to the agriculture and tourism base of the region;
- Increase the number of operating establishments of the region;
- Create additional employment opportunities within the region, and
- Contribute to enhance the overall level of human development and reduce the poverty level within the Ghanzi District and CKGR.

6.19.2 Human Resources and Infrastructure

Botswana's population amounted to 1.68 million in the latest census undertaken in 2001. Annual population growth amounted to 2.4% between 2001 and approximately 1.3% between 2001 and 2008, and it is anticipated that it will decline to 0.4% up to 2015. A strong level of urbanisation characterises the country with more than 50% of its residents residing in urban areas. It is anticipated that the urbanisation rate will increase to 80% over the next twenty years. It is also anticipated that population growth in the urban areas will decline as the urbanisation patterns stabilises.

Population concentration is also the highest in the eastern and south-eastern districts of Botswana. The lowest population concentrations are found in the western and south-western areas – Ghanzi and Kgalagadi Districts. As stated previously, the GDMP is located within the Ghanzi District. This district had a total of 33 170 people in 2001, of which 689 were residing within the CKGR. A population decline is also taking place in these areas, with emphasis on the CKGR due to the relocation of settlements to areas outside the CKGR, and a movement of people towards urban areas for employment reasons.

In terms of vital statistics it is evident that Botswana is severely impacted by the HIV/AIDS epidemic. This impact overall life expectancy, infant mortality rate and overall level of population growth. HIV/AIDS also presents a high risk to economic growth, due to the impact on the labour force, investment and savings. Government and mining companies are actively involved in addressing this issue and assisting those infected with the virus.

Botswana Government has also achieved a lot in terms of the provision of almost universal free education. In general the number of education facilities increased as well as the level of enrolment. The teacher student ratio also reflects the importance of education within the country.

In general the level of unemployment is relatively low, with the dominant employment sectors represented by agriculture, retail trade, public administration, education, manufacturing and private households and construction. The dominant occupations is represented by agricultural workers, elementary occupations, service workers, craft and related workers, technicians and associate professionals. The largest segment of the employed represents paid employees followed by those working on their own land or cattle posts, followed by those that are self employed or family workers.

In general the average earnings per month amounts to P2,788 - the highest paying industries include financial intermediaries, water and electricity, education, mining and quarrying.

The beauty of the country is found in its wilderness, wildlife and cultural diversity. Large areas of the country are designated as national parks and game reserves. In terms of natural resources it is evident that there are a lot of untapped mineral resources.

6.19.2.1 Population of the CKGR

The Basarwa have reportedly been residing in the CKGR for thousands of years. The Basarwa within the CKGR followed a hunting and gathering lifestyle – however due to the increased drought and government intervention permanent settlements developed around boreholes. With water as a resource they commenced with agriculture and cattle farming activities resulting in a movement away from their traditional lifestyle. This and other factors have led to government decision to relocate the Basarwa outside the CKGR.

Limited numbers of the Basarwa have any form of formal education and with the changing lifestyle, increased dependence on the state evolved resulting in the loss of transferring traditional skills. The result is a population segment with limited to no skills. The majority of the Basarwa are also unemployed, with a smaller segment employed at surrounding farms, or involved in government projects.

In general the Basarwa has adapted to this new way of living with continued interaction between the relocation settlement and areas outside the settlement, resulting in a flow of goods, services and natural resources between the areas.

Those residing in the relocation settlement were predominantly unemployed, whereas those outside the settlement continued their gathering and hunting lifestyle. Only a small segment has returned to the CKGR.

The population residing within the CKGR has no access to any formal social, health or educational facilities inside the CKGR. However, these services are provided to the current and former residents of the CKGR in three locations, namely Kaudwane, New Xade and Xere, located outside the CKGR.

6.19.3 Mining Project Development

Overall it is evident that mining resource-based urbanisation has a finite life-span characterised by both positive and negative impacts. Development planning processes should be informed by the necessity to plan for these impacts – with emphasis on the possible closure or down scale of mining operations.

Overall the boom and bust cycles associated with mining can not only be predicted but the capacity to mitigate impacts can be absorbed within a pro-active development management framework. The impact of the proposed project will be measured within the subsequent report section, followed by mitigation guidelines.

Evident in previous mining project developments was that if there is a perception of an economic activity in an area, people have an expectation with regards to employment opportunities. For this reason the reality of squatting becomes a real problem. In terms of the GDMP it should also be noted that squatting could be a factor. Although the mine is located within a state owned Game reserve the trends in mine development indicates that squatting might be a real threat and it needs to be managed properly.

6.20. CURRENT AND PROPOSED DEVELOPMENTS IN THE AREA

Development planning has been utilised by Botswana in formulating and documenting economic policy. This is done to ensure that the nations' limited financial, manpower and natural resources are put to effective use, and in accordance with national priorities. It must be noted, however, that the strategies outlined in the plans are not legally binding, The objectives and goals outlined therein, should as far as practicable, be incorporated into the mining operations to be undertaken.

6.20.1 Republic of Botswana National Development Plan 9, 2003/04 – 2008/09

The development of National Development Plans by Botswana has been aimed at guiding the development of the county's economy and drawing up programmes of public expenditure on recurrent and development projects, based on projected revenue resources. The NDP outlines the government's development priorities for the plan period and the policies, programmes and projects the Government will implement in pursuit of these priorities. It is based on the Macroeconomic Outline and Policy Framework, and is the map for expenditure that is approved by the Economic Committee of Cabinet (ECC), setting priorities over the long term and providing the framework for budgetary planning year-on-year. National development planning is drawn up in the context of the national principles of democracy, development, self-reliance, and unity, and 'Botho'[26].

The National Development Plan 9 (NDP 9) introduces strategic planning as part of the national planning process. The theme of this six year development plan is "Towards the Realisation of Vision 2016: Sustainable and Diversified Development through Competitiveness in Global Markets", requiring the enhancement of Botswana's competitiveness, particularly in key sectors where the country has a comparative advantage, in order to attain sustainable economic growth. The planning objectives, as espoused in the plan are:

- Sustained development;
- Rapid economic growth;
- Economic independence, and
- Social justice.

Sectoral strategies have been developed to address challenges and opportunities in meeting the objectives of the plan. . In particular, of relevance to the GDMP, the following are noted:

- Central to the mineral policy objective is maximising economic benefits for Botswana from the development of mineral resources, while allowing investors to earn competitive returns. In this regard, NDP 9 policy objectives focus on:
  - Encouraging prospecting and new mine developments;
  - Creating opportunities for generating linkages with the rest of the economy and increasing local value added;
  - Conserving and protecting the environment, and
  - Identifying and developing appropriate strategies for dealing with challenges facing the minerals sector.
- In respect of wildlife, national parks and tourism, a central focus will be on the sustainability of the wildlife population (including raising the numbers of those animal species that have become endangered). Additionally, in terms of the strategy, Government will pursue the policy on sustainable utilisation of Botswana's resources and will ensure that the tourism industry make greater contributions to socio-economic development, and facilitates the creation of opportunities for Batswana to derive significant levels of benefits.

[26] Refers to a state of being human, courteous and highly disciplined.

- Vision 2016 has identified the environment as one of the challenges that will be tackled in the pursuit of sustainable development. Policy and strategy for NDP 9 in this regard includes:
  - The creation of effective operational links with institutions that are involved in the management of the country's natural capital to foster continued policy review and reform;
  - The promotion of functional and effective links with the information centres of line ministries to ensure that environmental / sustainable development indicators are generated and updated;
  - The implementation of the environmental assessment guidelines for systematic EIA guidelines;
  - The intensification of CBNRM activities in collaboration with other stakeholders;
  - Information sharing such that every member of society may actively participate in the execution of national environmental responsibilities;
  - Integration of environmental concerns into development planning;
  - Resource valuation and costs assessment of environmental damage;
  - Review of policies and programmes to achieve the development objectives during NDP 9, and
  - Enactment of various legislation (including EIA legislation already promulgated) and an overarching Environmental Management Act (not yet in force).

Cognisance must be taken of the NDP and the strategies implemented in terms thereof, throughout the GDMP, in order to ensure the operation of the mine is aligned to the objectives and policies in terms thereof.

6.20.2 Republic of Botswana Ghanzi District Development Plan 6: 2003 - 2009

The Ghanzi District Development Plan 6 (DDP 6) is a framework of goals and objectives, as well as strategies to achieve district economic and social development, its primary goal being economic growth and poverty alleviation. The plan was developed concurrently with the NDP 9, and is aligned with Vision 2016, as discussed above, its purpose being to provide a framework for co-ordination and implementation of developments in the District. The overall goals of DDP 6 include:

- Economic growth and poverty alleviation;
- To ensure environmental conservation through the integration of environmental concerns / issues into development planning, and
- To intensify public education on environmental conservation.

In achieving the environmental conservation goals, *inter alia* the following objectives have been formulated:

- To undertaken strategic environmental assessment for all development projects;
- To carry out and intensify public education campaigns on environmental awareness through *Kgotla* meetings and schools;
- To protect groundwater sources through appropriate waste disposal methods;
- To promote the sustainable use of natural resources, and
- The enforcement of the Conservation Act, policies and legislation.

6.20.3 Republic of Botswana Kweneng District Development Plan 6: 2003 - 2009

Similarly to the Ghanzi District Development Plan, the Vision 2016 pillars inform the objectives of the Kweneng District Development Plan 6 objectives. The overall strategic goals of the Plan include:

- The provision of social services, such as water supply, education and health related aspects;
- The implementation of policies and programmes that address environmental concerns such as desertification, waste management, water pollution and environmental degradation, and
- Development goals as derived from the NDP 9 theme – the district goals are developed to address the areas of diversification and sustainable development.

Specific environmental goals and objectives, supporting the incorporation of environmental concerns into development planning, include:

- The promotion of sustainable development by implementing appropriate environmental mitigation measures;
- The enhancement of community participation by involving all stakeholders in the development process, including disadvantaged groups;
- The provision of economic diversification by providing an environment that is conducive for private sector investment;
- To collaborate with NGOs, parastatals and the private sector through district development structures, and
- To conserve natural resources by ensuring that exploitation of such compiles with statutory instruments.

Environmental priorities, as identified in the Development Plan, and which must be given consideration in the implementation of the proposed development, include:

- Littering / waste disposal and the enforcement of the Waste Management Act;
- The promotion of recycling and reuse opportunities of waste materials;

- Improved management of medial wastes;
- Management of run off and soil erosion[27], and
- Rehabilitation of abandoned extraction sites, including borrow pits.

[27] Action plans include the provision of gabion mattresses and / or weirs along steep slopes, terracing in undulating areas to slow down the speed of water flowing and wind speed, and provision of storm water drainages.

SECTION 7. PUBLIC CONSULTATION

7.1. INTRODUCTION

Due to the historical sensitivities surrounding the CKGR in which the proposed GDMP is located, the Public Consultation Process conducted by Marsh, is considered as a critical factor to the success of the SEIA. To this effect, Marsh consulted the public extensively as part of the ESS phase of the SEIA.

7.2. COMMUNICATION STRATEGY

During the inception meeting with the DEA held on 15 October 2007 (Appendix 13), Marsh was advised that the ESS process would require a detailed Communication Strategy to ensure that adequate consultation was undertaken throughout the SEIA. This requirement falls outside of present legislative requirements but is considered by the DEA to be a Best Practice Standard.

The Communication Strategy (Appendix 13) was compiled to address all stages of the Public Consultation Process (PCP), including public consultation, and Governmental and parastatal stakeholder engagement. The aim of this document is twofold:

a) The Communication Strategy serves as a guideline detailing how communication with stakeholders and I&APs will be undertaken for the proposed GDMP, and
b) The Communication Strategy affords both Governmental and parastatal stakeholders the opportunity to review the proposed approach to the PPP and Governmental and parastatal stakeholder engagement, with the view to obtaining their approval thereon.

A workshop was held at Tlotlo Conference Centre on 09 November 2007. The following Governmental Departments were invited, as per the list provided by the DEA:

- The Office of the President;
- Attorney General's Chambers;
- Department of Environmental Affairs;
- Department of Foreign Affairs;
- Department of Forestry and Range Resources;
- Department of Geological Surveys;
- Department of Local Government and Development;
- Department of Meteorological Services;
- Department of Mines;
- Department of National Museum, Monuments & Art Gallery;

- Department of Roads;
- Department of Social Services;
- Department of Tourism;
- Department of Town and Regional Planning;
- Department of Waste Management and Pollution Control;
- Department of Water Affairs;
- Department of Wildlife & National Parks;
- Local Authorities - Central District:
  - District Council;
  - Land Board;
  - District Administration / District Development Committee (DDC), and
  - The Tribal Administration.
- Local Authorities - Kweneng District:
  - District Council;
  - Land Board;
  - District Administration / DDC, and
  - The Tribal Administration.
- Local Authorities – Ghanzi District:
  - District Council;
  - Land Board;
  - District Administration / DDC, and
  - The Tribal Administration.
- Parastatal Stakeholders:
  - BPC;
  - Water Utilities Corporation (WUC);
  - Botswana Telecommunications Corporation (BTC), and
  - Botswana Tourism Board.

During the workshop, Marsh provided a detailed presentation on the proposed Communication Strategy and the various points of clarification was discussed with participants of the workshop. The minutes of this workshop is presented in Appendix 13 of this report.

Each Department was allowed a 2 week comment period after the workshop, and were requested to forward comments to the DEA. On 23 November 2007, it was confirmed by the DEA that no further comments were received and that Marsh could proceed with the proposed Public Consultation Process as per the Communication Strategy.

7.3. BACKGROUND INFORMATION DOCUMENT

The Background Information Document (BID) (Appendix 13) for the proposed GDMP, detailed the following information:

- Project proponent details;
- Identification of the proposed Social and Environmental Impact Assessment project team;
- Location of the proposed GDMP;
- Description of the proposed operational activities;
- A summary of the anticipated infrastructure requirements;
- An I&AP / Governmental and parastatal stakeholder registration form, and
- Contact details for the Environmental Consultants.

Distribution of the BID comprised:

- The BID was available online at http://www.marsh-africa.com under the 'Current Projects for Public Review' link for the duration of the ESS phase of the SEIA;
- The BID was also forwarded to I&APs, upon request, via email and / or facsimile, and
- The BID was handed to members of the public at each public meeting held.

7.4. IDENTIFICATION OF INTERESTED AND AFFECTED PARTIES (I&AP)

Identification of Governmental and parastatal stakeholders and I&APs was undertaken to determine who may be directly or indirectly affected, positively or negatively, by the proposed GDMP, to ensure that all parties were afforded the opportunity to comment on the assessment process and proposed project. Stakeholders local to Botswana and abroad were considered and involved in this process.

The following tasks have been undertaken to help achieve comprehensive identification of people affected by the GDMP, I&APs, and Governmental and parastatal stakeholders.

7.4.1 Identification of People Affected by the Project and I&APs

Identification of people affected by the GDMP and other I&APs is of critical importance to the SEIA process. Communities from three districts (Kweneng, Central and Ghanzi) were consulted during the process, and it was anticipated that the number of I&APs would be large. People affected by the GDMP and other I&APs were identified to include the following:

- Land users or assets impacted on by any aspect of the GDMP (i.e. mining, road upgrading and establishment of power reticulation systems);
- People using agricultural land or natural resources in proximity to the Gope Project Site;

- Indigenous or tribal people with special ties to land, or who have specific land, resource, and cultural rights;
- People's organisations and institutions affected by the GDMP, such as village development associations, recreational groups, women's groups, farmers, and religious groups;
- Locally disadvantaged and unrepresented groups, such as women and the poor, and
- People from surrounding villages.

7.4.2 Identification of Other Relevant Stakeholders

In addition to project affected people and other I&APs, other stakeholders may influence the outcome of the GDMP, either through contribution of knowledge or ideas to improve project design or mitigate environmental, social and economic impacts, or through political influences on the proposed GDMP that need to be considered. Other relevant stakeholders include the following groups:

- Politicians;
- Local Government authorities;
- Commercial and industrial enterprises including suppliers, customers, and contractors;
- The media;
- National environmental, social, and economic Government agencies;
- Local, national, and international environmental and developmental NGOs;
- International activist groups;
- Research institutes, and
- Colleges and universities.

7.4.3 Identification of Stakeholder Representatives

Identification of, and consultation with, stakeholder representatives and community leaders in particular, is an efficient way for the dissemination of information to large numbers of stakeholders, as well as to receive comments and further information from these people. It should be ensured that identified stakeholder representatives are true advocates of the views of their constituents. Stakeholder representatives are identified as:

- Elected public representatives of regional, local and village councils;
- Traditional representatives, such as the relevant Kgosi's, and
- Leaders (i.e. chairmen, directors) of local cooperatives, other Community Based Organisations (CBOs), local NGOs, and local women's groups.

I&APs from communities were informally and randomly consulted to verify that correct representatives were selected and that community views were accurately represented. Throughout the remainder of the GDMP (i.e. post scoping and during the detailed SEIA), the list of identified stakeholders will continually be refined, expanded and updated.

7.4.4 Detailed I&AP Registration List

A detailed list of identified and registered stakeholders comprising Governmental, NGOs & CBOs, commercial and industrial enterprises as well as members of the public or I&APs is presented in Table 47.

Table 47: List of I&APs

GOVERNMENT DEPARTMENTS		
ORGANISATION	**NAME**	**SURNAME**
Agriculture (MoA)	James	Masukwane
	Ntjidzi	Manyothwane
Attorney General's Chambers	Ataliah	Molokomme
	Dittah	Molodi
	Charidida	Thembe
Civil Aviation (DCA)	Sekgele	Kolo
Environmental Affairs (DEA)	Steve	Monna
	Portia K.	Segomelo
	David	Aniku
	Mmolaadira	Autlwetse
	Arabang	Kanego
	Tsalano	Kedikilwe
	Kulekani	Mpofu
	Judith	Maifala
	Julia	Ditlhong
	Tawana	Babili
	Khumo	Mokereitane
	Kesaitsi	Makgasa
	Nini	Motshubi
Foreign Affairs	Charles	Ntwaagae
Forestry and Range Resources	M.	Mmanthe-Tsuaneng
	Raymond	Kwerepe
	Anthony	Tema
Geological Surveys	T.	Ngwisanyi
	Ngonidzashe	Tobani
	Goboletswe Shima	Mangadi

ORGANISATION	NAME	SURNAME
Lands (DoL)	Ian	Tema
	T.	Kgatlwane
	S.	Makgosa
	Mr.	Mabiletsa
Local Government and Development	Peter	Mongwaketse
	C.	Mothakaja
Meteorological Services	P.	Phage
	Dorcas	Masisi
Minerals, Energy & Water Affairs, Ministry (MMEWA)	Khanlani	Fichani
	K.	Charles
Mines	Jacob	Thamage
	Ntishi	Mmulawa
	Hossia	Chimbombi
National Museum, Monuments & Art Gallery	Gaogakwe	Phorano
	Geofrey	Matlapeng
	Nonofo	Ndobochani
	P.	Segadika
Office of the President	Eric	Molale
	Jane	Mathware
Roads (DoR)	Ephraim	Masimega
	Bathoni	Moetse
	B.	Kimsley
	Lucas	Mpaleng
Social Services	Tshenolo	Omphitlhetse
	H.	Mogatusi
	Berenice	Mosime
Tourism (DoT)	Gloria	Kelebaone-Maselesele
Town and Regional Planning (DRTP)	Ralph	Chephethe
	Gaphelo M.	Chivsiwa
	Gomolemo	Tobedza
	Doreen	Kenaleeng
	Lesedi	Rantwa
	Nnete	Jobeta
Waste Management and Pollution Control	Enoch	Naane
	Nonofo	Kebaswele
	C.	Glass
	Moore	Moffat
	Kentlhafetse	Mokokwe
Water Affairs	V	Bagopi
	Oakantse Moses	Moehadu

ORGANISATION	NAME	SURNAME
Wildlife & National Parks (DWNP)	Rapelang	Mojaphoko
	T. C.	Mmopelwa
	Charles	Mojalemotho
Central District - Serowe		
District Council	Nelson	Molepolole
	Mr.	Malise
	Tiisetso	Dube
Land Board	Andrew	Pitse
	Mr.	Segole
District Administration Also Chair Person of the DDC	Tlale	Setumo
	George	Mogome
Tribal Administration	Tshegofatso	Setumo
	Kgosi	Kgamane
	Kgosi Tlholego	Seretse
Kweneng District – Molepolole		
District Council		
	M.	Koontse
	Mrs.	Sekwakwa
	Patrick	Manthe
	Silver	Moeng
	Mary	Tjibai
Land Board	Mr.	Malatsi
	Joseph B W	Barati
	Mr.	Mokotedi
District Administration Also Chair Person of the DDC	Sombe	Ongadile
	Boitumelo	Mogapi
Tribal Administration	Sylvia	Koronale
	Kgosi Keineetse	Sebele
	Kgosi	Segwaba
	Kgosi Kgari	Sechele III
	Kgosi	Lebati
Members of Parliament	Daniel	Kwelagobe
	Gaotlhaetse	Matlhabaphiri
	Filbert	Nagafela

ORGANISATION	NAME	SURNAME
Ghanzi District - Ghanzi		
District Council	Nelson	Mogapi
	Mr.	Mojalemotho
Land Board	Mr.	Moahi
	Mr.	Mpatisang
	Mr.	Molatole
District Administration Also Chair Person of the DDC	Jeff	Siamisang
DDC	Itani	Mathumo
	Segametsi	Chere
Tribal Administration	Kgosi Lobatse	Beslag
	Keaboka	Mosala
	Kgosi Silence	Setima
Parastatal Organizations		
BPC	Jacob	Raleru
WUC	Fred	Maunge
BTC	Vincent	Seretse
Botswana Tourism Board	Myra	Sekgororoane
	Mafila R.	Malesu

MEMBERS OF THE PUBLIC		
NAME	**SURNAME**	**CAPACITY**
Kerapetse	Bae	Private individual
Gabanangaka	Barekisi	Private individual
Daniel Bigani	Hubona	Big D Investments Botswana. Kg Section (Security Services)
Mick	Hudson	Private individual
Dikabelo	Kebasupe	Private individual
Modise	Kgoro	Private individual
Kuela	Kiema	Sociology student sponsored by UBTromso
Gababone	Majebeswane	Private individual
Mosepele	Mamoo	Private individual
Segoko	Mhitshane	Private individual
Selelo	Mhitshane	Private individual
Oakantse	Mmolaapudi	Private individual
Molathegi Chika	Moeti	Private individual
Smith	Moeti	Private individual
Tsholankonyetsa	Morogo	Private individual

MEMBERS OF THE PUBLIC		
NAME	**SURNAME**	**CAPACITY**
Dito	Motlhoiwe	Private individual
Omphile	Motlhose	Private individual
Nkemetseng	Motsoko	Private individual
Sekuta	Motsoko	Private individual
Ditse	Motswasele	Private individual
Lenyatso	Ntshetelang	Private individual
Motebejane	Ramohato	Private individual
E.	Roberts	Private individual
Kesalemang	Selelelabongaka	Private individual
Tebogo	Selelelabongaka	Private individual
Mokai	Seoramokha	Private individual
Omphemetse	Seoromeng	Environmental Scientist
Bihela	Sikere	Public Admin & Political Science students, sponsored by UBTromso
Phenyo	Thebe	University of Botswana: Archaeology Department
Moitshoki	Thomas	Private individual
Ofshinte	Tiroesele	Owner - Osh Investments
Gaonyatswe	Tlhanlapholo	Private individual
Mpolokelo	Tshiamo	Private individual
Tshiamiso	Viefentse	Private individual
Othusitse		Private individual

NGOS			
ORGANISATION	**NAME**	**SURNAME**	**CAPACITY**
	Gordon	Bennett	Barrister
Birdlife Botswana			The Secretary
Botswana Christian Council	Angela	Balfour	Unknown
Botswana Council of Non-Governmental Organisations (BOCONGO)	Baboloki	Tlale	Executive Secretary
Botswana Mine Workers Union			Director
Conservation International	Jacqueline	Semmee	Project Assistant
Conservation International	Moses	Selsebatso	Unknown
Conservation International	Hisso	Sebina	Unknown
Democracy Research Project			Director
Ditshwanelo - Botswana Centre for Human Rights	Alice	Mogwe	Director
European Commission - Delegation in Botswana	The Head of Delegation		Unknown
First People of the Kalahari (FPK)	Roy	Sesana	Head of FPK
	Jaumanda	Gakelebone	PA to Roy Sesana

NGOS			
ORGANISATION	**NAME**	**SURNAME**	**CAPACITY**
Flying Missions	John	Walters	Head of NGO
Kalahari Peoples Fund	Megan	Biesele	Unknown
	Robert Karl	Hitchcock	Unknown
Kalahari Conservation Society	Felix	Monggae	Unknown
	Bonatla	Tsholofelo	Unknown
Komku Trust	Xharae	Xhase	Coordinator of Komku Trust
Kuru Development Trust	Braam	le Roux	Unknown
Survival International	Steven	Corry	Director
Survival International	Lindsay	Duffield	Unknown
The Working Group of Minorities in Southern Africa (WIMSA)	Victoria	Haraseb	Unknown
The World Conservation Union	Masego	Madzwamuse	Country Programme Coordinator
	Matilda	Makebe	PA to Ms. Madzwamuse
	Tabeth	Chiuta	RSA Correspondent
Tshomarelo Tikologo			Unknown
UB Basarwa Research Project	Molefe	Rantsudu	Programme Administrator
UBTromso	Dr. Maitseo	Bolaane	UBTromso Coordinator
	Leema	Hiri	UBTromso Administrator & Education Outreach Officer

7.5. PUBLIC MEETINGS AND REGISTERED I&APS

Public meetings are the most common and efficient method of informing people affected by the GDMP, I&APs, and Governmental and parastatal stakeholders about the proposed GDMP, and when the field investigations have been consulted, the preliminary results of the SEIA. Public meetings also provide the proponent with the opportunity to appeal to I&APs and Governmental and parastatal stakeholders to provide comment on the GDMP and related project findings. Public meetings will, at a minimum, ensure that:

- People are informed about the environmental, social, and economic impacts of the GDMP;
- Meeting were held at venues that are accessible to the relevant communities;
- Meetings are held at times most convenient for the group/s targeted by the meeting;
- Information (technical and non-technical) is, where applicable, presented with the assistance of visual aids;
- People attending meetings are genuine project affected people, I&APs and / or Governmental and parastatal stakeholders;
- All participants wishing to raise their concerns or make comments are afforded the opportunity to do so;
- Issues and concerns raised, or comments made, are answered at the meeting or are actively followed up and / or investigated by the project team, and

- The GDMP proponent communicates to the participants of the meetings design changes that may result from issues, concerns or comments made during meetings.

Marsh identified 4 areas, spanning 3 districts, where public meetings relating to the GDMP were to be held. These included the Central District, the Kweneng District, the Ghanzi District, and the Khutse area.

These areas were selected as they represent the major districts surrounding the Gope Project Site, and are the areas most likely to be affected both positively and negatively by the proposed GDMP. The towns / villages where these meetings were held were selected based on the following criteria:

- Centrality of location;
- Ease of access for project affected people, I&APs, and other relevant stakeholders;
- Locality to the Gope Project Site, and
- Adequacy of meeting venues.

7.6. MEETING ADVERTISEMENT

Due to the remoteness of the Gope Project Site, the wide audience to be informed of the SEIA investigation and proposed mining activity at the GDMP, and the large numbers of the targeted audience, both printed media and radio was used to advertise the meetings.

7.6.1 Printed Advertisement

Advertisements were placed in the daily national newspaper, the Mmegi, regarding the proposed GDMP. The advertisements provided a brief description of the proposed GDMP and indicated the date, time and location of all the scheduled public meetings. Advertisements were placed in both English and Setswana (refer to Appendix 13). The printed advertisements were published on the following dates:

- Tuesday, 04 December 2007;
- Friday, 07 December 2007;
- Tuesday, 11 December 2007;
- Friday, 14 December 2007;
- Tuesday, 08 January 2008;
- Friday, 11 January 2008;
- Tuesday, 15 January 2008, and
- Friday, 18 January 2008.

During the second round of meetings, advertisements were placed in the following news papers on the following dates:

- Midweek Sun, 9 July 2008;
- Gazette, 16 July 2008;
- Daily News, 23 July 2008, and
- Mmegi, 27 June 2008.

7.6.2 Radio Advertisement

Radio advertising commenced on Radio Botswana (RB2), on 07 January 2008. Advertising was conducted in both English and Setswana and took the form of advertorials read by a broadcaster. Both the English and Setswana transcripts are presented in Figure 60 and Figure 61 below. The advertorials were read on the following dates:

- Monday 07 – Friday 11 January 2008, and
- Monday 14 – Friday 18 January 2008.

The readings of the advertorials were run on each of the above days at the following times, in both English and Setswana:

- 6:00;
- 7:00;
- 8:00, and
- 18:00.

No radio advertising was undertaken for the second round of public meetings.

PUBLIC NOTICE

The general public is invited to the Social and Environmental Impact Assessment consultation meetings for the proposed Gope Diamond Mining Project in the Central Kalahari Game Reserve. The project proponent is the Gope Exploration Company, owned by Gem Diamonds.

The meetings will be facilitated by Marsh Environmental Services who have been appointed as independent environmental consultants.

The meetings will be held as follows:

- 22nd January 2008 at 10am at Lephephe;
- 23rd January at 10am at Kaudwane;
- 25th January at 10am at New Xade;
- 29th January at 10am at Otse;
- 30th January at 10am at Xere;
- 31st January at 6am at Metsimanong;
- 1st February at 6am at Molapo and
- 2nd February 2008 at 6am at Kukama.

All members of the public are welcome and no prior registration / confirmation of attendance is required. Further, any member of the public wanting to register as interested and affected parties or comment on the proposed project can contact Pedro Kgobe of Marsh Environmental Services Botswana at Lot 50362 Gaborone Business Park, Fairgrounds or contact him at 3188000/71206112

Pedro Kgobe of Marsh Environmental Services Botswana at Lot 50362 Gaborone Business Park, Fairgrounds or contact him at 3188000/71206112

Figure 60: Advertorial for RB2 - English.

PUBLIC NOTICE

Setshaba se itsisiwe ka diphuthego tse di tla a tshwarwang mo kgaolong ya Central Kalahari Game Reserve tse moono wa tsone e leng go rerisana le batho ba metse e tla amiwang ke moepo wa teemane kwa Gope mo Central Kalahari Game Reserve.

Diphuthego tse di tla a bo di buisiwa ke ba Marsh Environmental Services ba eleng basekaseki ba tsa kamego ya tikologo.

Diphuthego tse di tla a tshwarwa jaana:

LEFELO	LETSATSI	NAKO
Lephephe	22/01/08	10:00am
Kaudwane	23/01/08	10:00am
New Xade	25/01/08	10:00am
Otse (Kwa Legare)	29/01/08	10:00am
Xere	30/01/08	10:00am
Metsiamanong	31/01/08	06:00am
Molapo	01/02/08	06:00am
Kukama	02/02/08	06:00am

Go kopiwa sechaba le batho ba metse e e builweng fano gore ba tsene diphuthego ka bontsi le ka nako e e boletsweng go tla go itseela ka tsebe.

Figure 61: Advertorial for RB2 - Setswana.

7.6.3 Other Notification Methods

In addition to the public advertising conducted, Marsh informed Governmental Stakeholders (both local and national) of the PCP and the public meetings via electronic mail and facsimile transmission.

Meeting Notices were not placed at any locations. In discussions with Portia Segomelo (DEA), it was confirmed that printed and radio advertising was regarded adequate advertisement of the meetings. Marsh did, however, contact the respective Kgosi's in each village during the first round of stakeholder consultation, where meetings were scheduled, and offered to forward notices to them, but no responses were received. The Kgosi's also indicated that they would use their own means to notify the people of the public meetings.

However, during the second round of meetings, letters detailing the time, location and purpose of the meetings were delivered to the following Kgosi's:

- Kgosi Lobatse Beslag, New Xade;
- Kgosi Segwabe, Kaudwane;
- Kgosi Lebati, Lephepe;
- The Community Leader, Kugama;
- The Community Leader, Metsimanong;
- The Community Leader, Molapo, and
- The Community Leader, Gope.

7.7. PUBLIC MEETINGS

7.7.1 Scoping Phase Public Meetings

During the ESS phase, Public Meetings were held at the following locations:

Kweneng District:

- Lephepe: 22 January 2008, and
- Kaudwane: 23 January 2008.

Central District:

- Otse: 29 January 2008, and
- Xere: 30 January 2008.

Ghanzi District:

- New Xade: 25 January 2008;
- Metsimanong: 31 January 2008 (CKGR);

- Molapo: 01 February 2008 (CKGR), and
- Kugama: 01 and 02 February 2008[28] (CKGR).

The meetings were conducted in the form of traditional Kgotla meetings, with the Kgosi in each location hosting the project team. A presentation of the GDMP was conducted by Marsh and GEC, and a questions and answers session for the public followed the presentation. The meetings were well attended, and approximately 590[29] members of the public attended the 8 meetings.

In general, the project team was received well by members of the public and there was a welcoming of the prospect of economic development in the region, and in particular each community wanted to gain maximum benefit from the development, with particular focus on the road and recruitment centres. People were appreciative of the consultation entered into by the project team, for the information disseminated to them and the time they were given to express their views, comments and concerns on the proposed development.

Detailed minutes of these meetings are presented in Appendix 13. The following issues are regarded as the most pertinent concerns / comments expressed by members of the public:

Table 48: Summary of Comments / Concerns Raised at Public Meetings.

ASPECT	GENERAL REMARKS	GENERAL RESPONSE
Road	At each of the meetings, members of the public requested that the permanent road be constructed through their village as this would bring socio-economic development to their area and allow for easy access between their village and the remainder of the country.	Investigations are continuing as part of the Feasibility Study. Feedback on the route selection will be given to the communities during the next round of meetings.

[28] The Department of Wildlife and National Parks (DWNP) collected members of the community from Kikao to attend a community meeting in Kaudwane on the 1st of February 2008. Because the community was aware of the Public Consultation meeting that was to be held the following day, they requested DWNP to transport as many of them back to the village of Kugama to attend the meeting. When the PPP team arrived in Kugama on the evening of 1 February, there was a request from the community to have the meeting before sun set in order for the residents of Kikao to attend while they were in Kugama.

In order to adhere to the commitment made in the advertising of the Public Meetings that the meeting in Kugama would be held on 2 February at 7:00, the project team went to the Kgotla to address more people that may have arrived during the evening. However, no new community members were present but the team spent approximately an hour discussing the previous day's events with some members of the community. Details of both the meetings at Kugama are presented in the minutes.

[29] Approximately 590 members of the public attended at the meetings. Due to the nature of the Kgotla meetings, people come and go throughout the meeting and for this reason, an exact number of participants could not be determined.

ASPECT	GENERAL REMARKS	GENERAL RESPONSE
Employment (general)	Members of the public felt that their community members should be given preference for employment opportunities, especially those living inside the CKGR. The participants of each meeting requested that recruitment centres be based in their village.	Investigations into the location of the recruitment centres are ongoing and feedback will be given to the public during the next round of meetings.
Employment (skilled)	Members of the public expressed a desperate need of employment, and requested that their 'able bodied' community members be given access to employment opportunities at the mine, even though many of them are illiterate. In addition, some community members have previously worked on the mines in South Africa and wanted to use the skills learned there to ensure employment at GDMP.	It was explained to people that skills acquired during their time of employment in the South African mines may not be relevant to the open pit operation. However, training programmes may be developed and implemented to accommodate people where practicable.
Employment (unskilled)	Many of the illiterate people and especially women enquired after the employment opportunities that will be available to them.	It was explained that opportunities do exist for unskilled labour at the operation (i.e. cooking, washing, cleaning, etc.) and for illiterate people (i.e. a possible ecotourism camp – field guides, trackers, etc.).
Consultation Process	Members of the public expressed their disappointment that the Government did not consult with them prior the consultations pertaining to the GDMP. They were appreciative of the consultation process undertaken by Marsh and the majority of people were excited about the prospects of a mine.	Members of the public were encouraged to freely air their opinions regarding the project.
Viability of the mine	There is a perception that Government have previously stated that there are no diamonds at Gope Project Site. People were now 'confused' that GEC are going to be mining diamonds that were previously denied to be there.	Clarification was given by Haile Mphusu regarding the economic viability of the resource, that it has always been there but had not been viable and hence the awarding of the Retention Licence
Community Trust	People were excited to hear about the possibility of a community trust being established. Clarification was sought on how the community trust would work and who would benefit from such a trust.	It was stated that all the intricacies of the trust still had to be investigated. People's needs and possible projects for the Trust are to be identified during the full SIA which will be carried out by Dr. David Cownie. People were invited to give their comments freely to David when he visited their communities.
Water	Water supply to the community was an issue that was frequently raised, as well as whether the mine would be able to provide the community with water, possibly through a community initiative associated with the trust.	This issue was still under investigation and feedback would be provided to the communities during the second round of consultations if possible.

ASPECT	GENERAL REMARKS	GENERAL RESPONSE
Archaeology & Heritage	There are graves and sacred sites located at and around the Gope Project Site. Various members of the Kaudwane community put their names forward to identify the graves and sacred sites to the specialists. There was some uncertainty (at Kaudwane) on how these graves would be affected by infrastructure.	The Archaeology and Heritage specialists are planning to take relevant members of the community to the Gope Project Site to identify grave sites. Depending on the type of impact (direct / indirect), a detailed management plan will be developed.
Camp and Shifts	Various questions were posed concerning the workings of a single status camp, visitation rights of family members and the impact of a large influx of people (i.e. HIV/Aids, crime, poaching) at GDMP upon the residents of the CKGR.	These issues were satisfactorily addressed during the meetings.
Fauna and Flora	Some questions around the impacts of the mining operation on fauna and flora were asked. At various meetings, the public asked that more attention be given to social matters rather than issues surrounding animals.	It was clarified that each component of the environment, including social, archaeology and heritage as well as each individual component of the bio-physical environment was being fully investigated and that a detailed specialist report would be produced on each of these components. The function of the SEIA was to ensure that an integrative and holistic assessment resulted from these investigations.
Mine name	People generally know the Gope area as Gaagoo (spelling to be confirmed). Only in Kugama did people refer to the area as Gope.	

BIDs were distributed to participants of the meetings. These documents contain I&APs Comment and Registration Forms. At the end of each meeting, participants were informed that further comments could be made using the Comment and Registration forms. Marsh collected the forms on the 14 and 15 February 2008 from the various Kgotlas.

7.7.2 SEIA Phase Public Meetings / Feedback Meetings

Subsequent to a Governmental Review workshop of the SEIA document, a second round of public meetings were held to provide feedback to affected communities. These meetings took place at the following locations:

Kweneng District:

- Kaudwane: 29 July 2008, and
- Lephepe: 2 August 2008.

Ghanzi District:

- New Xade: 28 July 2008;
- Kugama: 29 July (CKGR);

- Metsimanong: 30 July 2008 (CKGR);
- Molapo: 31 July 2008 (CKGR), and
- Gope: 1 August 2008 (CKGR).

The meetings were conducted in the form of traditional Kgotla meetings, with the Kgosi in each location hosting the project team. A presentation of the GDMP was conducted by Marsh and GEC, and a questions and answers session for the public followed the presentation. The meetings were well attended, and approximately 383[30] members of the public attended the 7 meetings.

People were generally thankful for the project team returning to give them feedback on the investigations conducted. The two main aspects of concern to people remained employment and the location of the access road. Each community was interested in how their people would benefit from the mine and associated infrastructure. Inside the CKGR itself, people showed a greater interest in how the mine would impact upon the natural environment and what would be done to mitigate those impacts.

Detailed minutes of these meetings are presented in Appendix 13. The following issues are regarded as the most pertinent concerns / comments expressed by members of the public:

Table 49: Summary of Comments / Concerns Raised at Public Meetings.

ASPECT	GENERAL REMARKS	GENERAL RESPONSE
Road	At each of the meetings, members of the public requested that the access road be constructed through their village as this would bring socio-economic development to their area and allow for easy access between their village and the remainder of the country.	Two routes were investigated by the consulting team, namely Lephepe-Gope and Kaudwane-Gope. A final decision on which route will be selected is currently with Government and the project team awaits their response.
Employment (general)	Members of the public felt that their community members should be given preference for employment opportunities, especially those living inside the CKGR.	Investigations into the location of the recruitment centres are ongoing and feedback will be given to the public during the next round of meetings.
Employment (recruitment)	The participants of each meeting requested that recruitment centres be based in their village. Questions were asked around the recruitment process and the notification of positions available.	Recruitment will be done all over Botswana, with final interviews and pre-employment medicals in either Kaudwane or Lephepe depending on where the final access road is located. Apart from the traditional means of advertisement, notices will be placed at Kgotlas.

[30] Approximately 383 members of the public attended at the meetings. Due to the nature of the Kgotla meetings, people come and go throughout the meeting and for this reason, an exact number of participants could not be determined.

ASPECT	GENERAL REMARKS	GENERAL RESPONSE
Employment (contractors)	Questions around the treatment of workers by contractors were asked.	Contractors will be given a set of guidelines by GEC to which their labour practices will need to adhere.
Community Trust	People were excited to hear about the possibility of a community trust being established. Clarification was sought on how the community trust would work and who would benefit from such a trust.	It was stated that all the intricacies of the trust still had to be investigated. People's needs and possible projects for the Trust, as well as the logistics surrounding the Trust, still had to be investigated further in consultation with members of each directly affected community.
Water	Water supply to the community was an issue that was frequently raised, as well as whether the mine would be able to provide the community inside the CKGR with water.	This matter needs to be finalised with the Government and boreholes will only be given to the DWNP, not to the individual communities themselves.
Archaeology & Heritage	People expressed an interest to know how the graves found at the Gope Project Site will be affected and how the grave relocation process would unfold.	Only one grave will be directly affected by the mining operation. Consultation with the family of the deceased will inform the exact process followed, but GEC will be responsible for the costs involved. No compensation will be paid to the family.

BIDs were distributed to participants of the meetings. These documents contain I&APs Comment and Registration Forms. At the end of each meeting, participants were informed that further comments could be made using the Comment and Registration forms. Marsh collected the forms on the 14 and 15 February 2008 from the various Kgotlas.

7.8. OTHER PUBLIC COMMENT RECEIVED

All comments[31] received via facsimile, email and teleconference as well as those received from I&APs at the public meetings and those collected after the meetings have been included in the Issues and Response Register discussed in Section 5.9.

7.9. ISSUES AND RESPONSE REGISTER

An issues and response register was opened, incorporating in detail, the issues raised by the project affected people, I&APs, and Governmental and parastatal stakeholders and is detailed in Appendix 13. Furthermore, the detailed minutes of the public meetings are attached in Appendix 13.

[31] With the exception of 30 forms from New Xade, (which are still on route to Marsh's offices), all comment forms were capture in the I&AP database. These outstanding I&APS and comments will be included in the detailed SEIA study.

Issues raised by I&APs have been divided into a number of aspects, of which a summary of the sub-aspects are presented in Table 50 below.

Table 50: Summary of Aspects Raised by I&APs.

ASPECT	SUB-TOPIC
Mine Planning	▪ Timeframes pertaining to LOM ▪ Mining operation – size, scale, type ▪ An appreciation of what the mining infrastructure would look like ▪ An understanding of how the camp would operate and why camp vs. township ▪ Concerns raised about safety and security of local communities ▪ Understanding of shift configuration was requested
Road	▪ Road type to be used (tar / gravel) ▪ There was much debate around the proposed route for the road ▪ Each community would prefer the road to pass through their village ▪ What the biophysical impact on environment would be ▪ Source of construction material – borrow-pits
Power Line	▪ Preferred routes were discussed ▪ Impact on birds and other wildlife
Public Consultation	▪ Appreciation / gratitude for consultations and feedback sessions ▪ There was no consultation prior to GEC initiating work on-site (ODS drilling) ▪ Would Survival International and FPK be consulted ▪ Which other authorities were consulted ▪ Desire to obtain an appreciation for the response to the consultations in the other locations, as part of this process ▪ Explanation requested for selection of the chosen locations for public meetings
SEIA	▪ Completion of SEIA Report - timeframe ▪ Feedback and review of SEIA Report – feedback mechanism
Ground- and Surface Water	▪ Water availability at the mine ▪ Affect of mine boreholes on local community boreholes ▪ Depletion of ground water reserves
Fauna and Flora	▪ Impact on wildlife and vegetation ▪ How is GEC going to protection the wildlife and vegetation ▪ Preservation and protection of wildlife using traditional skills ▪ Impact of the remaining pit upon wildlife
Economic	▪ Where would diamonds be sold ▪ The economic factors influencing Botswana to consider developing a Mine inside a protected game reserve
Social	▪ Employment opportunities (skilled and unskilled) ▪ Gender equalities in terms of employment ▪ Expatriates and local skills ▪ Recruitment and locations of recruitment centres ▪ Assistance to those inside CKGR to be transported to recruitment centres and to the mine for employment ▪ Safety and security of employees ▪ Water Supply to communities ▪ Negative impact on communities (HIV / AIDS, diseases, crime, squatter camps) ▪ What type of community projects are being considered ▪ How would the Community Trust work and who would it benefit ▪ Would the local communities benefit through equity / royalties ▪ What are the benefits of the mine to the local communities (Secondary Economic Impacts)

ASPECT	SUB-TOPIC
Waste	▪ Waste management and recycling options being considered
Noise	▪ Noise pollution and extent of noise pollution (people and wildlife)
Visual	▪ How is a mine concealed?
Archaeology and Heritage	▪ Requirements for the archaeological assessment ▪ How are burial / sacred sites being identified ▪ Will the families still have access to the graves ▪ How will the graves be exhumed ▪ Who will carry the cost for this process ▪ Will the families be compensated
Air Quality	▪ Impacts and management of dust on human health and vegetation
Rehabilitation	▪ How will the land be rehabilitated ▪ Post mining management of open pit and impacts on wildlife ▪ Use of existing infrastructure upon closure ▪ Maintenance of infrastructure post closure
Other	▪ Company information – Marsh and GEC ▪ Value of diamonds at the Gope Project Site ▪ Blood diamonds
General Sentiments	▪ There was support for the mine ▪ Concern / disappointment of project within protected conservation area ▪ Ignorance of real impacts of mine and associated infrastructure ▪ The need to respect local communities and their cultures
CKGR Issues	▪ Lack of government consultation around the court case ▪ Government indicated no diamonds in the CKGR in the past
Mine Name	▪ The name Gaagoo is generally recommended

7.10. AUTHORITIES REVIEW PROCESS

7.10.1 Authority Review of ESS

As part of the authority review process post submission of the SR, the DEA co-ordinated an authority review workshop, which took place on 3 April 2008. The minutes of this meeting are presented in Appendix 13. Subsequent to the receipt of all comments from the governmental stakeholders, the SR was reviewed and re-submitted to the DEA. The SR was approved by the DEA on 30 April 2008.

7.10.2 Authority Review of ESS

Post the submission of the SEIA, the DEA co-ordinated an authority review workshop, which took place on 17 June 2008. The minutes of this meeting are presented in Appendix 13. Subsequent to the receipt of all comments from the governmental stakeholders, the SEIA was reviewed and re-submitted to the DEA in order to issue a RoD.

7.11. THE WAY FORWARD

GEC is committed to continue stakeholder engagement throughout the life of the project with the directly affected communities. This will involve various components highlighted in the SEMP section of this document that requires ongoing consultation.

With regard to the creation of a servitude for the power line, including land expropriation and compensation (limited to acquisition only), BPC will undertake the following steps, once the SEIA approval has been granted:

- Apply for wayleaves or servitudes to the Land Authorities (i.e. Land Board);
- The Land Authorities assess requirements and grant wayleaves or servitudes;
- The Land Authorities assess the value of the land and developments thereon (those directly affected by the proposed project) in the presence of the BPC and land owner / lessee;
- The Land Authorities produces an assessment report and seek approval from the Department of Lands and Housing;
- The approved report is then submitted to BPC;
- Thereafter, BPC liaises with the land owners / lessees for acceptance or otherwise of the assessed value (through the use of offer letters), and
- If the owners / lessees are in agreement, BPC settles the claim. If the owners / lessees are in contention, BPC will negotiate with the said party until a suitable resolution is found.

SECTION 8. ANALYSIS OF ALTERNATIVES

8.1. INTRODUCTION

The consideration of alternatives[32] is a fundamental constituent of the Environmental Assessment Process and acknowledged Best Practice worldwide. The rationale for identifying and evaluating alternatives is to determine the generally effective method in meeting the need and purpose of the proposed development. This can either be achieved through enhancing the environmental benefits of the proposed activity, or by avoiding or reducing potentially significant negative impacts.

The ESS phase of the SEIA required the identification of feasible alternatives for consideration and further investigation during the SEIA phase of the environmental assessment process. During the ESS phase alternatives were identified based on key criterion and categorised according to Best Practice Standards.

As required in the SEIA Phase, each alternative identified during the ESS phase will be discussed in detail, comparatively assessed and evaluated and will focus on the impacts of each alternative in terms of the direct, indirect and cumulative effects associated thereto.

The following alternative categories and alternative options have been identified as being applicable to the GDMP and will therefore be considered during the comparative assessment process of the SEIA Phase:

Table 51: Summary of Alternatives Assessed

CATEGORY	ASPECT	ALTERNATIVES IDENTIFIED	OPTION SELECTED
ACTIVITY ALTERNATIVES	Mining Method	• Open pit mining	✓
		• Underground block cave mining	✗
	Site Access	• Permanent road	✗
		• Temporary road with upgrade to permanent road in due time	✓
		• Fly in – fly out option	✗
	Camp	• Single status camp at Gope Project Site	✓
		• Township outside CKGR	✗
		• Township inside CKGR	✗
	Shift Configuration	• 7 days on / 7 days off	✗

[32] For the purpose of this study alternative refers to a possible course of action in place of another to meet the same need and purpose of the proposal.

CATEGORY	ASPECT	ALTERNATIVES IDENTIFIED	OPTION SELECTED
		• 14 days on / 7 days off	✓
		• 10 days on / 5 days off	✗
		• 4 Days on / 4 Days off	✗
		• 1 Month on / 1 month off	✗
	Shift Duration	• 12 Hour shifts	✓
		• 10 Hour shifts	✗
		• 8 Hour shifts	✗
LOCATION ALTERNATIVES	Recruitment Centre Location	• Gaborone	✗
		• Lephepe	✓
		• Kaudwane	✗
	Water Supply – Well Field	• De Beers well field i.e. outside CKGR	✗
		• Inside MLA i.e. inside CKGR	✓
	Acidisation Plant	• On site	✓
		• Off site	✗
	Airstrip	• Upgrade of existing airstrip	✗
		• Construction of a new airstrip	✓
PROCESS ALTERNATIVES	Throughput Capacity	• 4 mtpa	✗
		• 5 mtpa	✗
		• 6 mtpa	✓
		• 8 mtpa	✗
	Mining Equipment – Pre-Strip	• Articulated trucks	✓
		• Rigid trucks	✗
	Crusher	• Mineral sizer	✓
		• Primary crusher	✗
	Liberation	• Conventional comminution	✗
		• Autogenous milling	✓
	Diamond Cleaning	• Acidisation	✓
		• No acidisation	✗
	Water Treatment	• Reverse Osmosis (RO)	✓
		• Other treatment types	✗
	Dust Suppression	• Watering of surfaces	✗
		• Chemical product	✗
		• Combination of chemical & water use	✓
INPUT ALTERNATIVES	Water Supply	• Groundwater	✓
		• Surface water	✗
		• Other	✗
	Type of Acid Used	• Hydrofluoric Acid	✓
		• Hydrochloric Acid	✓
	Power Supply	• Bulk power (BPC)	✓
		• Diesel generators	✓
ROUTING ALTERNATIVES	Power Line Route	• From Orapa	✓
		• From Thamaga	✗

CATEGORY	ASPECT	ALTERNATIVES IDENTIFIED	OPTION SELECTED
	Access Road	• Upgrade road from Lephepe (temporary road initially with upgrade to permanent road in due time)	✓
		• Upgrade road from Kaudwane (temporary road initially with upgrade to permanent road in due time)	✗
SITE LAYOUT ALTERNATIVES	Camp Location	• North-east of pit	✓
		• Other locations	✗
DESIGN ALTERNATIVES	Standard Accommodation	• Hot Bedding	✗
		• Dormitory	✗
		• Shared accommodation	✗
		• One person per room, shared ablution	✓
		• One person per room, own ablution	✓
	Waste Rock-Sand Berm and Separate Structures	• Conventional dump (separate sand and WRDs)	✓
		• Berm	✗
	TMF, Waste Rock and Sand Overburden Dump, Slimes Dam	• 20m Height	✗
		• 40 – 50m Height	✓
	Road Surface	• Calcrete surfacing	✓
		• Basalt surfacing	✓
		• Import surfacing material	✗
	Buildings & Accommodation	• Use of brick buildings / permanent structures	✗
		• Use of asbestos free pre-fabricated / temporary structures	✓
	Post Closure Land Use	• Wildlife area / total remediation	✗
		• Hand over of selected infrastructure to a third party	✓

8.2. ACTIVITY ALTERNATIVES

8.2.1 Mining Method: Open Pit vs. Underground Mining

Two mining options were considered, namely:

- Open pit mining, and
- Underground mining through use of the block caving method.

GEC commissioned SRK Consulting Engineers & Scientists to investigate the feasibility of the above mentioned mining methods. The report is provided in Appendix 14.

Some of the benefits and negative aspects of the two different mining types are detailed in Table 52 below:

Table 52: Comparative Analysis of Open Pit Mining vs. Block Caving.

ASPECT	OPEN PIT MINING (SURFACE)	BLOCK CAVING (UNDERGROUND)
Environmental footprint	• A primary reason for the block caving investigation being commissioned was to assess the option in terms of generating a reduced environmental footprint. However, the study revealed that the footprint created as a result of block caving would be similar to that of an open pit. In addition, the open pit is subject to design criteria that will ensure that the slope angle and hence final pit morphology is controlled through engineering intervention. This is opposed to block caving where the final pit morphology is dependent on various unknown factors relating to structural geology and gravity.	
Safety	• Side wall stabilisation is achieved largely as a result of detailed mine planning and engineering intervention. Additional side wall stabilisation is less expensive than for the stabilization of underground workings.	• Underground mining, and in the case of the GDMP specifically, various safety measures would need to be installed in the case of block caving due to the relative instability of the overburden material.
Infrastructure	• Less extensive infrastructure is required for open pit mining and extends to haul roads and pumping equipment used for dewatering of the lowest reaches of the open pit.	• More extensive infrastructure is required for underground mining. This includes transportation for workers, ore and waste material between the surface and underground workings, thus requiring an equipped shaft system, ventilation, water reticulation, electricity and more.
Dilution	• Very little dilution of ore concentration is expected.	• Due to the instability and incompetence of the overlaying Kalahari sand material, extensive dilution of the ore is expected to take place. It does not seem likely that the sand layer will stay in tact. It is more probable that the sand will collapse early and thus preferentially dilute the reserve.
Cost	• Due to the large volumes of Kalahari sand overburden found at the Gope Project Site, a higher stripping ratio applies, thereby increasing the cost of a tonne of ore mined than for other operations with lower stripping ratios. Despite this, based on GEC's business model, the operation remains more feasible than underground mining. • The open pit has a lower overall capex and opex.	• Costs are generally much higher than for open pit mining due to a series of shafts and tunnels that has to be developed for purposes of accessing and abstracting the ore. • Higher capex and opex as well as a delayed access to the ore. • In order to stabilise the sidewalls or minimise the dilution, some pre-stripping would be required.
Rehabilitation / Post Closure	• Due to the fact that the open pit will remain post closure (i.e. will not be backfilled), this option is far more economical than block caving. In addition, the open pit is designed and will be engineered in such a way that minimal intervention for stabilisation will be required during the rehabilitation phase. The final void will be made safe on the long term.	• Gravitational and compaction forces will continue to affect the block caving area post closure for the foreseen geological time span. This will result in an unstable localised surface area associated with the block caving operation. Very few mitigation / management measures can be implemented to ensure stability at closure.
Alternative Selected	✓	✗

A detailed assessment was conducted by members of the engineering design team, the client and the environmental team and consensus was reached that an open pit mining method would be the most feasible option to extract diamonds from the Gope deposit.

8.2.2 Site Access: Road (Permanent / Temporary) or Air Access

Various options for site access were considered. However the main options considered were:

- Road access option through the construction of a permanent road upfront, and
- Temporary road during construction phase, with the construction of the permanent road as soon as aggregate becomes available, and
- Air access (fly-in fly-out) option.

Table 53: Comparative Analysis: Road Access (Permanent / Temporary) vs. Air Access.

ASPECT	PERMANENT ACCESS ROAD UPFRONT	TEMPORARY / PERMANENT ACCESS ROAD	AIR ACCESS
Environmental Footprint	• No aggregate from the open pit would be available for this option, resulting in a significant increase in environmental footprint for the opening of extensive borrow pits. • The upgrade of the existing sand tracks would impact positively on the region as a whole. • Will result in a local negative impact (noise, road kill, other) along the length of the route. • Greater geographical extent of impact than the air strip option.	• Aggregate from the open pit can be used, thereby minimising the environmental footprint associated with the construction of dedicated borrow pits. • The upgrade of the existing sand tracks would impact positively on the region as a whole. • Will result in a local negative impact (dust, noise, road kill, other) along the length of the route. • Greater geographical extent of impact than the air strip option.	• Aggregate from the open pit can be used, thereby minimising the environmental footprint associated with the construction of dedicated borrow pits. • Small environmental footprint from the infrastructural point of view. • Local to the Gope Project Site itself.
Practicality	• Highly practical for all logistical requirements pertaining to the project. • Will result in a significant delay in the project start up around one year.	• Practical for all logistical requirements pertaining to the project. There will be some constraints in terms of the early start activities but these can be managed. • No delay to project start up.	• Practical for some components (i.e. people) only. • Not practical for large equipment and supplies. • Shortest construction period, resulting in no delay to project start up.

ASPECT	PERMANENT ACCESS ROAD UPFRONT	TEMPORARY / PERMANENT ACCESS ROAD	AIR ACCESS
Cost	• Excessively high capital expenditure prior to the project generating an income. • Low operating cost. • Significant economic benefit to project affected communities.	• High capital expenditure, but delayed capital input required. • Construction cost lowered due to the availability of aggregate form the open pit. • Medium level operating cost. • Significant economic benefit to project affected communities.	• Lower capital expenditure. • Higher operating cost. • No economic benefit to project communities. • The cost of flying in the bulk material would become prohibitive.
Public Opinion	• Highly desired development.	• Highly desired development.	• Will have no benefit to the communities.
Air Pollution	• Less significant impact.	• Less significant impact.	• Significant impact.
Alternative Selected	✘	✓	✘

8.2.3 Camp: On-Site Single Status vs. Township Outside CKGR, and Township Inside CKGR

The establishment of a township both inside and outside the CKGR were considered. However, due to the fact that the GDMP is located within a Game Reserve, the establishment of a township inside the CKGR was not considered to be viable option as this would result in an increased footprint required and thereby exacerbate the impact upon the game reserve with regard to human encroachment.

The option of establishment of a township outside the game reserve was considered, but the resultant loss of productivity in having to transport people in and out of the reserve on a daily basis proved to onerous upon the project viability. It is clear that this would have created very difficult working conditions for employees, in addition to a significant cost increase in transportation costs, coupled with significantly reduced production time available.

In addition, the establishment of a mine specific township typically leads to the creation of a boom and bust economy that would be detrimental to the project affected community. This is discussed in detail in Appendix 11: Socio-Economic Specialist Study Report. Mitigation and management measures have been instituted to limit this impact based on a single status camp configuration.

Table 54: Comparative Analysis: Single Status Camp vs. Township Inside the CKGR and Township Outside the CKGR.

ASPECT	SINGLE STATUS CAMP (CKGR)	TOWNSHIP OUTSIDE CKGR	TOWNSHIP INSIDE CKGR
Environmental footprint (CKGR specific)	• A very small portion of the MLA is affected as a result of the creation of an onsite accommodation camp. • Controlled settlement.	• Larger footprint required, but would be located outside of the CKGR. • Largely uncontrolled settlement, but is located in a less sensitive area.	• Large footprint required, but inside the CKGR. • Settlement would be semi controlled, but would include a large number of people (families of employees.)
Practicality	• Highly practical. This is the standard in Western Australia, where there has been a boom in mining in remote locations not dissimilar to GDMP.	• Significant loss of production time. • Creation of less than ideal working conditions for employees. • Very high operational costs relating to transportation. • High fatigue issue, impact on safety as significant travel time daily currently 2 to 3 hours each way.	• Highly practical considering the production efficiency. • Would require the construction of all township related social infrastructure (schools, churches, roads, bulk services, shops, etc.) but would create ideal family conditions for employees. • Very high capital and operational costs.
Regional economic impact	• Limitation of positive impact due to limited number of direct multiplier effects during the operational phase. • More manageable situation relating to creation of a project dependent economy. • More sustainable as CSR activities can focus on communities that will continue post mine closure.	• Increased positive multiplier effect as a result of the proximity of the project. • Great impact upon closure of the project. Will lead to a definite boom and bust scenario.	• Limited positive multiplier effect as a result of the proximity of the project. • Great impact upon closure of the project. Will lead to a definite ghost town scenario.
Alternative Selected	✓	✗	✗

Refer to section 8.8.1 for a detailed description of the single status employee accommodation camp.

8.2.4 Shift Configuration

Various options were assessed regarding shift configuration:

- 7 days on / 7 days off;
- 14 Weeks on / 7 days off;
- 10 days on / 5 days off;
- 4 Days on / 4 days off, and

- 1 Month on / 1 month off.

The 2 week on, 1 week off configuration was selected from the parent company, Gem Diamond's experience at other operations around the world. This configuration was selected as it is economically feasible and production is optimised in this manner. In addition, staff at other operations found this to work well relating to their family commitments.

Table 55: Comparative Analysis: Shift Configuration.

ASPECT	7 DAYS ON / 7 DAYS OFF	14 DAYS ON / 7 DAYS OFF	10 DAYS ON / 5 DAYS OFF	4 DAYS ON / 4 DAYS OFF	1 MONTH ON / 1 MONTH OFF
Economic feasibility	• Not practical from a production perspective. It is difficult to rotate these shifts and results in an additional crew being required, and thus is not viable.	• Highly practical. • Increased production efficiency. • The rotation works well with 3 crews.	• Less practical and makes movement of people difficult. • The	• Time frames are too short and interruptive. Therefore not practical.	• Times away from home are too long for employees and will be disruptive to families. It is difficult to rotate these shifts and results in an additional crew being required, and thus is not viable.
Preservation of family relations	• The 7 day break is good.	• The 7 day break is good and allows the individual to rest well prior to going back to work.	• Acceptable, but it is not always possible to head home for such a short duration.	• This sounds ideal if you live close to the mine, but it is not possible to head home for such a short duration if you stay some distance from the mine.	• This is the norm in the shipping industry but would not be practical here.
Productivity	• 7 days is a bit short to really get good continuity.	• This is a good time frame to get stuck into work and the 24 hour break is ideal.	• 10 Days allows for good continuity, but 10 days on night shift can cause fatigue.	• The 4 days on is too short to really get stuck into the work requirements. The trend is to leave work for the next cycle.	• Good continuity initially but towards the end of the month, fatigue does set in.

ASPECT	7 DAYS ON / 7 DAYS OFF	14 DAYS ON / 7 DAYS OFF	10 DAYS ON / 5 DAYS OFF	4 DAYS ON / 4 DAYS OFF	1 MONTH ON / 1 MONTH OFF
Rest Period	• Good rest period	• Good rest period	• Rest period is okay but travelling time might erode some.	• Rest period is too small, especially when travel is taken into account.	• Very good. in fact too good as the trend is for people to find alternative employment for these periods.
Additional travel associated costs	• High.	• Medium.	• High.	• Very high.	• Low.
Alternative Selected	✘	✓	✘	✘	✘

8.2.5 Shift Duration

Various options were assessed regarding shift duration:

- 8 Hour shifts;
- 10 Hour shifts, and
- 12 Hour shifts.

Due to the single status camp configuration, it was decided to optimise the productivity of staff members while on site. In addition, research has shown that employees tend to develop and exhibit social pathologies when housed in single status camps where there is too much time available to them outside of their work hours. In addition, as stated in section 8.2.4 above, this shift duration have been proved effective at other Gem Diamonds operations around the world.

Table 56: Comparative Analysis: Shift Duration.

ASPECT	8 HOUR SHIFTS	10 HOUR SHIFTS	12 HOUR SHIFTS
Economic feasibility / productivity	• Practical. • Would require that more people be employed, thereby significantly increasing the environmental footprint requirements.	• Less practical as there would be a four hour break in production on site.	• Highly practical. • Optimal balance between number of people on site and comfortable working conditions.
Day utilisation	• Good – 24 hour operation possible.	• 4 hours per day lost i.t.o. downtime.	• Good – 24 hour operation possible.
Fatigue	• Low fatigue occurrences as shifts are short.	• Medium fatigue occurrences.	• Fatigue can occur but this is offset by providing relieve operators and having regular breaks.

ASPECT	8 HOUR SHIFTS	10 HOUR SHIFTS	12 HOUR SHIFTS
Potential development of social pathologies	• Very likely, as people will have more free time at their disposal. This is particularly a problem on single status remote camps.	• Less likely, but people will still have ample free time at their disposal.	• Least likely, as people will be occupied with necessary activities for the majority of their time.
Alternative Selected	✘	✘	✓

8.3. LOCATION ALTERNATIVES

8.3.1 Staging Camp and Recruitment Centre

Three options were considered for the combined staging camp and recruitment centre:

- Gaborone;
- Lephepe, and
- Kaudwane.

The Lephepe and Kaudwane options were considered in conjunction with the access route selection process.

Table 57: Comparative Analysis: Recruitment Centre and Staging Camp Location.

ASPECT	GABORONE	LEPHEPE	KAUDWANE
Recruitment catchment	• Largest, but removed from the project.	• Smaller and far removed from the directly affected communities.	• Large catchment and proximate to affected communities.
Social license to operate	• No contribution to social license to operate.	• No contribution to social license to operate.	• Large contribution to social license to operate.
Community	• Limited community members affected by GDMP. • Large feeder community in the surrounding area.	• Limited number of community members affected by GDMP. • Lack of a feeder community in the surrounding area.	• Large number of people removed from Gope are living in Kaudwane. • Feeder community from Lethlakeng and Salajwe
Corporate Social Investment (CSI)	• Not effective for GEC to implement CSI initiatives.	• Little impact from CSI perspective.	• Large impact and ease of effectiveness monitoring of CSI initiatives. • Planned upgrade of the existing clinic for utilisation for pre-employment medical assessments.
Access road and associated infrastructure	• Not relevant.	• Selected option.	• Not preferred.

ASPECT	GABORONE	LEPHEPE	KAUDWANE
Economic feasibility	• Not practical.	• Less practical.	• Practical.
Alternative Selected	✘	✓	✘

8.3.2 Power Line Route

Two alternative power line options were considered, the first option originated from a new substation which would be constructed at Orapa (as discussed in section 4.4.3.6.1 above) and the second from the existing Thamaga substation near Gaborone. These options are described below:

- *Option 1 – Orapa Substation:*
  A new 132 kV Busbar is to be constructed at the new Orapa substation. For reliability of power supply to the Gope Project Site it has been deemed necessary to install two 220/13 2kV Transformers. One 132 kV Feeder Bay will be required. The 132 kV transmission line would be approximately 160 km in length.
- *Option 2 – Thamaga Substation:*
  A 132 kV Feeder Bay would need to be established at the existing Thamaga substation to feed the new Gope substation. The 132 kV Transmission line would be approximately 240 km in length.

It was concluded that due to inadequate infrastructure at Thamaga Substation, the most viable option for project was to use Option 1.

The following alternatives were assessed as part of this evaluation:

- Underground transmission lines where overland transmission lines are considered visually intrusive and affecting sensitive ecological areas. In addition this option was rejected based on the implications of time and cost;
- Consideration of alternative voltages: The supply of lower voltages would not meet the mine consumption demand;
- Consideration of alternative sources of electricity: Alternatives including solar, wind and hydro power were considered but would be prohibitively expensive and is unlikely to be reliable at the quantities required for the operation;
- DC transmission lines which permit narrower Right of Ways (ROWs) were considered, but would only be implementable at a prohibitive cost;
- The use of existing utility and transportation corridors were targeted to reduce impacts by opening new areas;
- Alternative transmission tower design and materials were considered, but none exist in the vicinity of the Gope Project Site, and

- Upgrading existing facilities as an alternative to building new ones: Alternative tower design was consider and the monopole was the design of choice for cost, visual and environmental footprint reasons.

Table 58: Comparative Analysis: Orapa Route vs. Thamaga Route.

ASPECT	ORAPA-GOPE ROUTE	THAMAGA ROUTE
Infrastructure	• Infrastructure associated with this route proved more capable for supporting requirements for the GDMP. • However, an upgrade of some infrastructure will be required.	• Infrastructure associated with this route is not capable of supporting the requirements for the GDMP.
Financial Feasibility	• Feasible, with some upgrade of infrastructure (i.e. substations).	• Not feasible in terms of upgrades on infrastructure (substations, etc.) required.
Land Use	• Land use associated with this route option comprises cattle posts, and hence a lower level of disturbance to people and their way of life. • No expropriation of land is required and an existing road servitude will be widened for the required power line servitude.	• More densely populated areas would be crossed with this route and would require disruption of people's way of life. • Large areas would need to be expropriated for creation of the required servitude.
Alternative Selected	✓	✘

8.3.3 Water Supply – Well Field

Two well field options with respect to the supplementation of water to the processing plant, were considered:

- Upgrading and expanding the existing 'De Beers' well field, located approximately 40 km to the north-east of the GDMP, on the eastern boundary of the CKGR, and
- Developing a new well field within the MLA area.

Based on the findings of the groundwater model undertaken as part of this investigation, a well field within a 5 km radius of the GDMP will be capable of supplying sufficient water to the project. However, the current hydrogeological model is under review and the need for the well field is being re-assessed.

An assessment of the ACC reports was conducted as part of the baseline information collection and review phase of this revision of the SEIA. It was found that De Beers and its consultants were of the opinion that the construction and operation of a well field outside the game reserve boundary would result in the mitigation of environmental impacts associated with the lowering of the groundwater table / abstraction & dewatering activities. The area in which the De Beers well field is located, is populated by various cattle posts that are dependent on groundwater for their existence. At the time of the compilation of this report, no boreholes, other than the GEC owned boreholes existed. Therefore, no existing groundwater users would be impacted as a result of the drawdown cone that will develop around the open pit and well field.

The total area to be impacted as a result of the mine dewatering and well field (within the MLA), will extend to a 16 km radius around the open pit. This enables the impact to be confined to one area, instead of affecting the groundwater table in two geographically distinct aquifer compartments. The aquifer is very deep and does not contribute to the sustainability of the ecosystem:

- No base flow of rivers are provided from groundwater sources, and
- Vegetation is not dependent on the aquifer for growth.

Costs associated with the installation and operation of an off site well field will far exceed those associated with the placement of a well field within the MLA.

Table 59: Comparative Analysis: Well Field Location.

ASPECT	DE BEERS WELL FIELD	WELL FIELD WITHIN GEC MLA
Feasibility of sustained water supply	• Feasible to sustain water supply.	• Feasible to sustain water supply.
Environmental footprint	• The environmental footprint will be spread over two geographically distinct aquifer compartments, as dewatering of the open pit will impact the area associated with the GDMP, while the well field will impact the area within which it is located. • A ~40 km pipeline would be required to move water to the Gope Project Site, resulting in an increase in the environmental footprint. • Additional power infrastructure would be required.	• The environmental footprint will be contained to one, geographically distinct aquifer compartment. • Only a short pipeline, located within the MLA, will be required. • No additional power infrastructure would be required.
Affect on groundwater users	• Will impact cattle post owners / operators that are largely dependent on groundwater for domestic and livestock cultivation use.	• Apart from boreholes owned by GEC, no other boreholes exist at the Gope Project Site.
Draw down cone	• The cone of depression around the well field, based upon the current water requirements of the 6 Mtpa plant, has not been assessed.	• The cone of depression (from as little as 1 m, onward), will extend to a 16 km radius around the open pit.
Impacts on the ecosystem	• Not determined.	• No impact due to depth of the aquifer.
Financial feasibility	• Less feasible as increased capital and operational costs will be experienced as a result of the distance over which pumping is to be conducted.	• Feasible.
Alternative Selected	✘	✓

8.3.4 Acidisation Plant

Acidisation is regarded as an accepted / standard practice in the diamond mining industry for the cleaning of the final product. A risk and feasibility investigation was undertaken to determine the location of the acid plant. The options considered included:

- Establish an acidisation plant at the Gope Project Site as part of the mineral processing facility;
- Construct a dedicated facility for the Gope Project Site in Gaborone, and
- Share an existing facility with another organisation.

GEC has taken a decision to construct the acid plant at the mine site itself. The main reasons for this include:

- Improved security at the mine;
- Lower security costs as there is no requirement to duplicate security at a second site;
- Environmental risks are similar for on-mine and off-mine sites (however, environmental sensitivity may be greater for the on-mine site due to the location of the mine within the CKGR). Management and mitigation measures will be implemented to ensure Best Practice Standards are achieved in the operation of the acidisation plant.
- Safety risks are assessed to be slightly less on mine due to more emphasis on this aspect of the work ethic than in major towns/cities and better management controls;
- Effluent disposal risks are similar for on-mine and off-mine sites;
- Lower manpower requirements, and
- Estimated lower overall costs.

Table 60: Comparative Analysis: Acidisation Plant.

ASPECT	GABORONE	SHARE EXISTING FACILITY	ON SITE
Security	• Practical, but expensive.	• Least practical option.	• Can tie in with mine required security system. • Least costly.
Safety	• Least desired option as exposure in Gaborone would be relevant. • The culture in large cities does not always lend itself to good safety standards., there are also potentially more people at risk.	• Feasible, as safety systems would already be in place.	• Mine sites generally have great emphasis on safety management and control. Exposure can be limited.
Environmental risks	• Less environmental sensitivities due to urban nature of the area.	• Less environmental sensitivities due to urban nature of the area.	• Environmentally sensitive area as it is located within the CKGR.

ASPECT	GABORONE	SHARE EXISTING FACILITY	ON SITE
Effluent disposal	• Similar for all.	• Similar for all.	• Similar for all. • Transport out of CKGR would pose an additional risk, but the volumes are such that it can be managed.
Man power requirements	• High man power requirements.	• Medium man power requirements.	• Limited man power requirements.
Overall cost	• High cost.	• Lowest cost.	• Medium cost.
Availability of Facility	• None available, too be built.	• None available, no other company to share with.	• Easily constructed as part of the plant.
Alternative Selected	✘	✘	✓

8.3.5 Airstrip

During the prospecting activities undertaken at the Gope Project Site, an airstrip was constructed. However, over years of disuse, the airstrip has degraded and is not considered to be in a usable state. Therefore, the potential upgrade of the existing airstrip was assessed in opposition to the construction of a new airstrip.

Engineering investigations were undertaken in this regard to determine the costs associated with the two options. In addition, all the environmental specialists assessed the two sites during their detailed assessments.

However, during the feasibility investigations, it was determined that the land on which the existing airstrip is located, falls outside the MLA and the prospecting rights for the underlying reserve, is held by another company.

The specialist investigations revealed that no environmentally sensitivities are associated with the proposed site for the new airstrip.

Therefore, the existing airstrip will be abandoned by the GDMP and a new strip constructed.

Table 61: Comparative Analysis: Location of Airstrip.

ASPECT	CONSTRUCT NEW	UPGRADE EXISTING
Costs	• Same cost.	• Same cost.
Environmental footprint	• Will entail the disturbance of pristine environment. • However, the proposed area was assessed and no sensitive environmental components were found.	• Limited to the existing footprint. • No environmental sensitivities were found.
Infrastructure placement	• A new air strip will be constructed within the GDMP MLA.	• The existing air strip will be covered with mineralogical waste material.
Land issue	• Within the existing MLA.	• On land with prospecting rights being held by another company.
Alternative Selected	✓	✘

8.4. PROCESS ALTERNATIVES

8.4.1 Throughput Capacity

Different throughput capacities were investigated as part of the engineering feasibility investigation and the deposit has been proved to be capable of supporting up to an 8.0 Mtpa production rate. Although various environmental considerations were taken into account, this was mainly determined based upon the best financially feasible option.

Water supply however, was considered a major limitation. This was assessed (refer to the full hydrogeological report, Appendix 4) and it was determined that the underlying aquifer was capable of supporting the plant water demand at around 6 Mtpa.

Based upon the financial models analysed, the 6 Mtpa option was selected. It has to be noted that as the project develops, increases to the mining rate will be reviewed, and if financially viable and practically achievable, the production rate may be increased.

Table 62: Comparative Analysis: Plant Throughput Capacity.

ASPECT	4 MTPA	5 MTPA	6 MTPA	8 MTPA
Economic feasibility	• Not feasible.	• Not feasible.	• Marginal operation, but feasible with the implementation of the unique Gem Diamonds business mode.	• To be considered as mining operation progresses.

ASPECT	4 MTPA	5 MTPA	6 MTPA	8 MTPA
Water supply	• Very feasible.	• Feasible.	• Feasible.	• Not feasible based on current data available.
LOM	• 20 years – long.	• 17 years – good.	• 15 years – good.	• LOM too short.
Alternative Selected	✘	✘	✓	✘

8.4.2 Mining Equipment – Pre-Strip

Two equipment options for the pre-strip were considered:

- ADTs and excavators, and
- Large frame rigid trucks in combination with shovels.

Table 63: Comparative Analysis: ADTs vs. Rigid Trucks.

ASPECT	ADT	RIGID
Order lead time	• ~ 6 months.	• ~ 12 – 15 months.
Efficiency in soft sandy conditions	• 6 x 6 wheel driven. • Low likelihood of getting stuck resulting in process disruption, lost production, low efficiency, costly damage to the units and low equipment availability. • Will operate within the OEM specification.	• Front wheel driven. • High likelihood of getting stuck resulting in process disruption, lost production, low efficiency, costly damage to the units and low equipment availability. • Will not operate within the OEM specification.
Flexibility	• More flexible as you have more units, allowing for more areas of attack. • Can be utilised for the hard rock mining operations.	• Less flexible due to the size of the equipment.
Site access	• Equipment can be 'walked' to site along the existing roads.	• Will require transportation on special off road flat bed trailers.
Cost of equipment	• Capex is higher / lower? • Opex is 5 – 10 % more expensive.	• Capex is higher / lower? • Opex is less expensive, but uncertain in this application.
Alternative Selected	✓	✘

8.4.3 Primary Crushing

Three alternatives are currently being considered:

- Gyratory crusher;
- Jaw crusher, and
- Mineral sizer.

No final decision had been taken at the time of the compilation of this report and was still subject to detailed assessment.

Table 64: Comparative Analysis: Crushing Options.

ASPECT	GYRATOR CRUSHER	JAW CRUSHER	MINERAL SIZER
Application	• More suited to hard rock materials.	• Suited to hard rock application	• Better suited for softer rock materials.
Cost	• Equipment is expensive. • Operating cost is high. • Require higher tipping bins, thereby increasing haul costs.	• High capital cost, and operating cost. •	• Equipment is less expensive. • Operating costs is lower. • Reduction in the height of the tipping bin reduces haul costs.
Product	• The product is slightly more controlled than a jaw but not ideal for milling.	• By its nature the jaw crusher can produce some very long pieces. • The potential for diamond damage is large.	• The product is more suited to the AG milling process, by virtue of the shape of the product.
Environmental	• Very high dust generation.	• Very high dust generation.	• Significantly reduced dust generation.
Alternative Selected	No decision taken at the time of finalisation of this report. This is under review as the latest Ore dressing studies have indicated a higher strength rock as well as a better understanding of the internal basalt.		

8.4.3.1 Autogenous Milling vs. Conventional Technology

Autogenous milling is considered the preferred option for diamond liberation at the Gope Project Site for the following reasons:

- Effective diamond liberation;
- Minimal diamond damage;
- Better power utilisation;
- Simpler flow sheet;
- Lower capital costs, and
- Lower operating costs.

The two main alternatives that were considered were cone crushing and High Pressure Grinding Rolls (HPGR's). Cone crushing was excluded due to less diamond liberation and greater diamond damage, whilst HPGR's were excluded as they operate better with harder ores and also due to the more complex flow sheet required which would have added considerably to both capital and operating costs.

Table 65: Comparative Analysis: Liberation Technology.

ASPECT	AUTOGENOUS MILLING	CONVENTIONAL TECHNOLOGY
Process	• One process. • 50% of slimes are generated in one pass, making the down stream process much smaller. • One comminution circuit only.	• Three or four processes with many circuits.
Diamond damage	• Unproven but is expected to be lower, due to the nature of the process.	• High diamond damage potential / risk.
Water Consumption	• Lower water consumption overall is expected in the plant	• Higher water consumption is expected.
Power consumption	• Higher.	• Lower.
Cost	• Capex cost is lower. • Opex is small.	• Higher capex cost. • Higher opex cost.
Liberation	• Expected to be higher than conventional technology.	• High liberation.
Technology	• Not proven outside Russia. • Catoca in Angola is also under Russian influence and therefore limited data is available.	• Proven technology.
Environmental	• Same impacts	
Alternative Selected	✓	✘

8.4.4 Diamond Cleaning

The diamond cleaning acid plant will be designed to cater for the use of hydrofluoric acid, nitric acid and hydrochloric acid in the cleaning process. This is essential to maximise the value of the diamonds at the site prior to sale thereby increasing the profitability of the mine. Due to health, safety and environmental risks, the plant will be commissioned without using hydrofluoric acid to assess whether or not the diamond cleaning is adequate without it.

Table 66: Comparative Analysis: Diamond Cleaning vs. Not Cleaning.

ASPECT	DIAMOND CLEANING	NO DIAMOND CLEANING
Cost	• High capital cost for specialist infrastructure construction.	• Elimination of cost.
Final product value	• Significantly higher final product value.	• Lower final product value.
Environmental	• Limited environmental impact, as small quantities of acid will be used. • Best practice standards will be implemented. • All handling of acids take place in a controlled environment (laboratory).	• No environmental impacts are associated with this option.
Alternative Selected	✓	✘

8.4.5 Water Treatment

8.4.5.1 Removal of Elevated Salts

It is proposed that potable water is produced by three, proprietary-design desalination plants using the R.O. process.

Due to the limited treatment technology available for the treatment of dissolved salts, only RO can be utilised and no other alternatives have been considered.

8.4.6 Dust Suppression

Watering of surfaces vs. the use of chemical products was considered.

Water is considered a precious resource in Botswana and is particularly scarce in the vicinity of the Gope Project Site and therefore is to be conserved. In addition, water found in the groundwater aquifer is naturally saline. It is not recommended that the raw water be applied to soil surfaces as a dust suppression, as this will definitely lead to the increase in salts contained in the soils and can have an adverse effect on the ecosystem.

Although much more expensive, than the use of chemical suppressants, biodegradable dust suppressants are to be used.

Table 67: Comparative Analysis: Dust Suppression Options.

ASPECT	WATER	BIODEGRADABLE DUST SUPPRESSANT
Conservation status of resource	• High conservation status.	• Low conservation status as it is a manufactured product.
Environmental	• Negative impact.	• Positive impact, as the
Cost	• High cost, as water would require R.O. treatment prior to application.	• High cost associated with the purchase and application of the suppressants.
Alternative Selected	✘	✓

8.5. INPUT ALTERNATIVES

8.5.1 Water Supply

The only source of water available in the vicinity of the mine site is groundwater. No surface water is available at the Gope Project Site on a permanent basis, as all precipitation infiltrates the sand rapidly. For this reason, there are no surface watercourses at the site.

Other potential water sources proposed during the authority consultation, was the option to obtain water from the nearby natural gas extraction project.

Water availability for the process plant comprises one of the major risks to the success of the GDMP. With this in mind, GEC is committed to the assurance of their water supply. For this reason, the groundwater alternative is regarded as the preferred option.

Table 68: Comparative Analysis: Water Supply.

ASPECT	SURFACE WATER	GROUNDWATER	OTHER
Economic feasibility	• Not applicable.	• Preferred option.	• Unknown, but expected to be prohibitive due to the distance of pumping and infrastructure required.
Reliability of resource.	• No resource available.	• Reliable.	• Reliable, but not within the project proponent's control
Alternative Selected	✘	✓	✘

8.5.2 Acid Type Used

The acid cleaning section has been designed to utilize hydrofluoric, hydrochloric and nitric acid as the main cleaning agents. However it is anticipated that the system will be commissioned using only hydrochloric and nitric acid in order to assess their effectiveness in cleaning the diamonds. If the final product is considered to be adequate for export and sale, then it will not be necessary to use hydrofluoric acid.

This is because hydrofluoric acid is regarded as a highly poisonous and hazardous chemical. The toxic fumes, when inhaled can cause death in a matter of hours. If the acid comes into contact with a person's skin, it will penetrate and attack calcium containing tissue (i.e. bones) as well as soft tissue within a matter of minutes. As little as a few drops can be fatal. However, hydrofluoric acid is highly water soluble and therefore can be effectively diluted easily.

Best practice standards prescribe that any person working with these acids, should do so only under highly controlled circumstances, including a working with the materials contained in a vapour containment system, with heavy duty gloves and wearing eye protection. In addition, calcium gluconate gel is to be stored in the acid room and the medical facility at the Gope Project Site will be suitably equipped to treat persons exposed to hydrofluoric acid.

8.5.3 Power Supply: Bulk Power vs. Diesel Power

During the construction phase and until BPC has completed the power line infrastructure, the operation will utilise diesel generators for power supply. Due to the uncertainties surrounding electrical power availability in the Southern African region at the time of this investigation, a decision has been taken that the infrastructure will remain on site as an alternative source of electricity in cases of load shedding or other incidents of non-supply.

However, it is not practical for the operation to run on diesel generated power alone during the operation phase.

Table 69: Comparative Analysis: Power Supply.

ASPECT	BULK POWER	DIESEL GENERATORS
Economic feasibility	• High capital cost (~ P700 million). • Low operational cost.	• Lower capital cost (~ P20 million). • High operational cost (~ P100 million / annum).
Environmental	• Low environmental impact. • Positive socio-economic impact.	• High environmental impact from a resource consumption and green house gas contribution point of view.
Alternative Selected	✓	✘

8.6. ROUTING ALTERNATIVES

8.6.1 Power Line

The proposed 132 kV power line will originate from Orapa with two proposed alternative routes under consideration:

- Route alternative 1 will run adjacent to the road from Orapa to the CKGR boundary in a south-westerly direction, where on reaching the CKGR boundary, continues along the fire break in a south-easterly direction, until reaching the Gope / De Beers road. The power line will then run parallel to the mine construction road in a westerly direction until reaching the Gope Project Site.
- Route alternative 2 will run directly along the same route from Orapa to the CKGR fire break, however on reaching the CKGR boundary it continues in a straight line to the Gope Project Site in a south-westerly direction.

Table 70: Comparative Analysis: Power Supply Route.

ASPECT	ROUTE ALTERNATIVE 1	ROUTE ALTERNATIVE 2
Economic feasibility	• Higher capital cost due to increased distance.	• Lower capital cost.
Environmental	• Same environmental impacts. • Larger footprint due to increased distance.	• Same environmental impacts. • Smaller footprint due to shorter distance.
Alternative Selected	✘	✓

8.6.2 Access Road Route

Two routes, namely the Kaudwane-Gope route and the Lephepe-Gope route, indicated in Figure 62 were assessed by EHES (Pty) Ltd in an environmental screening and assessment investigation.

Option 1: Kaudwane-Gope Route

The road starts from Letlhakeng traversing some cattle posts, settled areas and ploughing fields to Kaudwane. At Kaudwane, three options were proposed as depicted in Figure 62; the three options are discussed below:

Option1a: The first option of the Kaudwane-Gope route avoids going through KGR (dark blue route), it passes through Kaudwane village then straight into CKGR and joins the existing road to Gope almost halfway between Gope mine and Khutse gate. This option would require a new gate into CKGR.

Option 1b: The second option will avoid going through Khutse gate. This route follows a pipe line (dotted red line), then branches from the main road going to the KGR gate just after Kaudwane village following a waterline to the old camp, then enters KGR on the east side of the KGR gate, about 5.07 km from the gate. This proposed route used to be the road entering the KGR before the current gate was built. Choosing this route would require a new gate into the KGR.

Option 1c: The third alternative route goes through the existing Kaudwane road into KGR (grey line) through the tourist gate and then joins the road to the mine site.

It was determined that option 1c would not be a suitable route for mine traffic, as tourists utilises this route on a regular basis. In addition, the gate has been constructed for passenger vehicle traffic and would require considerable modification in order accommodate mine related vehicles and abnormal loads.

Option 1b passes the old KGR camp which is regularly used by educational groups. If this option were selected, the camp would have to be completely relocated, implying a further impact upon the KGR.

Option 1a has the advantage of not traversing the KGR at all and accesses the CKGR directly from Kaudwane. This will imply that GEC would have to construct their own gate into the CKGR. This is advantageous, mine related traffic will be completely separated from the traditional tourist routes and the KGR gate.

Three initial borrow pit sites were identified along this route and is discussed in section 4.4.3.3.4.

Option 2: Lephepe-Gope Route

The road runs from an intersection with the existing surfaced road at Lephepe, then along the cut line up to the border of the CKGR. It then runs along the unfenced edge of the CKGR for 110 km before turning west (45 km) into the CKGR along the old De Beers road. The route terminates at a prominent tree located to the south of the original De Beers excavations. The road is estimated at a length of 150 km from Lephepe turn-off to Gope.

This alignment has already been by CPP Botswana on contract from GEC. In summary, a road width of 7 m comprising a 5 m carriage and two 1 m shoulders of gravel was adopted. A road design speed of 80 km/hr was recommended. From initial consultations with the DWNP, it is not likely that the 80 km/hr design speed will be acceptable within the CKGR, but will be acceptable for the portion of the road located outside the CKGR.

Ten borrow pit sites were identified along this route and is discussed in section 4.4.3.3.4.

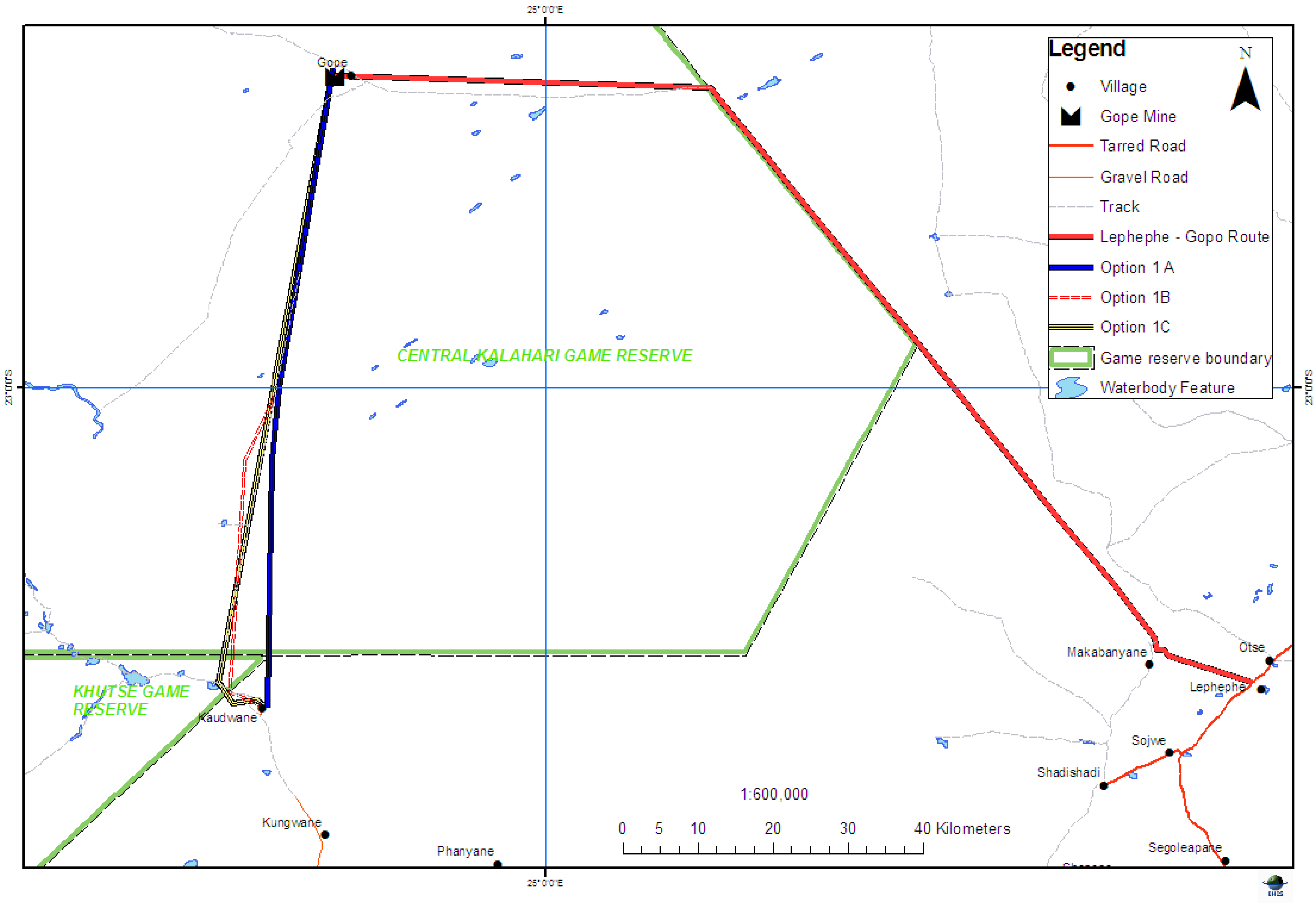


Figure 62: Access Road Route Options Investigated

Route Selection

EHES performed a route selection assessment based on environmental screening. The Botswana Roads Department Guideline No.5 was used for ranking the potential impacts as Large, Medium and Small / low value as indicated in Table 71:

Table 71: Botswana Roads Department, Guideline No. 5 Ranking Values.

VALUE RANK	EXPLANATION
Large value	Areas protected by law or zoning e.g. Habitats of engendered species, areas or assets of national or great local importance such as national parks or Kgotla and areas of high vulnerability
Medium value	Regionally important areas or areas which are considered to be important locally and of medium vulnerability
Small / low value	Locally important areas and areas of low Vulnerability

The following findings were presented by EHES.

Table 72: Environmental Screening Findings.

CRITERIA	OPTION 1		OPTION 2	
	OCCURANCE	RANKING	OCCURANCE	RANKING
Loss of vegetation	✓	Large	✓	Small
Soil erosion	✓	Large	✓	Medium
Noise pollution	✓	Large	✓	Small
Surface water pollution	✓	Small	✓	Small
Generation of waste	✓	Medium	✓	Medium
Creation of borrow pits	✓	Large	✓	Small
Game poaching	✓	Large	✓	Large
Disturbance of wild animals	✓	Large	✓	Medium
Speeding vehicles leading to animal deaths	✓	Large	✓	Large
Air Pollution	✓	Medium	✓	Medium
Traffic hazards to livestock	✓	Small	✓	Large
Destruction of animal habitats	✓	Large	✓	Small
Potential groundwater pollution	✓	Small	✓	Small

CRITERIA	OPTION 1		OPTION 2	
	OCCURANCE	RANKING	OCCURANCE	RANKING
Interruption with social amenities	✓	Medium	✓	Small
Health impacts	✓	Large	✓	Large
Construction of squatter camps	✓	Medium	✓	Small
Livestock theft across districts	✓	Small	✓	Small
Road traversing protected areas	✓	Large	✓	Small
Time spent within protected areas	✓	Large	✓	Small
Traffic Hazards	✓	Large	✓	Medium

Bio-physical and socio-economic impacts were assessed for both routes, as is outlined below.

ENVIRONMENTAL ASPECT	ENVIRONMENTAL SIGNIFICANCE RATING		BRD RANK VALUE		MITIGATION / ENHANCEMENT POSSIBLE?		ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION	
	OPTION 1 KAUDWANE	OPTION 2 LEPHEPE	OPTION 1	OPTION 2	OPTION 1	OPTION 2	OPTION 1	OPTION 2
Construction Phase:								
Loss of vegetation (-)	Moderate (56)	Low (24)	Large	Small	✓	✓	Low	Low
Soil erosion (-)	Low (27)	Moderate (60)	Large	Medium	✓	✓	Low	Low
Noise pollution (-)	High (70)	Low (24)	Large	Small	✓	✓	Medium	Low
Air pollution (-)	Moderate (55)	Moderate (60)	Medium	Medium	✓	✓	Low	Low
Groundwater contamination (-)	Low (12)	Low (12)	Small	Small	✓	✓	Low	Low
Waste generation (-)	Moderate (40)	Moderate (48)	Medium	Medium	✓	✓	Low	Low
Gravel material for construction (-)	Moderate (60)	Low (22)	Large	Small	✓	✓	Moderate	Low
Disturbance to wildlife (-)	Moderate (60)	Moderate (40)	Large	Medium	✓	✓	Low	Moderate
Game poaching (-)	Moderate (60)	High (75)	Large	Large	✓	✓	Low	Moderate
Employment creation (+)	Large (+++)	Large (+++)	-	-	✓	✓	-	-
Boost to local economy (+)	Large (+++)	Large (+++)	-	-	✓	✓	-	-

ENVIRONMENTAL ASPECT	ENVIRONMENTAL SIGNIFICANCE RATING		BRD RANK VALUE		MITIGATION / ENHANCEMENT POSSIBLE?		ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION	
	OPTION 1 KAUDWANE	OPTION 2 LEPHEPE	OPTION 1	OPTION 2	OPTION 1	OPTION 2	OPTION 1	OPTION 2
Traffic hazard to pedestrians, livestock & other road users (-)	Low (16)	Low (16)	Large	Medium	✓	✓	Low	Low
Interruption of access to social amenities (-)	Low (16)	Low (12)	Medium	Small	✓	✓	Low	Low
Health impacts (-)	High (64)	High (72)	Large	Large	✓	✓	Moderate	Moderate
Benefit to farmers along the road(+)	-	Large (+++)	-	-	-	✓	-	-
Operational Phase:								
Vehicles speeding beyond the stipulated 40 km/h (-)	Moderate (60)	Low (33)	-	-	✓	✓	High	Moderate
Increased road accidents (all) (-)	Moderate (60)	Moderate (60)	Medium	Large	✓	✓	Low	Low
Generation of dust (-)	Moderate (52)	Low (36)	Medium	Medium	✓	✓	Low	Low
Social ills (-)	Moderate (60)	Moderate (60)	Large	Large	✓	✓	-	-
Boost to local economy (+)	Large (+++)	Large (+++)	-	-	-	✗	-	-

ENVIRONMENTAL ASPECT	ENVIRONMENTAL SIGNIFICANCE RATING		BRD RANK VALUE		MITIGATION / ENHANCEMENT POSSIBLE?		ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION	
	OPTION 1 KAUDWANE	OPTION 2 LEPHEPE	OPTION 1	OPTION 2	OPTION 1	OPTION 2	OPTION 1	OPTION 2
Increase in land value (+)	Large (+++)	Large (+++)	-	-	-	-	-	-
Provision of unimpeded movement (+)	Large (+++)	-	-	-	-	-	-	-
Number of impacts assessed	22	22						
Total score[33]	-219	-265						

[33] The total score reflects the application of the Marsh methodology, as no numerical quantification of the positive impacts were undertaken by EHES.

EHES concluded in their assessment of the access road route options that the Lephepe-Gope route would be the preferred option to access the Gope Project Site.

During the initial stakeholder consultation process, each community / village consulted expressed a range of motivations on why the access road should be constructed through their village. Corporate Social Initiatives have been detailed in Section 6.18.7.3 and Section 10.2.2.15 of this report and will be relevant to directly affected communities.

The alternatives assessment included the economic trade off study conducted by the project proponent in terms of capital and operational expenditure associated with the two route options. Due to the significantly longer route associated with the Lephepe-Gope option, the capital and operational cost of this route would be much higher than the Kaudwane-Gope route option.

The third major motivation for the project proponent to favour the Kaudwane option, was the significantly larger unskilled and semi-skilled labour pool available in Kaudwane as compared to Lephepe and surrounds. However, regardless of the route selection being decided upon as being via Lephepe, Kaudwane residents will not be excluded from the recruitment process, but would be required to travel to the GEC recruitment centre in Lephepe for their final interview and pre-employment medical, as outlined in Section 4.4.3.4.

However, during the Governmental Stakeholder review workshop, Marsh were requested by the DWNP to assess the CKGR Draft Management Plan (DWNP, July 2002) as well as The Vision of the CKGR and KGR (DWNP, May 2003) and align the route selection with the land use zones as detailed in the reports. It has to be noted that neither of the afore-mentioned documents have been approved, but finalisation is pending upon negotiations between the Government of Botswana and Basarwa communities. DWNP confirmed that the plans serve as the guide to management of the two reserves as provided for in the DWNP legislation.

The following objectives have been outlined in the plan:

- To conserve the biodiversity of the game reserves;
- To manage the reserves in ways that will maintain their unique, largely unspoilt wilderness character;
- To obtain the optimum sustainable benefits from the reserves for the people of Botswana;
- To provide and regulate appropriate recreational and tourism services including the provision of suitable infrastructure;
- To ensure that local communities are able to benefit from the sustainable, non-consumptive, utilisation of wildlife resources and to try to minimise conflicts between communities and the reserves;
- To provide opportunities for the education and awareness of the public in general and school children in particular;

- To provide for the advancement of scientific knowledge through the coordination of scientific research, and
- To periodically revise the plan and adapt it to improved knowledge, experience and changing circumstances.

The route from Kaudwane to Gope traverses both the Kaudwane Community Use Zone, with the aim for this area being "sustainable use by adjacent communities", as well as the Low Density Tourism Zone, with the aim for this area being "conservation and low impact, low volume tourism", as outlined in the zonation map (p.37 of the CKGR Draft Management Plan). The Vision states that 'the plan describes how the capacity of the reserves for tourism will be increased'. The area falls within the classification of a 'core zone' with the objective of land use being conservation and tourism, aiming at the maintenance of 'a pristine wilderness quality of the natural environment'.

In Section 5: Zonation of the Reserves (p. 34 of the CKGR Draft Management Plan), it is stated that a survey revealed that tourists are attracted to the reserves for the following reasons: "It is the solitude, pristine conditions and wilderness experience that make the CKGR / Khutse desirable as a tourist destination. Recent surveys of visitor opinions have all shown that the tourists are attracted to the area *because* it is undeveloped and they want to get away from other people. They particularly like the idea that they are far away from the nearest person. Therefore, great care must be taken to develop the reserves in ways that will not spoil this attraction". And: "It is therefore important to realise that just a few vehicles can make some parts of the reserves seem quite crowded".

The CKGR and KGR have been classified as a World Commission on Protected Areas (IUCN) Category IV and can be described as a "Habitat / Species Management Area: A protected area managed mainly for conservation through management intervention". The IUCN believes that "exploration and extraction of mineral resources are incompatible with the purposes of protected areas corresponding to IUCN Protected Area Management Categories I to IV, and should therefore be prohibited by law or other effective means" (IUCN, 1999b, Appendix 6 of the CKGR Draft Management Plan).

In addition to the strong motivation and focus on the development of tourism in an unspoilt environment, mining and mineral prospecting has been identified as a threat to the effective implementation of the plan (refer to Section 6.2.2, p. 38 of the Draft CKGR Management Plan).

However, the CKGR Draft Management Plan does not preclude development and stipulates in Section 4.11 that EIA's are to be undertaken for any new developments within the CKGR and further states that "…the EIA should be checked and studied by appropriate DWNP and NCSA staff and the development should go ahead only if the EIA concludes that any impact is acceptable and that the recommended mitigation measures are followed" (p.31).

Therefore, despite GEC proposing various management and mitigation measures associated with the Kaudwane-Gope access road option, the use of the Lephepe-Gope route will result in the total negation of all impacts associated with mining vehicles upon tourism in the southern CKGR and KGR on route from Kaudwane to Gope. The selection of the Lephepe-Gope access road options therefore supports the unhindered implementation of macro planning undertaken to date by the DWNP in the KGR and immediately adjacent area of the CKGR, along the Kaudwane-Gope route.

Should other mines be developed in future in the south-eastern section of the CKGR, the Lephepe-Gope route could serve such operations as well, eliminating further requirements for access roads through the KGR and southern CKGR, thereby further assisting the DWNP in preserving tourism in the said areas.

A final decision regarding the access road was taken in early August 2008 by the Ministry of Environment, Wildlife and Tourism, concluding that the access road for the GDMP should avoid the Kaudwane route and follow the Lephepe route option. A decision which supports the EHES reccommenation. Based on the above points, as well as the study of EHES, Marsh supports this proposal.

8.7. LAYOUT ALTERNATIVES

8.7.1 Camp Location

Various options for the camp location were considered according to the prevailing wind direction, noise generation from the plant and proximity to the plant for employee access. A location, north-east of the plant was deemed most suitable.

8.8. DESIGN ALTERNATIVES

8.8.1 Standard Accommodation

Various options pertaining to the format of accommodation were investigated during the feasibility investigation, including:

- Hot bedding;
- Dormitory style accommodation;
- Shared accommodation, and
- One man per room.

Table 73: Comparative Analysis: Standard Accommodation.

ASPECT	HOT BEDDING	DORMITORY	SHARED ACCOMMODATION	ONE MAN PER ROOM
Cost	• Lowest cost as the lowest number of accommodation units is required and a very high residential density is achieved.	• Low cost as a low number of accommodation units are required and a high residential density is achieved.	• Medium cost as a number of accommodation units are required and a medium residential density occurs.	• High cost as a large number of accommodation units is required and a low residential density occurs.
Environmental footprint	• The smallest environmental footprint.	• Small environmental footprint.	• Medium sized environmental footprint.	• Large environmental footprint.
Health	• Very poor health conditions may result as many people share sleeping and ablution facilities.	• Poor health conditions may result as many people are living in very close proximity to each other.	• Health risks are significantly reduced.	• Lowest health risks apply with this type of accommodation.
Shift interference	• High as there are people from all shifts in proximity and thus difficult to get a good nights rest.	• High as there are people from all shifts in proximity and thus difficult to get a good nights rest.	• This can be mitigated if the two people or on different shifts.	• One room per person therefore no interference from other people, can get a good nights rest.
Personal privacy	• Very limited personal privacy and no safe place to retreat to as all facilities are shared.	• Limited personal privacy and limited place for retreat as facilities are largely shared.	• Medium level of personal privacy. An area restricted to certain persons is available for retreat.	• Excellent personal privacy and own space for personal retreat is available.
Sense of belonging	• It is difficult to belong when you do not have any space to call your own, and you share you bed	• Again this is difficult to belong when there are many people always around and you do not have your space.	• People will start to feel like they belong but there is that little bit of lack of privacy which is always there.	• People feel that they have their own space, their privacy is respected and they feel welcomed.
Retention of staff	• Poor due to substandard living conditions.	• Poor due to substandard living conditions.	• Good as living standards are acceptable but always an issue about privacy.	• Very good as living standards are of a high quality. And people have their own space.
Enabling mine values	• Poor as people may feel that they are not valued members of the organisation as reflected in their living conditions.	• Better than for hot bedding, but people still do not feel adequately treated / cared for.	• Good, as people feel valued as employees, as reflected in their living conditions.	• Very good, as it is evident to people that they are valued as employees and adequately treated / cared for.

ASPECT	HOT BEDDING	DORMITORY	SHARED ACCOMMODATION	ONE MAN PER ROOM
Social pathology development	• High risk of the development of social pathologies due to the dense living conditions.	• Lower risk than hot bedding, but still have a high risk of the development of social pathologies.	• Low risk of the development of social pathologies, as people has a place of safety to retreat to.	• Low risk of the development of social pathologies, as people has a place of safety to retreat to.
Alternative Selected	✘	✘	✘	✓

8.8.2 Mine Residue Deposits

Three mine residue deposits will be constructed at the proposed mine:

- Waste rock dump;
- Slimes dam, and
- Tailings management facility.

Alternative considerations for the mine residue deposits are detailed below.

8.8.2.1 Dumping Configuration: Waste Rock-Sand Berm and Separate Sand Dump and WRD

The GDMP operations will generate two types of waste rock material for disposal:

- Sand overburden, and
- Waste rock, comprising mainly basalt.

The first and most cost effective option is to create a conventional waste rock is through a haul and tipping operation. The most cost effective way of dumping is to have a separate sand overburden dump closest to the exit ramps from the pit. This could be constructed using a conveyor, thereby ensuring that costs be kept to a minimum during the construction phase while the mine is not producing diamonds.

Due to the sensitive nature of the area in which the project is located, an investigation was conducted to use the waste rock and sand overburden material to create a berm that could act as a visual barrier between the game reserve and the mining operation. To this effect, the waste rock dump could be shaped around the south-east edge of the mining operation. Sand removed during the initial stripping operation could be dumped on the inner circumference of the dump during 2008 – 2009 assuming that construction commences during late 2008.

Thereafter, sand stripped in order to access the ore could be hauled to the outer circumference of the dump and placed during 2010 to 2014. The engineering designs were altered to follow this pattern in order for environmental rehabilitation of the outer slope of the waste rock dump to commence as soon as possible in order to minimise visual impacts. During years 2010 – 2023 basalt material will be placed in the centre of the two outer layers of sand material for final disposal.

However, an assessment of tourist movement through the CKGR, revealed that the majority of activity was concentrated in the south-western section of the game reserve. Therefore, the waste structures were re-orientated to shield the operation from the south-western vantage point (refer to Figure 5 for the final mine layout). This option was also considered favourably with regard to the dust generation impact as it relates to the positioning of the accommodation camp.

Table 74: Comparative Analysis: Dump Configuration: Waste-Sand Berm and Separate Sand Dump and WRD

ASPECT	WASTE-SAND BERM	SEPARATE STRUCTURES
Visual barrier	• Sufficiently screens the operations from the public view.	• Sufficiently screens the operations from the public view.
Environmental	• This option would result in an increased risk of significant dust generation due to the fact that large areas would face the prevailing wind.	• Reduced dust generation risk. • Conveying can be used, which has a nett benefit w.r.t. environmental consideration.
Economic feasibility	• Very expensive as the number of trucks required to dump the sand around the berm, would increase significantly resulting in a significantly increased capital cost as well as operational costs.	• Most feasible and suitable for conveying, which is a cheaper option and is much more energy efficient.
Alternative Selected	✘	✓

8.8.2.2 Mine Residue Deposit Height

Initial criteria stipulated by the environmental team stated that the mine residue deposits (including the TMF, slimes dam and waste rock dumps) should be no more than 20 m high in order to attempt to limit the visual impact of the operation on the CKGR. Designs were generated but showed that this would impact significantly on the footprint of the operation, for example result in a TMF of 21 km in length. In order to mitigate the expected large footprint, a decision was taken to increase the height of the facility to 40 m. This reduced the footprint to 83 ha for the TMF. In addition, it was found in the VIA, that the mine will barely be visible from a distance of 15 km.

Table 75: Comparative Analysis: Mine Residue Deposit Height.

ASPECT	20 M	40 – 50 M

ASPECT	20 M	40 – 50 M
Visual barrier	• Visible from 10 km.	• Visible from 15 km.
Environmental footprint	• Extensive environmental footprint.	• Significantly reduced environmental footprint.
Economic feasibility	• Least feasible.	• Feasible.
Alternative Selected	✘	✓

8.8.3 Aggregate Material

Different options were assessed for aggregate material that is to be used for the surfacing of the roads (access, haul and internal roads), fill material and other construction requirements:

- Calcrete surfacing from borrow pits;
- Using basalt material from the open pit, and
- Importation of surface material from regional commercial sources.

Upon analysis, it became evident that the importation of material would not be feasible due to the remote nature of the site, as the costs would be prohibitive. Therefore, borrow pits were identified along the access route and at the Gope Project Site itself. The identified borrow pits are depicted in Figure 10.

Basalt material will only become available during 2010 and can then be used for the surfacing of roads resulting in the minimisation of the GDMPs environmental footprint.

Therefore, a combination of the above stated alternatives will be implemented.

Table 76: Comparative Analysis: Aggregate Material.

ASPECT	BASALT	CALCRETE	IMPORTED MATERIAL
Economic feasibility	• Highly feasible.	• Highly feasible.	• Not feasible.
Availability of material	• Available from 2010 onwards.	• Available immediately.	• Available immediately.
Environmental footprint	• No additional environmental footprint.	• Additional environmental footprint.	• Not assessed.
Alternative Selected	✓	✓	✘

8.8.4 Buildings and Accommodation

Due to the fact that the Gope Project Site is located within the CKGR, consideration was given to the nature of the buildings erected:

- Permanent / brick and mortar buildings, or
- Prefabricated (non-asbestos containing) buildings.

Table 77: Comparative Analysis: Buildings and Accommodation.

ASPECT	PERMANENT STRUCTURES	PREFABRICATED STRUCTURES
Environmental footprint	• Larger environmental footprint required for the construction of brick & mortar buildings.	• Smaller environmental footprint required for the erection of temporary structure.
Post closure	• Permanent structure will generate more building rubble at the decommissioning phase and would likely result in the disposal of such wastes on site.	• Temporary structures can be removed easily be removed from the site for recycling and/or off-site disposal.
Visual impact	• Permanent structures will result in a greater visual impact.	• Temporary structures will result in less intrusive visual impacts.
Financial feasibility	• Less feasible.	• More feasible.
Alternative Selected	✗	✓

8.8.5 Post Closure Land Use

Post closure land use is still to be determined. However, it has been established that stakeholders would prefer that some infrastructure remained post closure. This would include some of the accommodation units, dining hall, recreation facilities and potentially other, service related infrastructure (i.e. sewage, water purification). Communities have expressed that the water supply infrastructure would be required to remain post closure.

The Department of Wildlife have expressed an interest in taking ownership of the remaining infrastructure post closure, in order to establish a camp for members of their department within the CKGR.

For these reasons, stakeholder consultation would be required as the GDMP nears the cessation of operation to determine the exact post closure land use. The rehabilitation plan (refer to section 10.7.3) outlines measures that are to be implemented upon the completion of these negotiations.

Table 78: Comparative Analysis: Post Closure Land Use.

ASPECT	TOTAL REMEDIATION	HAND OVER TO 3RD PARTY
Optimisation of resources	• No post closure optimisation.	• Post closure optimisation of resources (structures).

ASPECT	TOTAL REMEDIATION	HAND OVER TO 3RD PARTY
Cost	• Prohibitive. Will render the project completely unfeasible.	• Significant, but feasible.
Alternative Selected	✘	✓

8.9. THE "NO PROJECT" OPTION

The "No-Project" alternative constitutes the continuation of the status quo conditions of the proposed development site, therefore inherently implying that no mining or any activities related thereto will ensue. The rationale for the inclusion of the "No-Project" alternative in the comparative assessment is to provide a baseline against which to assess the relative impacts associated with alternatives considered during the investigation.

Should this alternative be decided on by the authorities during the decision-making process the following is probable:

- The environmental status quo will prevail and none of the potential environmental impacts identified during the environmental assessment process will occur. The SEIA investigation therefore can be seen to amount to a report detailing mitigation and management measures pertaining to the environment.
- During the stakeholder engagement process as well as the economic investigation undertaken as a part of this study, a great need for economic development was identified in each of the local communities. The proposed mining operations will result in a significant positive economic benefit on a regional and a national level. Should the "No Project" option be selected, the economic benefits forthcoming from diamond mining will not materialise.
- The social status quo will remain in the local communities.

Table 79: Comparative Analysis: Project vs. No-Project Option.

ASPECT	PROJECT OPTION	NO-PROJECT OPTION
Geology	• Impacted permanently. However, should the geology not be impacted the resource cannot be mined and therefore no benefit derived from the ore resource.	• Geology will remain in tack and the resource un-utilised.
Soils	• Soils will be disturbed across areas affected by the mining, mining infrastructure, road and power line infrastructure. • These impacts can be mitigated through soil preservation methods. Upon rehabilitation, soils will be replaced and ameliorated prior to re-vegetation of the areas taking place.	• Soils will remain unaffected.
Land Capability & Land Use	• Land capability and land use will change permanently at the Gope Project Site and along the power line and access road.	• Land capability and land use will remain unaffected.
Natural Vegetation	• Natural vegetation will be disturbed at the Gope Project Site and along the access and power line routes. • All effort has been made to develop suitable mitigation, management and rehabilitation measures for implementation in order to mitigate these impacts. • Rehabilitation will be ongoing from the end of the construction phase until closure in order to mitigate the significance of this impact.	• Vegetation will remain in tact.
Animal Life	• Animal life will be disturbed at the Gope Project Site and along the access and power line routes. • All effort has been made to develop suitable mitigation, management and rehabilitation measures for implementation in order to mitigate these impacts. • Rehabilitation will be ongoing from the end of the construction phase until closure in order to mitigate the significance of this impact.	• Animal life will remain uninterrupted.
Surface Water	• No significant impacts are expected upon surface water due to the absence of any prominent surface water features associated with the Gope Project Site. • Along both the access road and power line, the infrastructure was routed around surface water features in order to ensure that they are not impacted.	• No surface water features will be disrupted.

ASPECT	PROJECT OPTION	NO-PROJECT OPTION
Groundwater.	• Groundwater will be impacted by the mining operation only. • There are no other groundwater users in the vicinity of the Gope Project Site. • Suitable mitigation and management measures have been implemented to minimise the impact that the operation will have on the environment.	• Groundwater will not be affected and will remain untapped.
Air Quality	• Air quality impacts associated with the Gope Project Site, power line and access route are all expected to be temporary in duration. • Suitable mitigation and management measures have been implemented to minimise the impact that the operation will have on the environment. • Ongoing rehabilitation commencing from the end of the construction phase have been developed in order to further mitigate the generation of dust at the GDMP.	• Air quality will remain as is.
Noise & Vibration	• Noise and vibration associated with the project is expected to be of a temporary nature. • Suitable mitigation and management measures have been implemented to minimise the impact that the operation will have on the environment. • The mineralogical waste structures have been placed on the perimeter of the Gope Project Site as far as is practicable in order to mitigate the noise impact upon the receiving environment. • Blasts will be designed by a suitably qualified engineer in order to adhere to acceptable blasting standards.	• Noise and vibration levels will remain unaffected.
Archaeology & Heritage	• Only one grave site will be directly impacted by the GDMP. • The grave will be removed through the acceptable practices post extensive consultation with the family. • Other graves that may suffer secondary impacts will be fenced and the key to the gate given to the family of the deceased. • Some old san settlements will be destroyed by the construction activities of the mine. • Three of these sites will be mapped and recorded using acceptable archaeological methods.	• No sites will be impacted.

ASPECT	PROJECT OPTION	NO-PROJECT OPTION
Visual	• The visual impact of the mine will be noticeable from 15 km from the Gope Project Site. • This impact has been mitigated through the placement of the mineralogical waste structures on the perimeter of the Gope Project Site as far as is practicable in order to screen the mining activities from the site. • Ongoing re-vegetation will be practices in order to ensure that the dumps blend with the surrounding environment as far as is possible.	• No visual impacts will be relevant.
Waste	• Various wastes will be generated by the mine, construction of the power line and access road. • A comprehensive waste management plan has been developed for implementation in order to ensure the mitigation of potential impacts upon the receiving environment.	• No wastes will be generated.
Socio-Economic	• Various social benefits as well as negative impacts will result from the GDMP. • Most negative impacts (apart form HIV/Aids) can be mitigated and benefits enhanced. • GEC is committed to the establishment of a Community Trust where the company with work with the community to ensure long term sustainable projects associated with the GDMP. • A detailed Community Action Plan will be developed and implemented in order to mitigate any negative impacts appropriately. • The directly affected communities, region and country as a whole will receive significant economic benefit from the development of the GDMP.	• The directly affected communities will remain unaffected and will not have an opportunity to derive any socio-economic and infrastructure benefits from a project of this nature.
Summary	None of the impacts identified during the course of the social and environmental impact assessment cannot be adequately mitigated or managed. No fatal flaws have been found attaching to the GDMP.	Should the project not proceed, no benefits will accrue to either the directly affected communities, the region or the country of Botswana.
Alternative Selected	✓	✗

SECTION 9. SOCIAL AND ENVIRONMENTAL IMPACT ASSESSMENT (SEIA)

This section of the report includes a description of the expected environmental impacts that will result from the proposed mine development and an evaluation of these impacts in terms of their significance. The assessment is predominantly informed by the impacts identified as part of specialised investigations is based on the following:

- Professional judgment and specialist assessment;
- Public participation;
- Physical and simulations or maps, and
- Past experience.

The expected environmental impacts were then rated in terms of its potential extent, duration probability and significance. The purpose of this assessment is to determine the significance of impact associated with the proposed development and to determine whether adverse impacts could be mitigated to acceptable standards.

Impacts have been identified for each of the phases of the proposed mining operation and the mine site, power line and road has been evaluated separately. The phases are set out as follows:

<u>Gope Project Site (Mine)</u>

- Construction Phase;
- Operational Phase, and
- Decommissioning and Rehabilitation Phase.

<u>Power Line</u>

- Construction Phase, and
- Operational Phase.

No decommissioning of the power line is expected and was therefore not assessed as part of this report.

<u>Access Road</u>

- Construction Phase, and
- Operational Phase.

No decommissioning of the access road is expected and was therefore not assessed as part of this report.

A cumulative impact assessment has been undertaken in order to evaluate the changes to the environment that are caused by activities in combination and when considered with other past, present and possible development future activities.

9.1. IDENTIFIED SOCIAL AND ENVIRONMENTAL IMPACTS

9.2. MINE SITE

9.2.1 Construction Phase

The construction phase will progress over a period of approximately 3 years and will include the construction of various facilities at the GDMP, the clearing and maintenance of the access road as well as the construction of the power line. This section details the anticipated impacts that may result from the proposed activities to be undertaken during this phase of the project.

9.2.1.1 Geology

During the course of the construction phase, the soils (topsoil and subsoil) and deep Aeolian sands will be impacted as a result of the stripping of the sand overburden to access the Kimberlite ore. In addition, foundations will be dug or drilled into the sands to accommodate the infrastructure that will need to be erected within the cleared footprint (top and subsoils will have been removed). Very little soft rock (Karoo Beds – Calcareous and Siliceous units) and hard rock geology (Stormberg Lavas) will be impacted upon during this phase of the project.

9.2.1.2 Soils

In the course of the construction phase, the following activities will potentially impact on the soils environment:

- Stripping and chipping of the large vegetation for the sand dump, TMF, WRD, slimes dam, inclusive of the two RWDs and open pit footprints and the required pipelines, conveyer routes, access and haulage roads and the mineral processing plant areas;
- Clearing of small shrubs and veld grasses (vegetation) in conjunction with the topsoils as part of the site preparation activities;
- The construction of the barrier layer for the footprints of the top and subsoil stockpiles with a layer of compacted sand, and
- The possible spillage of materials (hydrocarbons as well as natural by-products) during haulage / transportation activities.

The impact on the topsoils in all of the cases listed will be significant in the long term. Similarly, the impact upon the subsoils is expected to also be significant in the long term.

The silty and sandy loams that cover the majority of the areas that are planned to be disturbed are relatively sensitive to compaction and to a lesser degree to erosion. These soils are generally well drained, and can be worked in both the wet (not ideal) and dry state without impacting the structure of the soil to any great degree. However, the slightly more clay rich soils and slightly structured hydromorphic soils, are more susceptible to structural deformation, and the formation of clods on drying out, and will compact much more readily.

Compaction must be considered carefully in the working of the areas planned for development. The well drained silty and sandy loams are not as sensitive as the more clay rich, and drainage impaired soils, but will still need to be managed. The working of the wet based soils when wet will be detrimental, and compaction will occur. The structure of the soil will affect their workability, and provision will need to be made for the timing of the rehabilitation works to be undertaken if these soils are to be utilized.

9.2.1.3 Land Capability

Impact of mining activities on land capability will include, but are not necessarily confined to the removal of all large vegetation in the directly impacted areas. This will reduce the land capability from sensitive grazing land to "mining land" or at best very sensitive wilderness / conservation land.

9.2.1.4 Land Use

The impacts of mechanical earth moving equipment and mining associated activities will incur damage to the natural habitat and reduce the land use within the fenced off mining area to "mining land".

The impact of mining activities on the land use will include, but is not necessarily confined to the conversion of all areas within the fenced off Gope Project Site to mining land. No grazing, browsing or any natural activities will continue during the construction phase.

9.2.1.5 Flora

9.2.1.5.1 Loss / Degradation of Pristine Vegetation / Habitat

The effect of this impact is twofold, namely on the Gope Project Site specifically as well as on the status of the CKGR. During the construction phase all vegetation will be completely decimated in the areas that will be directly impacted. These effects are regarded permanent and recovery or mitigation thereof is not possible. The flora of the Gope Project Site per se is not regarded sensitive as no significant species or habitat types were identified during the site investigation.

The development will also be contained within the boundary of the MLA and only unforeseen events might result in the loss of small, additional portions of natural habitat.

However, the most significant aspect of the proposed development from the consideration of flora as an environmental aspect is the fact that the mining site is located within the CKGR. The proposed development comprises only a small portion of the CKGR, but the presence of a mining area within the CKGR are regarded a significant impact on the status of the CKGR as a pristine habitat. Approval of this mining operation is regarded to be the 'thin end of the wedge' for other mining projects and developments that will eventually and inevitably result in cumulative and deleterious impacts in the greater CKGR.

9.2.1.5.2 Alteration of Natural Ecological Processes / Ecosystem Functioning

It could be accepted that all ecological processes and existing ecosystems on the Gope Project Site will cease to function as a result of the severity of the impact. Ecosystems and processes are dependent on the natural status of the area; the complete removal of all vegetation, topsoil, severe surface disturbances across the directly affected areas coupled with the erection of mining infrastructure, totally negates any possibility of some ecosystem functioning remaining on the site. These impacts will however be confined to the Gope Project Site and at most to the MLA, and limited effects will be noted in adjacent areas. Mitigation of these effects is not possible.

9.2.1.5.3 Introduction of Species not Associated with the Region

Alien and invasive species represent a significant threat to the natural biodiversity of the region. The transformation of natural habitat during the proposed activity, the permanent presence of personnel and vehicles at the GDMP as well as the frequent travel between the Gope Project Site and areas outside the CKGR will inevitably result in the presence of species that are not considered representative of the region, particularly along the perimeter of all areas of impact. As a result of the severity of transformation in the MLA, surrounding areas are also frequently invaded by shrubs and woody species that are not associated with the region (invasive and exotic species), or the increase of species that occur naturally in the region, but at lower abundance values (encroacher species). The effect of alien and invasive species, once established, can reach astronomical proportions that could potentially affect the vegetation on a regional scale.

Ways in which this impact generally occurs include the local production of fruits and vegetables in small gardens, plants imported for aesthetic purposes, seeds trapped in mud underneath cars and in radiators, etc. Mitigation of this impact is, to a large extent possible by means of preventative measures. However, in the event of invasive species becoming a significant problem, mitigation becomes costly and difficult.

9.2.1.5.4 Changes in Vegetation Dynamics

Since all vegetation will be removed from the directly affected areas of the Gope Project Site, it could be accepted that little vegetation dynamics will remain at the GDMP. While some impacts might affect vegetation dynamics of surrounding areas, this impact is however expected to be confined to the site itself and limited effects will be noted in adjacent areas. Mitigation of these effects is not possible. Prevention of the spread of this impact to surrounding areas is possible through containment.

9.2.1.5.5 Impacts on Sensitive Habitat Types

No sensitive environments were observed within the mining site and the threat of this impact is fairly low. However, some sensitive areas were observed outside the boundary of the MLA and the possibility does exist that these areas might be affected by non-mining activities such as irresponsible access and uncontrolled activities. The likelihood of this happening is low and it can be mitigated against.

9.2.1.6 Fauna

9.2.1.6.1 Potential Loss or Degradation of Pristine Faunal Habitat

The loss or degradation of pristine faunal habitat within the Gope Project Site, although restricted in area, will be total and for at least the LOM. The potential for complete restoration of these habitats is very low and the loss of habitat is certain to happen if the proposed mining goes ahead. Hence the significance value of -14 (a negative impact of great significance to the local area of the GDMP) is expected. No mitigation is possible within the framework of the mining operation and for the duration of the construction phase.

9.2.1.6.2 Alterations of Natural Ecosystem Functioning and the Disruption of Localised Large Mammal Migration Routes

Large mammals within the CKGR roam over large areas to find water and grazing / prey – the destruction of a significant area within the CKGR in terms of faunal habitat and the fencing of such an area that restrict movement of large mammals as well as the creation of large areas of surface water in an area where water is a scarce commodity, is likely to have a significant impact on the natural ecosystem functioning as well as local migration routes of large mammals. No mitigation is possible within the framework of the mining operation and for the duration of the construction phase.

9.2.1.6.3 Increase of Poaching, Snaring and Trapping of Animals

This impact is relevant to the areas surrounding the GDMP and if left unchecked, it could be a serious impact on the local wildlife, especially on species resident to the local area that does not migrate over large areas (such as Steenbok). It is possible to mitigate this impact effectively through the implementation of suitable mitigation measures.

9.2.1.6.4 Impact of Chemical Compounds Used During Construction on Animals

The leaching of hazardous materials into the sandy soils of the Gope Project Site could potentially have a significant impact on the animal communities of the surrounding areas. It could influence vegetation growth and groundwater quality and hence impact significantly on the animals of the region. This impact is easily mitigated by stopping the leaching of such chemicals into the soils and subsequently the groundwater. Expand on section

9.2.1.6.5 Attraction of Animals to Large Surface Water Areas

The creation of the slimes dam and RWDs, as well as any other areas of open surface water is likely to attract animals to Gope Project Site. The impact on the animals itself as well as the surrounding environment is likely to be significant and last for the duration of the LOM. The impact is difficult to mitigate due to the size of the areas of open water, however effectively fencing these areas could keep large mammals from the water but not birds. The impact is likely to be significant in intensity, duration and probability.

9.2.1.6.6 Loss of Small Animals to Introduced Faunal Species

Domestic cats and dogs could potentially kill many small mammals and birds in the vicinity of the GDMP. This is easily mitigated by disallowing any pets to be brought into the CKGR and the Gope Project Site.

9.2.1.7 Surface Water

9.2.1.7.1 Impact of the Initial Topsoil Stripping Activities

During construction activities, various areas will be stripped of topsoil and vegetation to allow the bulk earthworks to commence. Typically the main areas affected will be the open pit area, the plant area and the sand dump area, although there will also be impacts at the TMF, WRD, and slimes dam. Because vegetation will be stripped from the area of construction, these activities could result in additional erosion by both water and wind. This will result in increased suspended solids content of water draining off the site.

The initial dump formations will also increase the risk of increased suspended solids due to the fact that the slopes will not be immediately sustainable, requiring time for new vegetation to establish or mitigatory measures to be put in place. However, because the area is endoreic and there are no dams or water courses that are directly affected, the impact will be confined to the localised area potentially affecting vegetation growth in areas where sand is deposited by water. Further, the occurrence of rainfall is generally erratic, so that wind erosion is probably the more significant risk factor. Nevertheless, the potential impact of surface water release to the surrounding receiving environment is assessed negative, affecting the local extent (potentially outside the site boundary), of low duration (in terms of the construction phase), the impact is definite and of an average intensity (natural processes will continue in a modified way).

9.2.1.8 Groundwater

The proposed GDMP has the potential to impact on the groundwater regime in the following ways:

- Depletion of the aquifer and lowering of the groundwater table, and
- Deterioration of the groundwater quality.

During the construction phase the dewatering boreholes around the pit will be established and dewatering will commence towards the end of the construction phase. Should it become evident that an additional well field be required to adequately supply the plant demand, the well field boreholes may also be drilled during this phase. It is not expected that pumping of the well field boreholes will be done during the construction phase, as the water volumes from the dewatering boreholes will be sufficient to meet the plant demand.

During the construction phase the waste and sewage management systems will be put in place. No adverse impacts are expected, but teething problems with waste management system may be encountered.

9.2.1.9 Air Quality

During the construction assessment phase it is expected that the main sources of impact will result due to the construction of roads, plant area and sand stripping operations. A qualitative description of the impacts are provided and involves the identification of possible sources of emissions and the provision of details related to their impacts.

Construction will consists of a series of different operations, each with its own duration and potential for dust generation. Dust emission will vary from day to day depending on the phase of construction, the level of activity, and the prevailing meteorological conditions (USEPA, 1996).

The following possible sources of fugitive dust have been identified as activities which could potentially generate dust during construction operations in the mining areas:

- Creation and Grading of Haul Roads:
  - Scraping;
  - Debris handling;
  - Debris stockpiles, and
  - Truck transport and dumping of debris.

- Preparation of plant area:
  - Clearing of area for infrastructure;
  - Debris handling;
  - Debris stockpiles, and
  - Truck transport and dumping of debris.

- Pre-strip of sand overburden material:
  - Initial cut for in pit mining operations.

9.2.1.9.1 Creation and Grading of Haul Roads

Haul roads are constructed by the removal of overlying topsoil, whereby the exposed surface is graded to provide a smooth compacted surface for vehicles to drive on. Material removed is to be stored in stockpiles close to areas where they can be used for rehabilitation purposes.

A large amount of dust emissions are generated by vehicle traffic over these temporary unpaved roads (USEPA, 1996). A positive correlation exists between the amount of dust generated (during vehicle entrainment) and the silt content of the soil as well as the speed and size of construction vehicles. Additionally, the higher the moisture content of the soil the lower the amount of dust generated.

9.2.1.9.2 Preparation of Areas Identified for the Construction of the Plant and Supporting Infrastructure.

Removal of material usually takes place with a bulldozer, extracted material is then stored in piles for later use during rehabilitation procedures. Fugitive dust is generated during the extraction and removal of overlying material, as well as from wind blown dust generated from cleared land and exposed material stockpiles. Dust problems can also be generated during the transportation of the extracted material, usually by truck, to the stockpiles. This dust can take the form of entrainment from the vehicle itself or due to dust blown from the back of the trucks during transportation.

To avoid the generation of unnecessary dust, material drop height should be reduced and material storage piles should be protected from wind erosion. This can take the form of wind breaks, water sprays or vegetation of piles. It should be noted that emissions generated by wind are also dependent on the frequency of disturbance of the erodible surface. Each time material is added to or removed from a storage pile or surface, the potential for erosion by wind is restored. Any crusting of the surface binds the erodible material (USEPA, 1996). Dust created during the transportation can be limited by watering the road sections that are being used.

9.2.1.9.3 Preparation of the Open Pit Mining Areas

Open pit mining will start with the pre-stripping of the sand overburden material. This will involve the removal of topsoil, and overburden by front end loader in order to gain access to the mineral bearing ore. Material that cannot be removed using the equipment on site, may be blasted. Bulldozing, drilling and blasting operations can result in the liberation of significant quantities of dust to atmosphere.

Dust liberated during bulldozing activity can be reduced by increasing the moisture content of the material being removed. An attempt should be made to coincide blasting operations with periods when poor atmospheric dispersion is expected i.e. early morning and late evening.

The removed topsoil will have to be transported to a designated collection point from where it can be recovered later during site rehabilitation. Likewise, waste rock removed from the pit will have to be discarded at a dedicated waste rock pile.

9.2.1.9.4 Overview of Potential Impacts

The following components of the environment may be impacted upon during the construction phase:

- Ambient air quality;
- Local residents and neighbouring communities;
- Employees;
- The aesthetic environment, and
- Possibly fauna and flora.

The impact on air quality and air pollution of fugitive dust is dependent on the quantity and drift potential of the dust particles (USEPA, 1996). Large particles settle out near the source causing a local nuisance problem. Fine particles can be dispersed over much greater distances. Fugitive dust may have significant adverse impacts such as reduced visibility, soiling of buildings and materials, reduced growth and production in vegetation and may affect sensitive industries and aesthetics. Fugitive dust can also adversely affect human health. It is important to note that impacts will be of a temporary nature, only occurring during the construction period.

Given the short duration and low level of activity expected during construction, but bearing in mind that no quantitative emission figures exist, no significant adverse impacts are anticipated on any sensitive receptors. Impact of fugitive dust emissions on employees on site could however be significant during the construction phase, but will vary between phases, with level of activity and meteorological conditions.

9.2.1.10 Noise

During the construction phase, impacts concerning noise will involve the following:

- Increased ambient noise levels due to:
  - Construction activities (mine and other associated infrastructure);
  - Diesel generators;
  - Increased vehicular flow;
  - Air traffic flow (aircraft & helicopter), and
  - Periodic blasting as part of sand stripping activities.

During the construction phase, impacts cause by blasting will involve the following:

- Vibrations as a result of blasting calcrete layers, which may cause disruption to sensitive fauna, employees & resident communities, and
- Impacts on building foundation stability as a result of the blasting activities.

Construction noise and blasting impacts associated with the GDMP are considered to be of medium significance.

9.2.1.11 Sites of Archaeological and Cultural Interest

This phase is associated with the construction of the GDMP's surface infrastructure and works and as a result is envisaged to have the highest levels of impact on the located sites. Direct primary impact (i.e. destruction of the sites) can be expected for 1 grave site and 13 settlements located during the field investigations. The direct individual impact of each surface component on the sites is summarized below:

Table 80: Expected Impacts upon Graves

GRAVE NUMBER	LOCATION	DIRECTLY IMPACTED?	EXPECTED IMPACT
Tcamm 1	Located within the WRD footprint.	✓	Destruction of grave without mitigation measures.
Tcamm 2	Located in close proximity to the WRD and inside the Gope Project Site.	✘	Secondary impacts expected.
Tcamm 3	Located in close proximity to the WRD and inside the Gope Project Site.	✘	Secondary impacts expected.
Tcamm 4	Located in the vicinity of the access road.	✘	Secondary impacts expected.
Tcamm 6	Located in close proximity to the WRD and inside the Gope Project Site.	✘	Secondary impacts expected.
Tcamm 10	Located within the fenced area of the Gope Project Site.	✘	Secondary impacts expected.

The following Aya's will be impacted upon:

Table 81: Expected Impacts upon Settlements (Aya's)

AYA NUMBER	LOCATION IN RELATION TO PLANNED INFRASTRUCTURE	DIRECTLY IMPACTED / NOT	EXPECTED IMPACT
Aya 1	Located within footprint of WRD.	✓	Destruction of the site.
Aya 2	Located in very close proximity to the WRD.	✘	Secondary impacts expected.
Aya 3	Located in vicinity to the access road.	✘	Secondary impacts expected.
Aya 4	Located outside MLA.	✘	No impacts expected.
Aya 5	Located inside the Gope Project Area.	✘	Secondary impacts expected.
Aya 6	Located within footprint of WRD.	✓	Destruction of the site.
Aya 7	Located inside the Gope Project Area.	✘	Secondary impacts expected.
Aya 8	Located outside the Gope Project Area, but inside the MLA.	✘	No impacts expected, but secondary impacts are possible.
Aya 9	Located in close proximity to the sand dump.	✘	Secondary impacts expected.
Aya 10	Located within the Gope Project Site.	✘	Secondary impacts expected.
Aya 11	Located within the footprint of the sand dump.	✓	Destruction of the site.
Aya 12	Located outside the MLA.	✘	No impacts expected.
Aya 13	Located outside the MLA.	✘	No impacts expected.
Aya 14	Located in close proximity to the sand dump.	✓	Secondary impacts expected.
Aya 15	Located within the footprint of the sand dump.	✓	Destruction of the site.
Aya 16	Located within the Gope Project Site.	✘	Secondary impacts expected.
Aya 17	Located in the crater stockpile / sand dump footprint.	✓	Destruction of the site.

AYA NUMBER	LOCATION IN RELATION TO PLANNED INFRASTRUCTURE	DIRECTLY IMPACTED / NOT	EXPECTED IMPACT
Aya 18	Located on the fence of the Gope Project Site.	✘	Secondary impacts expected.
Aya 19	Located within the footprint of the sand dump.	✓	Destruction of the site.
Aya 20	Located outside the Gope Project Area, but inside the MLA.	✘	No impacts expected, but secondary impacts are possible.
Aya 21	Located outside the Gope Project Area, but inside the MLA.	✘	No impacts expected, but secondary impacts are possible.
Aya 22	Located outside the Gope Project Area, but inside the MLA.	✘	No impacts expected, but secondary impacts are possible.
Aya 23	Located within the footprint of the accommodation camp.	✓	Destruction of the site.
Aya 24	Located outside the Gope Project Area, but inside the MLA.	✘	No impacts expected, but secondary impacts are possible.
Aya 25	Located in close proximity to the WRD.	✘	Secondary impacts expected.
Aya 26	Located in close proximity to the WRD.	✘	Secondary impacts expected.
Aya 27	Located outside the Gope Project Area, but inside the MLA.	✘	No impacts expected, but secondary impacts are possible.
Aya 28	Located within footprint of WRD.	✓	Destruction of the site.
Aya 29	Located within footprint of WRD.	✓	Destruction of the site.
Aya 30	Located within footprint of WRD.	✓	Destruction of the site.
Aya 31	Located within footprint of WRD.	✓	Destruction of the site.
Aya 32	Located outside the Gope Project Area, but inside the MLA.	✘	No impacts expected, but secondary impacts are possible.
Aya 33	Located outside the Gope Project Area, but inside the MLA.	✘	No impacts expected, but secondary impacts are possible.
Aya 34	Located outside the Gope Project Area, but inside the MLA.	✘	No impacts expected, but secondary impacts are possible.
Aya 35	Located outside the Gope Project Area, but inside the MLA.	✘	No impacts expected, but secondary impacts are possible.
Aya 36	Located outside the Gope Project Area, but inside the MLA.	✘	No impacts expected, but secondary impacts are possible.
Aya 37	Located outside MLA.	✘	No impacts expected.
Aya 38	Located in close proximity to the WRD.	✓	Secondary impacts expected.

A total of 9 sites (4 settlements and 5 graves) fall outside of the MLA and no impacts of any kind are expected on these sites.

9.2.1.12 Visual

Based on the visual simulation undertaken it is can concluded that the visual visibility of the proposed mining activity is low at a distance of 15 km and further, but could be regarded as a high impact when the proposed mine site is viewed from 10 km and closer.

Based on the baseline analysis undertaken during the ESS report, limited visual preceptors are present in the area and the general distance from the route tourist route from Khutse to the northern extent of the game reserve is too great to cause significant visual impact.

9.2.1.12.1 Landscape Capacity

Based on the baseline assessment, the landscape character of the CKGR is monotonous and thus the character is represented well. The character is, in the absence of stakeholder comments, regarded as high as the proposed mine will be situated in a game reserve. As previously stated, this section of the game reserve is not regularly visited by tourists thereby rendering the value less that that of the northern sector of the game reserve.

Tourist travelling through the game reserve will not necessarily notice the mining operation as the route from Khutse to the northern sector is more that 15 km from the Gope Project Site.

9.2.1.12.2 Landscape Value

As previously stated, few visitors travel to this section of the game reserve though the proposed mine site is located within a game reserve. However, the landscape value may be high as it has the potential to develop as a tourist destination.

9.2.1.12.3 Cumulative Landscape Sensitivity

Based on the above, the following proposed methodology, as published by the Countryside Agency is implemented to assess the landscape sensitivity cumulatively.

Landscape and visual sensitivity refers to the general visibility of the proposed activity and the scope to mitigate the visual effect. Based on the visual simulations, is can be concluded that the mining operations loose its significant visibility at 15 km. Sensitive receptors located within this radius may include, tourists (regarded as a low probability) and people who may choose the relocate to Gope. It is further concluded that the landscape has a high landscape capacity due to the broad extent of the landscape type.

Measures to mitigate the potential impact of the mining operation are limited to the restriction of the height of the mineralogical waste structures and measures to re-vegetate the final slopes.

Therefore the landscape character sensitivity is noted as medium and the visual sensitivity as low. It is important to note that the visual sensitivity is regarded as low due to the absence of sensitive receptors.

Landscape Character Sensitivity	Visual Sensitivity: Low	Visual Sensitivity: Medium	Visual Sensitivity: High
High	High	High	High
Medium	Medium	Medium	High
Low	Low	Medium	High

Landscape Sensitivity	Landscape Value: Low	Landscape Value: Medium	Landscape Value: High
High	High	High	High
Medium	Medium	Medium	High
Low	Low	Medium	High

Figure 63: Sensitivity Analysis.

It is therefore concluded that the landscape character is sensitive to change and that the proposed GDMP will have a significant visual impact on the visual landscape environment.

9.2.1.13 Waste Management

The handling, storage, transportation and disposal of wastes have the potential to cause several impacts that may affect the environment as well as staff and members of the public. There are increased risks associated with the management of hazardous wastes.

The major impacts are associated with the operational phase of the mine. These impacts are summarised in this section, and impacts associated with the construction phase highlighted.

Impacts include:

- Contamination of soil, groundwater and surface water (hazardous wastes):
  - Hazardous waste, if not handled and stored in the suitably constructed areas in which the ground is protected, may seep into the surrounding soils, and
  - Wastes of concern in the construction phase include oils and greases that may be generated from the operation and maintenance of the construction vehicles. As there will not be formalised waste facilities on site during the initial stages of the construction phase, there is a greater risk of spills of uncontained hazardous wastes.
- Consumption of landfill space:

  The final disposal of waste to landfill (general or hazardous landfill) results in the consumption of landfill space which is considered a resource. The impacts associated with the landfills include:
  - Groundwater contamination;
  - Odour;
  - Litter, and
  - Restrictions in land uses for landfill (once closed) and surrounding buffer zone.

Careful planning is required to prevent the unnecessary generation of waste that requires land filling.

- Litter:

  The inappropriate control of waste can result in the generation of litter, which can be injurious to animals (ingestion, constriction), and may also create a negative visual impact. As the Gope Project Site is situated in a game reserve, litter is more noticeable and requires more detailed management.
- Odour:

  Unhygienic conditions and waste that is not disposed of timeously can create malodours emissions that present health risks, and which may attract animals and pests creating further health risks).
- Health impacts to staff and public (hazardous wastes):

  Where hazardous wastes are not controlled adequately (on-site or off-site), staff and members of the public may be exposed to hazardous waste resulting in potential health related impacts.

The benefits of recycling are encouraged and are considered a preferred waste management practice to land filling. The following positive impacts are associated with recycling:

- Avoiding consumption of landfill space;
- Avoids depletion of resources (renewable and non-renewable), and
- Reduction in all impacts relating to the extracting, processing and transportation of virgin raw materials to the manufacturer (who has replaced a percentage of virgin materials with recycled materials).

9.2.1.14 Social Impacts

9.2.1.14.1 Employment

It is likely that employment benefits will accrue to local communities only with regard to unskilled labour contributions to road, local infrastructure, and power line road and associated infrastructure construction, and even this will exclude all CKGR settlements except Gope (the next closest location is 66 km away). Mine construction benefits are extremely uncertain, principally because the community members that were previously living at the Gope Project Site have only now started to return to the area after winning the right to return to the CKGR. It is extremely doubtful that these members will have the requisite skills for mine construction, with roles likely limited to unskilled labour provision on an irregular basis at best, unless proactive actions are taken.

9.2.1.14.2 HIV/AIDS

Almost all key informants, quantitative questionnaire respondents, and qualitative discussion participants were concerned that construction associated with the mine would significantly increase the risk of HIV infection. Qualitative findings in particular suggest that these concerns are warranted, and that poor knowledge, behavioural norms and economic vulnerabilities will increase the number of new infections. Remoteness, poor nutrition, and alcohol abuse exacerbate the situation, making any response to increased HIV infection especially difficult in directly-affected communities, even in the context of the remarkable gains made by the country in Anti-Retroviral drugs (ARV) roll-out and nutritional support. There are many other associated problems, including negative attitudes towards condoms, transactional sex work, and disrupted social networks that make women in particular more vulnerable. HIV&AIDS impacts on local communities associated with mine and mine-related infrastructure construction, therefore, are expected to be severe.

9.2.1.14.3 Employment System

Many respondents raised concerns about the impacts of long absences from home on home life, and on job satisfaction. The two-weeks-on-one-week-off work shift configuration was felt to result in minimum disruption.

Having said this, a number of the respondents admitted concerns about this shift work cycle on the possible non-return to the GDMP of locally employed residents. Past work experience, particularly on commercial farms and commercialised ranches on communal farms, highlighted a tendency to work for relatively short periods of time before returning home, and only returning to work when additional monies were needed. For construction-related employment for unskilled workers, the impacts of such tendencies can likely be managed, but this will not work for semi-skilled and skilled workers for construction, nor for permanent employees at the GDMP during operations.

9.2.1.14.4 Gope Residents

The return of former Gope residents to the mine site itself does not change the situation per se, as former residents were already considered as directly-affected persons. However, given that a community is now established at the Gope Project Site, specific mitigatory and enhancement actions are required that protect the newly re-established community from the negative effects of the GDMP's construction and operations. Of particular concern is the likelihood of informal settlements developing at the Gope Project Site that do not comprise former Gope residents. While the protected area status of the CKGR would normally be expected to provide protection from such a development, the CKGR is largely unfenced, the intended establishment of the mine is well known, and Batswana have an established history of migration to seek formal employment. The arrival of non-residents at the Gope Project Site could well overwhelm local resources, and raise numerous problems in the community.

9.2.1.14.5 Services for Workers

Should the policies associated with the operation of the mine be implemented in full by GEC, and should recommended and agreed means of impact mitigation noted in the SEIA be followed, significant benefits would be expected for those working on the mine. It is especially important that the mine proceed with recommended recreational activities that will provide entertainment beyond alcohol consumption.

9.2.1.14.6 Gender

It is likely that gender stereotypes are well entrenched. Without a specific focus on increasing female employment at the mine, and during construction, it is likely that most employees will be male.

The arrival of men with money in Kaudwane on a bi-weekly basis raises a number of concerns about the impacts this will have on gender relations in the community. There are considerable fears in this respect, associated with a variety of social pathologies.

9.2.1.15 Regional Socio-Economic Structure

In general mining and mining project development could result in the following positive impacts:

9.2.1.15.1 Opening Up of Communities

Large mining investments increasingly open up remote areas, such as Kaudwane, where local communities are often outside the economic mainstream of the national economy. In general this result in increased economic opportunities such as the sale of food, operating restaurants, sale of soft drinks, alcohol and other.

9.2.1.15.2 Increase the National GDP

The development of the GDMP will extend the current economic base of the district, region and national economy – contributing positively towards the economic contribution (GDP) of the various levels of economies. It will also extend and strengthen the trade sector in terms of exports and imports of the economies. Government income also increases due to mineral taxes.

9.2.1.15.3 Create Employment Opportunities

The GDMP will provide the opportunity of development of forward and backward linkages (multiplier effect) catering for the demands of the industry as well as the community in the affected villages and towns.

9.2.1.15.4 Alleviating Poverty

Increased employment opportunities will result in an increase of community income in the area, resulting in the alleviation of poverty.

9.2.1.15.5 Increased Access to Infrastructure

The GDMP will also result in improved levels of infrastructure development ranging from roads, to houses, social, health and educational facilities. This will improve access to services in areas where limited to no access existed.

9.2.1.15.6 Skills Development

Mining developments have increased social responsibilities reflected in the provision of specific health and educational facilities and training programmes. This empowers the local communities to be absorbed within the local economy.

9.2.1.15.7 Provide Additional Opportunities to the Informal Sector and Local Entrepreneurs

This sector will contribute to catering for the demands of the source town and workers of the mine.

9.2.1.15.8 Increased Government Commitment

With more economic activity in the area government could provide underlying social and business infrastructure to the source town.

The following negative impacts are associated with mine development and operation:

9.2.1.15.9 Establishment of Unplanned Settlements / Squatting

A number of the people may move to the affected Gope area in search of casual or other employment opportunities, which might lead to squatting around the Gope Project Site.

9.2.1.15.10 Infiltration of People

Movement of people into mining areas are also a problem. Besides increased pressures on infrastructure and housing in these areas it reflects the fact that new employment are not created but result in the relocation of employed people.

9.2.1.15.11 Lack of Coordination

Almost all mining proponents indicate a commitment towards social and economic development for surrounding communities. However, in several cases commitment is not followed through. This can largely be ascribed to a lack of communication and commitment from relevant authorities and investors refraining from direct dealings with local communities.

9.2.2 Operational Phase

9.2.2.1 Geology

During the course of the operation, the geology of both the soft rock (sands, compacted sands and sediments as well as evaporates – calcrete) and the hard rock (basalts and Kimberlite) will be impacted. During the operational phase, the sand stripping operation will continue to impact upon sub- and topsoil removal, as well as the removal of the second phase split shell's sand overburden and crater material. In addition, the ore zone and surrounding country rock will be mined out and permanently removed from the ground.

9.2.2.2 Soils

During the operational phase, the following activities will potentially impact on the soils environment:

- Maintenance of topsoil stockpiles;
- Maintenance of haulage and access roads;
- Erosion control on stockpiled and rehabilitated areas;
- Control of compaction on rehabilitated areas;
- Rehabilitation of completed areas;
- Dust suppression and control;
- Spillage from materials and product haulage, and
- Reagent spillage.

The activities that will potentially impact on the soil environment during the operational phase will include, the on-going use of and maintenance of the haulage and access roads, the maintenance of the soils stockpiles created during the construction phase, the potential for erosion due to wind and water impacts on the stored soils and cleared ground, the suppression of dust and suspended solids and possible loss of soils, and the management of spillage of materials (soils) product (Kimberlite and waste rock) and reagents (oils and fuels).

The on-going mining of the ore-body and the need for soils to be stripped in order to expose the viable materials will continue to impact on the topsoils and subsoils in the open pit footprint.

In addition, the haulage and access roadways, dam walls and storm water control facilities will be impacted due to use in the operation, and on-going maintenance will be needed throughout the operation.

Erosion and the potential for compaction of the soils while in storage, the existence of potentially un-vegetated ground being exposed to the elements during the operational phase, and the need to separate clean and dirty water in controlled but open berm / channel systems, will all have an effect on the soils environment. The stockpiles, TMF, sand dump and slimes dam will need to be managed for erosion and the potential for compaction.

The creation of dust due to the haulage of raw materials and product by road, the crushing of the ore and associated materials, and the potential for spillage of both product as well as contaminants from fuelled vehicles will all impact on the soils environment.

9.2.2.3 Land Capability

During the operational phase there will no added impacts. The Gope Project Site will have been fenced off, and all land within the proclaimed mining area will be considered to be of a “mining” or conservation status.

9.2.2.4 Land Use

During the operational phase there will no added impacts. The affected area will have been fenced off, and all land within the proclaimed mining area will be considered to be of a “mining” land use.

9.2.2.5 Flora

9.2.2.5.1 Loss / Degradation of Pristine Vegetation / Habitat

This impact is mostly limited to the construction phase and only in selected events will additional areas be affected adversely. These events cannot be foreseen at this stage and will most likely include uncontrolled activities. However, the effect of these events will be similar in nature and extent to the initial clearing of vegetation from the Gope Project Site. While the effects are regarded permanent and recovery or mitigation thereof is not possible, the prevention is regarded the important issue.

9.2.2.5.2 Alteration of Natural Ecological Processes / Ecosystem Functioning

This impact is mostly limited to the construction phase while the operational phase is not expected to contribute significantly to the increase or spread of the effects associated with this impact. However, uncontrolled activities in surrounding areas are expected to influence surrounds to the mining area adversely and the effects from this impact in surrounding areas are similar in nature and extent to those of the construction phase. From experience these impacts are expected to happen over the LOM.

9.2.2.5.3 Introduction of Species not Associated with the Region

This impact is expected to be most prominent during the operational phase of the GDMP, which is at this stage expected to be in the order of 17 years. During this period the infiltration of alien and invasive species are expected occur, most likely at a slow rate, but inevitably. The prolonged presence of personnel and vehicles on the site as well as the frequent travel between the Gope Project Site and areas outside the CKGR will inevitably result in the presence of species that are not considered representative of the region, particularly along the perimeter of all areas of impacts. As a result of the severity of transformation in the MLA, surrounding areas are also frequently invaded by shrubs and woody species that are not associated with the region (invasive and exotic species), or the increase of species that occur naturally in the region, but at lower abundance values (encroacher species). The effect of alien and invasive species, once established, can reach astronomical proportions that could potentially affect the vegetation on a regional scale.

Ways in which this impact generally occurs include the local production of fruits and vegetables in small gardens, plants imported for aesthetic purposes, seeds trapped in mud underneath cars and in radiators, etc. Mitigation of this impact is, to a large extent, possible by means of preventative measures. However, in the event of invasive species becoming a significant problem, mitigation becomes costly and difficult.

9.2.2.5.4 Changes in Vegetation Dynamics

The effect of this impact is expected to be most severe during the construction phase and only in limited occurrences of uncontrolled activities in the natural surrounds will this impact be exacerbated during the operational phase. The removal of vegetation implies that no vegetation dynamics will remain on affected areas. While some impacts might affect vegetation dynamics of surrounding areas, this impact is however expected to be confined to the MLA and limited effects will be noted in adjacent areas. Mitigation of these effects is not possible. Prevention of the spread of this impact to surrounding areas is possible through containment.

9.2.2.5.5 Impacts on Sensitive Habitat Types

No sensitive environments were observed within the MLA and the threat of this impact is fairly low. However, some sensitive areas were observed outside the MLA and the possibility does exist that these areas might be affected by non-mining activities such as irresponsible access and uncontrolled activities. The likelihood of this happening is low and it can be mitigated against.

9.2.2.6 Fauna

9.2.2.6.1 Potential Loss or Degradation of Local Pristine Faunal Habitat

The loss of faunal habitat within the Gope Project Site, although restricted in area, will be total and for at least the LOM. The potential for complete restoration of these habitats is very low and the loss of habitat is certain to happen if the proposed mining goes ahead. Hence the significance value of -14 (a negative impact of great significance to the local area of the mining site). No mitigation is possible within the framework of the mining operation and for the duration of the operational phase.

9.2.2.6.2 Alterations of Natural Ecosystem Functioning and the Disruption of Localised Large Mammal Migration Routes

Large mammals within the CKGR roam over large areas to find water and grazing / prey – the destruction of a significant area within the CKGR in terms of faunal habitat and the fencing of such an area that restrict movement of large mammals as well as the creation of large areas of surface water in an area where water is a scarce commodity, is likely to have a significant impact on the natural ecosystem functioning as well as local migration routes of large mammals. No mitigation is possible within the framework of the mining operation and for the duration of the operational phase.

9.2.2.6.3 Increase of Poaching, Snaring and Trapping of Animals

This impact is relevant to the areas surrounding the GDMP and if left unchecked, it could be a serious impact on the local wildlife, especially on species resident to the local area that does not migrate over large areas (such as Steenbok). It is possible to mitigate this impact effectively through the implementation of suitable mitigation measures.

9.2.2.6.4 Impact of Chemical Compounds Used During Construction on Animals

The leaching of hazardous materials into the sandy soils of the Gope Project Site could potentially have a significant impact on the animal communities of the surrounding areas. It could influence vegetation growth and groundwater quality and hence impact significantly on the animals of the region. This impact is easily mitigated by stopping the leaching of such chemicals into the soils and subsequently the groundwater.

9.2.2.6.5 Attraction of Animals to Large Surface Water Areas

The creation of the slimes dam and RWDs, as well as any other areas of open surface water is likely to attract animals to Gope Project Site. The impact on the animals itself as well as the surrounding environment is likely to be significant and last for the duration of the LOM. The impact is difficult to mitigate due to the size of the areas of open water, however effectively fencing these areas could keep large mammals from the water but not birds. The impact is likely to be significant in intensity, duration and probability.

9.2.2.6.6 Loss of Small Animals to Introduced Faunal Species

Domestic cats and dogs could potentially kill many small mammals and birds in the vicinity of the GDMP. This is easily mitigated by disallowing any pets to be brought into the CKGR and the Gope Project Site.

9.2.2.7 Surface Water

During the operational phase, the following potential impacts have been identified:

9.2.2.7.1 Reduction of Surface Water Yield

During the ESS phase, an area was identified where water was found to be ponding post rainfall events. These areas were found to support fauna with a bullfrog being found in this area.

On further investigation, it was found that the ponding was at the old De Beers processing area, where some concrete slabs have remained on site. However, the impact was found to be limited due to the following:

- There appear to be numerous areas where water will pond after rainfall events;
- The bullfrog is not considered a high conservation species in Botswana, resulting in a low conservation value given to the area of ponding (refer to fauna and flora study), and
- The key issue in terms of loss of yield is the impact of mining on a receiving water environment, normally a river or dam downstream of the proposed mining area. For the GDMP, the lack of drainage lines or a drainage direction means that no receiving water body is identifiable. The impact on yield is thus considered to be only a localised impact on localised areas of ponding. These are extremely difficult to map and identify because of the flat nature of the terrain, but no specific areas of high conservation value related to the ponding of water have been identified by any of the studies.

9.2.2.7.2 Impact on Surface Water Quality Related to Spilling

The water balance modelling has indicated that there are periods where significant rainfall can occur. During these events the GDMP will need to be able to store water from the pit. The modelling suggests that up to 400,000 m^3 of surplus water may need to be stored on the Gope Project Site during extreme events.

If this water were to be discharged into the veld over a long period of time at a rate similar to the current dewatering rate proposed for the groundwater system (typically 6,000 to 12,000 m^3/day) water would pond in the veld for a period of approximately 30 days.

9.2.2.7.3 Impact on Water Quality Related to Point Sources

There are several potential impacts on relating to discharge surface water quality on the receiving environment, related to point sources on the GDMP. These include the following:

- Brine and sludge from the RO Plant. This plant will be used to remove salinity from the groundwater so as to provide potable water and some water for the X-ray and grease units in the plant. The plant will produce brine which is effectively concentrated groundwater, primarily a sodium chloride water. This brine will be disposed of into a lined facility for evaporation and the residue disposed;
- Sludge and effluent from the sewage plant;
- From the workshop areas there are a range of fuels (diesel and petrol), lubricants and cleaning materials that have the potential to impact on water quality;
- Within the mining area where equipment will be operating, oil or diesel spills could occur;
- Accidental spillage could result from vehicle accidents or incorrect procedures during loading or handling;
- Chemical contamination could result from fertilisers or other chemicals used to enhance the growth of vegetation or stabilisation of slopes;
- Various mining infrastructure, but primarily the various waste dumps and stockpiles have the potential to impact on discharge water quality. These include the TMF, the slimes dam and associated RWD, WRD and the sand dump, and
- Water pumped from the pit for dewatering purposes will be reused in the plant during the operational phase. The water is saline and spillage or leakage of the water outside of the water handling infrastructure could result in impacts on the receiving environment.

It is important to note that most of the large volume materials (the sand, rock, slimes and tailings) are relatively inert by mining standards. Initial testing indicate some risk of elevated salinity, but probably mainly from the slimes dam which will be contained within an engineered structure. In terms of surface water, the other point sources are expected to be either very localised or small in extent.

9.2.2.7.4 Impact on Water Quality Related to Erosion of Stockpiles and Dumps

The current topography is extremely flat, largely because the stable landform for the sandy material encountered on site is flat. New landforms that will be established on the Gope Project Site using the sandy material will thus tend to flatten with time, resulting in an increased risk of erosion. Sandy material that is continually deposited will represent an increased risk for elevated suspended solids in surface water runoff. However, this risk is not that significant given that there is no receiving water body, but an “unsustainable landform” which continually erodes over decades or centuries is considered an undesirable consequence of mining that requires mitigation.

The main area at risk is the sandy and fine grained material expected to be present on the stockpiles, sand dumps, slimes dam and TMF.

9.2.2.8 Groundwater

9.2.2.8.1 Dewatering and Groundwater Levels

During the operational phase the water demand will be at its peak. The dewatering of the open pit as well as abstraction from the proposed well field (should this option become necessary), will impact on the regional groundwater table. Groundwater recharge is minimal and groundwater abstraction to dewater the open pit to supply the plant demand will far exceed the recharge volume. The groundwater level will therefore drop during the LOM and simulations have indicated that this impact will extend beyond the boundaries of the MLA. Impact is defined as a drop in water table >0 m.

The simulated impact of the proposed dewatering at the end of the mine’s life is illustrated in Figure 64 (16 boreholes around the pit and eight boreholes inside the pit). The final extent of the dewatering cone extends to a maximum distance of 16 km from the centre of the open pit.

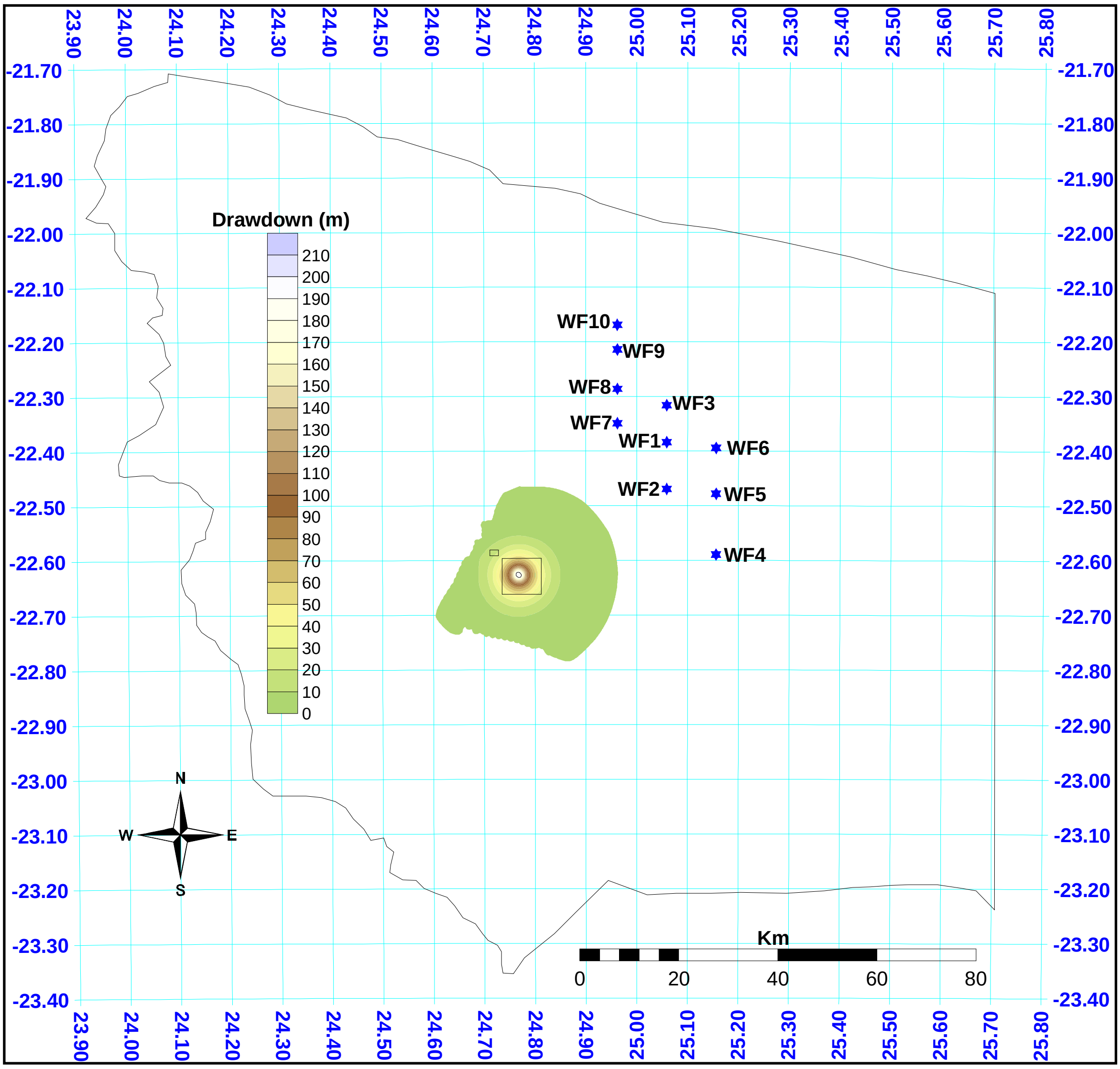


Figure 64: Extent of Dewatering Cone (2023) – 24 Dewatering Boreholes.

The simulated impacts of the combined dewatering and well field boreholes is illustrated in Figure 65 (28 well field boreholes, 1,000 m apart, each pumping 250 m^3/day).

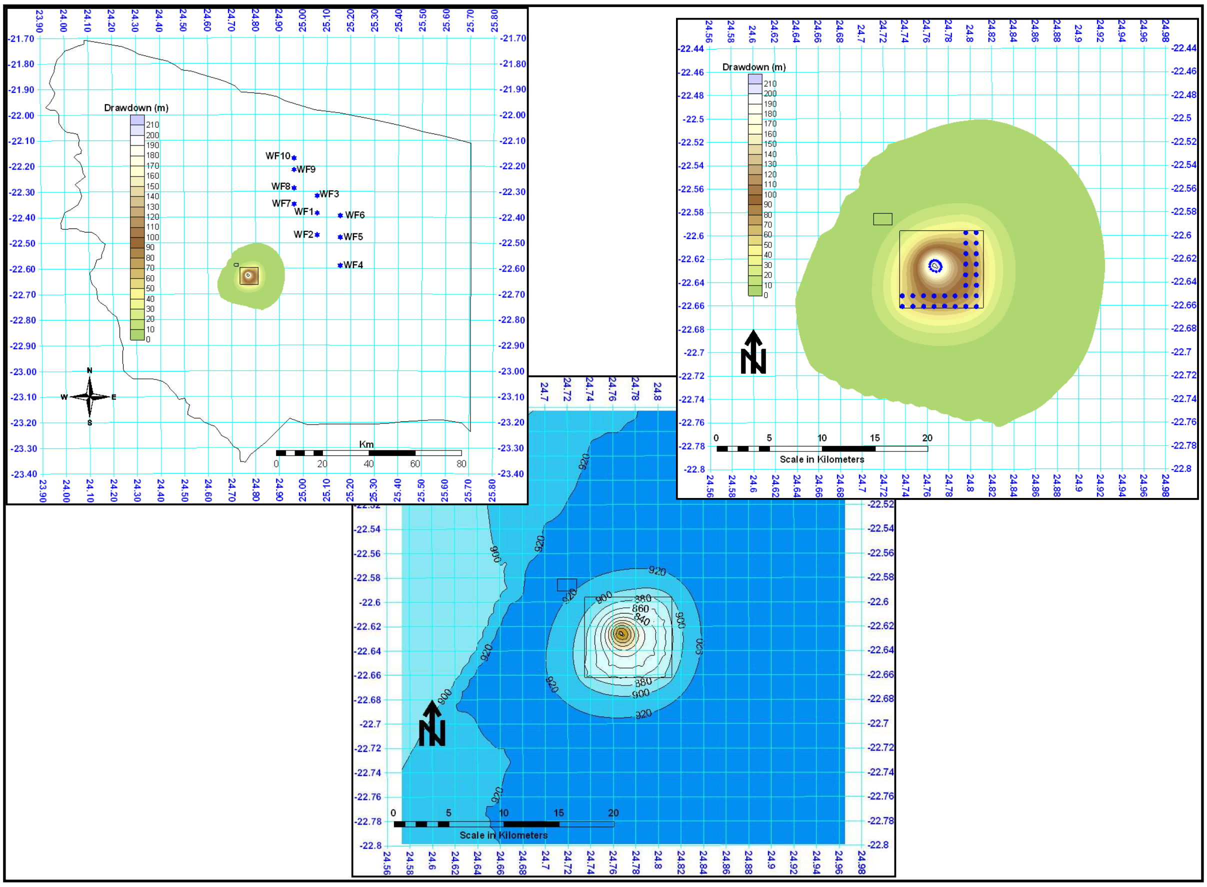


Figure 65: Extent of Dewatering Cone (2023).

The combined extent of the impact from this pumping arrangement is also 16 km from the centre of the open pit. The shape of the dewatering cone is relatively steep and the following impacts at various distances from the open pit is summarised in Table 82.

Table 82: Groundwater Table Drawdown at Various Distances from the Open Pit.

DISTANCE FROM OPEN PIT (M)	DRAWDOWN (M)
0	500
500	220
1,000	190
2,000	150
4,000	70
8,000	10
16,000	0.1

9.2.2.8.2 Groundwater Quality

The ambient groundwater quality at GDMP is poor and not potable. If untreated water is used for domestic purposes it will affect the health of employees and shorten the life of the plant and equipment. The mining process and activities has the potential to further deteriorate the groundwater quality, both inorganic and organic. The organic impact on the groundwater is related to domestic waste disposal and sewage treatment works, as well as hydrocarbon contamination from fuel spillages. The inorganic impact on the groundwater may result from the infiltration of rainwater through the TMF and slimes dam as well as from the evaporation and resulting concentration of salts in the RWD system.

9.2.2.9 Air Quality

9.2.2.9.1 Materials Handling Operations

Materials handling operations refers to the transfer of various raw materials and waste products by means of tipping, loading and off-loading of trucks and conveyor transfer operations. Emission rates calculated using the USEPA emission factors for these source types, are dependent on the material moisture content and the wind speed at the time. Table 83 summarises the source parameters used during the estimation of these emissions.

Table 83: **Source Characteristics Required for the Estimation of Emissions Due to Material Transfer Operations.**

OPERATION	THROUGHPUT (TONNES / DAY)	MOISTURE CONTENT (%)
ROM tipping area	1,200	5
CTP to stockpile	1,200	5
CTP to crusher	1,200	5
Crusher	1,200	5

CTP = Conveyor Transfer Point

9.2.2.9.2 Wind Erosion from Exposed Areas

Wind blown dust (wind erosion) from exposed stockpiles piles can be a significant contributor to particulate emissions on site, especially when large quantities of material are stored at any given point. Table 84 details the source characteristics of the stockpiles, waste rock and sand dump at the Gope Project Site, which were included in the current assessment of particulate impacts.

The combined particulate emissions estimated using the US-EPA emission factors (Appendix 5) were 0.025 tpa for total suspended particulates and 0.018 tonnes per annum for inhalable particulates respectively.

Table 84: Source Characteristics Pertaining to On-Site Storage Piles.

SOURCE	AREA (M^2)	MOISTURE (%)	SPECIFIC GRAVITY (G/CM^3)
WRD	1,448,834.6	8	3.6
Sand dump	1,088,650.1	3.65	1.215
Crater stockpile	134,238.6	8	3.6
TMF	677,823.3	3.65	1.215
Slimes dam	520,097.2	3.65	1.215

SOURCE	AREA (M^2)	MOISTURE (%)	SPECIFIC GRAVITY (G/CM^3)
Product stockpile	7,776.1	3.65	1.215
Storage pile	16,478.0	3.65	1.215

9.2.2.9.3 Vehicle Entrainment

Unpaved roads are used during the day to day operations on the site. Action of vehicle wheels on road surfaces results in the lifting and entrainment of particulates deposited on these surfaces. Table 85 outlines the source characteristics required for the calculation of vehicle entrained dust from the unpaved road surfaces investigated.

Table 85: **Parameters Used to Calculate Emissions from Vehicle-Entrained Dust on Unpaved Road at the Gope Project Site.**

ROAD	LENGTH (M)	AVERAGE SPEED (KM/H)	WIDTH	SILT (%)	AVERAGE VEHICLE WEIGHT (T)
Haul road from pit to WRD	845.6	20	15	5	166
Haul road from pit to sand dump	1,547.5	20	15	5	166
Haul road from pit to ROM tip	1,018.2	20	15	5	166
Road from plant to slimes dam	882.6	20	15	5	10
Road from plant past camp to site boundary	2,906.2	20	15	5	10

9.2.2.9.4 In-Pit Operations

In pit operations include aspects related to the abstraction of ore and the removal of both waste material and ore for storage or further processing at the mineral processing plant. Aspects related to the estimation of emissions resulting due to drilling, blasting, bulldozing and truck loading operations in-pit are summarised in Table 86.

Table 86: Source Specifications for In-Pit Sources.

SOURCE DESCRIPTION	MOISTURE % OF MATERIAL	SILT % OF MATERIAL	NUMBER OF DRILL HOLES PER MONTH	DIAMETER OF HOLES
Drilling – ROM	8	5	144	0.3
Blasting – ROM	9	5	160	0.3
Drilling – Overburden	5	5	144	0.3
Blasting – Overburden	5	5	160	0.3

Particulate matter and nuisance dust was identified as being the largest contributor to atmospheric emissions from the proposed GDMP. The following section details the impacts of these emissions on the surrounding area.

9.2.2.9.5 Inhalable Particulate Impacts

Figure 66 shows the isopleth plot for PM-10 concentrations potentially being generated as a result of the proposed mining activity and storage piles. The plot indicates that both the monthly and annual Botswana Standards will be exceeded at the Gope Project Site boundary. These results however are with no mitigation measures in place, resulting in the worst case scenario for the proposed GDMP.

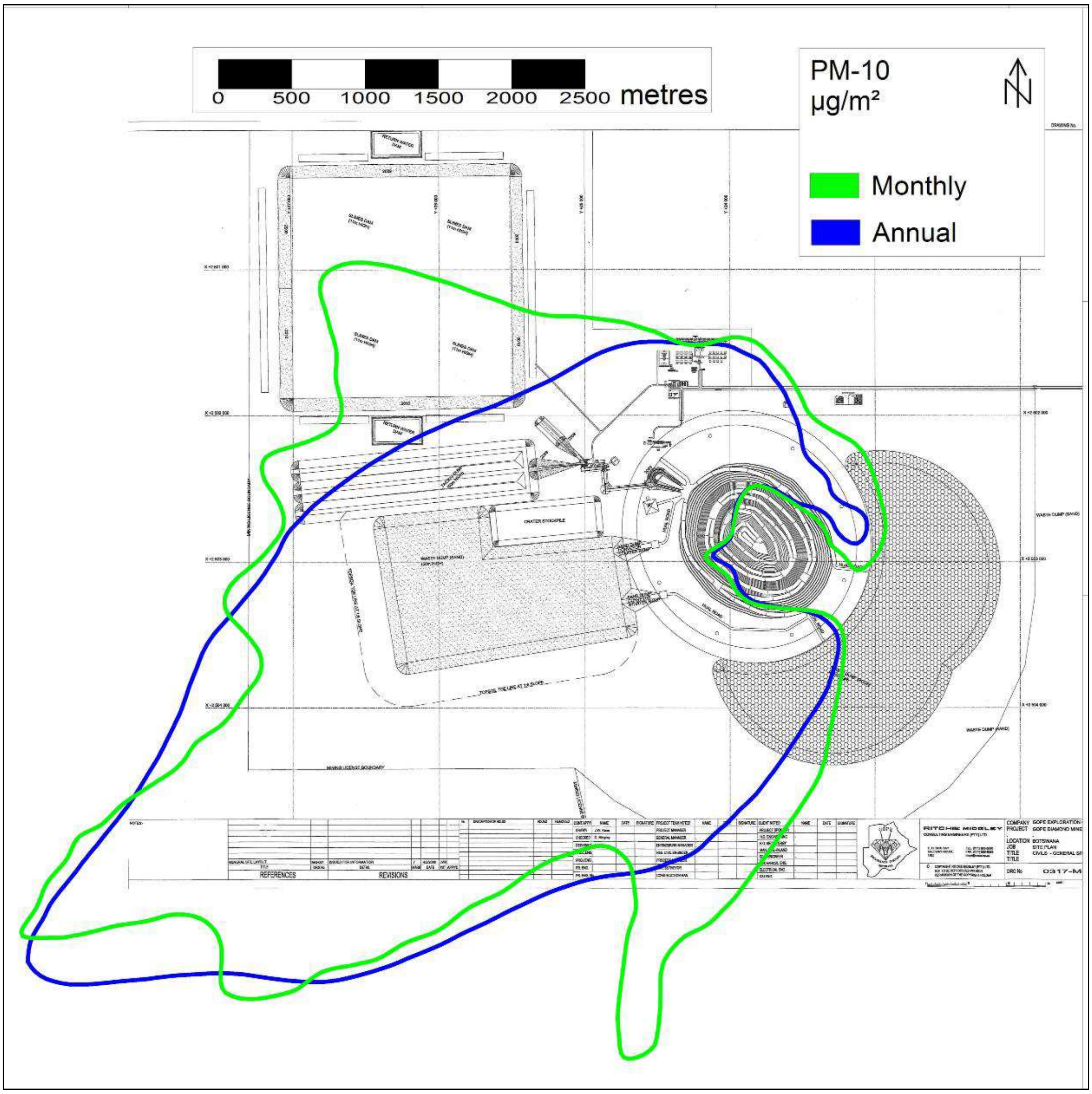


Figure 66: Showing Isopleth Plot for PM-10 Concentration with No Mitigation in Place, Plots Show the Current Botswana Legislative Standards.

Figure 67 provides the predicted concentrations which will result from the implementation of mitigation measures which protect 50% of the sources. The planned mitigation measures which are to be implemented for the GDMP are substantially higher resulting in a significant reduction of the impact, to the extent that the predicted concentrations will not exceed the legislative requirements at the Gope Project Site boundary, and therefore unlikely to be of environmental concern.

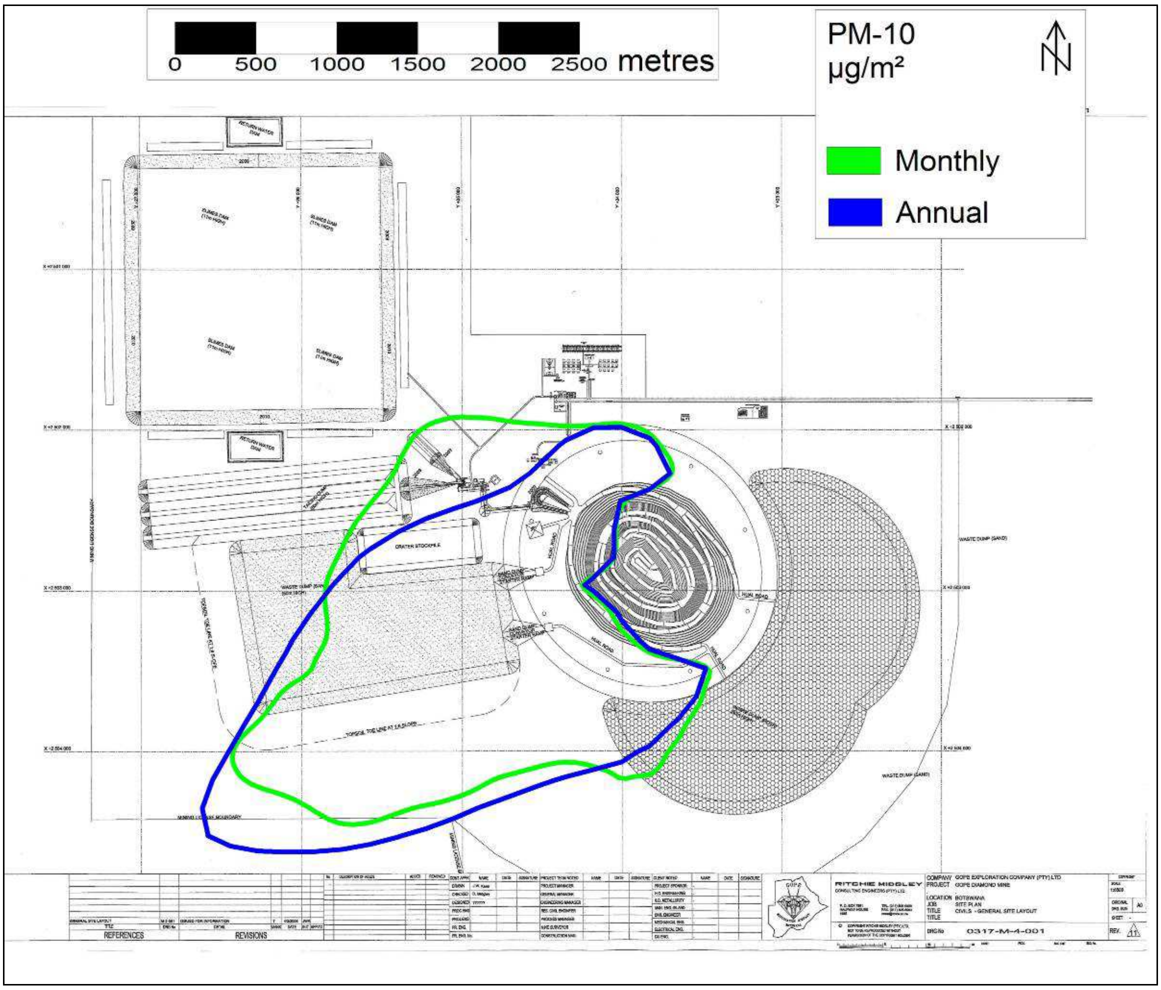


Figure 67: Showing Isopleth Plot for PM-10 Concentration with a 50% Mitigation Level in Place, Plots Show the Current Botswana Legislative Standards.

9.2.2.9.6 Dust Fallout Impacts

Figure 68 indicates the proposed dust fallout or nuisance dust concentrations from the GDMP. The standards used in this study are based on the SANS, this is due to South Africa being one of very few countries world wide who have implemented dust fallout standards. For the proposed Gope Project Site, a mitigation level of 50% was used with the area exceeding 2,400 mg/m^2/day being highlighted as an area of concern. In these high fallout areas, it is therefore recommended that additional mitigation measures are put in place to ensure dust levels are reduced to acceptable standard.

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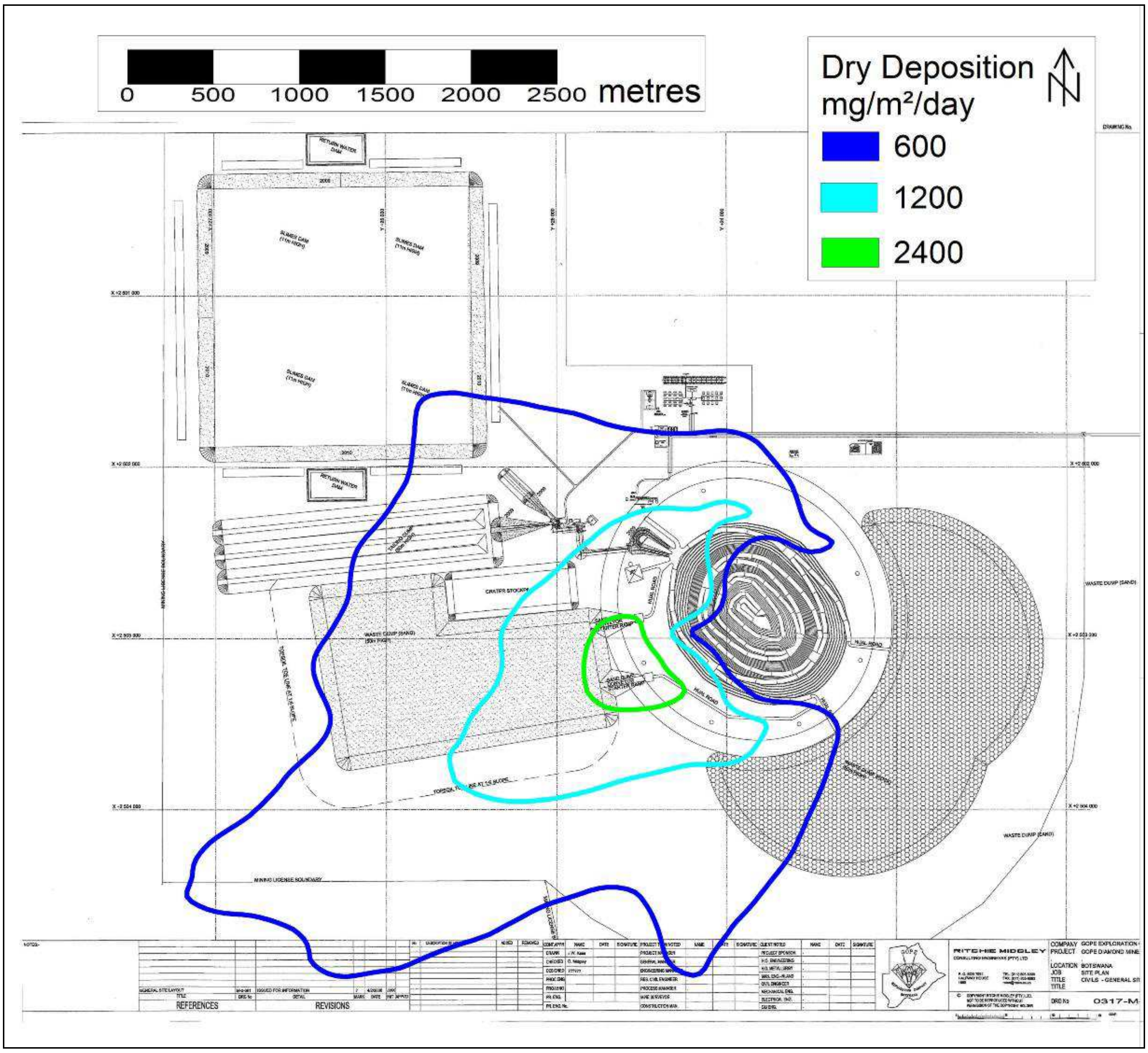

Figure 68: Showing Isopleth Plot for the Potential Dust Fallout Expected as a Result of the Mining Activity with the 50% Mitigation Measures in Place.

9.2.2.9.7 Fuel Storage

The storage of fuels, particularly in above-ground storage tanks is likely to produce emissions during use, or working losses, but also during refilling, being breathing losses. Due to the nature of the fuel being stored, being diesel and heavy oils, both of which have high flash points, will produce concentrations which will not result in health or environmental risk to the surrounding area.

Based on the above study, emission rates are likely to exceed Botswana National Standards if no mitigation measures are implemented. With mitigation measures in place with an efficiency of 50% it is unlikely that emissions from this project will exceed these standards.

9.2.2.10 Noise

During the operational phase, impacts concerning noise will involve the following:

- Increased ambient noise levels due to:
  - Increase vehicular flow;
  - Air traffic flow (aircraft & helicopter);
  - Mining operation (earth moving, mineral processing plant and crushing activities), and
  - Continuous blasting throughout operational phase.

During the operational phase, impacts cause by blasting will involve the following:-

- Vibrations as a result of blasting waste rock and ore, which will cause disruption to sensitive fauna, employees & resident communities, and
- Impacts on building foundation stability as a result of blasting activities.

9.2.2.11 Sites of Archaeological and Cultural Interest

During this phase the mine will be fully operational. On the condition that none of the surface works or infrastructural elements expands or be modified, no direct impact on any sites is expected. However, the potential for secondary impacts remain a possibility during this phase as well.

9.2.2.12 Visual

During the operational phase of the GDMP, the same impacts as outlined in Section 10.3.1.16 are expected.

9.2.2.13 Waste Management

The handling, storage, transportation and disposal of waste have the potential to cause various impacts that may affect the receiving environment as well as staff and surrounding communities. There are increased risks associated with the management of hazardous wastes.

These impacts are described as follows:

9.2.2.13.1 Contamination of Groundwater (Waste Rock, Tailings and Slimes)

Although the WRD, TMF and slimes dam (mineralogical waste streams) consist largely of the rock from the open pit, there is the potential for the contamination of soil, groundwater and surface water through the leaching elements contained in these mineralogical waste streams when exposed to air and water.

Samples from different rock groups (including the Kimberlite and Basalt) from different facies and at various depths, were obtained from the drilling conducted on site and logged in December 2007 by Venmyn Rand (Pty) Ltd. The samples were submitted to Inspectorate M&L laboratory (a SANAS accredited laboratory in South Africa) for Inductively Coupled Plasma Mass Spectrometry (ICP-MS) scans of 34 elements based on an acid rain extract. The Acid Rain test is used when inorganic wastes are disposed of in a dedicated site (mono-disposed) as would be the case for the waste rock, tailings and slimes dams. No organic acids would be generated in such a site. The TCLP (Toxicity Characteristic Leaching Procedure) test is used where wastes are co-disposed with domestic waste or other hazardous wastes containing organic matter that could generate organic acids.

Three samples representative of the waste rock, tailings and slimes respectively were made up of a combination of the original samples extracted. The material was crushed to the particle sizes expected to be deposited on these waste facilities, and tested accordingly. The results were analysed using the delisting calculations for total load prescribed by the Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste 2nd Edition (DWAF, 1998).

The total load of the current proposed disposal sites for the WRD, TMF and slimes dam has been calculated based on the quantity of material to be disposed over the LOM, and the area over which the waste will be deposited (for the waste rock, tailings and slimes respectively), in order to establish if the total load capacity of the disposal site may be exceeded. The load, as a percentage of the total load capacity was then established.

The results indicated that the load is less than 1% of the total load capacity for the waste rock, tailings and the slimes materials. Accordingly, the potential for leachate is considered extremely low, and liners would therefore not be considered necessary for these structures.

The percentage of the total load capacity for key element is indicated in the following tables for the three waste streams (indicated in the final column):

Table 87: Assessment of Leachate Potential - WRD (Percentage of Total Load Capacity of Each Respective Element Below 1%).

Analysis Sheet: Waste Rock Dump

Waste Description	OPX-GOP-010 COMBO1 1.5mm – 25mm COMP
Quantity Disposed (for delisting)	395833 tons
Area of Proposed site	404 ha

Element	Test Results (ppm)	Total quantity disposed (grams)	Capacity: grams/ha	Total Capactiy (grams)	Total qty disposed over life of mine (20 years) (kg)	% of total load capacity
As	0.05	19791.7	65 152	26 321	19.792	0.08
Se	0.05	19791.7	39 394	15 915	19.792	0.12
Ti	0.002	791.7	110 758	44 746	0.792	0.00
Al	0.05	19791.7	1 515 152	612 121	19.792	0.00
Ni	<0.003	1187.5	172 727	69 782	1.188	0.00
Mn	0.03	11875.0	45 455	18 364	11.875	0.06
Fe	0.14	55416.7	1 363 636	550 909	55.417	0.01
V	0.005	1979.2	196 970	79 576	1.979	0.00
Zn	<0.005	1979.2	106 061	42 848	1.979	0.00
Sb	<0.01	3958.3	10 000	4 040	3.958	0.10
Pb	<0.01	3958.3	15 152	6 121	3.958	0.06
Co	0.03	11875.0	1 045 455	422 364	11.875	0.00
Cu	<0.002	791.7	15 152	6 121	0.792	0.01
Cr	0.006	2375.0	712 121	287 697	2.375	0.00
Si	2.6	1029166.7	151 515 152	61 212 121	1029.167	0.00
Sn	<0.02	7916.7	151 515	61 212	7.917	0.01
Zr	<0.001	395.8	303 030	122 424	0.396	0.00
Be	<0.002	791.7	181 818	73 455	0.792	0.00
Cd	0.002	791.7	470	190	0.792	0.42
Sr	0.02	7916.7	151 515	61 212	7.917	0.01
B	<0.006	2375.0	4 545 455	1 836 364	2.375	0.00
U	<0.004	1583.3	90 909	36 727	1.583	0.00
Mo	0.003	1187.5	8 333 333	3 366 667	1.188	0.00
Ba	0.06	23750.0	1 181 818	477 455	23.750	0.00
K	2.3	910416.7	3 484 848	1 407 879	910.417	0.06
Mg	0.86	340416.7	1 515 152	612 121	340.417	0.06
Ca	6	2375000.0	8 787 879	3 550 303	2375.000	0.07
Ag	<0.004	1583.3	303 030	122 424	1.583	0.00

Table 88: Assessment of Leachate Potential – TMF (Percentage of Total Load Capacity of Each Respective Element Below 1%).

Analysis Sheet: Tailings Facility						
Waste Description		OPX GOP 011 1.5mm – 25mm COMP				
Quantity Disposed (for delisting)		175000 tons				
Area of Proposed site		84 ha				
Element	**Test Results ppm**	**Total grams to be disposed**	**Capacity: grams/ha**	**Capactiy: grams per site**	**Total kg disposed over life of mine (20 years)**	**% of total load capacity**
As	<0.02	3500	65 152	5 473	3.5	0.06
Se	<0.03	5250	39 394	3 309	5.25	0.16
Ti	0.01	1750	110 758	9 304	1.75	0.02
Al	0.23	40250	1 515 152	127 273	40.25	0.03
Ni	<0.003	525	172 727	14 509	0.525	0.00
Mn	0.03	5250	45 455	3 818	5.25	0.14
Fe	0.42	73500	1 363 636	114 545	73.5	0.06
V	0.01	1750	196 970	16 545	1.75	0.01
Zn	0.01	1750	106 061	8 909	1.75	0.02
Sb	<0.01	1750	10 000	840	1.75	0.21
Pb	<0.01	1750	15 152	1 273	1.75	0.14
Co	<0.001	175	1 045 455	87 818	0.175	0.00
Cu	<0.002	350	15 152	1 273	0.35	0.03
Cr	0.008	1400	712 121	59 818	1.4	0.00
Si	15.5	2712500	151 515 152	12 727 273	2712.5	0.02
Sn	<0.02	3500	151 515	12 727	3.5	0.03
Zr	0.001	175	303 030	25 455	0.175	0.00
Be	<0.002	350	181 818	15 273	0.35	0.00
Cd	0.002	350	470	39	0.35	0.89
Sr	0.06	10500	151 515	12 727	10.5	0.08
B	<0.006	1050	4 545 455	381 818	1.05	0.00
U	<0.004	700	90 909	7 636	0.7	0.01
Mo	0.003	525	8 333 333	700 000	0.525	0.00
Ba	0.08	14000	1 181 818	99 273	14	0.01
K	4.6	805000	3 484 848	292 727	805	0.28
Mg	2.8	490000	1 515 152	127 273	490	0.39
Ca	12.5	2187500	8 787 879	738 182	2187.5	0.30
Ag	<0.004	700	303 030	25 455	0.7	0.00

Table 89: Assessment of Leachate Potential – Slimes Dam (Percentage of Total Load Capacity of Each Respective Element Below 1%).

Analysis Sheet: Slimes Dam						
Waste Description		OPX GOP 11 <1.5mm COMP				
Quantity Disposed (for delisting)		358333 tons				
Area of Proposed site		272 ha				
Element	**Test Results ppm**	**Total grams to be disposed**	**Capacity: grams/ha**	**Capactiy: grams per site**	**Total kg disposed over life of mine (20 years)**	**% of total load capacity**
As	0.03	10750.0	65 152	17 721	10.8	0.06
Se	<0.03	10750.0	39 394	10 715	10.8	0.10
Ti	0.02	7166.7	110 758	30 126	7.2	0.02
Al	0.48	172000.0	1 515 152	412 121	172.0	0.04
Ni	0.01	3583.3	172 727	46 982	3.6	0.01
Mn	0.08	28666.7	45 455	12 364	28.7	0.23
Fe	0.75	268750.0	1 363 636	370 909	268.8	0.07
V	0.02	7166.7	196 970	53 576	7.2	0.01
Zn	<0.005	1791.7	106 061	28 848	1.8	0.01
Sb	<0.01	3583.3	10 000	2 720	3.6	0.13
Pb	<0.01	3583.3	15 152	4 121	3.6	0.09
Co	<0.001	358.3	1 045 455	284 364	0.4	0.00
Cu	0.005	1791.7	15 152	4 121	1.8	0.04
Cr	0.008	2866.7	712 121	193 697	2.9	0.00
Si	15.9	5697500.0	151 515 152	41 212 121	5697.5	0.01
Sn	<0.02	7166.7	151 515	41 212	7.2	0.02
Zr	0.02	7166.7	303 030	82 424	7.2	0.01
Be	<0.002	716.7	181 818	49 455	0.7	0.00
Cd	0.001	358.3	470	128	0.4	0.28
Sr	0.26	93166.7	151 515	41 212	93.2	0.23
B	<0.006	2150.0	4 545 455	1 236 364	2.2	0.00
U	<0.004	1433.3	90 909	24 727	1.4	0.01
Mo	0.008	2866.7	8 333 333	2 266 667	2.9	0.00
Ba	0.09	32250.0	1 181 818	321 455	32.3	0.01
K	6.7	2400833.3	3 484 848	947 879	2400.8	0.25
Mg	9.3	3332500.0	1 515 152	412 121	3332.5	0.81
Ca	57	20425000.0	8 787 879	2 390 303	20425.0	0.85
Ag	<0.004	1433.3	303 030	82 424	1.4	0.00

Note that the designs of the WRD, TMF and slimes dams (regarding quantities, location, shape, heights, angles, drainage) and impacts relating to surface runoff, erosion, dust and visual aspects are documented in further detail in other sections of this report or appended specialist studies.

9.2.2.13.2 Contamination of Soil, Groundwater and Surface Water (Hazardous Wastes)

Hazardous waste, if not handled and stored in suitably constructed areas in which the ground is protected, may seep into the surrounding ground. This impact must not only be considered for on-site storage areas, but all off-site areas where hazardous waste is disposed. This includes the staging camp, landfills and recycling facilities (e.g. for waste oil) managed by public and private organisations, both in Botswana and South Africa as the case may be.

As the hazardous wastes will be transported long distances to the final destination, the risk of spillages resulting in soil and surface water contamination during transport is also a concern. Systems must therefore be implemented (described in SEMP) to ensure suitable licensed waste contractors are used, and that spillages should they occur, are collected and disposed of appropriately.

If managed properly (through means described in the SEMP and Waste Management Plan), this impact can be adequately mitigated.

9.2.2.13.3 Consumption of Landfill Space

The final disposal of waste to landfill (general or hazardous landfill) results in the consumption of landfill space which is considered a resource. The impacts associated with the landfills are the same as was outlined for the construction phase of the project.

The impacts associated with land filling can only be mitigated through the application of the waste hierarchy, where the minimisation, re-use and recycling of wastes are considered.

9.2.2.13.4 Litter

The impacts associated with litter are the same as was outlined for the construction phase of the project.

9.2.2.13.5 Odour

The impacts associated with odour are the same as was outlined for the construction phase of the project.

9.2.2.13.6 Health Impacts to Staff and Public (Hazardous Wastes)

The impacts associated with hazardous wastes are described in the construction phase of the project.

9.2.2.13.7 Recycling

The following positive impacts may result from the implementation of recycling practices at the GDMP:

- Preservation of landfill space;
- Decrease in resources (virgin materials) required, and

- Decrease in impacts associated with the mining, transportation and processing of virgin resources into raw materials.

Through the selection of environmentally responsible recycling organisations, negative impacts may be reduced and positive impacts enhanced.

9.2.2.14 Social Impacts

9.2.2.14.1 Employment

During the operational phase of the GDMP, opportunities for the employment of unskilled and skilled labour will reduce significantly compared to the construction phase due to the completion of construction activities. This is expected to have a negative impact on the directly affected communities, as a source of income to members of such communities will diminish.

However, it has to be noted that the nett impact of increased employment (as measured from the current baseline) will continue to be positive and of a long term nature over the LOM. In addition to directly employed persons, significant forward and backward linkages (multiplier effects) will result.

However, it is expected that informal businesses will increase in source towns outside of the CKGR, resulting in a secondary positive impact on employment.

9.2.2.14.2 HIV/AIDS

The same impacts pertaining to HIV/Aids as outlined in the construction phase are expected to continue for the LOM.

9.2.2.14.3 Employment System

The same impacts pertaining to employment systems as outlined in the construction phase are expected to continue for the LOM.

9.2.2.14.4 Gope Residents

The same impacts on the Gope residents as outlined in the construction phase are expected to continue for the LOM.

9.2.2.14.5 Services for Workers

The same impacts on pertaining to services for workers as outlined in the construction phase are expected to continue for the LOM.

9.2.2.14.6 Gender

The same impacts with regard to gender issues as outlined in the construction phase are expected to continue for the LOM.

9.2.2.15 Regional Socio-Economic Structure

In general mining and mining project development could result in the following positive impacts:

9.2.2.15.1 Levels of Economic Activity

During the operational phase of the GDMP, it is expected that the levels of economic activity in the source towns will increase due to an increase in the GGP. This will be the result of an anticipated increase in demand for consumer services and goods in these towns / villages and will result in the increase of business activity – both formal and informal. It is expected that there will be a substantial increase in entrepreneurship from local community members in the source towns.

9.2.2.15.2 Opening Up of Communities

Large mining investments increasingly open up remote areas, such as Kaudwane, where local communities are often outside the economic mainstream of the national economy. In general this result in increased economic opportunities such as the sale of food, operating restaurants, sale of soft drinks, alcohol and other.

9.2.2.15.3 Increase the National GDP

The positive impact upon the local, regional and national economies will continue throughout the LOM.

9.2.2.15.4 Alleviating Poverty

Increased employment opportunities will result in an increase of community income in the area, resulting in the alleviation of poverty. In addition, it is expected that this will result in improved living conditions of people associated with the project.

9.2.2.15.5 Increased Access to Infrastructure

The GDMP will also result in improved levels of infrastructure development ranging from roads, to houses, social, health and educational facilities. This will improve access to services in areas where limited to no access existed. This positive impact is expected to continue for the LOM.

9.2.2.15.6 Skills Development

Mining developments have increased social responsibilities reflected in the provision of specific health and educational facilities and training programmes. This empowers the local communities to be absorbed within the local economy. During the operational phase, it is recommended that work related skills be the focus of training, in order to aide in the further increase of positive impacts.

9.2.2.15.7 Increased Government Commitment

With the continued expanded economic activity in the source towns, government could provide underlying social and business infrastructure in these areas.

The following negative impacts are associated with mine development and operation:

9.2.2.15.8 Establishment of Unplanned Settlements / Squatting

As outlined in the construction phase, a number of the people may move to the affected Gope area in search of casual or other employment opportunities, which might lead to squatting around the Gope Project Site. This may include former Gope residents and / or other people. This will have a negative impact upon the surrounding environment and will be difficult conditions for people to live in, as there are no services provided. May social pathologies can develop from these conditions that may impact very negatively on the local community.

9.2.2.15.9 Infiltration of People

Movement of people into mining areas are also a problem. Besides increased pressures on infrastructure and housing in these areas it reflects the fact that new employment are not created but result in the relocation of employed people.

9.2.2.15.10 Narrow Economic Base

As people become used to the GDMP, various socio-economic dependencies upon the mine will develop. The local economy of source towns will largely be based upon one project (GDMP) and the multiplier effects resulting from the project. This can lead to the typical ‘boom and bust’ scenario associated with many remotely located mining operations around the world.

9.2.3 Decommissioning and Closure Phase

9.2.3.1 Geology

There will be no additional impacts on the geology during the decommissioning and closure phase. The mining of the resource will cease, and no additional material will be removed from either the ore zone or the host rock lithologies.

9.2.3.2 Soils

During the decommissioning and closure phase, the following impacts will be imposed on the soils:

- Compaction and erosion of soils;
- Topdressing of the mineralogical waste structures;
- Rehabilitation of the slimes dam, roads and infrastructure footprint, and
- Use of the tailings material as an additive to the topsoil replaced as a cover to the rehabilitated areas.

Impacts will include possible compaction and erosion during the rehabilitation operation and the covering and topdressing of the sand dump and waste rock dumps, the rehabilitation of the processing plant footprint and the storm water control system (dams and berms / trenches), roads and haulage ways.

Ongoing rehabilitation during the decommissioning phase of the project will definitely bring about a significant positive impact on the transformed soils.

9.2.3.3 Land Capability

Impact of decommissioning and closure activities on land capability will involve the rehabilitation of disturbed areas, the final re-vegetation of the dumps and the demolishing of all infrastructure. This will result in a positive impact upon the land capability of the Gope Project Site.

9.2.3.4 Land Use

The removal of all equipment and demolishing of mining related infrastructure will make way for the rehabilitation of the land to as close as possible its original wilderness state, resulting in a positive impact.

9.2.3.5 Flora

9.2.3.5.1 Loss / Degradation of Pristine Vegetation / Habitat

This impact is mostly limited to the construction phase and only in limited or uncontrolled events will additional areas be affected adversely during the operational phase. During the decommissioning and closure phase the site will be rehabilitated and this previously negative impact will start to be reversed. However, it is unlikely that the environment will be restored to the pristine habitat of pre-mining activities, but it will be restored to a habitat as close as possible to that.

Residual impact of this activity will be that the remaining transformed areas as well as habitat types will not be associated with a natural status of vegetation. Several sections of infrastructure will remain that cannot be rehabilitated or removed and some areas will inevitably comprise vegetation that will not recover to a status similar to surrounding natural areas. These residual impacts will however be limited to the immediate surrounds of the activity and is not likely to influence the area beyond a small distance from the site. However, the residual impact of this development on the status of the CKGR will be permanent.

9.2.3.5.2 Alteration of Natural Ecological Processes / Ecosystem Functioning

During the decommissioning and closure phase, the impact of the rehabilitation of the Gope Project Site will be that the remaining transformed areas as well as habitat types will not be associated with a natural status of vegetation. Although a limited level of ecosystem functioning will return in areas where rehabilitation will be applied, the existing ecosystem functioning will not be achieved with any level of rehabilitation. These residual impacts will however be limited to the immediate surrounds of the activity and is not likely to influence the area beyond a small distance from the site.

9.2.3.5.3 Introduction of Species not Associated with the Region

The impact of introduced species will depend on the success of mitigation measures implemented over the LOM at the Gope Project Site. If effective, residual impacts will be limited and little effect will be noticed subsequent to mining activities. However, poorly managed invasive species control will result in uncontrolled spread of invasive species that could potentially change existing floristic patterns.

9.2.3.5.4 Changes in Vegetation Dynamics

Residual impact will be that the remaining transformed areas as well as habitat types will not be associated with a natural status of vegetation. Vegetation dynamics as currently observed will cease to exist on this area. Subsequent to mining and with intensive rehabilitation a changed level of vegetation dynamics will be noted.

The rehabilitation process will only be deemed completed once a 60% vegetation cover has been achieved. Therefore the overall change in vegetation dynamics across the site is expected to start to improve.

9.2.3.6 Fauna

During the decommissioning and closure phase, as the re-vegetation of the Gope Project Site progresses, the negative impacts imposed on the local fauna will start to decrease. As activities on the site decreases, animals will start to recolonise the area.

One remaining negative impact that remains during this phase, is the expected water source of the pit lake. Animal access to the pit lake should be minimised in order to prevent a permanent negative impact in terms of an increased carrying capacity upon the surrounding ecosystem because of water availability.

9.2.3.7 Surface Water

It is expected that during the operational and decommissioning phases, stable land forms will be established on site. The dumps, slimes dam and TMF will be “dry” (i.e. no ponding water), covered with vegetation and rock (although the rock dump may have only limited vegetation) and runoff from the surface features will drain back to the natural environment. All indications are that the quality of runoff will be acceptable, although in the case of the slimes dam the quality of seepage that may occur will need to be verified.

9.2.3.7.1 Impact on Water Quality Related to Erosion of Stockpiles and Dumps During Decommissioning Phase

It is expected that the open pit will be subject to erosional forces during the decommissioning and closure phase of the GDMP. The open pit area will be surrounded with mineralogical waste structures in order to limit access to the pit itself and the fence will remain in place around the open pit for added safety reasons. However, no stabilisation measures will be implemented in order to encourage natural erosion through wind and water action, thereby filling the pit in time.

With the increasing vegetation cover, it is expected that the erosional impacts will start to decrease as the rehabilitation progresses.

9.2.3.7.2 Impact on Water Quality Related to Water in the Open Pit During Closure Phase

The remaining pit will be deep, and once dewatering activities cease, water levels in the pit will gradually rise. As the water levels rise, the hydraulic gradient will reduce, resulting in lower inflow rates from groundwater. At the same time, the surface area of the exposed water will increase as the water level rises. This will increase the evaporation losses from the water body until, at some point, equilibrium is established. At this point the groundwater inflows will match the evaporation losses (on average), and the water level will fluctuate seasonally around the stable level.

Because evaporative losses will be clean water, and groundwater inflows are saline, the salinity of the pit will gradually increase with time until actions such as precipitation of salts are in equilibrium. Given that the water is largely sodium chloride in nature, a stable chemical concentration could easily be similar to other “bounded” salt seas, that is, with a salinity several times that of normal sea water. The suitability of this water for consumption will become problematic with time.

Ironically, given the scarcity of water in the area, the exposed water, even though becoming increasingly saline, will for an extended period of time attract game to the area. This is not considered sustainable by the fauna and flora specialists, since the current ecosystem cannot support large numbers of game.

Further, while not directly a surface water issue, the consequence of large numbers of game trying to access the water at the bottom of the pit will have implications for the sustainability of the sides of the pit in soft material, with the potential for damage to the side slopes and associated erosion of the rehabilitated slopes.

If not managed, the potential impact of water exposed in the base of the pit is considered to be negative, potentially extending beyond the site boundary since the area of impact could be around the site as game move into the area.

9.2.3.8 Groundwater

Groundwater abstraction will largely cease when mining is completed. The groundwater level will start to recover at this point, and although it is a slow process it is a positive impact on the regional geohydrology. The groundwater level will recover to an elevation of 720 mamsl, which is some 210 m below the pre-mining water level elevation. Post mining groundwater usage will only be for domestic purposes to supply the remaining camp and potentially the surrounding Gope residents.

The possibility remains that contaminants would continue to infiltrate from the slimes dam dams and RWD systems resulting in a negative impact on the receiving environment. Evaporation from the open pit will also cause accumulation of salts within the remaining water.

9.2.3.9 Air Quality

The decommissioning phase is associated with activities related to the demolition of infrastructure and the rehabilitation of disturbed areas. The following activities are associated with the decommissioning phase (US-EPA, 1996):

- Existing buildings and structures demolished, rubble removed and the area levelled;
- Remaining exposed excavated areas filled and levelled using overburden recovered from stockpiles;
- Stockpiles and tailings impoundments to be smoothed and contoured;
- Topsoil replaced using topsoil recovered from stockpiles, and
- Land and permanent waste piles prepared for re-vegetation.

Possible sources of fugitive dust emission during the closure and post-closure phase include:

- Smoothing of stockpiles by bulldozer;
- Grading of sites;
- Transport and dumping of overburden for filling;
- Infrastructure demolition;
- Infrastructure rubble piles;
- Transport and dumping of building rubble;
- Transport and dumping of topsoil, and
- Preparation of soil for re-vegetation – ploughing and addition of fertiliser and compost.

Exposed soil is often prone to erosion by water. The erodibility of soil depends on the amount of rainfall and its intensity, soil type and structure, slope of the terrain and the amount of vegetation cover (Brady, 1974). Re-vegetation of exposed areas for long-term dust and water erosion control is commonly used and is the most cost-effective option. Plant roots bind the soil, and vegetation cover breaks the impact of falling raindrops, thus preventing wind and water erosion. Plants used for re-vegetation should be indigenous to the area, hardy, fast-growing, nitrogen-fixing, provide high plant cover, be adapted to growing on exposed and disturbed soil (pioneer plants) and should easily be propagated by seed or cuttings.

9.2.3.10 Noise

During the decommissioning and closure phase, impacts concerning noise will involve the following:

- Increased ambient noise levels due to:
  - Continued vehicular flow;
  - Mining decommissioning (removal of plant and other associated infrastructure), and
  - Final rehabilitation activities (i.e. slimes dam capping, remaining final slope and exposed areas rehabilitation).

9.2.3.11 Sites of Archaeological and Cultural Interest

There will be no impact on sites of archaeological and cultural interest during this phase.

9.2.3.12 Visual

During the decommissioning and closure phase, the negative impacts associated with the visual aspects will start to decrease as the majority of the mining infrastructure will be removed from the site. In addition, final rehabilitation will be ongoing, thereby resulting in an improved visual character of the site as it becomes increasingly more natural looking.

9.2.3.13 Waste Management

The major impacts are associated with the operational phase of the mine. Only impacts that are different to those discussed for the decommissioning and closure phase are highlighted.

Additional hazardous wastes that may be mixed with general waste streams increase the risk of inappropriate waste disposal. This includes (for example), the contaminated concrete from spillage of hazardous substances and wastes in areas such as the hazardous waste stores, chemical stores and fuel storage facilities.

The demolition of these storage facilities will also increase the risk of soil contamination from in appropriate storage of chemicals and hazardous wastes.

Careful planning for the post-mine land use will be necessary to prevent wastage of unnecessary materials. The renovating of existing buildings (instead of their demolition) will decrease quantity of waste generated.

9.2.3.14 Social Impacts

9.2.3.14.1 Employment

During the decommissioning and closure phase of the GDMP, opportunities for the employment of unskilled and skilled labour will reduce significantly compared to the operational phase of the GDMP. This is expected to have a negative impact on the directly affected communities, as a source of income to members of such communities will cease upon closure of the GDMP.

A reduction in this negative impact upon the affected community will only be achievable if structures set up as a result of the Community Trust are implemented effectively. It is anticipated that non mining related projects will result from the activities of the community trust, thereby limiting the impact and extent of the closure of the GDMP.

9.2.3.14.2 HIV/AIDS

The impacts associated with the spread of HIV/Aids associated with the operational LOM of the GDMP are expected to cease once the mine closes.

9.2.3.14.3 Employment System

Impacts resulting from the employment system associated with the GDMP will cease.

9.2.3.14.4 Gope Residents

During the decommissioning and closure phase of the GDMP, impacts resulting from the operation of the mine will diminish and eventually cease. This may result in secondary impacts that may vary from positive to negative upon the residents of Gope and will be largely dependent upon the effectiveness of the implementation of projects run by the Community Trust.

9.2.3.14.5 Services for Workers

All these impacts will cease at closure.

9.2.3.14.6 Gender

These impacts will cease at closure.

9.2.3.15 Regional Socio-Economic Structure

The following socio-economic impacts are relevant to the decommissioning phase of the GDMP:

- Increase in unemployment and a vulnerable economic base resulting from down scaling and closure, and
- Squatting can increase as many people will have lost their means of income and this may result a negative impact upon social service delivery and infrastructure.

9.3. POWER LINE

9.3.1 Construction Phase

9.3.1.1 Geology

There will be only limited impact on the geology during the construction phase of the erection of the power line. Foundations will be dug for the pylons to a depth of approximately 2 m into the sands and possibly the hard rock calcrete and sediments in the northern third of the route close to Orapa.

9.3.1.2 Soils

During the construction phase of the power line there will definitely be a low negative impact on the soils of the linear feature. The access road will need to be upgraded (already exists for the total length of route) in order to get construction and supply vehicles to site and for the excavation of the pylon foundations. The foundations will be dug through / into the sands to a depth that will secure the structures in place (2 – 3 m). Small footprint areas will be disturbed around each pylon (<5 m^2).

The soils disturbed will be stockpiled in close proximity to the pylon for use in rehabilitation of affected areas. In addition, all materials removed from the surface in order for the construction / up-grading of the access route will need to be stockpiled along the side of the access way, and vegetated so as to protect the soil from wind and water erosion. Again, these soils should be conserved for use in rehabilitation if and when the access way is no longer needed.

Construction camps will need to be built to accommodate the construction teams. It is recommended, that the existing cattle posts and government camps that exist along the length of the existing access road be used in order to minimise the impacts associated with the construction of new camps. These will need to be expanded in size to accommodate the larger number of people, but will be confined to existing disturbed areas. Once inside the CKGR it is recommended that the camps be confined to the edge of the reserve (on the cut line), and to the mine area (50 km), and that the construction is undertaken from the two ends.

In addition, the soils will potentially be impacted by the leakage of fuels and oils (hydrocarbons) from the construction vehicles during the erection of the pylons. A strict management plan will be detailed to cater for this eventuality.

9.3.1.3 Land Capability

The capability of the land will be altered permanently along the length of the proposed power line route. A strip width of approximately 30 m wide along the length of the line will be altered along the existing roadway. The route will be serviced by the existing access road for the total length of the line. The roadway will need to be up-graded.

The impact on the land capability by the erecting of the proposed power line will have a definite negative impact and the access road and pylon points will alter the capability of the soils to industrial use.

9.3.1.4 Land Use

The land is at present used as an access road to the cattle posts and onto the cut line that services the boundary of the CKGR. The road continues into the reserve, and access the Gope Project Site area. The land use will be altered significantly for the life of the service.

The land will be altered from its present status to industrial use for the duration of the service and the impact on the land use will definitely be altered negatively.

9.3.1.5 Flora

9.3.1.5.1 Loss / Degradation of Pristine Vegetation / Habitat

The effect of this impact is twofold, namely on the site specifically as well as on the status of the CKGR. During the construction phase some vegetation will be lost by clearance of the servitude. Although a permanent effect is expected some recovery to a status that approximates natural is possible, but only after an extremely long period. The flora of the study area per se is not regarded sensitive as no significant species or habitat types were identified during the site investigation. The development will also be contained within the servitude and only unforeseen events might result in the loss of small, additional portions of natural habitat.

9.3.1.5.2 Alteration of Natural Ecological Processes / Ecosystem Functioning

Some ecological processes and existing ecosystems on the site will be affected adversely as a result of construction activities. Ecosystems and processes are dependent on the natural status of the area; changes to this effect will similarly affect the ecosystem. These impacts will however be confined to the site and limited effects will be noted in adjacent areas. Mitigation of these effects is not possible, but a high recovery rate is expected as a result of the fairly small area affected.

9.3.1.5.3 Introduction of Species not Associated with the Region

Alien and invasive species represent a significant threat to the natural biodiversity of the region. The transformation of natural habitat during the proposed activity, the periodic presence of personnel and vehicles will inevitably result in the presence of species that are not considered representative of the region, particularly along the perimeter of all areas of impacts. Also, some species that occur naturally in the area might become dominant as a result of changed habitat and also invade surrounding areas. The effect of alien and invasive species, once established, can reach astronomical proportions that could potentially affect the vegetation on a regional scale.

9.3.1.5.4 Changes in Vegetation Dynamics

The removal of some vegetation from the servitude will result in locally changed vegetation dynamics. This impact is expected to be confined to the servitude and limited effects will be noted in adjacent areas and is not expected to influence surrounding areas. Mitigation of these effects is however not possible. Prevention of the spread of this impact to surrounding areas is possible through containment.

9.3.1.5.5 Impacts on Sensitive Habitat Types

No sensitive environments were observed within the servitude variants and the threat of this impact is fairly low. However, some sensitive areas were observed in close proximity and the possibility does exist that these areas might be affected by non-construction activities such as irresponsible access and uncontrolled activities. The likelihood of this happening is low and it can be mitigated against.

9.3.1.6 Fauna

9.3.1.6.1 Bird Deaths on the Power Line

Raptors, especially vultures, could aggregate on the power lines and electrocutions of some of these birds are inevitable. This impact could be significant if left without mitigation – the use of mitigation structures as detailed in the SEMP, is likely to significantly lessen the impact of the power line on large raptors and the likelihood of electrocutions.

9.3.1.7 Surface Water

9.3.1.7.1 Impact on Surface Water Quality

During construction activities, some vegetation will be removed for the power line and access road servitude, as well as at the construction camps. The removal of vegetation could result in additional erosion by both water and wind. This will result in increased suspended solids content of water draining from the affected areas. As mentioned above as the area is endoreic and there are no dams or water courses that are directly affected. The impact will be confined to the localised area potentially affecting vegetation growth in areas where sand is deposited by water and wind. The occurrence of rainfall is generally erratic, so that wind erosion is probably the more significant risk factor.

As part of the construction of the power line construction camps will be erected. It is anticipated that diesel and oil will be stored at these camps. In addition, portable sewage units will be erected. These facilities could impact on surface water quality should any spills be experienced.

The potential impact on surface water quality is therefore assessed as negative, affecting the local extent.

9.3.1.8 Groundwater

The construction of above ground power lines will not result in any impacts on the groundwater.

9.3.1.9 Air Quality

The construction of a power line requires the general clearing of the servitude reserved for the line and associated road, as a result of this wind erosion may take place along the servitude until pioneer grasses can re-vegetated the area. The digging of holes for the pylon can cause nuisance dust, however this activity is of a short duration and unlikely to result in any significant emissions

9.3.1.10 Noise

During the construction phase, impacts concerning noise will involve the following:

- Increased ambient noise levels due to:
  - Power line construction activities, and
  - Increased vehicular flow (contractor's vehicles).

Construction noise impacts associated with the Orapa-Gope Power Line are considered to be of medium significance.

9.3.1.11 Sites of Archaeological and Cultural Interest

There will be no impact on sites of archaeological and cultural interest.

9.3.1.12 Visual

There will be a very limited impact on the visual aspect of the environment associated with the power line as pylons are a familiar sight to people and is not typically perceived as visually intrusive.

9.3.1.13 Waste Management

Impacts that are associated with the construction and operation of the mine (e.g. land filling, recycling,) will also apply to the construction of the power lines. The concern with regards to the power lines is that there will not be established waste facilities at the camps which will be setup for their construction, which can result in the following:

- Burying of wastes;
- Burning of wastes;
- Dumping of wastes (rubble, scrap metals), and
- Litter.

The wastes that are likely to be generated include the following:

- Food;
- Packaging wastes (e.g. paper, plastic, tins);
- Sewage;
- Hydrocarbons (from vehicles and machinery);
- Vegetation wastes (from clearing areas), and
- Scrap metal, plastics and other materials required for the erection of the power lines.

9.3.1.14 Social Impacts

The power line route area is not heavily populated, comprising mostly farm workers living on remote cattle posts. The farm workers are heavily dependent on Government transfers, which are collected in Letlhakane. Equally importantly, they also rely on Letlhakane for shopping, health services, and for education facilities for their children (who board at schools in Letlhakane and other areas in Central District). Any improvements in transport infrastructure would have important positive social impacts, but is not likely to increase vehicle traffic sufficiently to increase negative risks associated with in-migration and increased traffic.

9.3.1.15 Regional Socio-Economic Structure

Power supply to the region will contribute to the development of additional infrastructure (roads, water etc.) in the region.

9.3.2 Operational Phase

9.3.2.1 Geology

There will no impact on the geology due to the operation of the power lines.

9.3.2.2 Soils

During the operational phase of the power line there will be little to no impact on the soils of the linear feature. An access track or road will be driven on a routine schedule to inspect the lines. Usage of the road by public vehicles will inevitably require that repairs to erosion of the surface will be undertaken. A joint venture between BPC and the government roads department or cattle farmers will need to be considered.

9.3.2.3 Land Capability

The capability of the land will be altered permanently along the length of the proposed power line route. A power line strip width of approximately 30 m along the length of the line will be altered by the service / access road for the total length of the line.

9.3.2.4 Land Use

The use of the land will be altered permanently along the length of the proposed power line route. A power line strip width of approximately 30 m along the length of the line will be altered by the service / access road for the total length of the line. The existing roadway will be used and upgraded to accommodate the needs of the service maintainers.

9.3.2.5 Flora

Impacts relating to flora during the operational phase of the power line are limited to the occasional maintenance clearing of vegetation for the safe operation of the power line. This is considered a low negative impact.

9.3.2.6 Fauna

Raptors, especially vultures, could aggregate on the power lines and electrocutions of some of these birds are inevitable. This impact could be significant if left without mitigation – the use of mitigation structures as detailed in the SEMP, is likely to significantly lessen the impact of the power line on large raptors and the likelihood of electrocutions.

9.3.2.7 Surface Water

During the operational phase, the following potential impacts have been identified:

9.3.2.7.1 Reduction of Surface Water Yield

The power line servitude and access road will run from GDMP to Orapa, with the servitude width of approximately 30 m. The potential impact of the loss of yield is therefore assessed as no impact as there will be no storage or use of water along the power line route.

9.3.2.7.2 Impact on Surface Water Quality

The project area is endoreic and there are no dams or water courses that are directly affected by the power line and access road route, therefore no impacts on surface water quality have been identified for the operation of the power line and access road. Point source surface water impacts could result from vehicle accidental spillage during usage of the access road, however this impact is classified as minimal.

9.3.2.8 Groundwater

Due to the nature of the activity (i.e. overhead power lines), no impacts on the area groundwater is predicted.

9.3.2.9 Air Quality

Due to the nature of the work done with power lines the only emissions likely during the operational phase of the power line, would be the maintenance vehicles carrying out checks on the line. This impact is unlikely to have any significant health or environmental risks associated with it.

9.3.2.10 Noise

During the operational phase, impacts concerning noise will involve increased ambient noise levels due to:

- Power line noise generation (humming), and
- Vehicular movement (maintenance vehicles).

It has to be noted that the humming noise generated by the power line are a constant noise and becomes an integral part of the environment as soon as people and animals have had an opportunity to adjust to this. Thereafter, it is not regarded as a perceived impact.

9.3.2.11 Sites of Archaeological and Cultural Interest

There will be no impact on sites of Archaeological and Cultural Interest.

9.3.2.12 Visual

Once construction of the power line and servitude has been completed, no additional impacts relating to the visual aspect are expected.

9.3.2.13 Waste Management

Once operational, the power lines will only generate wastes when maintenance is required, in which the quantities of wastes generated are expected to be relatively low.

The types of wastes generated and associated impacts described above for the construction phase of the power lines would therefore apply to the operational phase, but to a much less extent.

9.3.2.14 Social Impact

No social impacts are expected during the operational phase of the power line.

9.3.2.15 Regional Socio-Economic Structure

There are no impacts expected during this phase as the power line will be dedicated to the GDMP for use.

9.3.3 Decommissioning and Closure Phase

It is not expected that the power line will be removed and the footprint remediated as BPC will take full ownership of the power line for use post the closure of the GDMP. Therefore no impact assessment has been compiled for this phase of the project.

9.4. ACCESS ROAD

The environmental assessment of the road options for access to Gope was undertaken by EHES.

In order to comparatively assess the two route options (Lephepe-Gope and Kaudwane-Gope), an impact assessment was undertaken for both routes. However, only the Lephepe-Gope option is outlined in this report, as this route have been assessed to be the preferred option. The EIA for the Kaudwane-Gope option is available in Appendix 15, which comprises the full report compiled by the sub-consultant.

9.4.1 Impact Assessment Methodology

Two methods were employed to assess the identified impacts, namely the Roads Department Guidelines and the EIA Model. The Roads Department Guidelines No. 5 were used to assess the positive impacts whereas the negative impacts were assessed using the EIA model. In order to compare the two options, the significance scores of the negative values were summed up. The lower the negative value the less severe the cumulative negative impacts of the option.

The Department of Roads Guideline No.5 may be represented in the diagram below.

Value + Magnitude

↓

Significance of Impacts

Value according to the Guideline No.5 refers to the use of the land area proposed for the road development. The value must be seen in relation to national and international strategies for conservation and development (Roads Department, 2001). The value of impacts has been ranked and provided by the Guideline as Large, Medium and Small/low value. These are explained in Table 90.

Table 90: Rank of Values

VALUE RANK	EXPLANATION
Large value	Areas protected by law or zoning, e.g. habitats of endangered species, areas or assets of national or great local importance, such as national parks or Kgotlas and areas of high vulnerability.
Medium value	Regionally important areas or areas which are considered to be important locally and of medium vulnerability.
Small / low value	Locally important areas and areas of low vulnerability

Source: Roads Department 2001

Magnitude explains the degree / extent / severity of the impact to the physical and/or socio-economic environment. Where possible it has been quantified. The scale for measuring the magnitude as provided in the Guideline and used in the assessment is provided in Table 91.

Table 91: Rank of Magnitude

MAGNITUDE SCALE	EXPLANATION
Large positive	Substantial positive effects
Medium	Condition noticeably improved
Small /None	Little or no change
Medium negative	Condition Noticeably worsened
Large Negative	Substantial adverse effects

Source: Roads Department 2001

The significance of an impact is the combination of the value and magnitude and done by judgemental value of the environmentalist. As indicated in the guideline the scale for assessing the significance is shown in Table 92.

Table 92: Rank of Significance

SYMBOL	MEANING
++++	Very Large Positive Significance
+++	Large Positive Significance
++	Fairly Positive Significance
+	Small Positive Significance
0	Small / no Significance
-	Small Negative Significance
--	Fairly Negative Significance
---	Large Negative Significance
----	Very Large Negative Significance

Source: Roads Department 2001

The potential negative impacts identified have been assessed below using the International Standards Organisation (ISO) Environmental Management System Standards (ISO, 1996). The system assesses the anticipated significance of the impacts associated with the project as follows:

Significance of Environmental Impact = Probability x Consequence

The consequences of impacts are described by considering the:

- Severity / magnitude of impacts;
- Spatial extent, and
- Duration of the impacts.

So that

Consequence = severity + duration + spatial scale

Probability refers to an assessed probability of the occurrence of the predicted impact. The ranking scale for measuring the consequence of impacts and their significance is given in Table 93.

Table 93: Consequence and Probability Ranking Scale

SEVERITY / MAGNITUDE	DURATION	SPATIAL SCALE	PROBABILITY
10 – Very high / don't know	5 – Permanent	5 – International	5 – Definite / don't know
8 – High	4 – Long-term (impact ceases after operational life)	4 – National	4 – Highly probable
6 – Moderate	3 – Medium-term (4-40 years)	3 – Regional	3 – Medium probability
4 – Low	2 – Short-term (0-3 years)	2 – Local	2 – Low probability
2 – Minor	1 – Immediate	1 – Site only	1 – Improbable
0 – None			0 – None

The highest Significance score or Significance Points (SP) is 100. The significance of environmental effects is then classified as follows:

SP>60	High environmental significance
SP = 30 to 60	Moderate environmental significance
SP <30	Low environmental significance

Apart from conforming to a recognized and accepted international standard, this approach to EIAs also provides a clear assessment of all the negative and positive impacts that result from the proposed development, and thus a clear indication as to whether or not the project should proceed. For all identified negative impacts, mitigation measures have been proposed.

9.4.2 Construction Phase

9.4.2.1 Geology

Opening of borrow pits along the Lephepe-Gope route will not impact much on the game reserve because all the 10 identified borrow pits fall outside the CKGR. The severity of this impact is assessed as low particular that the borrow pits are located outside the CKGR.

9.4.2.2 Soils

As observed during the site visit, the project site is highly undulating with numerous sections associated with deep sand. It is anticipated that the scarifying of the road may initiate soil erosion. This impact is significant given the general undulating terrain along most sections of the road, such that storm runoff from the road could initiate erosion in the clayey sections along the road.

9.4.2.3 Land Capability

The land capability of the corridor along the access road is unlikely to be significantly impacted.

9.4.2.4 Land Use

The land use along the expanded servitude of the access road will be altered permanently.

9.4.2.5 Flora

While species poor (Menaut, 1983), and typified as a shrub and low tree savanna with a field layer of tufted perennials, the vegetation of the proposed road corridors is rather complex in detail, because woody and herbaceous plants combine to form mosaics of considerable heterogeneity (Weare, 1971). The construction of the road will result in loss of some of this vegetation due to clearing of the access corridor. Associated with this is the resulting disturbance of the topsoil, but due to sandy and flat terrain, it is not expected that this disturbance will lead to soil erosion. Regardless, the areas are already somewhat disturbed due to the presence of the road and associated tourist movement along such roads.

This impact is significant given that the traversed land is a protected zone and also that most of the clearing is to be done in areas not ecologically disturbed.

9.4.2.6 Fauna

9.4.2.6.1 Game Poaching

The construction of a well maintained road will provide an easy route into a protected area. This will create a potential for large poaching and illegal entry problems. The long stretch of the road from Lephepe along the unfenced CKGR boundary may prove attractive for illegal entry into the park.

9.4.2.6.2 Disturbance to Wildlife

During the road construction, it is anticipated that there will be noise generated from the machinery used. This noise generated will force wildlife to relocate to a quite place. The significance of the impact is fairy negative basing of the short distance within the CKGR.

9.4.2.7 Surface Water

This environmental aspect was not assessed, but no significant impacts are expected to occur on the endoreic surface water regime during the construction phase of the access road.

9.4.2.8 Groundwater

The construction of the access road will involve the use of machinery, which may leak oil into the environment especially if repairs are undertaken on site. However, due to the sandy nature of the terrain, the depth to groundwater which exceeds 100 m in the Kalahari, the potential for pollution of groundwater is considered to be negligible.

9.4.2.9 Air Quality

Land excavation, scooping of topsoils and hauling of road construction material tend to generate dust, which may form capping on vegetation which is detrimental to vegetation.

9.4.2.10 Noise

Ambient noise levels along this road are low. The noise generated from machinery would be of fairly negative significance.

9.4.2.11 Sites of Archaeological and Cultural Interest

No sites of archaeological significance were found during the assessment for the road alignment, therefore no impacts are anticipated.

9.4.2.12 Visual

The only visual aspect identified was that of littering along the access road and is regarded as a negative visual impact.

9.4.2.13 Waste Management

Waste is likely to be generated by the workers at the project site. Haphazard littering is likely to impact negatively on the aesthetics of the CKGR. Some waste materials can also attract wild animals to consume them, which can be detrimental to the health of such animals. The severity of this impact is assessed as low on the basis of the number of people to be on site. However, if not carefully handled the effects of littering may be disastrous and significant.

9.4.2.14 Regional Socio-Economic Structure

This route does not have much social amenities that can be interrupted by the road construction. The significance of this impact is small negative.

9.4.2.14.1 Employment Creation

The construction of the road would create short-term employment. Employment of the local community is largely positive in that it contributes to the socio-economic development of the community.

9.4.2.14.2 Boost to Local Economy

It is anticipated that the proposed project would lead to an injection of cash into the local economy. With an influx of temporary workers during the construction phase, it is envisaged that there would be an increase in informal economic activities such as food and street vendors.

This is a fairly positive significant impact, which would occur during the construction phase.

9.4.2.14.3 Benefit to Farmers

It is anticipated that the proposed road will be of good use to farmers who own cattle posts and farms near the road. The estimated cattle population in the region is around 200,000 according to the Annual Agricultural Survey Report, Ministry of Agriculture.

9.4.2.14.4 Social Pathologies

It is anticipated that a staging camp will be erected in Lephepe village for recruitment purposes. With this influx of people there is potential for the spread of sexually transmitted diseases such as HIV/Aids.

This impact is highly anticipated during the construction phase. Experience from other areas in the country have shown that the influx of construction workers in rural areas often leads to an increase in casual relationships with its associated problems of lawlessness and pregnancies especially amongst the youth. The impact is therefore judged as largely negative.

9.4.2.15 Traffic

It is anticipated that there would be traffic hazards during the construction phase due to the presence of cattle posts. The significance of this impact is fairly negative.

9.4.3 Operational Phase

9.4.3.1 Geology

No impacts on the geology of the project site will occur during the operational phase.

9.4.3.2 Soils

No further impacts on the soils associated with the access road are expected to occur during the operational phase.

9.4.3.3 Land Capability

No further impacts upon the land capability were identified.

9.4.3.4 Land Use

No further impacts upon the land use were identified, but for the duration of the operational phase of the road, the land use would remain changed.

9.4.3.5 Flora

No further impacts upon the flora were identified for the operational phase of the road.

9.4.3.6 Fauna

As noted earlier, the road traverses cattle post areas and finally enters into a protected area. The improvement of the road in an area with animals such as cattle, duiker, kudu, eland and birds such as ostriches and guinea fowls pose a threat to the animals as well as the motorists.

If the Dibete cordon fence is not sealed, animals will be attracted to the road to drink water from the side drainage channels. The animals may eventually sleep on the road hence posing a threat to the motorists.

9.4.3.7 Surface Water

No impacts upon surface water were identified.

9.4.3.8 Groundwater

No further impacts upon the groundwater regime were identified.

9.4.3.9 Air Quality

The effects of dust will be experienced during the operational stage of the road. This will mostly affect vegetation and wildlife in the area. The severity of this impact is assessed as fairly negative.

9.4.3.10 Noise

No impacts upon noise levels water were identified for the operational phase of the access road. However, it can be expected that noise levels will increase intermittently during the course of each day the road is in operation as vehicles move along the road.

9.4.3.11 Sites of Archaeological and Cultural Interest

No sites of archaeological significance were found during the assessment for the road alignment, therefore no impacts are anticipated.

9.4.3.12 Visual

No impacts upon visual aspects of the environment were identified.

9.4.3.13 Waste Management

No impacts regarding waste were identified for the operational phase of the proposed access road. Apart from a potential impact resulting from littering, no further waste generation is likely to be associated with the operation of the access road.

9.4.3.14 Regional Socio-Economic Structure

9.4.3.14.1 Boost to the Local Economy

It was noted that the first 50 km of the road from Lephepe passes through cattle posts. This section of the road will therefore be beneficial to the local farmers as they will be able to reach Botswana Meat Commission / abattoirs relatively easily. This is a fairly positive significant impact which would occur during the operation phase.

9.4.3.14.2 Increase in Land Value

With the road in operation, it is anticipated that land values along the section of the road may increase with all year round access along it. The development and expansion of Lephepe settlement will result in significant increase in land value. This is a potential positive impact with long term benefits.

9.4.3.14.3 Social Ills Associated with Truck Stops such as Prostitution and Spread of HIV/Aids

Restrictions will be placed on entry into the game reserve after 6pm. That means trucks arriving after 6pm would have to be held at Lephepe or at a holding area at the gate overnight. This stopover is likely to increase or introduce prostitution and HIV/Aids into Lephepe. This is a potentially significant negative impact.

9.4.3.15 Traffic

9.4.3.15.1 Increase in Road Accidents due to Road Improvement

The road improvement would likely lead to motorists speeding up. This is a potential fairly negative impact.

9.4.3.15.2 Vehicles Speeding Beyond the Stipulated Speed Limit

The provision of an improved road within the game reserve will result in increased speed by motorists. Animals such as duiker and guinea fowls that prefers to use open corridors will be at risk. The severity of this impact is large negative based on the life span of the mine in which the road will be in existence.

9.4.4 Decommissioning and Closure Phase

It is not expected that the access road will require rehabilitation, decommissioning or closure at the end of LOM, therefore no assessment of such impacts were undertaken.

9.5. IMPACT EVALUATION

The evaluation of impacts is conducted in terms of the criteria detailed in Table 94 to Table 98. The various environmental impacts and benefits of this project are discussed in terms of impact status, extent, duration, probability, and intensity. Impact significant is regarded as the sum of the impact extent, duration, probability and intensity and a numerical rating system will be applied to evaluate impact significance; therefore an impact magnitude and significance rating is applied to rate each identified impact in terms of its overall magnitude and significance (Table 99).

In order to adequately assess and evaluate the impacts and benefits associated with the project it was necessary to develop a methodology that would scientifically achieve this and to reduce the subjectivity involved in making such evaluations. To enable informed decision-making it is necessary to assess all legal requirements and clearly defined criteria in order to accurately determine the significance of the predicted impact or benefit on the surrounding natural and social environment.

9.5.1 Impact Status

The nature or status of the impact is determined by the conditions of the environment prior to construction and operation. A discussion on the nature of the impact will include a description of what causes the effect, what will be affected and how it will be affected. The nature of the impact can be described as negative, positive or neutral.

Table 94: Status of Impact.

RATING	DESCRIPTION	QUANTITATIVE RATING
Positive	A benefit to the receiving environment.	+
Neutral	No cost or benefit to the receiving environment.	N
Negative	A cost to the receiving environment.	-

9.5.2 Impact Extent

The extent of an impact is considered as to whether impacts are either limited in extent of if it affects a wide area or group of people. Impact extent can be site specific (within the boundaries of the development area), local, regional or national and/or international.

Table 95: Extent of Impact.

RATING	DESCRIPTION	QUANTITATIVE RATING
Low	Site Specific; Occurs within the site boundary.	1
Medium	Local; Extends beyond the site boundary; Affects the immediate surrounding environment (i.e. up to 5 km from Gope Project Site boundary).	2
High	Regional; Extends far beyond the site boundary; Widespread effect (i.e. 5 km and more from Gope Project Site boundary).	3
Very High	National and/or international; Extends far beyond the site boundary; Widespread effect.	4

9.5.3 Impact Duration

The duration of the impact refers to the time scale of the impact or benefit.

Table 96: Duration of Impact.

RATING	DESCRIPTION	QUANTITATIVE RATING
Low	Short term; Quickly reversible; Less than the project lifespan; 0 – 5 years.	1
Medium	Medium term; Reversible over time; Approximate lifespan of the project; 5 – 17 years.	2
High	Long term; Permanent; Extends beyond the decommissioning phase; >17 years.	3

9.5.4 Impact Probability

The probability of the impact describes the likelihood of the impact actually occurring.

Table 97: Probability of Impact.

RATING	DESCRIPTION	QUANTITATIVE RATING
Improbable	Possibility of the impact materialising is negligible; Chance of occurrence <10%.	1
Probable	Possibility that the impact will materialise is likely; Chance of occurrence 10 – 49.9%.	2
Highly Probable	It is expected that the impact will occur; Chance of occurrence 50 – 90%.	3

RATING	DESCRIPTION	QUANTITATIVE RATING
Definite	Impact will occur regardless of any prevention measures; Chance of occurrence >90%.	4

9.5.5 Impact Intensity

The intensity of the impact is determined to quantify the magnitude of the impacts and benefits associated with the proposed project.

Table 98: Intensity of Impact.

RATING	DESCRIPTION	QUANTITATIVE RATING
Maximum Benefit	Where natural, cultural and / or social functions or processes are positively affected resulting in the maximum possible and permanent benefit.	+ 5
Significant Benefit	Where natural, cultural and / or social functions or processes are altered to the extent that it will result in temporary but significant benefit.	+ 4
Beneficial	Where the affected environment is altered but natural, cultural and / or social functions or processes continue, albeit in a modified, beneficial way.	+ 3
Minor Benefit	Where the impact affects the environment in such a way that natural, cultural and / or social functions or processes are only marginally benefited.	+ 2
Negligible Benefit	Where the impact affects the environment in such a way that natural, cultural and / or social functions or processes are negligibly benefited.	+ 1
Neutral	Where the impact affects the environment in such a way that natural, cultural and / or social functions or processes are not affected.	0
Negligible	Where the impact affects the environment in such a way that natural, cultural and / or social functions or processes are negligibly affected	- 1
Minor	Where the impact affects the environment in such a way that natural, cultural and / or social functions or processes are only marginally affected.	- 2
Average	Where the affected environment is altered but natural, cultural and / or social functions or processes continue, albeit in a modified way.	- 3
Severe	Where natural, cultural and / or social functions or processes are	- 4

RATING	DESCRIPTION	QUANTITATIVE RATING
	altered to the extent that it will temporarily cease.	
Very Severe	Where natural, cultural and / or social functions or processes are altered to the extent that it will permanently cease.	- 5

9.5.6 Impact Significance

The impact magnitude and significance rating is utilised to rate each identified impact in terms of its overall magnitude and significance.

Table 99: Impact Magnitude and Significance Rating.

IMPACT	RATING	DESCRIPTION	QUANTITATIVE RATING
Positive	High	Of the highest positive order possible within the bounds of impacts that could occur.	+ 12 – 16
	Medium	Impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur. Other means of achieving this benefit are approximately equal in time, cost and effort.	+ 6 – 11
	Low	Impacts is of a low order and therefore likely to have a limited effect. Alternative means of achieving this benefit are likely to be easier, cheaper, more effective and less time-consuming.	+ 1 – 5
No Impact	No Impact	Zero impact.	0
Negative	Low	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts, mitigation is either easily achieved or little will be required, or both. Social, cultural, and economic activities of communities can continue unchanged.	- 1 – 5
	Medium	Impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur. In the case of adverse impacts, mitigation is both feasible and fairly possible. Social cultural and economic activities of communities are changed but can be continued (albeit in a different form). Modification of the project design or alternative action may be required.	- 6 – 11
	High	Of the highest order possible within the bounds of impacts that could occur. In the case of adverse	- 12 - 16

IMPACT	RATING	DESCRIPTION	QUANTITATIVE RATING
		impacts, there is no possible mitigation that could offset the impact, or mitigation is difficult, expensive, time-consuming or a combination of these. Social, cultural and economic activities of communities are disrupted to such an extent that these come to a halt.	

Table 100, summarises the impacts for each individual phase of the project, namely the construction, operational and decommissioning / closure phases. The table summarises the identified / expected impacts of a proposed activity during each project phase both before and after the proposed mitigations measures. A description of the terms used in the table is detailed below:

Aspect:	Refers to the physical, biophysical or socio-economic environmental components as investigated in the SEIA.
General Impact:	Refers to the broad-spectrum or category of the expected impact being pollution, degradation, loss; etc.
Specific Impact:	Refers to the actual activity that will cause the expected impact.

Table 100: Mine Site – Construction Phase

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
Climate	Contribution to climate change	Carbon and other greenhouse gasses into the atmosphere	Construction operations	Negative (-)	-1	-1	-3	-1	-6	• Ensure vehicle exhaust systems function correctly. • Ensure energy reduction practices are developed & implemented.	-1	-1	-1	-1	-4
			Land based vehicle activity	Negative (-)	-1	-2	-3	-1	-7		-1	-2	-1	-1	-5
			Use of backup diesel generators during construction	Negative (-)	-1	-2	-3	-1	-7		-1	-2	-1	-1	-5
Geology	Destruction of geology	Total removal of target ore body and overlying waste material (sand & basalt)	Kimberlite and overburden material will be removed, processed and either stockpiled as slimes, tailings or as waste rock	Negative (-)	-1	-3	-4	-5	-13	• None possible – geology will be permanently destroyed. • Limit impacts of geology to the MLA only.	-1	-3	-4	-5	-13
Soils	Disturbance of topsoil	Soil disturbance, loss of nutrients, loss of topsoil cover, loss of in situ structure and physical/Chemica l Properties.	Clearing of vegetation of mining and infrastructure	Negative (-)	-1	-3	-4	-5	-13	• Strip and stockpile top- and subsoils appropriately • Commence rehabilitation of affected and completed areas • Application of soil handling and removal practices (including vegetative cover) • Application of soil emplacement and storage practices • Fertilisation and amendments	-1	-1	-3	3	-2
			Removal of topsoil – TMF and WRD	Negative (-)	-1	-3	-4	-5	-13		-1	-3	-3	3	-4
			Removal of topsoil – processing plant	Negative (-)	-1	-3	-3	-5	-12		-1	-2	-2	3	-2
			Removal of topsoil and subsoil in the open pit mining area	Negative (-)	-1	-3	-4	-5	-13		-1	-3	-3	3	-4

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
		Soil removal and / or disturbance (compaction, erosion & contamination).	TMF construction – footprint	Negative (-)	-1	-3	-4	-5	-13	• Re-use top- and subsoils during ongoing rehabilitation • Rehabilitate as soon as possible • Erosion control and treatment • Implementation of good house keeping practices • Spill clean up	-1	-2	-3	3	-3
			Establishment of plant – footprint & foundations	Negative (-)	-1	-3	-4	-5	-13		-1	-2	-3	3	-3
			RWD construction wall & footprint	Negative (-)	-1	-3	-4	-5	-13		-1	-2	-4	3	-4
			WRD construction – footprint	Negative (-)	-1	-3	-4	-5	-13		-1	-3	-3	3	-4
			Construction of surface water management systems	Negative (-)	-1	-3	-4	-5	-13		-1	-2	-4	2	-5
			ROM Stockpile pad construction	Negative (-)	-1	-3	-4	-5	-13		-1	-2	-3	3	-3
			Stockpiling of soils	Negative (-)	-1	-2	-4	-5	-12		-1	-1	-3	4	-1
			Spillages	Negative (-)	-1	-3	-3	-4	-11		-1	-1	-3	-1	-6
Land Capability & Land Use	Change of land capability	Land Capability will be reduced to “mining land” conservation status at best	Disruption of ecosystem due to mining activities and infrastructure	Negative (-)	-1	-3	-3	-5	-12	• Effective soil handling and removal practices • Effective soil emplacement and storage practices • Fertilisation and amendments. • Soil amelioration	-1	-3	-3	-3	-10
	Change of land	Loss of natural	Mining operation and	Negative	-1	-3	-3	-5	-12	• Limiting the	-1	-3	-3	-4	-11

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
	use	habitat (i.e. a change of land use from wilderness to mining)	infrastructure	(-)						footprint of the mining operation to the MLA • Prevention of dust and spillage of rock material • Appropriate maintenance of the road ways					
Natural Vegetation / Plant Life	Destruction of local ecological integrity, decimation of vegetation on site, peripheral impacts relating to human presence & mining activities	Potential loss / degradation of local pristine vegetation / habitat	Land transformation though mine & associated infrastructure development	Negative (-)	-2	-3	-4	-5	-14	• Minimise GDMP footprint: - Use existing roads where possible - Clear minimum vegetation - Maximise site vegetation retention areas • Erection of fence • Preservation of vegetation • Implementation of conservation practices • Fire prevention • Ongoing rehabilitation	-2	-3	-4	-5	-14
		Alteration of natural ecological processes / ecosystem functioning	Creation of atypical/ non-natural habitat, presence of humans for prolonged periods	Negative (-)	-2	-3	-4	-5	-14		-2	-3	-4	-5	-14
		Introduction of species not associated with the region	High traffic volume between site & other areas	Negative (-)	-3	-3	-2	-3	-11		-2	-2	-1	-1	-6
		Changes in vegetation dynamics	Fires, water, vegetation transformation	Negative (-)	-2	-3	-3	-4	-12		-2	-3	-3	-4	-12
		Impacts on sensitive environments (receiving water body / pan)	Direct/ indirect impacts, physical or cumulative, wood harvesting, plant collection	Negative (-)	-2	-3	-1	-4	-10		-1	-3	-1	0	-5
An im	Destruction of local ecological	Potential loss / degradation of	Land transformation though mine &	Negative	-2	-3	-4	-5	-14	• Ensure pockets of vegetation remain in	-2	-3	-4	-4	-13

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
	integrity, decimation of faunal habitat on site, peripheral impacts relating to human presence & mining activities	**local pristine faunal habitat and/or communities**	**associated infrastructure development**	**(-)**						**order to ensure a measure of ecological connectivity** • **Limit impacts to the MLA**					
		Road deaths of animals on access roads	**Reckless driving and night-time driving on access roads**	**Negative (-)**	**-1**	**-1**	**-4**	**-3**	**-9**	• **Vehicles are to yield to larger mammals** • **Keep within the applicable speed limits** • **Prohibit night driving, except in case of emergencies**	**-1**	**-3**	**-1**	**-2**	**-7**
		Alteration of natural ecosystem functioning/ disruption of migration routes	**Land transformation though mine & associated infrastructure development**	**Negative (-)**	**-3**	**-3**	**-4**	**-2**	**-12**	• **Ensure pockets of vegetation remain in order to ensure a measure of ecological connectivity** • **Limit impacts to the MLA**	**-3**	**-3**	**-4**	**-2**	**-12**
		Increase in poaching, snaring and trapping of animals	**Increase in human habitation at the site and lack of environmental awareness**	**Negative (-)**	**-2**	**-1**	**-4**	**-3**	**-10**	• **Fencing of the Gope Project Site** • **Policing of boundary fence** • **GEC stipulated disciplinary action** • **Warning signs** • **Appointment of Honorary Game**	**-2**	**-1**	**-2**	**-2**	**-7**

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
										Wardens.					
		Impact of chemical compounds from construction on animals	Release of hazardous/ bio-accumulating chemicals into the environment	Negative (-)	-2	-3	-2	-2	-9	• Eliminate leaching of chemicals • Implementation of containment structures • Responsible transportation and storage of chemicals	-2	-3	-1	-1	-7
		Attraction of animals to artificial surface water	Large sources of artificial surface water introduced	Negative (-)	-3	-1	-4	-4	-12	• Limit open water sources to those required only • Monitor animal access • If required, upgrade fences immediately surrounding open water sources to electrified fencing	-1	-1	-2	-2	-6
		Loss of natural faunal species to introduced faunal species	Killing of small mammals by domestic cats and dogs	Negative (-)	-2	-2	4	-4	-12	• Prevent introduction of foreign species to the CKGR by prohibiting all pets	0	0	0	0	0
Surface Water	Impact on surface water quality	Increased TDS, possible erosion (wind and water)	Stripping of vegetation as part of construction Instability of stockpiles (sand)	Negative (-)	-2	-1	-4	-3	-10	• Limit areas to be stripped for construction purposes • Minimise wind and water erosion • Slope stabilisation • DTM model and implementation of surface water management	-1	-1	-4	-1	-7

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
										structures					
Groundwater	Depletion of aquifer	Lowering of groundwater level	Dewatering of the aquifer to ensure dry mining conditions and pit slope stability	Negative (-)	-2	-3	-4	-5	-14	• Impact on drawdown is minimal, therefore no mitigation measures proposed	-2	-3	-4	-5	-14
			Groundwater abstraction for potable and process water demand		-2	-2	-4	-3	-11		-2	-2	-4	-1	-9
	Pollution	Groundwater quality deterioration	Biological contamination of localised aquifer due to domestic and sewage effluent disposal	Negative (-)	-1	-2	-1	-1	-5	• 80m sand filter between surface & aquifer, thus very little risk of biological contamination • Implement recommended waste management systems • Manage inorganic substances on surface to prevent groundwater impacts	-1	-1	-1	-1	-4
Air Quality	Fugitive Dust and PM	Reduction in ambient air quality from fugitive dust emissions	Construction and grading of haul roads	Negative (-)	-2	-1	-2	-2	-7	• Reduce extent of construction operation taking place, rather phase in (thus reduce exposure) • Use of windbreaks, chemical + water	-2	-1	-2	-2	-7
			Civil site preparation	Negative (-)	-2	-1	-2	-1	-6		-2	-1	-2	-1	-6
			Construction of mining operations /	Negative (-)	-3	-1	-2	-3	-9		-3	-1	-2	-3	-9

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
			infrastructure							suppression					
			Pre-stripping of sand	Negative (-)	-3	-1	-3	-3	-10	• Rock cladding of stockpiles / dumps on prevailing wind facing slopes	-3	-1	-3	-2	-9
			Overburden & waste rock dumping	Negative (-)	-2	-2	-3	-3	-10	• Re-vegetation of areas as soon as possible	-2	-2	-3	-2	-9
			Construction of plant and other infrastructure	Negative (-)	-1	-1	-2	-2	-6	• Reduction of drop height as far as is practicable	-1	-1	-2	-2	-6
			Material transfer operations	Negative (-)	-3	-2	-3	-3	-11	• Reduction of speed of vehicles to keep within the applicable speed limits	-3	-2	-3	-2	-10
			Wind erosion from exposed storage (stockpiles & mine residue deposits) piles	Negative (-)	-3	-3	-3	-3	-12		-2	-1	-1	-1	-5
			Vehicle entrained dust from both paved and unpaved road surfaces	Negative (-)	-2	-2	-3	-3	-10		-2	-1	-1	-1	-5
			Process fugitive emissions (crushing and screening operations)	Negative (-)	-2	-2	-3	-3	-10		-2	-2	-3	-2	-9
			Remediation and rehabilitation	Neutral (N)	-1	-1	-1	-0	-3		-1	-1	-1	+2	-1
		Dust emissions resulting in respiratory and		Negative (-)	-2	-2	-1	-3	-8		-2	-1	-1	-1	-5

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
		cardiovascular ailments													
		Reduced visibility, soiling of buildings and materials		**Negative (-)**	**-1**	**-2**	**-1**	**-3**	**-7**		**-1**	**-2**	**-1**	**-1**	**-5**
Noise & Vibration	**Noise Pollution**	**Increased ambient noise levels**	**Construction activities (mine and other infrastructure)**	**Negative (-)**	**-1**	**-1**	**-4**	**-3**	**-9**	• **All machinery used during construction will be maintained in sound mechanical condition** • **Placement of waste structures (slimes dam, sand dump, WRD) has been designed such as to create a noise barrier** • **PPE**	**-1**	**-1**	**-2**	**-1**	**-5**
			Use of diesel generators	**Negative (-)**	**-1**	**-1**	**-4**	**-3**	**-9**	• **On-site generators should be clad in suitable material or housed in structures that would reduce their noise impacts** • **Generators will be fitted with appropriate silencers.** • **PPE**	**-1**	**-1**	**-2**	**-1**	**-5**
			Increase traffic flow (on-site)	**Negative (-)**	**-1**	**-2**	**-4**	**-3**	**-10**	• **All vehicles will be fitted with appropriate sound suppression devices**	**-1**	**-1**	**-2**	**-2**	**-6**

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
										or silencers • Keep within the applicable speed limits					
			Air traffic flow (aircraft & helicopter)	Negative (-)	-2	-2	-4	-2	-10	• Weekly flights to & from the GDMP will be restricted to daylight hours, except for emergencies	-2	-2	-3	-2	-9
			Periodic blasting as part of sand stripping activities	Negative (-)	-2	-1	-2	-3	-8	• Placement of waste structures (slimes dam, sand dump, WRD) has been designed such as to create a noise barrier. • PPE will be worn at all times during construction activities.	-2	-1	-2	-2	-7
	Vibration	Nuisance disruption to sensitive fauna, employees & communities	Blasting of waste material and ore	Negative (-)	-2	-1	-3	-3	-9	• Complaints by I&APs will be recorded in a Complaints Register and addressed throughout the duration of the existence of the power line • Blasts will be designed by a suitably qualified engineer	-2	-1	-2	-2	-7
		Impact on building	Blasting of waste material and ore	Negative	-1	-2	-2	-3	-8	• Foundations of buildings closer to	-1	-1	-1	-1	-4

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
		foundation stability		(-)						the open-pit area are to be able to withstand the effects of the vibrations.					
Archaeology & Heritage	Impact of the mining development on San graves	Impact of mining development on the one grave directly impacted by the mining operation.	Construction and establishment of mine and infrastructure	Negative (-)	-1	-3	-4	-5	-13	• Relocation of grave(s)	-1	-1	-1	0	-3
		Impact of mining development on graves located within the Gope Project Site.	Construction and establishment of mine and infrastructure	Negative (-)	-1	-3	-1	-1	-6	• Fencing and management of site	-1	-1	-1	+2	-1
		Impact of mining development on the graves situated outside of Gope Project Site and those situated outside of the MLA.	Construction and establishment of mine and infrastructure	Neutral (N)	0	0	0	0	0	• No mitigation required	0	0	0	0	0
	Impact of the mining development on San settlements	Impact of mining development on the settlements situated within the Gope Project Site.	Construction and establishment of mine and infrastructure	Negative (-)	-1	-3	-4	-2	-10	• Documentation of three significant settlements by a qualified archaeologist.	-1	-1	-1	+3	0
		Impact of mining development on the settlements situated outside of the Gope Project Site but	Construction and establishment of mine and infrastructure	Neutral (N)	0	0	0	0	0	• No mitigation required	0	0	0	0	0

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
		inside the MLA.													
		Impact of mining development on the settlements situated outside of the MLA	Construction and establishment of mine and infrastructure	Neutral (N)	0	0	0	0	0	• No mitigation required	0	0	0	0	0
Visual	Visual impact	Change in land-use and available view	Construction vehicle movement (sequential impact).	Negative (-)	-3	-1	-4	-2	-10	• Fleet design and optimisation.	-2	-1	-2	-1	-6
			Temporary structures (including temporary residential facilities and contractors camp).	Negative (-)	-2	-1	-4	-2	-9	• All buildings and structures shall be finished in a colour (or a surface which weathers to a colour) in shades of green, brown or grey with a maximum reflectance value of 37% (excluding fittings)	-2	-1	-2	-1	-6
			Entrances, signs and boundary treatment.	Negative (-)	-1	-1	-4	-2	-8	• Limit signage (number & size) to fall within the GEC requirements.	-1	-1	-2	-1	-5
			Material storage (topsoil stockpiles and material stockpiles).	Negative (-)	-3	-3	-4	-3	-13	• Restriction of the height of mineralogical waste structures • Ongoing rehabilitation and re-vegetation of mineralogical waste structures	-3	-3	-4	-2	-12
		Light pollution	Lighting of mining	Negative	-2	-2	4	2	-10	• Appropriate light	-2	-2	-2	-1	-7

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
			operations during night time	(-)						fitting installation • Installation of shielding • Limit light intensity					
Waste	Contamination of soil and groundwater Landfill space Health risks - exposure to hazardous wastes	Contamination of groundwater, surface water	Leaching of hazardous substances from tailings and slimes	Negative (-)	-1	-1	-1	-1	-4	• Leaching probability is low – no additional mitigation measures required	-1	-1	-1	-1	-4
		Consumption of land space	Generation and disposal of general waste to landfill	Negative (-)	-1	-3	-3	-2	-9	• Re-use of wastes – avoidance of virgin material • Recycling of wastes off site	-2	-3	-2	+4	-3
		Contamination of soil & groundwater. Consumption of land space	On-site land filling / burial of biodegradable wastes (permanent on-site disposal)	Negative (-)	-1	-3	-2	-2	-8	• On-site disposal of organic food wastes only	-1	-1	-1	-1	-4
		Contamination of soil	Temporary storage of hazardous waste on unprotected ground – on site or off-site (e.g. at Ramotswa Landfill) Hazardous waste spills outside contained areas.	Negative (-)	-1	-2	-3	-3	-9	• Storage of hazardous wastes in purpose built stores (impermeable floors, bunding etc.) • Labelling of containers	-1	-1	-1	-1	-4
		Contamination of groundwater	Disposal of hazardous wastes on general landfills	Negative (-)	-2	-3	-3	-5	-13	• Contactor control • Traceability (documentation) and reconciliation of waste disposed	-2	-3	-1	-2	-8

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
		Litter -aesthetic impacts Litter - ingestion by animals	Waste not placed in designated waste bins / containers	Negative (-)	-1	-1	-2	-2	-6	• Provision of bins • Management and education of people	-1	-1	-1	-1	-4
		Odour – unpleasant and may attract pests and wildlife	Waste not disposed of timeously or kept in closed containers	Negative (-)	-2	-1	-2	-2	-7	• Frequent removal of waste	-1	-1	-1	-2	-5
		Infections from medical waste	Unsuitable handling and disposal of medical waste (sharps and bandages)	Negative (-)	-2	-3	-3	-4	-12	• Provision of suitable waste containers • Contractor control • Disposal to authorised sites	-2	-1	-1	-1	-5
		Health risks of staff and public from exposure to hazardous wastes	Handling of hazardous waste without suitable PPE by staff or public	Negative (-)	-2	-3	-3	-4	-12	• Provision of suitable waste containers and PPE • Contractor control • Disposal to authorised sites	-1	-1	-1	-3	-6
		Air pollution, including dioxins and furans from incineration of medical wastes	Air emissions from incinerator	Negative (-)	-3	-2	-2	-3	-10	• Contractor control • Disposal to authorised sites	-2	-2	-1	-1	-6
		Waste volume - compacting and bailing at Gope Project Site	Compacting and bailing of recyclables at Gope Project site	Negative (-)	-3	-2	-3	-3	-11	• Equipment sized for use • Equipment turned off when not in use	-3	-2	-2	4	-3
Social	Employment (mine specific)	Creation of mine specific employment	Opening of the GDMP.	Positive (+)	3	3	4	2	+12	• Site-specific construction positive impacts on unskilled, semi-	3	3	4	5	+15

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
		opportunities								**skilled, skilled labour. But, little likelihood of sustained high involvement of local labour across community members. No clear means of mitigation, even with sourcing labour from directly affected area**					
	Employment (directly affected area)	**Creation of employment opportunities not directly related to the mine itself.**	**Opening of the GDMP.**	**Positive (+)**	**3**	**1**	**2**	**2**	+8	• **Focus on short-term employment opportunities near communities, preceded by extensive community liaison to support employment across community members**	**3**	**1**	**3**	**5**	+12
	HIV&AIDS (mine specific)	**Increased infection rates.**	**Opening of the GDMP.**	**Negative (-)**	**-1**	**-2**	**-4**	**-5**	-12	• **GEC interventions on site, as per HIV/AIDS plan of action instituted by GEC, and as per the Wellness Policy. Need to include condom programming, information and attitudinal change, gender relations and power over sexual decision-making, life skills education, testing, ARVs, recreational**	**-1**	**-2**	**-4**	**-1**	-8

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
										activities • Conduct within the context of a broader wellness programme					
	HIV&AIDS (directly affected area)	**Increased infection rates.**	**Opening of the GDMP.**	**Negative (-)**	-3	-3	-4	-4	-14	• **Construction firms required to engage in enhanced HIV&AIDS response. Consider contracting local partner NGO skilled in the HIV&AIDS prevention and response arena**	-3	-3	-2	-3	-11
	Employment system		**Opening of the GDMP.**	**Positive (+)**	3	3	2	2	+10	• **Institute a two week on one week off system for permanent staff members** • **Provide transport to a central location**	3	3	4	5	+15
	Mine-community interface		**Opening of the GDMP.**	**Negative (-)**	-1	-2	-2	-4	-9	• **Noted above, with the majority organised around the Community Action Plan. Possibility of shifting from negative to positive impacts with active mine management intervention**	1	3	3	4	11
	Impacts on Kaudwane		**Opening of the GDMP.**	**Negative (-)**	1	3	3	5	-12	• **Community Action Plan** • **Work with community**	1	3	3	2	+9

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
										representative institutions • Establish effective consultation networks • Respond to negative social impacts through these structures					
	Services for Workers		Opening of the GDMP.	Positive (+)	1	2	1	1	+5	• Provide services as intended	1	3	5	5	+14
	Gender		Opening of the GDMP.	Negative (-)	-2	-2	-4	-4	-12	• Open dialogue about male and female employment opportunities • Specific requests for females with experience to apply for mine jobs	2	2	4	2	10
Economic	Levels of economic activity	Increase in Gross Geographic Product (GGP)	Increase in business activity / sales and demand for consumer services	Positive (+)	4	2	4	5	+15	• Encourage procurement of domestic upstream and downstream services to the value chain, where possible	4	2	4	5	+15
	Employment (National)	Employment opportunities	Reduction in unemployment Forward and backward linkages	Positive (+)	3	2	4	4	+13	• Encourage employment practices beneficial to local / domestic labour, as far as possible • Encourage business	3	2	4	4	+13

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
										networking / sourcing from local / domestic service providers, as far as possible					
	Living conditions	**Poverty alleviation**	**Increase in spending power**	**Positive (+)**	**3**	**2**	**4**	**4**	+13	• **Maximise on multiplier effect** • **Develop & implement community trust**	**3**	**2**	**4**	**5**	+14
	Enabling environment	**Infrastructure**	**Development of roads, electricity, houses, social, health and educational facilities**	**Positive (+)**	**3**	**3**	**2**	**3**	+11	• **Align roads to connect with larger, rather than smaller regional economic nodes** • **Encourage and facilitate the use of local materials and labour intensive practices, if and where possible**	**4**	**3**	**2**	**4**	+13
	Skills	**Improvement of skill levels**	**Provision of training programmes related to work**	**Positive (+)**	**4**	**3**	**3**	**2**	+12	• **Procure training service providers to skill / re-skill local labourers** • **Rotation of labour to facilitate multi-skilling, if and where possible**	**4**	**3**	**3**	**3**	+13
	Health (regional)	**Impact of HIV/AIDS on the health care system-**	**Transitory work force and sex trade**	**Negative (-)**	**-3**	**-2**	**-3**	**-3**	-11	• **Social & labour plan**	**-2**	**-1**	**-2**	**-2**	-7

Table 101: Mine Site – Operational Phase

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
Geology	Destruction of geology	Total removal of target ore body and overlaying waste material (sand & basalt)	Kimberlite and overburden material will be removed, processed and either stockpiled as slimes, tailings or as waste rock	Negative (-)	-1	-3	-4	-5	-13	None possible as the geology will be permanently destroyed.	-1	-3	-4	-5	-13
Soils	Expansion of Disturbed areas	Soil resource management (compaction, erosion, denutrification)	Stockpiling	Negative (-)	-1	-2	-4	-5	-12	• Strip and stockpile top- and subsoils appropriately. • Commence rehabilitation of affected and completed areas as soon as possible. • Application of soil handling and removal practices (including vegetative cover). • Application of soil emplacement and storage practices. • Fertilisation and amendments. • Erosion control and treatment. • Implementation of good house	-1	-1	-3	4	-1
			Erosion	Negative (-)	-1	-3	-4	-5	-13		-1	-2	-4	3	-4
			Dust suppression	Negative (-)	-1	-3	-4	-5	-13		-1	-3	-4	3	-5
			Spillage from conveyors and / or roads	Negative (-)	-1	-3	-3	-4	-11		-1	-1	-3	-1	-6

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
										keeping practices. • Spill clean up.					
Land Capability & Land Use	Change of land capability over larger proportion of the site (within the MLA).	Land Capability will be reduced to "mining land" conservation status at best	Disruption of ecosystem due to mining activities and infrastructure	Negative (-)	-1	-3	-3	-5	-12	• Effective soil handling and removal practices. • Effective soil emplacement and storage practices. • Fertilisation and amendments. • Soil amelioration. • Ongoing rehabilitation. • Topdressing of permanent features.	-1	-3	-3	-2	-9
	Change of land use over larger proportion of the site (within MLA)	Loss of natural habitat (i.e. a change of land use from wilderness to mining)	Mining operation and infrastructure	Negative (-)	-1	-3	-3	-5	-12	• Limiting the footprint of the mining operation to the MLA. • Prevention of dust and spillage of rock material. • Appropriate maintenance of the road ways.	-1	-3	-3	-4	-11

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
Natural Vegetation / Plant Life	Prolonged presence of humans & mining activities on site, unforeseen events, possible expansion of existing infrastructure & development	Potential loss / degradation of local pristine vegetation / habitat in surrounds to mining site	Additional land transformation though unforeseen events, possible expansion	Negative (-)	-2	-3	-1	-5	-11	• Minimise GDMP footprint: - Use existing roads where possible. - Clear minimum vegetation. - Maximise site vegetation retention areas. • Maintenance of the boundary fence. • Preservation of vegetation. • Implementation of conservation practices. • Fire prevention. • Ongoing rehabilitation.	-2	-1	-1	-1	-5
		Alteration of natural ecological processes / ecosystem functioning	Creation of atypical/ non-natural habitat, presence of humans for prolonged periods, infrastructure & impact sprawl	Negative (-)	-3	-3	-2	-3	-11		-2	-2	-1	-1	-6
		Introduction of species not associated with the region	Aesthetic development, gardens, high traffic volume between site & other areas	Negative (-)	-2	-3	-4	-3	-12		-2	-3	-2	2	-9
		Changes in vegetation dynamics	Fires, water, vegetation control/ management, wood harvesting, plant collection	Negative (-)	-2	-2	-2	-3	-9		-2	-2	-1	-2	-7
Animal Life	Prolonged presence of humans & mining activities on site, unforeseen events, possible expansion of	Potential loss / degradation of local pristine faunal habitat and/or communities	Land transformation though mine & associated infrastructure development	Negative (-)	-1	-2	-4	-4	-11	• Ensure pockets of vegetation remain in order to ensure a measure of ecological connectivity. • Limit impacts to the MLA.	-1	-2	-4	-2	-9

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
	existing infrastructure & development	Road deaths of animals on access roads	Reckless driving and night-time driving on access roads	Negative (-)	-1	-2	-4	-3	-10	• Vehicles are to yield to larger mammals. • Keep within the applicable speed limits. • No night time driving except in emergencies.	-1	-2	-1	-1	-5
		Alteration of natural ecosystem functioning / disruption of local migration routes	Land transformation though mine & associated infrastructure development	Negative (-)	-3	-3	-4	-2	-12	• Ensure pockets of vegetation remain in order to ensure a measure of ecological connectivity. • Limit impacts to the Gope Project Site.	-2	-2	-3	1	-8
		Increase in poaching, snaring and trapping of animals	Increase in human habitation at the site and lack of environmental awareness	Negative (-)	-2	-2	-4	-3	-11	• Maintenance of the boundary fence of the site. • Policing of boundary fence. • GEC stipulated disciplinary action. • Warning signs. • Appointment of Honorary Game Wardens.	-2	-2	-2	-2	-8

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
		Impact of chemical compounds from construction on animals	Release of hazardous/ bio-accumulating chemicals into the environment	Negative (-)	-2	-3	-2	-2	-9	• Eliminate leaching of chemicals. • Implementation of containment structures. • Responsible transportation and storage of chemicals.	-2	-3	-1	-1	-7
		Attraction of animals to artificial surface water	Large sources of artificial surface water introduced	Negative (-)	-3	-2	-4	-4	-13	• Limit open water sources to those required only. • Monitor animal access. • If required, upgrade fences immediately surrounding open water sources to electrified fencing.	-1	-2	-2	-2	-7
		Loss of natural faunal species to introduced faunal species	Killing of small mammals by domestic cats and dogs	Negative (-)	2	-2	-4	-4	-12	• Prevent introduction of foreign species to the CKGR by prohibiting all pets	0	0	0	0	0
		Potential loss / degradation of local pristine faunal habitat and/or communities	Land transformation though mine & associated infrastructure development	Negative (-)	-2	-3	-4	-5	-14	• Maintenance of fence • Limit causing activities	-2	-3	-4	-5	-14

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
Surface water	Reduction of Surface Water yield	Reduced catchment to localised pond areas and ecological systems.	Development of mining infrastructure. Considered at ESS phase due to possible pan to be conserved. However, no significant conservation value of area of ponding	Negative (-)	-2	-2	-3	-1	-8	• None, ponding area not of significant conservation value. • Follow general principle to allow clean runoff to flow back to the environment from the various dumps.	-2	-2	-3	-1	-8
	Impact on water qualities	Spillage of water from the mine during extreme rainfall events	Insufficient storage on site for the 1:50 year event	Negative (-)	-2	-1	-3	-3	-9	• DTM model and implementation of surface water management structures. • Limit discharge of mine affected water to the receiving -environment.	-2	-1	-2	-2	-7
	Impact on water qualities	Surface water contamination	Brine & sludge from RO plant. Sludge and water effluent from sewage works. Impact from workshop area, including areas of storage of diesel, fuel, lubricants and cleaning materials. Surface water runoff	Negative (-)	-2	-2	-2	-4	-10	• Brine will be managed in terms of legal requirements for its hazard classification. • Sewage sludge will be classified and managed accordingly. • Hydrocarbons	-2	-2	-1	-2	-7

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
			from roads and mining areas affected by oil spills or other contaminated material Accidental fuel and other hazardous, toxic, chemical spills Ongoing chemical contamination (e.g. fertiliser application during rehabilitation) Leachate from mining infrastructure (i.e. TMF, slimes dam, waste rock and sand overburden dump & RWDs) Water pumped from open pit for dewatering purposes							will be contained within engineered areas at point sources and managed accordingly. • Remediation kits to be made available on site for diesel and other hydrocarbon related spills. • Slimes dam design has been undertaken to mitigate seepage impacts. • Waste rock is predicted to be inert and therefore no further mitigation is proposed.					
	Impacts on water quality	Increased TDS in surface water discharge to receiving environment	Steep slopes will result in accelerated erosion (i.e. side walls of stockpiles, TMF, slimes dam and waste rock dump / sand berm)	Negative (-)	-2	-3	-3	-4	-12	• Minimise wind and water erosion. • Slope stabilisation.	-2	-1	-2	-1	-6
Gro	Depletion of	Lowering of	Dewatering of the	Negative	-2	-3	-4	-5	-14	• No	-2	-3	-4	-5	-14

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
	aquifer	groundwater level	aquifer to ensure dry mining conditions and pit slope stability	(-)						groundwater users are located in the vicinity of the GDMP (human / ecological). • Groundwater to be provided to any Gope returnees by GEC.					
			Groundwater abstraction for potable and process water demand		-2	-2	-4	-3	-11		-2	-2	-4	-1	-9
	Pollution	Groundwater quality deterioration	Return of mine operation contaminated water to the aquifer due to infiltration (TMF, slimes dam, RWDs and other infrastructure)	Negative (-)	-2	-3	-3	-3	-11	• All contaminants to be contained and managed at the point source.	-2	-3	-1	-1	-7
			Biological contamination of localised aquifer due to domestic and sewage effluent disposal	Negative (-)	-1	-2	-1	-1	-5		-1	-1	-1	-1	-4
Air Quality	Fugitive Dust and PM	Reduction in ambient air quality from fugitive dust emissions	Sand stripping Drilling and blasting Loading and hauling Dumping Continued construction of plant and other infrastructure Material transfer	Negative (-)	-2	-2	-3	-3	-10	• Reduce extent of construction operation taking place, rather phase in (thus reduce exposure). • Use of windbreaks, chemical + water	-1	-2	-2	-1	-6

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
			operations - Wind erosion from exposed storage (stockpiles & mine residue deposits) piles - Vehicle entrained dust from both paved and unpaved road surfaces Process fugitive emissions (crushing and screening operations) Remediation and rehabilitation							suppression. • Rock cladding of stockpiles / dumps on prevailing wind facing slopes. • Re-vegetation of areas as soon as possible. • Reduction of drop height as far as is practicable. • Reduction of speed of vehicles to keep within the applicable speed limits.					
		Reduced visibility, soiling of buildings and materials	Mining operation causing elevated dust levels.	Negative (-)	-2	-2	-1	-3	-8	• Maintenance of vehicles. • Vehicle speed reduction to keep within the applicable speed limits. • Road maintenance and dust suppression. • PPE	-1	-2	-1	-1	-5
		PM, Carbon monoxide, VOC, nitrogen oxides - reduction in ambient air	Veld fires	Negative (-)	-3	-2	-2	-3	-10	• No pollution in the area (i.e. glass, cigarette buts).	-1	-1	-1	-1	-4

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
		quality.								• Restrict fires from being made on site to designated areas only. • Fire breaks.					
Noise & Vibration	Noise pollution	Increased ambient noise levels	Increase traffic flow (on-site)	Negative (-)	-1	-2	-4	-3	-10	• All vehicles will be fitted with appropriate sound suppression devices or silencers. • Keep within the applicable speed limits.	-1	-1	-2	-2	-6
			Air traffic flow (aircraft & helicopter)	Negative (-)	-2	-2	-4	-2	-10	• Weekly flights to & from the GDMP will be restricted to daylight hours, except for emergencies.	-2	-1	-3	-2	-9
			Mining operation (earth moving, mineral processing plant, specifically crushing)	Negative (-)	-1	-2	-4	-3	-10	• All machinery used during operation will be maintained in sound mechanical condition. • Placement of waste structures has been designed such as to create a noise	-1	-2	-3	-2	-8

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
										barrier.					
		Nuisance disruption to sensitive fauna, employees & community	Continuous blasting throughout operational phase	Negative (-)	-2	-2	-4	-3	-11	• Placement of waste structures has been designed such as to create a noise barrier. • PPE will be worn as per GECs stipulations. • Complaints by I&APs will be recorded in a Complaints Register and addressed throughout the LOM. • Blasts will be designed by a suitably qualified engineer.	-2	-2	-3	-2	-9
		Impact on building foundation stability	Continuous blasting throughout operational phase	Negative (-)	-1	-2	-2	-3	-8	• Foundations of buildings closer to the open pit area are to be able to withstand the effects of the vibrations.	-1	-1	-1	-1	-4
Archa eolog y &	Impact of mining on San graves	Impact of mining activities on the graves situated	Mining	Negative (-)	-1	-3	-1	-1	-6	• Maintenance of fence and management of	-1	-1	-1	+2	-1

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
		outside of the Gope Project Site, but inside the MLA.								sites					
	Impact of mining on San graves	Impact of mining on the graves situated outside of the MLA.	Mining	Neutral (N)	0	0	0	0	0	• No mitigation required	0	0	0	0	0
	Impact of mining on San settlements	Impact of mining on the settlements situated outside of the Gope Project Site, but inside the MLA.	Mining	Neutral (N)	0	0	0	0	0	• No mitigation required.	0	0	0	0	0
	Impact of the mining on San settlements	Impact of mining on the settlements situated outside of the MLA	Mining	Neutral (N)	0	0	0	0	0	• No mitigation required.	0	0	0	0	0
Visual	Visual impact	Change in land-use and available view	Vehicle movement (sequential)	Negative (-)	-3	-2	-4	-2	-11	• No mitigation	-3	-2	-4	-2	-11
			Buildings and other structures (including residential structures, process plant and offices)	Negative (-)	-2	-2	-4	-2	-10	• All buildings are to be maintained regularly.	-2	-2	-4	-1	-9
			Entrances, signs and boundary treatment	Negative (-)	-1	-3	-4	-2	-10	• Limit signage (number & size) to fall within the GEC requirements.	-1	-3	-4	-1	-9

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
			Material storage (sand dump, slimes dam, topsoil stockpiles and material stockpiles).	Negative (-)	-3	-3	-4	-2	-12	• Restriction of the height of mineralogical waste structures. • Ongoing rehabilitation and re-vegetation of mineralogical waste structures.	-3	-3	-4	+3	-7
			Lighting of mining operations during night time	Negative (-)	-2	-2	-4	-2	-10	• Appropriate light fitting installation. • Installation of shielding. • Limit light intensity.	-2	-2	-4	-1	-9
Waste	Contamination of soil and groundwater Landfill space Health risks - exposure to hazardous wastes	Contamination of groundwater, surface water	Leaching of hazardous substances from tailings and slimes	Negative (-)	-1	-1	-1	-1	-4	• Leaching probability – no additional mitigation measures required	-1	-1	-1	-1	-4
		Consumption of land space	Generation and disposal of general waste to landfill	Negative (-)	-1	-3	-3	-2	-9	• Re-use of wastes – avoidance of virgin material • Recycling of wastes off site	-2	-3	-2	+4	-3
		Consumption of land space	Generation and disposal of hazardous waste to	Negative (-)	-1	-3	-3	-3	-11	• On-site disposal of organic food	-1	-1	-1	-1	-4

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
			landfill							wastes only					
		Contamination of soil & groundwater. Consumption of land space	On-site land filling/burial of biodegradable wastes (permanent on-site disposal)	Negative (-)	-1	-3	-3	-3	-11	• On-site disposal of organic food waste only	-1	-1	-1	-1	-4
		Contamination of soil	Temporary storage of hazardous waste on unprotected ground – on site or off-site (e.g. at Ramotswa Landfill) Hazardous waste spills outside contained areas.	Negative (-)	-1	-2	-3	-3	-9	• Contactor control • Traceability (documentatio n) and reconciliation of waste disposed	-1	-1	-1	-1	-4
		Contamination of groundwater	Disposal of hazardous wastes on general landfills	Negative (-)	-1	-1	-2	-2	-6	• Provision of bins • Management and of people	-1	-1	-1	-1	-4
		Litter -aesthetic impacts Litter - ingestion by animals	Waste not placed in designated waste bins/containers	Negative (-)	-2	-1	-2	-2	-7	• Frequent removal of waste	-1	-1	-1	-2	-5
		Odour – unpleasant and may attract pests and wildlife	Waste not disposed of timeously or kept in closed containers	Negative (-)	-2	-2	-3	-3	-10	• Provision of suitable waste containers • Contractor control • Disposal to authorised sites	-2	-1	-1	-1	-5
		Infections from	Unsuitable handling	Negative	-2	-3	-3	-4	-12	• Provision of	-2	-1	-1	-1	-5

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
		medical waste	and disposal of medical waste (sharps and bandages)	(-)						suitable waste containers • Contractor control • Disposal to authorised sites					
		Health risks of staff and public from exposure to hazardous wastes	Handling of hazardous waste without suitable PPE by staff or public	Negative (-)	-2	-3	-3	-4	-12	• Provision of suitable waste containers and PPE • Contractor control • Disposal to authorised sites	-1	-1	-1	-3	-6
		Air pollution, including dioxins and furans from incineration of medical wastes	Air emissions from incinerator	Negative (-)	-3	-2	-2	-3	-10	• Contractor control • Disposal to authorised sites	-2	-2	-1	-1	-6
		Waste volume - compacting and bailing at Gope Project Site	Compacting and bailing of recyclables at Gope Project site	Negative (-)	-3	-2	-3	-3	-11	• Equipment sized for use • Equipment turned off when not in use	-3	-2	-2	4	-3
Social	Employment (mine specific)	Creation of mine specific employment opportunities	Opening of the GDMP.	Positive (+)	3	3	4	2	+12	• Continuation of application of best practice standards in labour hiring and management	3	3	4	5	+15

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
										practices. • Work with Mineworkers Union, offer competitive packages.					
	Employment (directly affected area)	Creation of employment opportunities not directly related to the mine itself.	Opening of the GDMP.		3	1	2	2	+8	• Skills training and internship opportunities to prepare for mining employment throughout the LOM, through extensive community liaison. • Closure and Rehabilitation - focus on short-term employment opportunities near communities.	3	1	3	5	+12
	HIV&AIDS (mine specific)	Increased infection rates.	Opening of the GDMP.	Negative (-)	-1	-2	-4	-5	-12	• Mine owner interventions on site, as per HIV/AIDS plan of action instituted by GEC, and as per the Wellness Policy. Need to include condom programming,	-1	-2	-4	-1	-8

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
										information and attitudinal change, gender relations and power over sexual decision-making, life skills education, testing, ARVs, recreational activities. • Conduct within the context of a broader wellness programme.					
	HIV&AIDS (directly affected area)	**Increased infection rates.**	**Opening of the GDMP.**	**Negative (-)**	**-3**	**-3**	**-4**	**-4**	**-14**	• **GEC required to engage in enhanced HIV&AIDS response. Consider contracting local partner NGO skilled in the HIV&AIDS prevention and response arena.**	**-3**	**-3**	**-2**	**-3**	**-11**
	Mine-community interface		**Opening of the GDMP.**	**Negative (-)**	**-1**	**-2**	**-2**	**-4**	**-9**	• **Noted above, with the majority organised around the Community Action Plan. Possibility of**	**+1**	**+3**	**+3**	**+4**	**+11**

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
										shifting from negative to positive impacts with active mine management intervention.					
	Impacts on Kaudwane		Opening of the GDMP.	Negative (-)	-1	-3	-3	-5	-12	• Community Action Plan. • Work with community representative institutions. • Establish effective consultation networks. • Respond to negative social impacts through these structures.	1	3	3	2	+9
	Services for Workers		Opening of the GDMP.	Positive (+)	1	2	1	1	+5	• Provide services as intended.	1	3	5	5	+14
	Gender		Opening of the GDMP.	Negative (-)	-2	-2	-4	-4	-12	• Open dialogue about male and female employment opportunities. Specific requests for females with experience to apply for mine jobs.	-2	-2	-4	-2	-10

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
Economic	Levels of economic activity	Increase in GGP	Increase in business activity / sales and demand for consumer services	Positive (+)	4	2	4	5	+15	• Optimise economic lifespan of the mine • Encourage procurement of domestic upstream and downstream services to the value chain, where possible	4	3	4	5	+16
	Employment (National)	Employment opportunities	Reduction in unemployment Forward and backward linkages	Positive (+)	3	2	4	4	+13	• Encourage employment practices beneficial to local / domestic labour, as far as possible • Encourage business networking / sourcing from local / domestic service providers, as far as possible)	3	2	4	4	+13
	Employment (Local & Regional)	Employment opportunities	Reduction in unemployment Forward and backward linkages	Positive (+)	2	2	4	4	+12	• Encourage employment practices beneficial to local / domestic labour, as far	2	3	4	4	+13

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
										as possible • Encourage business networking / sourcing from local / domestic service providers, as far as possible					
	Living conditions	Poverty alleviation	Increase in spending power	Positive (+)	3	2	4	4	+13	• Maximise on multiplier effect • Develop & implement community trust	3	2	4	4	+13
	Enabling environment	Infrastructure	Development of roads, electricity, houses, social, health and educational facilities	Positive (+)	3	3	2	3	+11	• Infrastructure maintenance initiatives should encourage and facilitate the use of local materials and labour intensive practices, if and where possible • Infrastructure should be accessible to local economic activities, if and where possible	4	3	2	3	+12
	Skills	Improvement of	Provision of training	Positive	4	3	3	2	+12	• Procure	4	3	3	3	+13

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
		skill levels	programmes related to work	(+)						training service providers to skill / re-skill local labourers • Rotation of labour to facilitate multi-skilling, if and where possible					
	Economic activity	Entrepreneurship	Growth of the informal sector	Positive (+)	3	2	3	3	+11	• Harness informal economic activities to supply the mine and workers with selected goods and services to predetermined and negotiated minimum standards, e.g. fresh fruit, meat, etc. • Rotate contracts to small scale service providers on a raster basis to encourage fair trade practices and business diversification	3	3	3	4	+13
	Governance	Increase commitment for government in the area	Government involves communities and drives/funds	Positive (+)	3	2	2	3	+10	• Ongoing engagement between mine management	3	2	2	3	+10

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
			community projects (LED)							and government to ensure economic and social issues promptly identified and addressed					
	Returning of local communities to the Gope area	Due to the expectation of economic activity in the site area the local communities could return to the area	Local communities return to the affected area (Gope). The site itself is will not be accessible but people could settle in the surrounding area.	Negative (-)	-1	-3	-4	-5	-13	• In-situ upgrade programme.	-1	-2	-3	-3	-9
	Unplanned settlements (regional)	Strain on Social services delivery and infrastructure	Squatting takes place	Negative (-)	-2	-2	-2	-4	-10	• Squatting management plan. • Involve DWNP.	-1	-1	-1	-3	-6
	Unplanned settlements (local)	Unplanned settlements outside the GDMP boundary	Squatting takes place in search of employment	Negative (-)	-1	-2	-3	-4	-10	• Squatting management plan. • Involve DWNP.	-1	-1	-2	-3	-7
	Urbanisation	Lower standards of living due to risk of squatting	Increase in unemployment, health risks, crime	Negative (-)	-3	-2	-3	-4	-12	• Social & labour plan.	-2	-1	-2	-3	-8
	Health (regional)	Impact of HIV/AIDS on the health care system	Transitory work force and sex trade	Negative (-)	-3	-2	-3	-3	-11	• Social & labour plan.	-2	-1	-2	-2	-7
	Health (national)	Impact of HIV/AIDS on the health care	Transitory work force and sex trade	Negative (-)	-3	-2	-3	-3	-11	• Social & labour plan.	-2	-1	-2	-2	-7

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
		system													
	Land use	Destruction of land / wildlife and tourism attraction	Decline in attractiveness	Negative (-)	-2	-1	-2	-2	-7	• Spatial Development Framework.	-1	-1	-1	-1	-4
	Narrow economic base	No diversification in economic base	Local economy is dependant on a single economic activity Affected by market fluctuations and economic trends	Negative (-)	-3	-2	-3	-3	-11	• Social & labour plan and Local Economic Development Plan.	-3	-2	-2	-2	-9

Table 102: Mine Site – Decommissioning Phase

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
Geology & Soils	Improvement in soil status & reclamation of soil area – no affect on geology	Rehabilitation, soil replacement and re-vegetation	Rehabilitation, including soil emplacement, soil fertilisation and amendments, sloping and re-vegetation.	Positive (+)	1	3	3	2	**+9**	• Follow SEMP recommendations for final rehabilitation	1	3	3	3	**+10**
Land Capability & Land Use	Re-vegetation of natural area (roads etc.) + vegetation & topdressing of dumps	Re-use of some areas for natural vegetative growth	Rehabilitation, including soil emplacement, soil fertilisation and amendments, sloping and re-vegetation.	Positive (+)	1	3	3	4	**+11**	• Follow SEMP recommendations for final rehabilitation	1	3	4	4	**+12**
Natural Vegetation / Plant Life	Prolonged presence of humans & mining activities on site, unforeseen events, possible expansion of existing infrastructure & development	Potential loss / degradation of local pristine vegetation / habitat in surrounds to mining site	Additional land transformation though unforeseen events, possible expansion	Negative (-)	-2	-3	-1	-5	**-11**	• Follow SEMP recommendations for final rehabilitation. • Dismantle & remove infrastructure. • Ensure monitoring compliance. • Maintain fencing. • Eradicate alien / invasive species.	-2	-1	-1	+3	**-1**
		Alteration of natural ecological processes / ecosystem functioning	Creation of atypical / non-natural habitat, presence of humans for prolonged periods, infrastructure & impact sprawl	Negative (-)	-3	-3	-2	-3	**-11**		-2	-2	-1	+3	**-2**
		Introduction of species not associated with the region	Aesthetic development, gardens, high traffic volume between site & other areas	Negative (-)	-2	-3	-4	-3	**-12**		-2	-3	-3	+3	**-5**

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
		Changes in vegetation dynamics	Fires, water, vegetation control/ management, wood harvesting, plant collection	Negative (-)	-2	-2	-2	-3	**-9**		-2	-2	-1	+3	**-2**
Animal Life	Sprawl of impacts beyond site boundaries, effectiveness of rehabilitation programs	Potential loss / degradation of local pristine faunal habitat and/or communities	Land transformation though mine & associated infrastructure development	Negative (-)	-2	-3	-4	-5	**-14**	• Remediate the environment through the implementation of rehabilitation plan.	-1	-3	-2	3	**-3**
		Road deaths of animals on access roads	Reckless driving and night-time driving on access roads	Negative (-)	-1	-3	-4	-3	**-11**	• Vehicles are to yield to larger mammals. • Keep within the applicable speed limits. • No night time driving except in emergencies.	-1	-1	-1	3	**0**
		Alteration of natural ecosystem functioning/ disruption of migration routes	Land transformation though mine & associated infrastructure development	Negative (-)	-3	-3	-4	-2	**-12**	• Remediate the environment through the implementation of rehabilitation plan.	-1	-3	-4	3	**-5**

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
		Increase in poaching, snaring and trapping of animals	Increase in human habitation at the site and lack of environmental awareness	Negative (-)	-2	-2	-4	-3	**-11**	• Maintenance of the boundary fence of the site. • Policing of boundary fence. • GEC stipulated disciplinary action. • Warning signs. • Appointment of Honorary Game Wardens.	-2	-2	-2	3	**-3**
		Impact of chemical compounds from construction on animals	Release of hazardous/ bio-accumulating chemicals into the environment	Negative (-)	-2	-3	-2	-2	**-9**	• Eliminate leaching of chemicals. • Implementation of containment structures. • Responsible transportation and storage of chemicals.	-2	-3	-1	-1	**-7**
		Attraction of animals to artificial surface water	Large sources of artificial surface water introduced	Negative (-)	-3	-3	-4	-4	**-14**	• Limit open water sources to those required only. • Monitor animal access. • If required, upgrade fences immediately surrounding open water sources to electrified fencing.	0	0	0	0	**0**

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
		Loss of natural faunal species to introduced faunal species	Killing of small mammals by domestic cats and dogs	Negative (-)	-2	-2	-4	-4	**-12**	• Prevent introduction of foreign species to the CKGR by prohibiting all pets	0	0	0	0	**0**
Surface Water	Erosion of side slopes	Unstable land form, increased erosion	As final side slopes as post closure profile formed	Negative (-)	-2	-2	-3	-4	**-11**	• Flatten slopes to 18° and achieve recommended slope profile. • Vegetate all slopes.	-1	-1	-1	0	**-3**
	Water quality impact	Increase in saline conditions in pit lake (post closure)	Continued evapo-concentration of water resulting in increased saline conditions of pit lake Suitability of water for consumption by game questionable.	Negative (-)	-1	-3	-3	-4	**-11**	• Keep the bottom of the open pit dry as far as practicable. • Study to be implemented during operational phase on alternative strategies.	-1	-3	-3	-2	**-9**
	Sustainability	Erosion of the side slopes of the pit	Side slopes too steep, damage by game trying to access water into the pit	Negative (-)	-1	-3	-3	-3	**-10**	• Leave the open pit area to become susceptible to erosional forces.	-1	-3	-3	0	**-7**
Groundwat er	Recharge of aquifer	Recovery of the groundwater level	Rainfall recharge	Positive (+)	2	3	5	5	**+15**	• Positive aspect, although a very slow process.	2	3	5	5	**+15**

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
	Pollution	Groundwater quality deterioration	Continued infiltration of contaminated water to the aquifer (TMF and slimes dam)	Negative (-)	-2	-3	-3	-3	**-11**	• Due to the slow movement of groundwater the contaminants will largely be restricted to the immediate vicinity of the mine.	-2	-3	-2	-1	**-8**
			Continued natural infiltration of water into the pit lake exacerbated by high evaporation rates	Negative (-)	-2	-3	-3	-3	**-11**		-2	-3	-2	-1	**-8**
Air Quality	Fugitive Dust and PM	Reduction in ambient air quality from fugitive dust emissions	Material transfer operations	Negative (-)	-2	-1	-3	-3	**-9**	• Continued use of windbreaks, chemical + water suppression. • Rock cladding on prevailing wind facing slopes of piles / dumps. • Continue with re-vegetation of areas. • Reduction of drop height. • Reduction of speed of vehicles to keep within the applicable speed limits.	-1	-1	-1	-1	**-4**
			Wind erosion from exposed storage (stockpiles & mine residue deposits) piles	Negative (-)	-2	-1	-2	-1	**-6**		-1	-1	-1	0	**-3**
			Vehicle entrained dust from both paved and unpaved road surfaces	Negative (-)	-2	-1	-3	-3	**-9**		-1	-1	-2	-1	**-5**
			Process fugitive emissions (crushing and screening operations)	Negative (-)	-2	-1	-3	-3	**-9**		-1	-1	-2	-1	**-5**

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
			Remediation and rehabilitation	Positive (+)	1	1	3	2	**7**		1	1	3	2	**7**
Noise & Vibration	Noise pollution		Increase traffic flow (on-site)	Negative (-)	-1	-2	-4	-3	**-10**	• The number of vehicles will significantly reduce during this phase. • All vehicles will be fitted with appropriate sound suppression devices or silencers. • Keep within the applicable speed limits.	-1	-1	-2	-1	**-5**
			Decommissioning activities (plant and associated building removal).	Negative (-)	-1	-1	-4	-3	**-9**	• All machinery used during decommissioning and closure will be maintained in sound mechanical condition.	-1	-1	-3	-1	**-6**
			Final rehabilitation (i.e. slimes dam capping, remaining final slope and exposed areas rehabilitation)	Negative (-)	-1	-1	-4	-3	**-9**	• Limited movement on site.	-1	-1	-1	-1	**-4**

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
Archaeology & Heritage	Impact of mine closure and rehabilitation on San graves	Impact of mine closure and rehabilitation on the graves situated outside of the Gope Project Site, but outside the MLA.	Mine closure and rehabilitation activities	Negative (-)	-1	-1	-1	-1	**-4**	Maintenance of fence. Hand keys over to family of deceased.	-1	-1	-1	+2	**-1**
	Impact of mine closure and rehabilitation on San graves	Impact of mine closure and rehabilitation on the five graves situated outside of the mine license area	Mine closure and rehabilitation activities	Neutral (N)	0	0	0	0	**0**	• No mitigation required	0	0	0	0	**0**
	Impact of mine closure and rehabilitation on San settlements	Impact of mine closure and rehabilitation on the 11 settlements situated outside of the mining footprint but inside the mine license area.	Mine closure and rehabilitation activities	Neutral (N)	0	0	0	0	**0**	• No mitigation required.	0	0	0	0	**0**
	Impact of mine closure and rehabilitation on San settlements	Impact of mine closure and rehabilitation on the four settlements situated outside of the mine license area	Mine closure and rehabilitation activities	Neutral (N)	0	0	0	0	**0**	• No mitigation required.	0	0	0	0	**0**

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
Visual	Visual Impact	Change in land-use and available view	Buildings and other structures (including residential structures, process plant and offices), including any signage erected during the construction and/or operational phases	Negative (-)	-2	-2	-4	-2	**-10**	• At closure, all buildings and infrastructure that are not re-used and handed over must be demolished and footprints rehabilitated to re-establish vegetation cover	-2	-3	-4	+4	**-5**
			Material storage (sand dump, slimes dam, topsoil stockpiles and material stockpiles)	Negative (-)	-2	-2	-4	-2	**-10**	• All permanent mine residue stockpiles must be re-vegetated to establish a 60% vegetation cover	-2	-3	-4	+4	**-5**
Waste	Contamination of soil and groundwater Landfill space Health risks - exposure to hazardous wastes	Consumption of landfill space	Generation and disposal of general waste (e.g. rubble) to landfill	Negative (-)	-2	-3	-3	-2	**-10**	• Recycling of wastes off site • Use of rubble waste on site for future purposes	-2	-3	-3	-1	**-9**
		Consumption of landfill space	Generation and disposal of hazardous waste to landfill (e.g. oil-contaminated rubble)	Negative (-)	-2	-2	-2	-3	**-9**	• Cleaning rubble to reduce quantity of hazardous wastes.	-2	-2	-2	-2	**-8**

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
		Contamination of soil & groundwater. Consumption of land space	Burial of wastes on site (e.g. contaminated rubble)	Negative (-)	-2	-3	-1	-2	**-7**	• Off-site disposal at authorised facilities	-1	-1	-1	-1	**-4**
Social	Employment (mine specific)			Positive (+)	3	3	4	2	**+12**	• Retirement packages, skills retooling as required, assisting with CVs and job seeking.	3	3	4	5	**+15**
	Employment (directly affected area)			Positive (+)	3	1	2	2	**+8**	• Focus on short-term employment opportunities near communities.	3	2	2	3	**+10**
	Mine-community interface			Negative (-)	-1	-3	-3	-4	**-11**	• As local residents, Gope residents will be affected by decommissioning and rehabilitation arrangements. Of particular importance are safety aspects in terms of pit closure, and the removal of any hazardous substances.	-1	-2	-2	1	**-4**

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
	Impacts on Kaudwane			Negative (-)	-1	-3	-3	-5	**-12**	• Community Action Plan. • Work with community representative institutions. • Establish effective consultation networks. • Respond to negative social impacts through these structures.	1	3	3	2	**+9**
Economic	Employment (National, Local and Regional)	Decline in employment opportunities	Increase in unemployment	Negative (-)	-3	-2	-4	-4	**-13**	• Downstream activities and local project identification for future employment	-3	-1	-3	-3	-10

Table 103: Power Line – Construction Phase

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
Geology & Soils	Soil Disturbance and possible degradation	Soils disturbance, loss of nutrients, loss of topsoil cover, loss of in situ structure and physical / chemical properties.	Removal of topsoils along access route associated with the power line.	Negative (-)	-1	-1	-3	-2	-7	• Stockpile topsoils for a short period until construction of the particular pylon is completed. • Limitation of extent of impacts to construction footprint only. • Prevention of hydrocarbon contamination of soils. • Spill clean up.	-1	-1	-3	2	-3
		Soil removal and / or disturbance (compaction, erosion & contamination)	Access road associated with the power line	Negative (-)	-1	-1	-3	-5	-10		-1	-1	-3	2	-3
	Restoration of construction affected areas	Replacement of topsoils over affected areas	Environmental rehabilitation	Positive (+)	1	1	2	0	+4	• Appropriate rehabilitation of affected areas immediately after construction ceases	1	1	3	3	8

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
Land Capability & Land Use	Change of land capability from wilderness to industrial land	Land unable to be used for any natural activities during the mining operation	Power line Erection	Negative (-)	-1	-3	-3	-2	-9	• Effective soil emplacement and storage practices • Finalisation of rehabilitation. • Fertilisation and amendments. • Maintenance of natural vegetative cover along access route	-1	-1	-2	2	-2
	Restoration of construction affected areas	Replacement of topsoils over affected areas coupled with seed sowing	Environmental rehabilitation	Positive (+)	1	1	2	0	+4	• Appropriate rehabilitation of affected areas immediately after construction ceases	1	1	3	3	8
Natural Vegetation / Plant Life	Destruction of local ecological integrity, alteration of vegetation on site, peripheral impacts relating to construction activities	Introduction of species not associated with the region	High traffic volume during construction period	Negative (-)	-1	-2	-3	-4	-10	• Walk though to identify and remove Red Data species. • Limit damage / pruning, cutting of trees in servitude / road.	-1	-2	-2	-2	-7
		Changes in vegetation dynamics	Fires, wood harvesting, plant collection	Negative (-)	-1	-2	-2	-3	-8		-1	-2	-2	-2	-7

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
		Impacts on sensitive environments (receiving water body / pan)	Direct/ indirect impacts, physical or cumulative	Negative (-)	-1	-2	-3	-4	-10	• Avoid pans and other sensitive environments during the construction of the power line.	-1	-2	-1	-1	-5
		Potential loss / degradation of local pristine vegetation / habitat	Land transformation though construction activities	Negative (-)	-1	-2	-4	-4	-11	• Minimise power line footprint: - Use existing roads where possible. - Clear minimum vegetation. - Maximise site vegetation retention areas. - Erection of fence. • Preservation of vegetation. • Implementation of conservation practices. • Fire prevention. • Ongoing rehabilitation.	-1	-2	-3	-3	-9
		Alteration of natural ecological processes / ecosystem functioning	Creation of atypical/ non-natural habitat	Negative (-)	-1	-2	-3	-3	-9		-1	-2	-2	-2	-7
		Introduction of species not associated with the region	High traffic volume during construction period	Negative (-)	-1	-2	-3	-4	-10		-1	-2	-2	-2	-7
	Restoration of construction affected areas	Re-vegetation through seeding	Environmental rehabilitation	Positive (+)	1	1	2	0	+4	• Appropriate rehabilitation of affected areas immediately after construction ceases	1	1	3	3	8

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
Animal Life	Destruction of local ecological integrity, decimation of faunal habitat on site, peripheral impacts relating to human presence & power line construction	Potential loss / degradation of local pristine faunal habitat and/or communities	Land transformation though development of power line infrastructure	Negative (-)	-1	-1	-4	-1	-7	• No mitigation possible	-1	-1	-4	-1	-7
		Increase in poaching, snaring and trapping of animals	Increase in human habitation at the site and lack of environmental awareness	Negative (-)	-1	-2	-4	-3	-10	• GEC stipulated disciplinary action. • Appointment of Honorary Game Wardens.	-1	-2	-2	-2	-7
		Loss of natural faunal species to introduced faunal species	Killing of small mammals by domestic cats and dogs	Negative (-)	-2	-2	-4	-4	-12	• Absolute prohibition of all pets	0	0	0	0	0
	Restoration of construction affected areas	Re-vegetation through seeding enabling wildlife to return to the affected areas	Environmental rehabilitation	Positive (+)	1	1	2	0	+4	• Appropriate rehabilitation of affected areas immediately after construction ceases	1	1	3	3	+8
Surface water	Impact on surface water quality	Construction through sensitive landscapes	Power line through "pans"	Negative (-)	-2	-1	-4	-2	-9	• Avoid pans with route	0	0	0	0	0

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
Noise & Vibration	Noise pollution	Increased ambient noise levels	Construction of the power line infrastructure	Negative (-)	-1	-1	-4	-3	-9	• Construction activities will only take place during day time hours.	-1	-1	-3	-2	-7
			Use of diesel generators at contractor's camps, workshops and equipment storage areas	Negative (-)	-1	-1	-4	-3	-9	• On-site generators should be clad in suitable material or housed in structures that would reduce their noise impacts. • Generators will be fitted with appropriate silencers.	-1	-1	-3	-2	-7
			Increase traffic flow	Negative (-)	-1	-2	-4	-3	-10	• All vehicles will be fitted with appropriate sound suppression devices or silencers.	-1	-2	-3	-2	-8
Archaeology & Heritage	Impact of the construction of power line on archaeological sites	Impact of construction of power line on two low significant archaeological sites situated within the line footprint.	Establishment of power line	Neutral (N)	0	0	0	0	0	• No mitigation measures required	0	0	0	0	0

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
	Impact of the construction of power line on archaeological sites	**Impact of construction of power line on two archaeological sites situated outside the line footprint.**	**Establishment of power line**	**Neutral (N)**	**0**	**0**	**0**	**0**	**0**	• **No mitigation measures required**	**0**	**0**	**0**	**0**	**0**
Waste	**Contamination of soil and groundwater** **Landfill space** **Health risks - exposure to hazardous wastes**	**Consumption of landfill space**	**Generation and disposal of general waste to landfill**	**Negative (-)**	**-2**	**-3**	**-3**	**-3**	**-11**	• **Recycling of wastes off site**	**-2**	**-3**	**-3**	**-1**	**-9**
		Consumption of landfill space	**Generation and disposal of hazardous waste to landfill**	**Negative (-)**	**-2**	**-3**	**-3**	**-3**	**-11**	• **Recycling of wastes off site (e.g. oils)**	**-2**	**-3**	**-3**	**-2**	**-10**
		Contamination of soil & groundwater. **Consumption of land space**	**Burial of wastes on site**	**Negative (-)**	**-2**	**-3**	**-1**	**-2**	**-7**	• **On-site disposal of organic food waste only.** • **Disposal to an authorised site / transport to Gope Project site for appropriate waste handling & disposal.**	**-1**	**-1**	**-1**	**-1**	**-4**

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
		Contamination of soil	Temporary storage of hazardous waste on unprotected ground Hazardous waste spills	Negative (-)	-1	-2	-3	-3	-9	• Storage of hazardous wastes in containers • Labelling of containers	-1	-1	-1	-1	-4
		Contamination of groundwater	Disposal of hazardous wastes on general landfills	Negative (-)	-2	-3	-3	-4	-12	• Disposal to an authorised site / transport to Gope Project site for appropriate waste handling & disposal. • Contactor control. • Traceability (documentation) and reconciliation of waste disposed.	-2	-3	-1	-3	-9
		Litter - aesthetic impacts Litter - ingestion by animals	Waste not contained and placed in suitable containers	Negative (-)	-1	-1	-2	-2	-6	• Provision of bins • Management and of people	-1	-1	-1	-2	-5
		Odour – unpleasant and may attract pests and wildlife	Waste not disposed of timeously or kept in closed containers	Negative (-)	-1	-1	-2	-2	-6	• Frequent removal of waste.	-1	-1	-1	-2	-5

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
Social	Power line impacts	Increased mobility of directly affected community	Construction / upgrade of infrastructure	Positive (+)	1	2	2	1	+6	• Mitigation - road signage, speed limits, passing areas. • Mitigation - provide temporary employment during construction. • Enhancement - road safety interventions • Enhancement - provide paper garbage bags to all transit vehicles, institute penalties for littering.	1	3	2	1	+7

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
Economic	**Employment (National)**	**Employment opportunities**	**Reduction in unemployment**	**Positive (+)**	**3**	**2**	**4**	**4**	**+13**	• **Encourage employment practices beneficial to local / domestic labour, as far as possible.** • **Encourage business networking / sourcing from local / domestic service providers, as far as possible).**	**3**	**3**	**4**	**5**	**+15**
	Enabling environment	**Infrastructure**	**Development of electricity**	**Positive (+)**	**3**	**3**	**2**	**3**	**+11**	• **Design and construction should be sensitive to multi-functional use requirements, both during operational and decommissioning phases (i.e. facilitate timeless design, if and where possible).**	**4**	**3**	**2**	**3**	**+12**

Table 104: Power Line – Operational Phase

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
Geology & Soils	Soil Disturbance and possible degradation due to compaction along access route	Soils disturbance, compaction and erosion	Travelling along access route below power line.	Negative (-)	-1	-1	-3	-1	-6	No mitigation proposed as the maintenance road is currently a public road and will be continued to be used as such.	-1	-1	-3	-1	-6
Land Capability & Land Use	Status quo. Land will be confined to industrial usage – power generation	Area will be under control of power generation company and mining house. There will be no other use for this land. Capability is reduced to industrial/mining	Power line maintenance	Negative (-)	-1	-1	-2	-1	-5	Maintenance of natural vegetative cover along access route	-1	-1	-1	0	-3
Natural Vegetation / Plant Life	Seasonal/ periodic maintenance activities	Potential loss / degradation of local pristine vegetation / habitat in surrounds to mining site	Additional land transformation though unforeseen events	Negative (-)	-1	-2	-1	-1	-5	SEMP Guidelines, limited clearing of vegetation during ongoing maintenance	-1	-1	-1	-1	-4
		Alteration of natural ecological processes / ecosystem functioning	Disturbance of adjacent areas during maintenance periods	Negative (-)	-1	-2	-1	-1	-5	SEMP Guidelines, limited clearing of vegetation during ongoing maintenance	-1	-1	-1	-1	-4

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
		Introduction of species not associated with the region	Cumulative impact, presence of humans and vehicles during periods of maintenance	Negative (-)	-1	-2	-2	-2	-7	Monitor and control	-1	-1	-1	-0	-3
		Changes in vegetation dynamics	Fires, maintenance of vegetation underneath lines	Negative (-)	-1	-2	-2	-1	-6	SEMP Guidelines	-1	-1	-1	-0	-3
Animal Life	Operation and maintenance of the power line	Bird deaths as a result of electrocution on the power line	Birds, particularly raptors colliding with the power line	Negative (-)	-1	-3	-4	-3	-11	Mitigate with necessary equipment.	-1	-3	-1	-1	-6
Noise	Noise pollution	Increased ambient noise levels.	Power line noise generation (humming)	Negative (-)	-1	-3	-2	-2	-8	All equipment will be checked regularly and maintained by BPC to ensure it operates in a sound mechanical condition.	-1	-3	-1	-1	-6
			Increase traffic flow (BPC maintenance vehicles)	Negative (-)	-1	-2	-2	-2	-7	All vehicles will be fitted with appropriate sound suppression devices or silencers.	-1	-2	-1	-1	-5

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
Archaeology & Heritage	Impact of the operation of power line on archaeological sites	Impact of the operation of the power line on two archaeological sites situated outside the line footprint.	Operation of power line	Neutral (N)	0	0	0	0	0	No mitigation measures required	0	0	0	0	0
Visual	Visual Impact	Change in land-use and available view	Visibility of Power Line	Negative (-)	-3	-3	-4	-2	-12	No mitigation	-3	-3	-4	-1	-11
Waste	Contamination of soil and groundwater Landfill space Health risks - exposure to hazardous wastes	Consumption of landfill space	Generation and disposal of general waste to landfill	Negative (-)	-2	-3	-3	-1	-9	Recycling of wastes off site	-2	-3	-1	-1	-7
		Consumption of landfill space	Generation and disposal of hazardous waste to landfill	Negative (-)	-2	-3	-3	-3	-11	Recycling of wastes off site (e.g. oils)	-2	-3	-1	-1	-7
		Contamination of soil & groundwater. Consumption of land space	Burial of wastes on site	Negative (-)	-2	-3	-1	-2	-8	Off-site disposal at authorised facilities	-1	-1	-1	-1	-4

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
		Contamination of soil	Temporary storage of hazardous waste on unprotected ground Hazardous waste spills	Negative (-)	-1	-2	-3	-3	-9	Storage of hazardous wastes in containers Labelling of containers	-1	-1	-1	-1	-4
		Contamination of groundwater	Disposal of hazardous wastes on general landfills	Negative (-)	-2	-3	-3	-3	-11	Contactor control Traceability (documentation) and reconciliation of waste disposed	-2	-3	-1	-1	-7
		Litter - aesthetic impacts Litter - ingestion by animals	Waste not contained and placed in suitable containers	Negative (-)	-1	-1	-2	-2	-6	Provision of bins Management and of people	-1	-1	-1	-2	-5
		Odour – unpleasant and may attract pests and wildlife	Waste not disposed of timeously or kept in closed containers	Negative (-)	-1	-1	-2	-2	-6	Frequent removal of waste.	-1	-1	-1	-1	-4
Economic	Employment (Local & Regional)	Employment opportunities	Reduction in unemployment Forward and backward linkages	Positive (+)	2	2	4	4	+12	Infrastructure construction initiatives should encourage and facilitate the use of local materials and labour intensive practices, if and where possible.	2	2	4	4	+12

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
	Enabling environment	Infrastructure	Development of roads, electricity, houses, social, health and educational facilities	Positive (+)	3	3	2	3	+11	Infrastructure should be accessible to local economic activities, if and where possible.	4	3	3	3	+13

Table 105: Access Road – Lephepe Option – Construction Phase

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
Geology & Soils	Soil erosion	Erosion of soil along the access road	Scarifying and water action	Negative (-)	-2	-3	-3	-4	-12	Provide drainage ditches to direct runoff away from the road	Not stipulated				-5
	Geological impacts	Opening of borrow pits for aggregate material	Mining of borrow material	Negative (-)	-2	-2	-1	-3	-8	Appropriate rehabilitation	Not stipulated				-5
Natural Vegetation / Plant Life	Environmental degradation	Loss of vegetation along the access route	Vegetation clearing for the widening of the road	Negative (-)	-2	-3	-2	-1	-8	Limit the extent of vegetation clearing to the areas needed for construction only	Not stipulated				-5
Animal Life	Disturbance of fauna	Game poaching	Construction workers on site practicing poaching	Negative (-)	-3	-3	-3	-4	-13	Training of labour force. Increased patrols of DWNP. Warning signs to be erected. Appointment of Honorary Game Wardens.	Not stipulated				-11
	Disturbance of wildlife	Other disturbances, including noise	Construction of road and general increase in human activity	Negative (-)	-2	-3	-3	-3	-11	Limit activity to the construction areas only.	Not stipulated				-11

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
Groundwater	Deterioration of groundwater resource	Pollution of groundwater through oil and other hydrocarbon material	Spillages	Negative (-)	-1	-1	-1	-2	-5	Ensure that oil baths are used when repairs are undertaken	Not stipulated				-5
Air Quality	Fugitive dust and other emissions	Increase in fugitive dust and other emissions	Vehicle entrained dust. Construction generated dust. Vehicle emissions	Negative (-)	-3	-2	-3	-3	-11	Dust suppression measures are to be implemented	Not stipulated				-5
Noise	Increase in ambient noise levels	Disruption to sensitive fauna and people	Construction activities along the road. Increased traffic load.	Negative (-)	-1	-2	-2	-2	-7	None required	Not stipulated				-5
Waste	Waste generation	Generation of waste from construction activities	Construction activities	Negative (-)	-3	-2	-3	-3	-11	Ensure waste is handled properly and disposed of at designated sites. Provide bins and empty regularly	Not stipulated				-5
Traffic	Traffic impacts	Increased hazard to pedestrians, livestock, & other road users	Construction activities Increased traffic volume	Negative (-)	-2	-1	-1	-2	-6	Education Keeping within stipulated speed limit	Not stipulated				-5

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
Socio-Economic	Employment creation	Short term employment creation	Construction of the access road	Positive (+)	Not stipulated				+12	Ensure that local employment is optimised	Not stipulated				
	Health effects	Increase in HIV/Aids, STDs and other health impacts	Increased people in project area	Negative (-)	-4	-3	-3	-4	-14	Implement community action plan	Not stipulated				-11
	Boost to local economy	Increased economic activity and multiplier effect impacts	Construction activities	Positive (+)	Not stipulated				+12	Ensure that local employment and procurement is optimised	Not stipulated				
		Benefit to farmers along the road	Construction of the access road	Positive (+)	Not stipulated				+12	No enhancement measures stipulated	Not stipulated				
	Social access	Access to social amenities	Construction of access road	Negative (-)	-2	-1	-1	-1	-5	Not many social amenities that can be interrupted	Not stipulated				-5

Table 106: Access Road – Lephepe Option – Operational Phase

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
Animal Life	Disturbance of wildlife	Other disturbances	Construction of road and general increase in human activity	Negative (-)	-3	-2	-3	-3	-11	Keep to stipulated speed limit	Not stipulated				-5
Air Quality	Fugitive dust and other emissions	Increase in fugitive dust and other emissions	Vehicle entrained dust. Construction generated dust. Vehicle emissions	Negative (-)	-2	-3	-2	-3	-10	Dust suppression measures are to be implemented	Not stipulated				-5
Traffic	Traffic impacts	Vehicles speeding beyond the stipulated speed limit	Increased traffic volume	Negative (-)	-2	-2	-2	-3	-9	Education Keeping within stipulated speed limit	Not stipulated				-6
		Increased road accidents	Increased traffic volume	Negative (-)	-2	-2	-2	-3	-9	Keep within speed limit. Community education.	Not stipulated				-5
Socio-Economic	Social ills	Increase in social pathologies	Increased movement of people along access road.	Negative (-)	-2	-3	-3	-3	-11	Continued efforts of community action plan	Not stipulated				-5

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
	Boost to local economy	**Increased economic activity and multiplier effect impacts**	**Increased movement of people along access road.** **Increased accessibility of remote area**	**Positive (+)**	**Not stipulated**				**+12**	**Ensure that local employment and procurement for road maintenance activities are practices.**	**Not stipulated**				
	Local economic improvement	**Increased land value**	**Improved accessibility to once remote area**	**Positive (+)**	**Not stipulated**				**+12**	**Ensure that the road is adequately maintained**	**Not stipulated**				

9.6. Impact Weighting and Residual Impacts After Mitigation

9.6.1 Introduction

The following table present an averaged impact rating for each of the environmental parameters and well as the rating that could be achieved after mitigation measures have been implemented. The final column in the table reflects a percentage of mitigation that could be achieved though the implementation of the prescribed mitigation and management measures. Though averaging the impact ratings, a broad overview is established with regard to the environmental aspects that would be impacted on most significantly.

Table 107: Mine Site – Construction Phase.

ISSUE	IMPACT RATING PRIOR MITIGATION	IMPACT RATING AFTER MITIGATION	% OF MITIGATION THAT COULD BE ACHIEVED
Climate	-6.67	-4.67	30.00
Geology	-13.00	-13.00	0.00
Soils	-12.67	-3.42	73.03
Land Capability & Land Use	-12.00	-10.50	12.50
Natural Vegetation / Plant Life	-12.20	-10.20	16.39
Animal Life	-11.14	-7.43	16.39
Surface Water	-3.33	-2.33	33.33
Groundwater	-10.00	-9.00	30.00
Air Quality	-8.38	-6.62	10.00
Noise & Vibration	-9.00	-6.14	21.10
Archaeology & Heritage	-9.67	-3.33	31.75
Visual	-10.00	-7.20	65.52
Waste	-8.00	-4.43	28.00
Social	-2.67	5.44	44.64
Economic	7.67	10.17	304.17

Negative impacts of highest significance during the construction phase of the proposed mine relates to the impact of the construction activities on the geology and no measures are available to mitigate these impacts. There is also a low positive social benefit and a high positive economic benefit mainly due to the employment of impoverished communities in the area and regional economic growth. While the social benefit is high, the negative impact relating to higher HIV risk factor introduced in the region renders the social benefit low.

Table 108: Mine Site – Operational Phase.

ISSUE	IMPACT RATING PRIOR MITIGATION	IMPACT RATING AFTER MITIGATION	% OF MITIGATION THAT COULD BE ACHIEVED
Geology & Soils	-13.00	-13.00	0.00
Land Capability & Land Use	-12.25	-5.25	57.14
Natural Vegetation / Plant Life	-12.00	-10.00	16.67
Animal Life	-10.75	-6.75	37.21
Surface water	-11.50	-7.25	36.96
Ground Water	-9.75	-7.00	28.21
Air Quality	-10.25	-8.50	17.07
Noise & Vibration	-9.00	-5.75	36.11
Archaeology & Heritage	-9.83	-7.33	25.42
Visual	-6.00	-5.00	16.67
Waste	-10.60	-9.00	15.09
Social	-7.86	-3.79	51.82
Economic	-2.67	2.78	204.17

While the social benefit is high other negative impacts such as a higher HIV risk factor introduced in the region renders the social benefit low. The economic benefits are generally high but are completely averaged out by the negative impact relating to informal settlement activities of people seeking employment which will result in increased incidents of crime within these settlements, health risks due to HIV infection and the eventual dependency on a single economic activity.

Table 109: Mine Site – Decommissioning Phase.

ISSUE	IMPACT RATING PRIOR MITIGATION	IMPACT RATING AFTER MITIGATION	% OF MITIGATION THAT COULD BE ACHIEVED
Geology & Soils	9.00	10.00	11.11
Land Capability & Land Use	11.00	12.00	9.09
Natural Vegetation / Plant Life	-10.75	-2.50	76.74
Animal Life	-11.86	-2.00	83.13
Surface Water	-10.67	-6.33	40.63
Groundwater	-2.33	-0.33	85.71
Air Quality	-5.20	-2.00	61.54
Noise & Vibration	-9.33	-5.00	46.43
Archaeology & Heritage	-4.00	-1.00	75.00
Visual	-10.00	-5.00	50.00
Waste	-9.00	-7.00	22.22
Social	-0.50	2.00	500.00
Economic	-3.25	-2.50	23.08

At de-commissioning, most impacts return to medium significance though a positive impact is expected as rehabilitation activities are commenced. It should be noted that this positive impact is reflected when the rehabilitation of the land is measured against the land degradation that occurred during the mine operation. Impact of high significance relates to the impact on fauna which is based on the transformation of land and increased human activities in the area which will increase incidents of poaching. A high visual impact will remain as the removal of mine residue dumps is not economically feasible. Social impacts are regarded as positive in the case that measures are implemented. The economic environment is negatively impacted on as at mine closure unemployment rates will increase.

Table 110: Power Line – Construction Phase.

ISSUE	IMPACT RATING PRIOR MITIGATION	IMPACT RATING AFTER MITIGATION	% OF MITIGATION THAT COULD BE ACHIEVED
Geology & Soils	-4.33	0.67	115.38
Land Capability & Land Use	-2.50	3.00	220.00
Natural Vegetation / Plant Life	-7.71	-4.86	37.04
Animal Life	-6.25	-1.50	76.00
Surface water	-9.00	0.00	100.00
Ground water	0.00	0.00	0.00
Air Quality	0.00	0.00	0.00
Noise & Vibration	-9.33	-7.33	21.43
Archaeology & Heritage	0.00	0.00	0.00
Visual	0.00	0.00	0.00
Waste	-8.86	-6.57	25.81
Social	6.00	7.00	16.67
Economic	12	13.5	12.50

The construction phase of the power line constructed is not regarded to have any positive impacts apart from an economic benefit brought on by employment opportunities and the enabling of the economic environment through infrastructure development. There are various environmental parameters in terms of which no significant impacts are expected.

Table 111: Power Line – Operational Phase.

ISSUE	IMPACT RATING PRIOR MITIGATION	IMPACT RATING AFTER MITIGATION	% OF MITIGATION THAT COULD BE ACHIEVED
Geology & Soils	-6.00	-6.00	0.00
Land Capability & Land Use	-5.00	-3.00	40.00
Natural Vegetation / Plant Life	-5.75	-3.50	39.13
Animal Life	-11.00	-6.00	45.45
Surface water	0.00	0.00	0.00
Ground Water	0.00	0.00	0.00
Air Quality	0.00	0.00	0.00
Noise	-7.50	-5.50	26.67
Archaeology & Heritage	0.00	0.00	0.00
Visual	-12.00	-11.00	8.33
Waste	-8.57	-5.42	36.67
Economic	11.50	12.50	8.70

Most negative impacts are regarded as low. Negative impact of high significance relates to the soil disturbance and compaction during infrastructure maintenance, and a high visual impact of the power line due to its high visibility. There is an economic benefit brought on by employment opportunities and the enabling of the economic environment through infrastructure development.

Table 112: Road – Construction Phase.

ISSUE	IMPACT RATING PRIOR MITIGATION	IMPACT RATING AFTER MITIGATION	% OF MITIGATION THAT COULD BE ACHIEVED
Geology & Soils	-10.00	-5.00	50.00
Natural Vegetation / Plant Life	-8.00	-5.00	37.50
Animal Life	-12.00	-11.00	8.33
Groundwater	-5.00	-5.00	0.00
Air Quality	-11.00	-5.00	54.54
Noise	-7.00	-5.00	28.57
Waste	-11.00	-5.00	54.54
Traffic	-6.00	-5.00	16.67
Socio-economic	3.40	4.00	17.64

During the construction phase of the access road, disturbance to animal life, the generation of dust and waste management poses the greatest risks to the environment.

Table 113: Road – Operational Phase.

ISSUE	IMPACT RATING PRIOR MITIGATION	IMPACT RATING AFTER MITIGATION	% OF MITIGATION THAT COULD BE ACHIEVED
Animal Life	-11.00	-5.00	54.54
Air Quality	-10.00	-5.00	50.00
Traffic	-4.50	-3.00	33.33
Socio-economic	4.33	6.33	46.15

The impacts associated with increased traffic associated with the access road, will remain elevated throughout the operational life of the access road.

9.6.2 Impact Weighting

All environmental parameters cannot be considered to be equal. For example, while the mining operation may look unattractive and is regarded as a visual disturbance is cannot be regarded as significant as the effect of the mining operation on the availability and pollution of ground water. The pollution of ground water may have health effect on future water users while the fact the mine look unattractive remains a static impact only perceived by people.

Therefore the following methodology has been developed for the weighting of the impact to enable an understanding of not only the significance, but the importance of specific impacts on the environment.

Two principles are applied in the prioritisation of environment aspects. These two principles is adopted from the South African Environmental Management Act[34], and include:

- That people has the right to an environment that is not harmful to their health or well-being, and
- That environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably.

Based on these principles impacts relating to socio-economic development is regarded to have the highest importance. Impacts relating to the physical environment, including aspect such as groundwater, land capability, etc. as second priority, and then followed by the biophysical and visual environment.

[34] *National Environmental Management Act (Act 107 of 1998)*

Divisional factors have been allocated for the environmental parameters in order to reflect a weighted average which will reflect environment parameter importance:

Table 114: Divisional Factors.

ENVIRONMENTAL ASPECT	FACTOR
Social	1
Economic	
Archaeology & Heritage	
Geology	2
Soils	
Land Capability & Land Use	
Groundwater	
Air Quality	
Surface Water	
Waste	
Natural Vegetation / Plant Life	3
Animal Life	
Noise & Vibration	
Visual	

Based on this weighting the rating impact rating for each environmental parameter post mitigation is as follows.

Table 115: Weighting – Mining Operation Construction Phase.

ASPECT	IMPACT RATING PRIOR MITIGATION	IMPACT RATING AFTER MITIGATION	% OF MITIGATION THAT COULD BE ACHIEVED	DIVISIONAL FACTOR	WEIGHTED RATING
Climate	-6.67	-4.67	30.00	2	-2.33
Geology	-13.00	-13.00	0.00	2	-6.50
Soils	-12.67	-3.42	73.03	2	-1.71
Land Capability & Land Use	-12.00	-10.50	12.50	2	-5.25
Natural Vegetation / Plant Life	-12.20	-10.20	16.39	3	-3.40
Animal Life	-11.14	-7.43	16.39	3	-2.48
Surface Water	-3.33	-2.33	33.33	2	-1.17
Groundwater	-10.00	-9.00	30.00	2	-4.50
Air Quality	-8.38	-6.62	10.00	2	-3.31
Noise & Vibration	-9.00	-6.14	21.10	3	-2.05
Archaeology & Heritage	-9.67	-3.33	31.75	1	-3.33
Visual	-10.00	-7.20	65.52	3	-2.40
Waste	-8.00	-4.43	28.00	2	-2.21
Social	-2.67	5.44	44.64	1	5.44

ASPECT	IMPACT RATING PRIOR MITIGATION	IMPACT RATING AFTER MITIGATION	% OF MITIGATION THAT COULD BE ACHIEVED	DIVISIONAL FACTOR	WEIGHTED RATING
Economic	7.67	10.17	304.17	1	10.17

Table 116: Weighting – Mining Operational Phase.

ASPECT	IMPACT RATING PRIOR MITIGATION	IMPACT RATING AFTER MITIGATION	% OF MITIGATION THAT COULD BE ACHIEVED	DIVISIONAL FACTOR	WEIGHTED RATING
Geology	-13.00	-13.00	0.00	2	-6.50
Soils	-12.25	-5.25	57.14	2	-2.63
Land Capability & Land Use	-12.00	-10.00	16.67	2	-5.00
Natural Vegetation / Plant Life	-10.75	-6.75	37.21	3	-2.25
Animal Life	-11.50	-7.25	36.96	3	-2.42
Surface water	-9.75	-7.00	28.21	2	-3.50
Ground Water	-10.25	-8.50	17.07	2	-4.25
Air Quality	-9.00	-5.75	36.11	2	-2.88
Noise & Vibration	-9.83	-7.33	25.42	3	-2.44
Archaeology & Heritage	-6.00	-5.00	16.67	1	-5.00
Visual	-10.60	-9.00	15.09	3	-3.00
Waste	-7.86	-3.79	51.82	2	-1.89
Social	-2.67	2.78	204.17	1	2.78
Economic	0.00	0.00	0.00	1	0.00

Table 117: Weighting – Mining Decommissioning Phase.

ASPECT	IMPACT RATING PRIOR MITIGATION	IMPACT RATING AFTER MITIGATION	% OF MITIGATION THAT COULD BE ACHIEVED	DIVISIONAL FACTOR	WEIGHTED RATING
Geology & Soils	9.00	10.00	-9.09	2	5.00
Land Capability & Land Use	11.00	12.00	76.74	2	6.00
Natural Vegetation / Plant Life	-10.75	-2.50	83.13	3	-0.83
Animal Life	-11.86	-2.00	40.63	3	-0.67
Surface Water	-10.67	-6.33	85.71	2	-3.17
Groundwater	-2.33	-0.33	61.54	2	-0.17
Air Quality	-5.20	-2.00	46.43	2	-1.00
Noise & Vibration	-9.33	-5.00	75.00	3	-1.67
Archaeology & Heritage	-4.00	-1.00	50.00	1	-1.00
Visual	-10.00	-5.00	22.22	3	-1.67
Waste	-9.00	-7.00	500.00	2	-3.50

ASPECT	IMPACT RATING PRIOR MITIGATION	IMPACT RATING AFTER MITIGATION	% OF MITIGATION THAT COULD BE ACHIEVED	DIVISIONAL FACTOR	WEIGHTED RATING
Social	-0.50	2.00	23.08	1	2.00
Economic	-3.25	-2.50	23.08	1	-2.50

Table 118: Weighting – Power Line Construction Phase.

ASPECT	IMPACT RATING PRIOR MITIGATION	IMPACT RATING AFTER MITIGATION	% OF MITIGATION THAT COULD BE ACHIEVED	DIVISIONAL FACTOR	WEIGHTED RATING
Geology & Soils	-4.33	0.67	115.38	2	0.33
Land Capability & Land Use	-2.50	3.00	220.00	2	1.50
Natural Vegetation / Plant Life	-7.71	-4.86	37.04	3	-1.62
Animal Life	-6.25	-1.50	76.00	3	-0.50
Surface water	-9.00	0.00	100.00	2	0.00
Ground water	0.00	0.00	0.00	2	0.00
Air Quality	0.00	0.00	0.00	2	0.00
Noise & Vibration	-9.33	-7.33	21.43	3	-2.44
Archaeology & Heritage	0.00	0.00	0.00	1	0.00
Visual	0.00	0.00	0.00	3	0.00
Waste	-8.86	-6.57	25.81	2	-3.29
Social	6.00	7.00	16.67	1	7.00
Economic	12	13.5	12.50	1	13.50

Table 119: Weighting – Power Line Operational Phase.

ASPECT	IMPACT RATING PRIOR MITIGATION	IMPACT RATING AFTER MITIGATION	% OF MITIGATION THAT COULD BE ACHIEVED	DIVISIONAL FACTOR	WEIGHTED RATING
Geology & Soils	-6.00	-6.00	0.00	2	-3.00
Land Capability & Land Use	-5.00	-3.00	40.00	2	-1.50
Natural Vegetation / Plant Life	-5.75	-3.50	39.13	3	-1.17
Animal Life	-11.00	-6.00	45.45	3	-2.00
Surface water	0.00	0.00	0.00	2	0.00
Ground Water	0.00	0.00	0.00	2	0.00
Air Quality	0.00	0.00	0.00	2	0.00
Noise	-7.50	-5.50	26.67	3	-1.83
Archaeology & Heritage	0.00	0.00	0.00	1	0.00
Visual	-12.00	-11.00	0.00	3	-3.67
Waste	-8.57	-5.42	8.33	2	-2.71

ASPECT	IMPACT RATING PRIOR MITIGATION	IMPACT RATING AFTER MITIGATION	% OF MITIGATION THAT COULD BE ACHIEVED	DIVISIONAL FACTOR	WEIGHTED RATING
Economic	11.50	12.5	36.67	1	12.50

Table 120: Weighting – Access Road Construction Phase.

ASPECT	IMPACT RATING PRIOR MITIGATION	IMPACT RATING AFTER MITIGATION	% OF MITIGATION THAT COULD BE ACHIEVED	DIVISIONAL FACTOR	WEIGHTED RATING
Geology and Soils	-10.00	-5.00	50.00	2	-2.50
Natural Vegetation / Plant Life	-8.00	-5.00	37.50	3	-1.70
Animal Life	-12.00	-11.00	8.33	3	-3.70
Groundwater	-5.00	-5.00	0.00	2	-2.50
Air Quality	-11.00	-5.00	54.54	2	-2.50
Noise	-7.00	-5.00	28.57	3	-1.70
Waste	-11.00	-5.00	54.54	2	-2.50
Traffic	-6.00	-5.00	16.67	3	-1.70
Socio-Economic	3.40	4.00	17.64	1	4.00

Table 121: Weighting – Access Road Operational Phase.

ASPECT	IMPACT RATING PRIOR MITIGATION	IMPACT RATING AFTER MITIGATION	% OF MITIGATION THAT COULD BE ACHIEVED	DIVISIONAL FACTOR	WEIGHTED RATING
Animal Life	-11.00	-5.00	54.54	3	-1.70
Air Quality	-10.00	-5.00	50.00	2	-2.50
Traffic	-4.50	-3.00	33.33	3	-1.00
Socio-Economic	4.33	6.33	46.15	1	6.30

The purpose of the application of weighting of impacts post mitigation is to determine if the mitigation and management measures proposed, are sufficient as relating to the impacts themselves. None of the impacts identified as part of this study ranked as high significance and there are no impacts that cannot be mitigated sufficiently.

Medium to high positive ratings are achievable for the following environmental aspects:

Mining Operation – Construction Phase:

- Social, and
- Economic.

Mining Operation – Operational Phase:

- Social, and
- Economic.

Mining Operation – Decommissioning Phase:

- Geology, soils, and
- Land use, land capability.

Power Line – Construction Phase:

- Geology, soils;
- Land use and land capability;
- Social and
- Socio-economic.

Power Line – Operational Phase:

- Social.

Access Road – Operational Phase:

- Socio-economic.

Low positive ratings are achievable for the following environmental aspects:
Access Road – Construction Phase:

- Socio-economic.

The following impacts rated medium significance post implementation of mitigation measures:
Mining Operation – Construction Phase:

- Geology.

Mining Operation – Operational Phase:

- Geology.

Mining Operation – Decommissioning Phase:

- No moderate impacts, all are positive, neutral or low negative.

Power Line – Construction Phase:
No moderate impacts, all are positive, neutral or low negative.

Power Line – Operational Phase:

- No moderate impacts, all are positive, neutral or low negative.

Access Road – Construction Phase:

- No moderate impacts, all are positive, neutral or low negative.

Access Road – Operational Phase:

- No moderate impacts, all are positive, neutral or low negative.

9.7. Additional Considerations for Transboundary Impacts

There are no transboundary impacts associated with this project.

SECTION 10. MITIGATION MEASURES AND SOCIAL & ENVIRONMENTAL MANAGEMENT PROGRAMME (SEMP)

Based on the results of the impact assessment, recommendations have been made on the management strategy that should be implemented for the construction, operation and closure of the proposed mining operation.

The overall management plan has been based on the premise of sound environmental management and cost effective measures that will ensure wherever possible a stand alone solution to the remediation of the impacts caused by the construction operation.

It should be noted that the SEMP should be regarded as a live document and that additional or alternative measures should be incorporated during course of the implementation of the plan where required, in order to ensure that the objectives as set by the document are met.

It is recommended that an Environmental Officer be appointed prior to the commencement of the construction phase of the GDMP. Responsibilities should include, but not limited to ensuring adherence to SEMP guidelines, guidance of activities, planning, reporting, adaptive management, incident control, etc.;

10.1. ORGANISATIONAL COMMITMENT AND ENVIRONMENTAL POLICY

The GDL organisational commitment and environmental policy is presented in Appendix 16.

10.2. MINE SITE

10.2.1 Design and Construction Phase

IMPACT	CAUSE / ASPECT	OBJECTIVE	MANAGEMENT & MITIGATION PRACTICE	SCHEDULE OF ACTIONS	RESPONSIBLE PERSON	MONITORING REQUIREMENTS	CLOSURE OBJECTIVE
CLIMATE							
Carbon and other greenhouse gasses into the atmosphere.	• Construction operations. • Land based vehicle activity. • Use of backup diesel generators during construction.	• Minimise the carbon footprint of the mine.	• Ensure vehicle exhaust systems function correctly. • Ensure energy reduction practices are developed & implemented.	Ongoing monitoring.	Environmental officer. Environmental officer. Environmental officer.	• Conduct air quality monitoring.	• Eliminate all carbon and greenhouse gas emissions
GEOLOGY							
Destruction of target geology	• Total removal of targeted sand and basalt material.	• Kimberlite and overburden material will be removed, processed and either stockpiled as slimes, tailings or as waste rock	• No management / mitigation measures can be implemented. • Impacts resulting from the mining operation are to be limited to the MLA area only.	Ongoing / continuous throughout construction phase.	Project manager / Principle contractor. Environmental officer.	• Visual inspection.	• All mineralogical waste sites will be rehabilitated accordingly. • The open pit will be rehabilitated accordingly. • All shallow foundations are to be removed during rehabilitation. • All deep foundations are to be top-dressed and the area re-vegetated.
SOILS							
Soil disturbance, loss of nutrients, loss of topsoil cover, loss of in situ structure and physical / chemical properties.	• Clearing of vegetation and removal of top- and subsoils for mining and infrastructure.	• Minimisation of disturbed area. • Implementation of ongoing rehabilitation programme.	• Strip and stockpile top- and subsoils appropriately. • Commence rehabilitation of affected and completed areas. • Application of soil handling and removal practices (including vegetative cover). • Application of soil emplacement and storage practices. • Fertilisation and amendments.	Ad hoc throughout construction phase when required.	Project manager / Principle contractor. Environmental officer.	• Visual inspection. • Measurement of dimensions. • Soil testing.	• Preservation of soils to result in productive soils available for rehabilitation purposes. • Soil profiles simulating pre-mining conditions. • Self sustaining ecosystem.
Soil removal and / or disturbance (compaction, erosion & contamination).	• Construction of TMF, RWD, WRD, surface water management systems, stockpiles, stockpiling of soils, spillages, plant construction.	• Soil conservation.	• Re-use top- and subsoils during ongoing rehabilitation. • Rehabilitate as soon as possible. • Erosion control and treatment. • Implementation of good house keeping practices. • Spill clean up.	Ad hoc throughout construction phase when required.	Project manager / Principle contractor. Environmental officer.	• Visual inspection. • Measurement of dimensions. • Soil testing.	• Preservation of soils to result in productive soils available for rehabilitation purposes. • Soil profiles simulating pre-mining conditions. • Self sustaining ecosystem.
LAND CAPABILITY							
Change of land capability to mining land.	• Disruption of ecosystem due to mining activities and construction of infrastructure.	• Conserve land capability.	• Effective soil handling and removal practices. • Effective soil emplacement and storage practices. • Fertilisation and amendments. • Soil amelioration.	Ad hoc throughout construction phase when required.	Project manager / Principle contractor. Environmental officer.	• Visual inspection. • Measurement of dimensions. • Soil testing.	• Return land to wilderness conservation status or as close as possible to that.
LAND USE							
Change of land use from wilderness to mining, resulting in a loss of natural habitat.	• Mining operation and construction of infrastructure.	• Mitigate the GDMP footprint.	• Limiting the footprint of the mining operation to the MLA. • Prevention of dust and spillage of rock material. • Appropriate maintenance of the road ways.	Ongoing throughout construction phase.	Project manager / principle contractor. Environmental officer.	• Visual inspections. • Complaints from surrounding community.	• Return land to wilderness conservation status or as close as possible to that.
FLORA							
Loss / degradation of pristine vegetation / habitat.	• Land transformation though mine & associated infrastructure development.	• Preserve as much pristine habitat as possible. • Limit and prevent ecological degradation where possible. • Ensure long term success of rehabilitation.	• Minimise GDMP footprint: - Use existing roads where possible. - Clear minimum vegetation. - Maximise site vegetation retention areas. - Erection of fence. • Preservation of vegetation. • Implementation of conservation practices. • Fire prevention. • Ongoing rehabilitation.	Bi-annual monitoring	Environmental officer.	• Visual inspections to ensure 60% vegetation cover.	• Competent ecosystem. • 60% Vegetation cover.
Alteration of natural ecological processes / ecosystem functioning.	• Creation of atypical/ non-natural habitat, presence of humans for prolonged periods.						
Introduction of species not associated with the region.	• High traffic volume between site & other areas.						
Changes in vegetation dynamics.	• Fires, water, vegetation transformation.						

IMPACT	CAUSE / ASPECT	OBJECTIVE	MANAGEMENT & MITIGATION PRACTICE	SCHEDULE OF ACTIONS	RESPONSIBLE PERSON	MONITORING REQUIREMENTS	CLOSURE OBJECTIVE
Impacts on sensitive environments (receiving water body / pan).	• Direct/ indirect impacts, physical or cumulative, wood harvesting, plant collection.						
FAUNA							
Potential loss / degradation of local pristine faunal habitat and/or communities.	• Land transformation though mine & associated infrastructure development.	• Minimise land transformation.	• Ensure pockets of vegetation remain in order to ensure a measure of ecological connectivity. • Limit impacts to the MLA.	Ongoing throughout construction phase.	Environmental officer.	• % Of land transformed.	• Rehabilitation of entire site.
Road deaths of animals on access roads.	• Reckless driving and night-time driving on access roads.	• Minimise road deaths of animals.	• Vehicles are to yield to larger mammals. • **Keep within the applicable speed limits**. • Prohibit night driving, except in cases of emergency.	Continuous throughout LOM.	Vehicle drivers. Environmental officer.	• Recording of animal deaths on roads in log book.	• Elimination of animal road deaths on roads.
Alteration of natural ecosystem functioning/ disruption of migration routes.	• Land transformation though mine & associated infrastructure development.	• Minimise land transformation.	• Ensure pockets of vegetation remain in order to ensure a measure of ecological connectivity. • Limit impacts to the MLA.	Ongoing throughout construction phase.	Environmental officer.	• % Of land transformed.	• Rehabilitation of entire site.
Increase in poaching, snaring and trapping of animals.	• Increase in human habitation at the site and lack of environmental awareness.	• Prevent poaching, snaring, trapping.	• Fencing of Gope Project Site. • Policing of boundary fence. • GEC prescribed disciplinary action. • Warning signs. • Appointment of Honorary Game Wardens.	Ongoing throughout construction phase.	Environmental officer.	• Number of incidents recorded. • Inspections in area surrounding Gope Project Site of veld.	• Elimination of poaching, snaring and trapping.
Impact of chemical compounds from construction on animals.	• Release of hazardous/ bio-accumulating chemicals into the environment.	• Prevention of animal death / health hazard due to chemical contamination.	• Eliminate leaching of chemicals. • Implementation of containment structures. • Responsible transportation and storage of chemicals.	Ongoing throughout construction phase.	Environmental officer.	• Number of incidents recorded.	• Removal of all hazardous / bio-accumulating chemicals, effluents, leachates.
Attraction of animals to artificial surface water.	• Large sources of artificial surface water introduced.	• Prevention of ecological alteration.	• Limit open water sources to those required only. • Monitor animal access. • If required, upgrade fences immediately surrounding open water sources to electrified fencing.	Ongoing throughout construction phase.	Environmental officer.	• Size of open water sources.	• Elimination of open water sources.
Loss of natural faunal species to introduced faunal species.	• Killing of small mammals by domestic cats and dogs.	• Prevention of ecological alteration.	• Prevent introduction of foreign species to the CKGR by prohibiting all pets.	Ongoing throughout construction phase.	Environmental officer.	• Inspections.	• Prevention of long term ecological alteration through introduction of foreign species.
SURFACE WATER							
Impact on surface water quality through increased TDS, possible erosion (wind & water).	• Stripping of vegetation as part of construction activities. • Instability of stockpiles / sand.	• Elimination of impacts on surface water movement.	• Limit areas to be stripped for construction purposes. • Minimise wind and water erosion. • Slope stabilisation. • DTM model and implementation of surface water management structures.	Ongoing throughout construction phase.	Environmental officer.	• Inspections of cleared areas.	• Prevention of long term ecological alteration through introduction of foreign species.
GROUNDWATER							
Groundwater quantity.	• Dewatering of open pit aquifer to ensure safe mining operation.	• Dewater aquifer to ensure safe mining conditions.	• Impact on drawdown is minimal, therefore no mitigation measures proposed.	Ongoing throughout construction phase.	Environmental officer.	• Inspections.	• Rehabilitate area post use to same as prior to impact.
Groundwater quality deterioration	• Organic and inorganic contamination of localised aquifer due to domestic and sewage effluent disposal	• Prevention of contamination of aquifer.	• 80m sand filter between surface & aquifer, thus very little risk of biological contamination. • Implement recommended waste management systems. • Manage inorganic substances on surface to prevent groundwater impacts.	Quarterly monitoring at relevant monitoring boreholes.	Environmental officer	• Major cations. • Major anions. • Microbiological elements.	• Ensure that the aquifer is not contaminated.

IMPACT	CAUSE / ASPECT	OBJECTIVE	MANAGEMENT & MITIGATION PRACTICE	SCHEDULE OF ACTIONS	RESPONSIBLE PERSON	MONITORING REQUIREMENTS	CLOSURE OBJECTIVE
AIR QUALITY							
Reduction in ambient air quality from fugitive dust emissions.	• Construction and grading of haul roads. • Civil site preparation. • Construction of mining operations / infrastructure: - Pre-stripping of sand. - Overburden & waste rock dumping. - Construction of plant and other infrastructure. - Material transfer operations. - Wind erosion from exposed storage (stockpiles & mine residue deposits) piles. - Vehicle entrained dust from both paved and unpaved road surfaces. - Process fugitive emissions (crushing and screening operations). - Remediation and rehabilitation.	• Reduce fugitive dust emissions to acceptable standards.	• Reduce extent of construction operation taking place, rather phase in (thus reduce exposure). • Use of windbreaks, chemical + water suppression. • Rock cladding of stockpiles / dumps on prevailing wind facing slopes. • Re-vegetation of areas as soon as possible. • Reduction of drop height as far as is practicable. • Reduction of speed of vehicles to keep within the applicable speed limit.	Ongoing throughout construction phase.	Environmental officer.	• Ongoing dust fallout monitoring. • Annual audits.	• Elimination of fugitive dust and other sources of air contaminants.
	• Dust emissions resulting in respiratory and cardiovascular ailments.						
	• Reduced visibility, soiling of buildings and materials.						
NOISE & VIBRATION							
Increased ambient noise levels	• Construction activities (mine and other infrastructure)	• Comply with noise level criteria in legislative and Best Practice requirements.	• All machinery used during construction will be maintained in sound mechanical condition. • Placement of waste structures (slimes dam, sand dump, WRD) has been designed such as to create a noise barrier. • PPE will be worn at all times during construction activities.	Monthly noise monitoring. Investigation of each noise complaint. Annual audits.	Environmental officer.	• Annual audits. • Investigation of all noise related complaints. • Monthly noise monitoring.	• Elimination of mine operation related noise sources.
	• Use of diesel generators		• On-site generators should be clad in suitable material or housed in structures that would reduce their noise impacts. • Generators will be fitted with appropriate silencers. • PPE will be worn at all times during construction activities.				
	• Increase traffic flow (on-site)		• All vehicles will be fitted with appropriate sound suppression devices or silencers. • Keep within the applicable speed limits.				
	• Air traffic flow (aircraft & helicopter)		• Weekly flights to & from the GDMP will be restricted to daylight hours, except for emergencies.				
	• Periodic blasting as part of sand stripping activities		• Placement of waste structures (slimes dam, sand dump, WRD) has been designed such as to create a noise barrier. • PPE will be worn at all times during construction activities.				
Nuisance disruption to sensitive fauna, employees & communities	• Blasting of waste material and ore	• Comply with noise level criteria in legislative and Best Practice requirements.	• Complaints by I&APs will be recorded in a Complaints Register and addressed throughout the duration of the existence of the power line. • Blasts will be designed by a suitably qualified engineer.	Noise & vibration monitoring with each blast. Annual audits.	Environmental officer.	• Noise & vibration monitoring with each blast. • Annual audits.	• Cessation of blasting activities.
Impact on building foundation stability	• Blasting of waste material and ore		• Foundations of buildings closer to the open-pit area are to be able to withstand the effects of the vibrations. • Blasts will be designed by a suitably qualified engineer.				
ARCHAEOLOGY & HERITAGE							
Impact of mining development on the one grave directly impacted by the mining operation.	• Construction and establishment of mine and infrastructure.	• Remove graves to a safe place. • Access to be provided to the family of the deceased.	• Relocation of graves where necessary.	Once off during construction phase.	Environmental officer. Operations manager.	• Legal compliance. • Compliance with procedure agreed with affected family.	• Safety of graves. • Access for families.

IMPACT	CAUSE / ASPECT	OBJECTIVE	MANAGEMENT & MITIGATION PRACTICE	SCHEDULE OF ACTIONS	RESPONSIBLE PERSON	MONITORING REQUIREMENTS	CLOSURE OBJECTIVE
Impact of mining development on graves located within the Gope Project Site.	• Construction and establishment of mine and infrastructure.	• Safety of grave and access to family.	• Fencing and management of site.				
Impact of mining development on the graves situated outside of Gope Project Site and those situated outside of the MLA.	• Construction and establishment of mine and infrastructure.	• Safety of grave and access to family.	• No mitigation required.	Not applicable.	Not applicable.	• Not applicable.	• Safety of graves. • Access for families.
Impact of mining development on the settlements situated within the Gope Project Site.	• Construction and establishment of mine and infrastructure.	• Preservation of historical sites.	• Documentation of three significant settlements by a qualified archaeologist.	Once off during construction phase.	Environmental officer. Operations manager.	• Legal compliance. • Compliance with affected community procedure.	• Conservation of culturally significant information.
Impact of mining development on the settlements situated outside of the Gope Project Site but inside the MLA.	• Construction and establishment of mine and infrastructure.	• Preservation of historical sites.	• No mitigation required.	Not applicable.	Not applicable.	• Not applicable.	• Conservation of culturally significant information.
Impact of mining development on the settlements situated outside of the MLA							
VISUAL ASPECT							
Change in land-use and available view.	• Construction vehicle movement (sequential impact).	• Minimise the visual impact and associated available view.	• Fleet design and optimisation.	Undertaken during detailed design phase.	Operations manager	• None.	• Eliminate EMV at the Gope Project Site.
	• Temporary structures construction.		• All buildings and structures shall be finished in a colour (or surface which weathers to a colour) in shades of green, brown or grey. • Reduce reflectance value to 37%.	Ad hoc during construction phase.	Project manager / Principle contractor.	• Visual inspection.	• All buildings that won't be used post closure will be removed from site. • All remaining buildings are to be resurfaced at GEC's cost for future use by the end user of the infrastructure.
	• Entrances, signs and boundary treatment.		• Limit signage (number & size) to fall within the GEC requirements.				• All signage to be removed during closure. • Boundary fence to be removed upon obtaining closure.
	• Material storage.		• Restriction of the height of mineralogical waste structures. • Ongoing rehabilitation and re-vegetation of mineralogical waste structures.	Detailed design. Ongoing throughout construction phase.	Operations manager / environmental officer		• Obtain a final landform that blends with the surrounding environment.
Light pollution	• Lighting of mining operations.	• Minimisation of illumination and sky glow.	• Appropriate light fitting installation. • Installation of shielding. • Limit light intensity.	Ongoing throughout construction phase.	Environmental officer.		• All mining related lighting will be removed from the Gope Project Site.
WASTE MANAGEMENT							
Contamination of groundwater, surface water.	• Leaching of hazardous substances from tailings and slimes.	• Mitigation of contamination of ground- and surface water resources.	• Leaching probability is low – no additional mitigation measures required.	Ongoing throughout construction phase.	Environmental officer.	• Quarterly surface- and groundwater monitoring.	• Preservation of groundwater aquifer.
Consumption of land space.	• Generation and disposal of general waste to landfill.	• Optimisation of resources.	• Re-use of wastes – avoidance of virgin material. • Recycling of wastes off site.	Ongoing throughout construction phase.	Environmental officer.	• Volume of waste land filled.	• Elimination of waste generation.
Consumption of land space.	• Generation and disposal of hazardous waste to landfill.	• Optimisation of recycling practices.	• Recycling of wastes off site (e.g. oils).	Ongoing throughout construction phase.	Environmental officer.	• % of oils used recycled.	• Elimination of waste generation.
Contamination of soil & groundwater. Consumption of land space.	• On-site land filling / burial of wastes (permanent on-site disposal).	• Mitigation of contamination of ground- and surface water resources.	• On-site disposal of organic food wastes only.	Ongoing throughout construction phase.	Environmental officer.	• Visual inspection.	• Land filling of organic food waste only.

IMPACT	CAUSE / ASPECT	OBJECTIVE	MANAGEMENT & MITIGATION PRACTICE	SCHEDULE OF ACTIONS	RESPONSIBLE PERSON	MONITORING REQUIREMENTS	CLOSURE OBJECTIVE
Contamination of soil.	• Temporary storage of hazardous waste on unprotected ground – on site or off-site (e.g. at Ramotswa Landfill). • Hazardous waste spills outside contained areas.	• Prevention of soil contamination.	• Storage of hazardous wastes in purpose built stores (impermeable floors, bunding etc.). • Labelling of containers.	Ongoing throughout construction phase.	Environmental officer.	• Visual inspection. • Incident register.	• Elimination of all soil contamination. • Rehabilitation of affected soils.
Contamination of groundwater.	• Disposal of hazardous wastes on general landfills.	• Mitigation of contamination of groundwater resources.	• Contactor control. • Traceability (documentation) and reconciliation of waste disposed.	Ongoing throughout construction phase.	Environmental officer.	• Quarterly groundwater monitoring. • Incident register.	• Preservation of groundwater aquifer. • Rehabilitation of groundwater aquifer if required.
Litter - aesthetic impacts. Litter - ingestion by animals.	• Waste not placed in designated waste bins/containers.	• Litter prevention.	• Provision of bins. • Management and education of people.	Ongoing throughout construction phase.	Environmental officer.	• Litter management programme. • Visual inspections.	• Removal of all litter associated with the mining operation.
Odour – unpleasant and may attract pests and wildlife.	• Waste not disposed of timeously or kept in closed containers.	• Elimination / management of unpleasant odours / attraction of pests & wildlife.	• Frequent removal of waste.	Ongoing throughout construction phase.	Environmental officer.	• Regularity of waste removal. • Annual audits.	• Removal of all waste associated with the mining operation.
Infections from medical waste.	• Unsuitable handling and disposal of medical waste (sharps and bandages).	• Appropriate management of medical waste.	• Provision of suitable waste containers. • Contractor control. • Disposal to authorised sites.	Ongoing throughout construction phase.	Environmental officer.	• Regularity of medical waste removal. • Annual audits.	• Removal of all medical waste associated with the mining operation.
Health risks of staff and public from exposure to hazardous wastes.	• Handling of hazardous waste with out suitable PPE by staff or public.	• Prevention of hazardous waste related illnesses.	• Provision of suitable waste containers and PPE. • Contractor control. • Disposal to authorised sites.	Ongoing throughout construction phase.	Environmental officer.	• Regularity of hazardous waste removal. • Incidents register. • Annual audits.	• Elimination of hazardous waste related illnesses.
SOCIAL ASPECT							
Employment at GDMP.	• Construction of mining operation.	• Maximisation of positive benefit.	• Site-specific construction positive impacts on unskilled, semi-skilled, skilled labour. But, little likelihood of sustained high involvement of local labour across community members. No clear means of mitigation, even with sourcing labour from directly affected area.	Ongoing throughout construction phase.	HR Manager.	• Number of people employed: - Employees from directly affected community. - Local employees. - Expatriates.	• Skills development for long term sustainability.
Employment in surrounding communities.	• Construction of mining operation.	• Maximisation of positive benefit.	• Focus on short-term employment opportunities near communities. Preceded by extensive community liaison to support employment across community members.	Ongoing throughout construction phase.	HR Manager.	• Number of people employed: - Employees from directly affected community. - Local employees. - Expatriates.	• Skills development for long term sustainability. • Empowered community.
HIV& AIDS at GDMP.	• Construction of mining- and associated infrastructure.	• Minimising infection rates.	• GEC interventions on site, as per HIV/AIDS plan of action instituted by GEC, and as per the Wellness Policy. Need to include condom programming, information and attitudinal change, gender relations and power over sexual decision-making, life skills education, testing, ARVs, recreational activities. • Conduct within the context of a broader wellness programme.	Ongoing throughout construction phase.	HR Manager.	• Staff participation in voluntary HIV/Aids programmes. • Sick days above expected median. • Staff productivity.	• Increased awareness around HIV/Aids.
HIV& AIDS in surrounding communities.	• Construction of mining- and associated infrastructure.	• Minimising infection rates.	• Construction firms required to engage in enhanced HIV/AIDS response. Consider contracting local partner NGO skilled in the HIV/AIDS prevention and response arena.	Ongoing throughout construction phase.	Community liaison manager.	• Staff participation in voluntary HIV/Aids programmes. • Sick days above expected median. • Staff productivity.	• Increased awareness around HIV/Aids.
Shift work.	• Mining operation.	• Maximum distribution of employment benefits. • Best fit with local livelihood strategies.	• Institute a two week on one week off system. • Provide transport to a central location.	Ongoing throughout construction phase.	HR Manager.	• Sustained employment. • Annual audits.	• Positive socio-economic benefit to communities.

IMPACT	CAUSE / ASPECT	OBJECTIVE	MANAGEMENT & MITIGATION PRACTICE	SCHEDULE OF ACTIONS	RESPONSIBLE PERSON	MONITORING REQUIREMENTS	CLOSURE OBJECTIVE
Gope settlement.	• Mining operation.	• Maximisation of benefit to the Gope and greater CKGR residents.	• Extensive and sustained consultation. • Agreement to prioritise employment among Gope residents and where appropriate, from Kaudwane. • Development and implementation of a Community Action Plan and communication plan. • Provision of water subsequent to consultation with the responsible authorities and within the CKGR Draft Management Plan framework. • Access to health services. • Minimisation of violence. • Minimisation of alcohol abuse. • Maximisation of informal enterprises. • Prevention of establishment of sex trade. • HIV/Aids spread prevention. • As local residents, Gope residents will be affected by decommissioning and rehabilitation arrangements. Of particular importance are safety aspects in terms of pit closure, and the removal of any hazardous substances. • Consider referring to the area as Gaagoo.	Ongoing throughout construction phase.	Community liaison manager.	• Community surveys. • Annual audits.	• Positive socio-economic benefit to communities.
Kaudwane.	• Mining development.	• Maximise positive benefit to community. • Mitigate negative impacts on community, including social pathologies.	• Community Action Plan. • Work with community representative institutions. • Establish effective consultation networks. • Respond to negative social impacts through these structures.	Ongoing throughout construction phase.	Community liaison manager.	• Community surveys. • Annual audits.	• Positive socio-economic benefit to communities.
Services at GDMP.	• Mining operation.	• Maximise in house services to staff and Gope residents.	• Provide services as intended where practicable. • Extend services (i.e. medical emergency care) to Gope residents where practicable.	Ongoing throughout construction phase.	HR Manager.	• Community surveys. • Annual audits.	• Improved health and wellbeing of Gope residents.
Gender aspects.	• Gender stereotyping associated with mining related project.	• Minimise gender in-equality.	• Open dialogue about male and female employment opportunities. • Specific requests for females with experience to apply for mine jobs.	Ongoing throughout construction phase.	HR Manager.	• Employee surveys. • Community surveys. • Annual audits.	• Empowered staff and community members.
REGIONAL SOCIO-ECONOMIC STRUCTURE							
Increase in GGP.	• Increase in business activity / sales and demand for consumer services.	• Maximise socio-economic benefit to communities.	• Encourage procurement of domestic upstream and downstream services to the value chain where possible.	Ongoing throughout construction phase.	HR Manager.	• Employee surveys. • Community surveys. • Annual audits.	• Positive socio-economic benefits to the communities.
Living conditions improvement and reduction in poverty.	• Increase in spending power in local communities.	• Maximise socio-economic benefit to communities.	• Maximise on multiplier effect. • Develop & implement community trust.	Ongoing throughout construction phase.	Community liaison manager.	• Community surveys. • Annual audits.	• Positive socio-economic benefits to the communities.
Enabling environment – infrastructure	• Development of roads, electricity, houses, social, health and educational facilities.	• Maximise socio-economic benefit to communities.	• Align roads to connect with larger, rather than smaller regional economic nodes. • Encourage and facilitate the use of local materials and labour intensive practices, if and where possible.	Ongoing throughout construction phase.	Community liaison manager.	• Community surveys. • Annual audits.	•
Improvement of skill levels.	• Provision of training programmes related to work.	• Maximise long term socio-economic benefit to communities.	• Procure training service providers to skill / re-skill local labourers.	Ongoing throughout construction phase.	Community liaison manager.	• Community surveys. • Annual audits.	•
Squatting at GDMP, Kaudwane and Lephepe.	• Construction of mine.	• Maximise socio-economic benefit to communities.	• Security gates and fence around GDMP. • Access control at access gate to CKGR. • Security to minimise goods trading between community and GEC employees. • Develop eviction strategy with the DWNP. • Implementation of social and labour plan.	Ongoing throughout construction phase.	Community liaison manager.	• Community surveys. • Annual audits.	• Positive socio-economic benefits to the communities.

10.2.1.1 Climate

In order to minimise the release of greenhouse gasses and other contaminants to the atmosphere, maintenance of vehicles with specific focus on exhaust systems are required. Energy conservation programmes will be required to be put in place.

10.2.1.2 Geology

During the construction phase of the GDMP there will be little to no impact on the hard rock geology. Surface materials (soil) will be stripped away in sections to expose the underlying resource and its associated host rock geology, with the overlying sand cover to be mined in stages.

The impact upon the geology is to be confined to the MLA only.

10.2.1.3 Soils

During the construction phase, significant impacts will be imposed on the surface features of the site, inclusive of the soils and their capability to sustain an environmental equilibrium.

The management strategy proposed for the construction phase includes:

- The minimisation of the area to be disturbed by the mining operation itself to the footprint of the Gope Project Site as far as is possible, and at most, to the footprint of the MLA, and
- Implementation of the mitigation and ongoing rehabilitation plan pertaining to any temporary structures or facilities that are imposed on the environment.

The objective is to:

- Strip and stockpile the topsoils and subsoils that are to be removed from the open pit mining area and all footprints that are to be used for the beneficiation of the raw materials, and
- To conserve the valuable natural resources that will be needed as part of the rehabilitation process.

The mitigation measures aim to reduce the impacts of construction on the areas that are to be disturbed (including the open pit mining area, the processing areas, tailings dump, slimes dam, sand dump, stockpile sites, lay-down sites, dams, camp and water treatment facilities) and post operation, to rehabilitate all un-used areas after construction so as to create a feature that emulates the existing landscape as closely as possible, and does not adversely impact on the area in general.

10.2.1.3.1 Soil Handling and Removal

The basic philosophy used in the management of soils is one of "Total Soil Utilization", and is based on the understanding that all "utilizable" soil will be removed and stored for use at closure for rehabilitation. With this basic understanding, a more detailed prescription for the handling of the soils during the construction phase is proposed.

The topsoil portion of the profile (sandy loams and silty loams) must be stripped and stockpiled separately from the subsoils wherever possible. The topsoils can be used to create berm structures upslope of the facilities and open pit mining area, sand dump, TMF and WRD, while the subsoil can be stored as separate stockpiles close to the areas where they will be required for rehabilitation.

The soils removed from the haul roads and access routes must be stored as close as possible to the linear structures and separately managed in stockpiles that can be easily used for rehabilitation of the infrastructure at closure.

Stripping is undertaken to conserve the valuable natural resources that will be needed as part of the rehabilitation and the following stripping is recommended:

Table 122: Soil Stripping Ratios.

AREA / FOOTPRINT OF IMPACT	STRIPPING DEPTH[35]	SOIL TYPE	STORAGE	STRIPPING SEQUENCE
Road ways	500 mm	Top and subsoils	Top and subsoils stored together	Progressive stripping is recommended as the road building progresses
Slimes dam, RWDs, stockpile areas and haul ramps	300 mm Up to 1,500 mm	Topsoil Subsoil	Top and subsoils separately stored	All at once during the construction of the slimes dam
WRD, sand dump, tailings dump, open pit	300 mm Up to 1,500 mm	Topsoil Subsoil	Top and subsoils separately stored	Progressively as the operation progresses
Camp area	0 mm	N/A	N/A	No stripping is recommended between the small accommodation units, in order to preserve as much of the natural state as possible

[35] Stripping depths are recommendations only and should be adhered to where possible, or until hard sand lenses or Calcrete are encountered or until refusal.

AREA / FOOTPRINT OF IMPACT	STRIPPING DEPTH[35]	SOIL TYPE	STORAGE	STRIPPING SEQUENCE
Plant and associated infrastructure	500 mm	Top and subsoils	Top and subsoils stored together	All plant and infrastructure areas are to be stripped prior to commencement of construction

It is recommended that the camp infrastructure area is not to be stripped of top or subsoils. This recommendation is made in order to retain as much ecologically in tact areas as possible between the accommodation units.

As outlined above, it will be necessary to differentially strip the topsoil and subsoil horizons, while every endeavour should be made not to disturb or work the soils during the wet months due to their susceptibility to compaction.

The stripping of the topsoils should take place without removing the grass, forb and shrub vegetation. The shrub and larger trees should be chipped on site and left on the surface to be stripped and included in the stockpiling of the topsoil. This will help to retain the seed pool and maintain the nutrient levels within the soils during storage. The larger trees and thick bush areas will need to be felled and chipped before the stripping process is undertaken.

Grasslands and transitional zone soils should be fertilized as described below in section 10.2.1.3.3 prior to the stripping taking place. This will ensure that the fertilizer is well mixed into the soil during the stripping operation and will reduce the amount of fertilizer required during the rehabilitation program. This will be monitored based on available nutrient content analysis as outlined in the monitoring programme.

However, during the construction phase of the GDMP, it was requested by the project proponent that all affected soils, including Cut 1 of the open pit, the slimes dam footprint area, initial laydown area of the sand dump, plant and other built infrastructure be stripped together to a depth of 500 mm and not differentially. The following motivation for this was provided:

- Soils stripped during this time will be stockpiled for final rehabilitation, likely for a period of between 15 – 20 years, as opposed to other soils that will be placed as soon as an area have been finalised. This will result in very little viability of the soils remaining at the time of rehabilitation and such soils will require significant additions of fertiliser, compost and seed mix to regain its original viability;
- The differential stripping of soils will result in a serious time delay in the commencement of sand stripping and eventually the mining of the Kimberlite ore, and

- The differential stripping of soils hold a significant cost implication for the operation, which will not be generating a turn over during the construction phase, thereby placing additional pressure onto the financial feasibility of the project.

10.2.1.3.2 Soil Emplacement and Storage

The soil emplacement and storage process will comprise the following action items:

- Any hydromorphic (wet) soils will need to be stockpiled separately from the dry sandy loams and sands, while the topsoils and subsoils must be stockpiled in separate piles. The storage of all soil should be designed to be upslope of the proposed facilities that are to be constructed, where feasible, but in close proximity to the area that will need to be rehabilitated at closure;
- It is proposed that the construction of the topsoil storage stockpiles is undertaken in a series of 1.5 m lifts if the storage facilities are to be greater than 1.5 m high. Subsoils can be stored in stockpiles up to 30 m in height or as required;
- The soils are exceptionally sensitive to wind erosion if exposed (de-vegetated), and will need to be conserved if there is to be sufficient material of good quality (nutrient content) at the time of rehabilitation. It may be necessary in the first two to three years to us a synthetic dust suppressing agent or some other bio-degradable dust suppressant to minimise the effects of wind erosion, until vegetation has reached a 60% cover. Furthermore, this will improve the efficiency of ongoing, as well as final rehabilitation;
- Any top or subsoils that will be stored for a period of more than 6 months are to be adequately re-vegetated as soon after construction as possible and maintained throughout the LOM. This will reduce the effects of erosion, compaction and nutrient loss. It is recommended that the following actions be implemented:
  - Store the stripped topsoils (300 mm) and combined stripped soils (500 mm) in well constructed stockpiles on a compacted footing (95% MODAshto) close to the areas where the soils will be needed for rehabilitation purposes;
  - Store the stripped subsoils (300 mm to 1,500 mm) as a separate stockpile alongside the topsoils or in areas close to where they will be used for rehabilitation;
  - It is imperative that the slopes of the soil stockpiles are constructed to 18° or shallower slope angle. This will minimise the occurrence of erosion of the topsoil / subsoil and allow for the mechanical management of the soils on the slopes. However, prior to the establishment / planting of vegetation, it is recommended that erosion control measures, (planting of Vetiver hedges or the construction of gabion benches and cut-off drains) be included in the stockpile / berm designs;
  - Vegetative cover to the topsoil and subsoil stockpiles must be encouraged (addition of fertiliser, compost, seed mix, temporary irrigation) for the sustainability of this material over the 8 – 10 years that it will be stockpiled;

- Should it be required, the soil stockpiling areas are to be fenced off in order to mitigate impacts that may be caused by humans or wildlife. This will allow the vegetation to germinate and grow more easily, and will reduce the problems of erosion associated with animal or human impacts on unprotected ground.
- All other material removed from across the site, deeper than 1,500 mm and therefore other than the topsoil and subsoil, can be dumped as part of either the sand dump or as part of the WRD;

Soil should be replaced as soon as possible where there are sites that are no-longer to be utilized or are prepared for final rehabilitation during the construction and operational LOM. These soils are to be prepared as a medium that will support vegetative re-growth.

10.2.1.3.3 Fertilisation and Amendments

Based on the chemistry of the in-situ soils mapped, it is evident that the soils will require some input of nutrients at the time of emplacement. The leached nature of the soils, and high permeability rates coupled with the length of time that the majority of the soils will be stored for, will require that soil amelioration is undertaken.
It is recommended that a standard commercial fertilizer high in the standard elements is added to the soil before re-vegetation, at a rate of 200 – 400 kg/ha. The fertilizer should be added to the soil in a slow release granular form.

It is necessary however, to distinguish between the initial application of fertilizers or soil amendments and maintenance dressings:

- Basal or initial applications are required to correct disorders that might be present in the in-situ material and raise the fertility status of the soil to a suitable level prior to seeding. The initial application of fertilizer and compost to the soils is necessary to establish a healthy plant cover as soon as possible, which will aid in the prevention of erosion, and
- Maintenance dressings are applied for the purpose of maintaining the nutrient levels. These applications will be undertaken only if required, and only after additional sample analysis has been undertaken. Monitoring of the nutrient status will be essential (refer to the monitoring plan). It will be necessary to re-evaluate the nutrient status of the soils at regular intervals (once annually) to determine the possibility of needing additional fertilizer applications.

An additional management measure proposed is to add tailings material to the soils in order to provide an improved growth medium for re-vegetation purposes. However, a final decision in this regard can only be made once the plant has been in operation for some time as metallurgical testing will need to be conducted to ensure that no diamonds remain in the tailings material, prior to the mixing with soils.

10.2.1.3.4 Soil Erosion

Areas showing erosion due to wind or water activity should be addressed timeously (not exceeding one month) from when the erosion is first noticed. The treatment of the erosion will depend on the type of erosion and the following guidelines are to be followed:

Wind Erosion:

Where wind erosion is noticed and depending on the circumstances, any of the following measures should be implemented:

- Rock cladding of the wind facing slope;
- Increased re-vegetation effort;
- The planting of Vetiver grass;
- Temporary application of synthetic / bio-degradable soil stabilisation product, and/or
- The construction of a temporary / permanent wind break structure.

Water Erosion:

- Construction of rip-rap structure, placement of small stones to break water speed or other suitable engineering solution to prevent ongoing erosion;
- Increased re-vegetation effort;
- The planting of Vetiver grass;
- Temporary application of synthetic / bio-degradable soil stabilisation product, and/or
- The reconstruction of looping mounds (refer to Figure 77).

The areas affected by erosion are to be monitored for a period of a year after the implementation of the corrective action in order to ensure the effective rehabilitation of the area.

10.2.1.3.5 Mineralogical Contamination Amelioration

Where spillage of mineralogical material occurs, the ore bearing materials will be removed to the mineral processing plant.

Good housekeeping practices are to be implemented across the Gope Project Site to minimise the spread of ore to areas not associated with the plant and keeping the site neat.

10.2.1.3.6 Hydrocarbon Contamination Amelioration

Hydrocarbon contamination of soils (and other components of the receiving environment) should be avoided through the implementation of good housekeeping practices, including the following:

- Vehicle and equipment repairs are to take place only in designated workshop areas where the appropriate management measures have been implemented;
- Such areas are to be constructed with an area of hard standing material (concrete or other) to prevent seepage of foreign material into the soils. Such surfaces are to be drained to the oil skimmer and sump for treatment of surface runoff water;
- Bunding should be provided for around areas where hydrocarbon material are to be stored or handled and any surface runoff is to be collected and treated appropriately, and
- Where vehicles or equipment are repaired under emergency conditions outside of the designated areas, drip trays capable of accommodating all fluids are to be used in as far as is practically possible. All liquids collected are to be contained and taken to the designated area for appropriate treatment or disposal.

The area of highest risk associated with accidental hydrocarbon spillages, is within the open pit itself due to the high concentration of EMVs within the open pit. Where accidental hydrocarbon contamination occurs, the following steps are to be taken in terms of clean up and remediation:

- If practical, the hydrocarbon spill is to be contained through the use of a physical barrier, to prevent the spread of the spill;
- The spatial extent of the spill is to be determined (surface and depth);
- The affected materials are to be excavated from the in-situ location and containerised, and
- The affected material is to be removed to the closest facility capable of dealing with hydrocarbon contaminated materials.

10.2.1.4 Land Capability

During the LOM, the affected areas will only be classifiable as mining land. However, provided that the guidelines outlined in section 10.2.1.3 above are followed and instituted, the capability of the land (other than the dumps) will be returned in due time, to a state that is as close to its original state as possible, but at least a rating of "Grazing Land" as defined in the Chamber of Mines Guidelines (1997). In summary, this will entail:

- The effective replacement of the soils once the site or facility is no-longer needed during the construction or operational phases;
- The correct order of replacement of the soils and the preparation of an adequate seed bed will facilitate the re-vegetation program, will help to limit the potential for erosion, and will enhance the ability of obtaining a land capability of at least a grazing rating, and
- The amelioration of the soils will enhance the capability of the soils, aid in the prevention of erosion and the sustainability of the vegetative cover.

The areas that have been dedicated to the dumping of materials (sand dump, WRD and slimes dam) will be covered with rock (where necessary to prevent wind erosion), sub- and topsoil and vegetated with a naturally occurring grass seed throughout the LOM as and when an area of these structures is finalised.

10.2.1.5 Land Use

For the duration of the construction phase, land use will change to mining use and few mitigation measures can be implemented. However, GEC is committed to reducing the footprint of the mining operation to within the MLA and this has been accommodated in the design phase.

Dust and spillage of rock during transportation, and the excessive use of space that will disturb the natural habitat will be managed accordingly and may include the implementation of road patrols, road sweeping, regulation on the loads to be carried and regular inspection of the roads for structural damage will be undertaken.

The GEC is furthermore committed to register and address all complaints from potentially affected residents.

10.2.1.6 Flora

The objective of the flora management plan, is to ensure the long term success of rehabilitation and the limitation and prevention (where possible) of ecological degradation.

During the construction phase, it is important that the environmental footprint of the GDMP be kept to a minimum. For this purpose:

- Existing roads are to be used in as far as is practicable and the construction of additional roads are to be limited to the minimum;
- The clearing of vegetation should be kept to a minimum and should be limited to the areas where infrastructure will be erected;
- The areas of vegetation cover retention are to be maximised in order to create a mosaic of vegetation patches in order to retain some measure of ecological connectivity across the directly affected project site, and
- All mining areas are to be demarcated by means of a permanent fence or other suitable, temporary methods in order to control movement of personnel and vehicles, thereby providing boundaries for construction sites in order to limit dilution or spread of peripheral impacts.

Preservation is to be undertaken through:

- The removal and appropriate storage of top and subsoils in areas where construction takes place, and
- The implementation of proper infrastructure construction practices to ensure maintenance of cleared areas in order to limit erosion and proliferation of weeds.

Conservation principles are to be applied at the Gope Project Site, including:

- The prevention of the collection of plants, parts of plants and or firewood from areas outside of the MLA, apart from materials sustainably harvested for rehabilitation purposes;
- The collection of firewood is to be undertaken by authorised personnel only and such firewood should be harvested in a sustainable manner;
- The purchasing of firewood from local communities residing in the CKGR will not be permitted;
- Any employee / contractor of GEC contravening these practices, will be subject to the relevant GEC disciplinary action;
- The importation of foreign plant species is to be limited in as far as this is practical. It should be noted that no foreign plants, capable of natural replication is to be brought onto the Gope Project Site or used for ongoing rehabilitation purposes;
- A vehicle wash bay is to be established at the staging camp location in order to clear vehicles from seeds (radiator and undercarriage);
- It has to be noted that the use of Vetiver grass is proposed as part of the ongoing rehabilitation plan. It has been proven that this grass does not replicate on its own and therefore has no potential to spread to areas where it was not specifically planted for soil stabilisation purposes;
- Only locally occurring plant species are to be used for ongoing rehabilitation purposes. These plants / seeds should be collected in a sustainable manner from the immediately surrounding areas, in order to ensure the long term sustainability of the project, and
- An alien plant identification, eradication and control programme is to be developed and implemented.

10.2.1.6.1 Fire Prevention

Although the occurrence of fire in this type of ecosystem is a natural process, fire prevention measures are to be implemented, including:

- Open fires will be prohibited at the GDMP, except in designated, controlled areas;
- Fire safe zones, comprising fire containing facilities will be demarcated at the Gope Project Site and only such areas are to be used for fire making purposes, and
- Fire control measures will be implemented at the GDMP.

10.2.1.6.2 Vegetation Stripping Process

Top and subsoils will be removed from infrastructure related areas associated with the Gope Project Site. However, part of the soil stripping practice will comprise vegetation clearing.

The following site / action specific mitigation measures are recommended:

- Relocate suitable woody individuals to specific areas and for specific purposes such as wind, visual and noise breaks. This should be done prior to clearance of vegetation. The planting of trees immediately adjacent areas of impact is recommended;
- Chip all woody plant material on site and remove together with topsoil to storage areas for use during rehabilitation;
- Establish an on-site nursery that will act as a source from which plants can be used for rehabilitation purposes. Prior to the vegetation stripping taking place, some smaller woody individuals can be moved to the nursery for rehabilitation purposes, and
- Re-vegetate all finalised areas and infrastructure on an ongoing basis by means of establishing a layer of grasses and forbs.

10.2.1.7 Fauna

Although most of the impacts such as habitat destruction and alteration are impossible to mitigate, some mitigation measures are proposed that could significantly lessen the total impact of the proposed GDMP. Although not all potential scenarios can be predicted, the most likely impacts that can be mitigated (either wholly or partially) are addressed.

No significant mitigation of the loss and degradation of pristine faunal habitat are possible within the MLA. Impacts are to be geographically limited by prohibiting habitat degradation or destruction outside of the MLA. In addition, areas disturbed inside the MLA is to be kept to a minimum in order to create pockets of vegetation that will ensure some level of ecological connectivity.

The disruption of ecological connectivity, localised migration routes as well as territorial infringement will result from the construction of the GDMP. All impacts must be limited to the Gope Project Site itself and no land use changes or other disturbances of animals outside of the site are to be allowed. Outside the Gope Project Site, vehicles are to yield to larger mammals on the access roads where possible.

During the construction phase, prior to the completion of the fence around the Gope Project Site, an increase in poaching, snaring and trapping of animals may occur as a result of an influx of large numbers of people. In order to manage this, the fence is to be completed as a first priority. During the construction phase (and throughout the LOM), the border fence is to be policed by mine security staff as per the security requirements of GEC. A double fence will be erected around the perimeter of the camp area in order to create a further barrier for the prevention of trade opportunities.

Appropriate disciplinary action is to be taken against transgressors (GEC employees / contractors) who poach, snare or traps animals or who purchase / trade meat and animal products from the surrounding local community. In addition, such transgressors will be reported to the DWNP. This aspect is to be addressed during the induction process (refer to section 10.5, detailing the Environmental Awareness Programme). Warning signs to this effect should be placed along the Gope Project Site border fence as well as on the access road.

Volunteer staff members of GEC, will be appointed as Honorary Game Wardens in order to ease the enforcement of anti-poaching measures.

In addition, a community training programme will be implemented to educate community members on the long term negative impacts that may result from the trade of animal products. This will hopefully lead to a system of self policing through the empowerment of people.

In order to manage and mitigate any impact of chemical compounds from the operation on animals, GEC has to ensure that no leaching of chemicals occur to soils and groundwater resources, through the implementation of appropriate structures (i.e. bunding). Likewise, transportation and storage of all chemicals must be undertaken in such a manner that no animal can gain access to these chemicals.

A major concern associated with the GDMP, is the attraction of fauna to open water sources that will result from the mining operation. These areas include the slimes dam and RWDs. Open water sources must be limited as far as is practicable. Should it become evident that animals are regularly accessing these open water sources, the boundary fence surrounding the open water source should be electrified in order to limit such access.

Areas comprising steep slopes of fine, silty settled sediments are to be avoided to protect birds drinking from getting stuck and drowning. If and when areas form where birds get stuck, fabric (i.e. shade netting material) should be placed in such areas. This will not interfere with the operation of the water storage areas and will provide a secure footing for the birds to still access the said water in a safe manner.

In order to prevent the loss of natural faunal species to introduced faunal species, all pets should be disallowed at the Gope Project Site.

10.2.1.8 Surface Water

During the construction phase, the stripping of vegetation and topsoils will certainly have an impact on surface water movement. Mitigation for this impact includes the following:

- Areas to be stripped are to be limited to the active and required areas as far as is practical;

- The issue of slopes, vegetation and rock cladding are key aspects for surface water and wind erosion and are discussed in detail in the operational phase assessment where they are more critical. However, it is considered that even temporary slopes should be battered to 18° or flatter, where practicable.
- The use of rock on slopes (where necessary) is also recommended for permanent slopes, but this will only be exposed towards the end of the construction phase, and
- Several commercial products are available to assist with slope stabilisation while enhancing vegetation establishment, including natural products such as jute netting, nets using local grass and others, which may be considered for stabilising slopes where required. Chemical stabilisation using binding products can also be utilised for temporary slopes. A key principle here is that as soon as possible, final slopes should be achieved and the final rehabilitation strategy applied. This process of finalising surfaces allows the un-rehabilitated footprint to be minimised, and also gives more time prior to closure for rehabilitation methods to be tested. Refer to section 10.7.2 for details regarding the Ongoing Rehabilitation Plan.

During the detailed design phase, a Digital Terrain Model (DTM) will be constructed to determine areas of concentrated water flow as the operation progresses. This will enable the detailed design of storm water management structures to be implemented at the Gope Project Site.

10.2.1.9 Groundwater

10.2.1.9.1 Dewatering

During the construction phase of the GDMP, the dewatering cone is unlikely to extend beyond the MLA. At the time of the compilation of this report, there were no groundwater users within the zone to be affected. In addition, no baseflow for any surface water courses or vegetation is reliant upon groundwater and the resultant impact is therefore considered negligible. Therefore no management / mitigation measures relating to groundwater quantity is proposed during this phase of the LOM.

During the construction phase, dewatering infrastructure will comprise the drilling of new boreholes around the pit. These newly drilled boreholes are to be pump tested to determine the actual yield per hole. Subsequently, it is recommended that the groundwater flow model be upgraded and the simulations re-run to confirm the original predictions. As not all the boreholes will be utilised during the construction phase, groundwater levels in the boreholes that are not pumped are to be measured on a weekly basis. The groundwater level response to pumping is to be recorded and a database established. At least one borehole should be earmarked as a dedicated monitoring borehole through this and subsequent phases of the GDMP. The borehole with the lowest yield will be the most suitable.

10.2.1.9.2 Groundwater Quality

Groundwater contamination during this stage is also considered negligible, provided that the proposed waste management systems are put in place. Quarterly groundwater samples are to be collected from the dedicated monitoring boreholes and analysed for the major cations, anions and microbiological elements. The results must be included in the groundwater database.

10.2.1.10 Air Quality

Particulate emissions during construction as well as during general operations, are a major source of pollution, there area a number of ways that these emissions can be reduced or eliminated to reduce the loss of material.

An overarching principle pertaining to the minimisation of dust generation, is to clear as little vegetation as is practicably possible. However, the following management practices are recommended:

10.2.1.10.1 Roads

- The simplest and most cost effective method when using unpaved roads is to reduce the speed at which the construction and mining machinery, including haul trucks, travel at. By keeping the speed below 40 km/h inside the game reserve and at the appropriate speed limit as agreed with the Department of Roads outside the game reserve, there is a significant reduction in the dust entrainment from bigger vehicles;
- By also limiting the number of unnecessary vehicles travelling on unpaved roads will also reduce dust generation;
- Wet suppression can be implemented on unpaved roads, by spraying the surface of the road, to keep it damp and so reducing airborne particulates;
- Chemical stabilisers can also be used on roads, however it is not recommended at sites with high traffic volumes or heavy vehicles. This method is best used where the road is close to sensitive receptors, to avoid nuisance dust, and
- If the roads are going to be used constantly or for a long period of time, it may be worth paving the road with basalt or another suitable gravel material.

10.2.1.10.2 Plant Related Activities

- When loading the haul trucks, the fall height of the material is to be kept to the practicable minimum, in order to avoid dust generation. It is recommended that a similar principle be used when offloading the trucks, to keep the drop height to a practicable minimum;

- The wetting of material is preferred, but adds a significant amount of water to the mineral processing operation. Once the plant has been commissioned, the practicality of wetting of the ore is to be re-investigated and considered as a dust mitigation measure;
- Only a small section of the plant will contain conveyors moving dry material and based on the current design, no transfer points pertain to this section of the conveyor. Therefore, no mitigation measures for the conveyors are currently recommended. However, should it become evident that significant quantities of dust is being generated in this area, either or a combination of the following measures are to be implemented:
  - Reduce the speed of conveying;
  - Wetting of the material being conveyed, and/or
  - Cover the transfer points to contain liberated dust.

10.2.1.10.3 Material Storage

- In cases of very fine particulate matter, storage piles can also be kept undercover (synthetic dust suppressants or vegetation), or have wind breaks built. These wind breaks should however be placed correctly in conjunction with the prevailing wind field in the area;
- Long term storage piles, such as top and subsoil, which will be used for rehabilitation at a later stage, should be watered and hydro-seeded or vegetated. A short term method which can be deployed to reduce wind blown dust from piles is to cover waste piles with shade netting to avoid wind blown dust should such a drastic measure be required;
- As detailed in section 10.2.1.6.2, small trees and shrubs removed during the vegetation clearing process, can be placed alongside the affected areas, or alongside the boundary fence (where practical) to reduce the speed of prevailing winds, and
- It is recommended that stockpiles be situated away from the site boundary and nearby receptors and should take into account the predominant wind direction (US-EPA, 1996), in order to mitigate the potential effects of wind blown fugitive dust.

10.2.1.10.4 Drilling Operations

- Another major source of dust generation is the percussion drilling required for the drilling of water supply and dewatering boreholes. It is important that drill rigs, equipped with suitable dust casets be used, in order to minimise the generation of dust during these operations.

10.2.1.11 Noise & Vibration

Baseline data indicates a very quiet environment and any increase in the ambient noise levels will be substantial.

During the construction phase, the activities responsible for the increased noise levels include construction of the mine and associated infrastructure, the operation of diesel generators which will provide initial site power, heavy vehicles transferring materials, aircraft accessing the GDMP (once the airstrip has been completed) and periodic blasting activities, should this be required.

The preferred method for controlling noise from stationary sources is to implement noise control measures at the source. Methods for prevention and control of sources of noise emissions are dependant on the source and proximity of receptors.

The following noise reduction mitigatory options are recommended to keep noise levels within the legislative limits:

- Ensure the required silences are fitted on all engines and compressors;
- Where practical, the engineering design has made provision for the installation of enclosures around source equipment;
- On site generators should be clad in suitable material or housed in structures that would reduce their noise impacts;
- Buildings have been positioned and constructed in such a way to insulate against noise as far as is practicable;
- The positioning of mineralogical waste structures (slimes dam, tailings dump, WRD, etc.) have been placed on the outer perimeter of the site in order to shield the surrounding environment and sensitive receptors from noise as far as possible;
- Enforce an appropriate speed limit for all vehicles to and at the Gope Project Site;
- Regular maintenance of heavy equipment, vehicles and earth moving machinery;
- Blasting is to be minimised to areas that cannot be excavated through the use of available equipment;
- Use of specific blasting plans (i.e. as approved by the Drill and Blast Engineer), with notification of surrounding community members before hand; correct charging procedures and blasting ratios; delayed, micro delayed, or electronic detonators; and specific *in situ* blasting tests;
- PPE should be worn as specified by Work Place Health and Safety Legislation;
- Flights to and from the GDMP should be restricted to daylight hours, except in the case of emergencies;
- Any noise complaints received will be subject to a complaints management system that provides for the assessment and management of the complaint, and
- For persistent noise complaints, specific monitoring of noise should be undertaken to determine whether daytime levels exceed ambient +3 dBA.

Measurement method to ensure implementation of actions:

- Annual audits;

- The Operations Manager shall investigate all noise complaints, or an official appointed by him / her, and assessed to determine if the noise is unreasonable. All complaints will be recorded and kept on file, and
- Monthly noise monitoring is required in order to measure daily levels of exposure, and implement mitigation measure when required. These values will assist in assessing the impact of noise on the surrounding environment and the nearby sensitive receptors.

Periodic blasting may form part of the sand stripping activities during the construction phase. The vibrational impact, although short in duration, is not expected to have a significant effect on the surrounding environment, due to the un-consolidated nature of the sand material.

The following mitigation actions are required to keep blasting activities within the appropriate legislative limits:

- Foundations of buildings closer to the open-pit area, is to be designed and built to withstand the effects of the vibrations, and
- The suitably qualified Drill and Blast Engineer will undertake the development of the blast design as required for safe operation.

Measurement method to ensure implementation of actions:

- Annual audits, and
- Monitoring of blasting activities is to be undertaken on the perimeter of the open-pit area or at the nearest building structure. This is essential in obtaining a baseline reading of the vibration and blasting impacts as measured at a point not located close to the source of blasting.

These values will assist in assessing the impact of the vibration and blasting on the surrounding environment.

10.2.1.12 Sites of Archaeological and Cultural Interest

Six identified graves were identified as potentially being impacted upon. These are *Tcamm* 1, *Tcamm* 2, *Tcamm* 3, *Tcamm* 4, *Tcamm* 6 and *Tcamm* 10. The mining development will have a high negative impact on these graves if they are not mitigated and may result in their destruction. A summary of the expected impacts upon the above mentioned graves is given in Table 123 below.

Table 123: Impacted Grave Sites

GRAVE NUMBER	LOCATION	DIRECTLY IMPACTED?	EXPECTED IMPACT	PROPOSED MITIGATION MEASURE(S)
Tcamm 1	Located within the WRD footprint.	✓	Destruction of grave without mitigation measures.	Exhume and relocate grave as per the recommended process.
Tcamm 2	Located in close proximity to the WRD and inside the Gope Project Site.	✗	Secondary impacts expected.	The Gope Project Site fence has been designed to exclude this grave from the site.
Tcamm 3	Located in close proximity to the WRD and inside the Gope Project Site.	✗	Secondary impacts expected.	The Gope Project Site fence has been designed to exclude this grave from the site.
Tcamm 4	Located in the vicinity of the access road.	✗	Secondary impacts expected.	Since the discovery of the grave, the access road route have been moved closer to the Gope Project Site's fence in order to increase the area between the grave and the road.
Tcamm 6	Located in close proximity to the WRD and inside the Gope Project Site.	✗	Secondary impacts expected.	The Gope Project Site fence has been designed to exclude this grave from the site.
Tcamm 10	Located within the fenced area of the Gope Project Site.	✗	Secondary impacts expected.	The Gope Project Site fence has been designed to exclude this grave from the site.

The remainder of graves are located well outside the zone of influence of the GDMP, with some of those being inside the MLA, and some outside the MLA.

10.2.1.12.1 Full Grave Relocation Process

The full grave relocation process is expected to be followed for Tcamm 1 only and will be in compliance with all relevant legislation and best practice methodology.

This process will have to be respectful to the deceased. Furthermore, the former residents of the area will have to form part of the entire process so that their specific cultural and logistical needs in the relocation are met. Such a grave relocation process will typically consist of the following elements:

- Identification of the grave;
- Notification that the grave is to be relocated. Such notification would comprise both on-site notices as well as the notification of relevant government individuals and institutions. The site notices would consist of a trilingual (San, English & Setswana) notice that is erected at each of the affected graves indicating that the grave is to be relocated, the reasons why this is to

be undertaken and asking all I&APs to respond to the contact person whose details are provided on the notice. The nearest Police Station, a Medical Officer, the Environmental Officer at the District Council as well as the BNMMAG must all be notified of the intended relocation;

- Public participation will be the next step in the process and is firstly aimed at identifying the affected family members followed by consultation with such affected family members. The community Kgosi will also be consulted with at this stage. The aims of this consultation component is to determine what the wishes of the affected families for such a proposed exhumation and relocation process are and whether they have any objections to such a process. Should the families agree to the proposed relocation, written permission must be obtained from them;
- A suitable dispute resolution committee is to be established to deal with the resolution of any disputes between the community and GEC pertaining to the said relocations. The procedure to be followed for such dispute resolution is to be agreed upon with the BNMMAG prior to the commencement of the construction activities at the Gope Project Site.
- Once written permissions have been obtained from the affected families, a permit application must be lodged with the District Council for the disinterment of the burials. This must include written approval of the descendants or, if there has not been success in identifying direct descendants, written documentation of the consultation process, which must indicate to the District Council's satisfaction, the efforts that have been made to locate them. It must also include details of the exhumation process and the place to which the burials are to be relocated. (Regulations regarding creating new cemeteries exist and usually entails that relocation must be to an established communal, rural or authorized cemetery), and
- Should the permit be approved, the exhumation of the graves can take place. The exhumation must be done under supervision of a qualified archaeologist and overseen by a principal investigator. It will be done with due respect for the human remains and the customs and beliefs of any person or community concerned and when requested, in the presence of such person or community representative. Depending on the requirements of the affected family the exhumed remains will then be placed in a coffin. A registered funeral undertaker will be responsible for transporting the coffin to the new burial site followed by reburial of the deceased in compliance with the requests of the affected family.

10.2.1.12.2 Protection of Grave Sites

Five graves have been identified that may be subject to secondary impacts resulting from the construction and operation of the mine. These include, Tcamm 2, 3, 4, 6 and 10. The following mitigation measures are recommended:

- Consultation with the affected family is to be undertaken and should be fenced / excluded from the Gope Project Site;

- A gate will be installed within the fence. This gate shall be kept locked at all times and access restricted to members of the affected family as well as the heritage specialist undertaking site monitoring. The original key for the lock on the gate will be presented to the affected family while a copy will be kept by the Operations Manager / designated official. For the aims of mine health and safety an understanding must be reached with the affected family that they are report to the Operations Manager / designated official before visiting the grave, should the grave be located within the fenced area of the Gope Project Site. A visitor's book containing the names and contact details of all individuals visiting the grave is to be maintained by the Operations Manager / designated official, and
- A monitoring process is to be undertaken with which any impacts at the grave sites can be identified and acted upon. During the construction phase a monitoring schedule consisting of a monitoring visit once every three months is to be implemented. However, should any impacts on the site be identified, these must be acted upon and at the same time the monitoring schedule should be increased (i.e. to once every month). Monitoring should be undertaken by a suitably qualified heritage specialist.

10.2.1.12.3 San Settlements Situated Within the Footprint of the MLA

A total of 23 of the located San settlements fall within the proposed footprint of the MLA. These are *Aya* 1, *Aya* 2, *Aya* 3, *Aya* 5, *Aya* 6, *Aya* 7, *Aya* 9, *Aya* 10, *Aya* 11, *Aya* 14, *Aya* 15, *Aya* 16, *Aya* 17, *Aya* 18, *Aya* 19, *Aya* 23, *Aya* 25, *Aya* 26, *Aya* 28, *Aya* 29, *Aya* 30, *Aya* 31 and *Aya* 38. The mining development is expected to have a medium negative impact on these settlements. However, only three of these sites (*Aya* 1, *Aya* 2 & *Aya* 3) are significant enough to warrant any mitigation measures. The mitigation measures required for these three sites are as follows:

- Surveying and mapping of each of the three settlements;
- Photographic and qualitative documentation of the three settlements and its components;
- Consultation with the erstwhile residents of these three settlements and the recording of their explanations for the settlement components and its respective functions, and
- Compilation of this data set into a bound report. A copy of this report can be provided to the BNMMAG.

10.2.1.13 Visual

Measures for the mitigation of impacts associated with the visual impact of the GDMP are outlined below:

- A change in the land use from wilderness to mining will result in a change in the available view. During the construction phase, this will be due to the construction of the plant and camp infrastructure and temporary infrastructure like the contractors' tented camp. In order to mitigate these impacts, all buildings and structures are to be finished in a colour, or surface that weathers to a colour in shades in green, brown or grey. These surfaces should not exceed a maximum reflective value of 37% (excluding fittings).

- In addition to the change of view resulting from buildings and plant infrastructure, an additional impact will result from the entrance gate, sign posts and the boundary fence. In order to minimise this impact, signage is to be restricted to the mine stipulated standards and requirements.
- During the construction phase, the stand stripping operation will continue 24 hours a day. In order to minimise illumination impacts, it is important that all outdoor lighting be installed in such a manner and be so shielded that the cone of light shall fall substantially within the perimeter of the defined Gope Project Site. The use of shielding and limitations upon intensity, ambient light travelling outward and upward, producing a sky glow, shall be reduced to the greatest extent practicable without unduly interfering with the intent and purpose of the outside lighting in the first place.

10.2.1.14 Waste Management

Appendix 11 includes a comprehensive Waste Management Plan. In order to ensure that the Waste Management Plan is effective for the construction phase, the necessary bins, storage areas and waste contracts must be established at the beginning of the construction phase such that the wastes can be sorted, stored on site without posing the risks and associated impacts described in previous sections of this report.

The SEMP for the construction phase therefore includes the following, which must be read in conjunction with the Waste Management Plan and SEMP for the operational phase:

- Area to be designated for the safe storage of hazardous waste, and a hazardous waste store erected. Store to include concrete / impermeable hardstanding and bunding to prevent spillage of hazardous wastes;
- Area to be designated for the safe storage of general wastes, where the wastes can be separated into recyclables and non-recyclables;
- Bins to be provided and labelled / colour coded regarding the allowed contents;
- All staff, contractors and visitors to be trained in the waste management procedures;
- Staff assigned the responsibility to manage the waste on-site;
- Composting or vermicomposting facilities to be established for the composting of vegetable food waste. This will be trialled on site to determine the feasibility of the system;
- Waste oil generated on site to be collected for recycling;
- Medical facility to include purpose designed medical waste bins. These bins will be safely transported to an authorised medical waste incinerator (or other approved disposal method);
- Vegetation will be cleared with the topsoils, and used re-vegetation purposes;
- Littering, dumping, burying and burning of any waste not allowed;

- Empty waste containers that previously contained hazardous wastes may not be given / sold to staff or the public;
- Staff to conduct inspections to ensure hazardous waste is separated from general waste, and that waste is disposed of in the designated waste receptacles;
- Contracts to be established with waste contractors to ensure that the waste is disposed of at registered facilities;
- Waste Carriers transporting wastes off-site must have a waste license, including in-house waste transporters (e.g. where waste transported to the staging camp planned to be located at Lephepe) and external contractors; and
- Records of waste collected from the Gope Project Site to be kept on file.

10.2.1.15 Social Aspects

Upon the request of the DWNP, all community and/or social projects and programmes are to be discussed with the relevant Government Department as may apply to the specific project to be undertaken, in order to ensure that such programme or project, aligns with the planning of the Government of Botswana. In addition, all programmes and projects will take cognisance of Governmental planning policies and procedures applying to the area in question.

10.2.1.15.1 Employment

Assuming that no preference will be given to local hiring, beyond local labour for some construction-related inputs (as per clause 3.4 in GEC's Recruitment and Selection Policy), even the limited employment opportunities discussed above will only accrue if consultative systems are put into place before construction begins with directly-affected communities. These systems need to ensure broad-based participation, including community members who do not feel that they have been given sufficient voice in local decision-making. Respondents repeatedly noted their concerns about not being consulted about matters that directly affected their lives, and were pleased that the mine appeared to want to speak with them and hear their opinions. This is a positive legacy to build on.

Respondents were hopeful that the construction phase would be preceded by, and coincide with, skills development among local community members, and that skills development target current and former residents, rather than in-migrants. Nevertheless, the skills gap, coupled with other factors constraining employability, would suggest that any attention to skills development would need to recognise these many constraints. There are particular problems with regard to CKGR residents living away from the Gope Project Site. At the same time, offering employment and training priority to CKGR residents may well encourage other in-migration into the CKGR. This would suggest that, if employment priority is given to CKGR residents for whatever reason, this should also include Kaudwane and New Xade, as well as other settlements where former CKGR residents currently reside.

For mine-related operations employment, key informants asked about skills availability in Botswana felt that the mine would be able to source most skilled and semi-skilled labour from within the country. Local level key informants highlighted the lack of these skills in their areas, and raised a concern that their communities would not be able to compete against people from elsewhere in the country. No clear means of mitigating these constraints are evident, but should be raised during consultations. These discussions should include internship and apprenticeship opportunities, bursaries for university and vocational training, and other skills development opportunities (if possible building on relevant skills training that has already taken place through the RADP). More broadly, GEC's policy on service suppliers reflects a desire to contract citizen companies to the extent possible.

Respondents who spoke a Sesarwa language or Sekgalagadi raised concerns about discrimination, noting that this was a common occurrence in the past. Should Sesarwa or Sekgalagadi speakers be employed during construction or operations, attention should be devoted to dialogue and sensitisation around these issues.

10.2.1.15.2 HIV&AIDS

With relevance to the GDMPs mining operations, it is incumbent upon mine management to institute sound HIV prevention and HIV/AIDS mitigation measures that allow those who are HIV negative to maintain their status, and allow those who are HIV positive to live long, productive lives. While a minimalist approach could be followed, there are sound reasons for considering an enhanced 'best practice' approach to HIV/AIDS, taking place within a broader wellness programme. The GEC has issued a Wellness Policy with guiding principles that are consistent with an enhanced HIV/AIDS response. However, it is uncertain whether the on-site medical services will be sufficient to institute the enhanced HIV/AIDS response required, as well as the other elements of the wellness programme (discussed below). A review of medical services currently planned for the Gope Project Site is therefore recommended.

For directly-affected communities and for the mine site itself, during construction all tender documents can require an enhanced HIV/AIDS response from contractors, consistent with intended actions at the Gope Project Site during operation. It is, unfortunately, easy to simply require a minimalist response from contractors that would involve, for example, making condoms available to construction workers. At this juncture therefore, and separate from any Corporate Social Responsibility Initiatives (CSRI), attention would be focused on construction workers including temporary and longer-term personnel. However, consultative structures would offer important opportunities to raise issues with the wider affected communities around HIV/AIDS as construction progresses.

10.2.1.15.3 Work Shifts

For unskilled labour, short-term employment opportunities during construction may well suit local livelihood strategies. To the extent that this can be accommodated and managed by construction contractors, this will 1) allow the maximum distribution of employment benefits across local households; and 2) best suit local livelihood strategies.

At the GDMP, this is a much more difficult issue, given the lack of settlement nearby. While it would therefore apply for Gope residents (those who are entitled to return to the area, not other in-migrants), other employees would need to be in a position to provide labour over the longer term, and would therefore need to return to site following their week off at home. This will likely mean employment for many who do not come from the directly-affected communities.

Means of mitigation at construction sites away from the mine would comprise worker contract arrangements allowing flexibility in hiring arrangements, and effective consultation channels that encourage effective employee performance among directly-affected community members.

For the mine-site, during construction specific attention will need to be devoted to local hiring among Gope returnees, which again requires effective consultation, and an extremely flexible management structure to accommodate complexities that may arise in terms of employment performance and skills levels.

For mine operations, there is clear support for the shift work schedule as proposed by GEC, suggesting that the company should proceed as planned.

For work on the mine, a number of respondents highlighted the importance of transport to and from the site being provided from the point of view of worker safety and security. From the point of view of social impacts on directly affected communities (discussed below), there is a need to partially isolate the drop-off point in Kaudwane from the population of Kaudwane. For this reason, a decision was taken to increase the number of drop-off points to include areas such as Salajwe, Gaborone and Molepolole. However, the exact locations are still to be determined, based on where the majority of employees originate from.

10.2.1.15.4 Gope Residents

At the time of the SIA fieldwork being undertaken, there were no current residents at the proposed Gope Project Site, and therefore the SIA included former Gope residents in interviews at Kaudwane. However, some former residents returned to Gope after the fieldwork was completed. The SIA team were re-mobilised to the site, and interviewed the total 18 returnees.

Discussion about opportunities for mitigation / enhancement is therefore tentative, until further SIA fieldwork can be conducted. Based on current knowledge, four mitigatory factors would appear to be especially important:

- Extensive and sustained consultation;
- Prioritisation of skilled and unskilled labour from the local communities, and
- The development of a joint plan of action for the GEC-community interface.

In the longer-term, the rapidly changing situation in the CKGR, including at Gope, will require careful consideration, of course within the context of Government's decision on the way forward for the CKGR.

Most importantly, there is a need to secure the services of an anthropologist to focus specific attention on current and former Gope residents, focused on environmental risk management and effective mitigation and enhancement. It is strongly recommended that an anthropologist be engaged by GEC as part of the establishment and implementation of consultative structures in directly-affected communities, serving as a key resource person in terms of construction employment and mine operations employment in particular, and the mine-community interface more generally.

With the establishment of the mine and the consequent geographical adjustment of Gope residents' settlement in relation to the mine, the question arises about the mine's relationship with the settlement beyond employment matters. While the mine itself will be a closed and fenced site, the proximity of Gope residents will necessary involve regular interactions between the mine and the settlement. This raises a plethora of questions that will need to be specifically considered in a proposed Community Action Plan prepared by Gope residents and GEC, setting down in writing, in detail, the relationship between the two. While the SIA recommendations on mitigation cannot pre-empt this, there are a number of points that will need consideration as the Community Action Plan is developed. It should be underlined that any Community Action Plan recommendations must be consistent with Government policy towards settlement in the CKGR, and service provision in this regard (and the National Settlement Policy).

<u>Provision of Water</u>

Historical patterns of settlement in the CKGR highlight significant changes to settlement arising from the provision of water. This is especially important for domestic livestock watering (domestic livestock are currently prohibited by Government; the allowing of domestic livestock in the CKGR would also raise a number of livestock disease control issues), but to a lesser extent is also

important for residents. With the provision of water, permanent settlement at the site would be the likely outcome. There are rules and regulations around the provision of water, some of which (e.g., payment for water) would be extremely difficult to manage, but which are central to effective water management. Without the provision of water, beyond the public relations impacts would be the likely emergence of trade in water from mineworkers to Gope residents, with prices set based on availability of water under such a situation (illicit trade) and the ability to pay. While there is no clear way in which the mine could realistically *not* provide water, significant consultation is required with Government and Gope residents before any such services are agreed. Indeed, these early actions would largely 'set the tone', and could result in persistent patterns of dependency, or a change that would result in a more sustained development model.
Thereafter, the situation would need extremely careful management, as there is the potential to place the GDMP in a difficult situation (especially if domestic animals are watered at the site).

Consultation with the relevant authorities will be undertaken in this regard.

Health Services

Key informants and FGD participants, including those from other CKGR settlements, were especially hopeful that they would be allowed access to what were expected to be first-class medical services provided by the mine. A number of key informants were well aware of services provided at Jwaneng and Orapa, and assumed that the GDMP would provide similar services. Many of the basic services the mine provides for employees, therefore, will be expected to be offered to Gope residents.

Currently the mine plans to only offer limited medical services related to emergency medical care for simple ailments, and evacuation of mine employees in cases of service medical emergencies. In addition to this, it is understood that the mine will follow the provisions of the Employee Wellness Policy, which offers a proactive, prevention-focused programme intended to ensure a healthy workforce. Beyond the occupational health and safety issues, the wellness policy outlines a strategy that could well improve the lives of Gope residents as well.

At this juncture, it is too early to make recommendations about how health services should be handled in terms of Gope resident access. Nevertheless, given security issues around the mine itself, it may make considerably more sense to consider extending whatever health services are provided at the Gope Project Site to Gope residents, effectively providing a mobile service, linked to emergency services as required.

Settlement

Sesarwa-speaking and Sekgalagadi-speaking participants in qualitative discussions, and respondents more generally to the quantitative questionnaire, highlighted the difficulties these communities faced in preventing undesired actions by others. There is therefore a specific concern that non-returnees will try and settle at Gope in an effort to secure preferential treatment for employment. Mine hiring at the mine site would therefore need to be strictly prohibited (which is already planned), and any hiring of 'legitimate' Gope residents would still need to follow the hiring practices and systems in place for the project. Any local hiring lists would be subject to unwanted influence in adding new names, whether through pressure or payment. Beyond this, the Community Action Plan should ideally include a list of Gope residents, and procedures for handling illegal settlement.

There is a separate issue of resettlement at the Gope Project Site of residents from other settlements in the CKGR. In key informant interviews and group discussions, it was clear that residents of these other settlements also regard it as their right to settle at the Gope Project Site if it improved their chances to secure employment and other benefits from proximity to the mine. Given that their situation is different that other potential in-migrants, it will need separate consideration.

Violence

Violence will certainly be a problem at the mine site during construction, and it is possible that this may involve Gope residents. As a settlement with fewer than 250 persons, and in the context of continued differences of opinion about the provision of services to CKGR residents (Government only provides services to resettlement sites outside of the CKGR), it is unlikely that a police officer will be provided to the site. It may therefore be best to identify a community police officer from Gope as part of the Community Action Plan exercise, coupled with the mine's provision of mine security officers that offer services not just to the mine, but also to the Gope community should such intervention be required. In addition, the fence will be erected as a first priority to limit contact between GEC personnel and the Gope residents.

Alcohol Sales and Abuse

It is likely that Gope residents will see an opportunity to earn some money through the sale of various forms of alcohol. Although malt and wine will be provided to employees in the mess area, it is expected that an informal trade will development between the Gope community and GEC employees / contractors, especially during construction.

Whether such trade is unwanted is a separate issue. Given the alcohol will be on offer during the operation of the mine, it is not an issue of alcohol use itself that is a problem, but rather of:

- Alcohol abuse;
- Un-standardised brewing processes that could have direct negative health consequences, and
- Alcohol sales during construction.

Ideally, the Community Action Plan would include a recommended way forward in this regard.

For the mine operation, entry / exit restrictions would likely drive such trade underground, unless it is regularised by then. The fence will be erected as a first priority to limit contact between GEC personnel and the Gope residents. A double fence will be erected around the camp in order to further limit contact for trade opportunities.

<u>Informal Enterprises</u>

Beyond alcohol, it is likely that other informal enterprises will develop among Gope residents for sales to construction workers and mine workers. Trade in cooked vegetables and local fruits, medicinal plants, biltong and fresh meat, etc. may develop, and various services could be offered (e.g., washing clothes, selling processed foods, etc.). Again, these services may be desired outcomes, but that would need to be determined.

In order to limit the possibility of such a trade developing, the following mitigation measures will be instituted:

- All vehicle drivers transporting supplies and people to and from the GDMP, will be screened appropriately during the recruitment process;
- Applicants for these positions will be subjected to baseline polygraph examinations;
- All vehicle drivers will be made aware of the prohibition of the trade of goods (including meat products, plants / plant materials, alcohol, etc.) between those people at the Gope Project Site and the Gope residents;
- Random spot tests, including polygraph testing will be undertaken on a regular basis to determine any of the driver's involvement in such practices. Should any person be found guilty, immediate dismissal will apply.

<u>Sex Work</u>

A number of respondents involved in the SIA highlighted a concern about an increase in sex work coinciding with construction activities. This may be a particular problem facing Gope residents, given high levels of poverty and the presence of income earners in rural areas. This would need to be a central issue for the Community Action Plan, and would need particular attention given the poor understanding of sexual diseases.

During mine operations, entry / exit regulations, community police, and security personnel would need to be in a position to enforce rules around sex work.

Sexual Harassment

Gope residents were concerned about the sexual harassment of women in their community, in particular because it was felt that their culture was not respected. No clear solution was offered, and in a situation where mineworkers may have considerable income in an area where all households are poor, such harassment may well occur.

In interviews with Gope residents, it became clear that an issue such as sexual harassment was one of many problems that could arise unless Gope residents were directly involved as partners in decisions made around the mine. With such consultations, and with the establishment of a consultation system (which would also involve the FPK), it was felt that these types of problems could be avoided. Communication, dialogue, and respect were noted as key.

HIV/AIDS

HIV/AIDS was mentioned by many key informants as a serious problem that would 'arrive with construction' (remembering that quite a few local respondents felt that HIV/AIDS was not a problem in their area). At the same time, there was considerable confusion and lack of understanding around HIV/AIDS. Linked to the discussion of sex work, the Community Action Plan would need to devote particular attention to HIV/AIDS with regard to Gope residents.

Earlier it was recommended that enhanced HIV/AIDS services be provided to mine personnel. Mine management will need to decide which of these services, if any, should be extended to Gope residents. Given that the mine will change the local environment, likely increasing the risk of HIV transmission among directly affected persons, extending some or all services to Gope residents would seem to be warranted.

Communications

The cell phone installation that will serve the mine will also provide services to Gope residents.

Mine Closure

In discussions with Gope residents, it became clear that the impacts of mine closure on Gope were intimately tied up with how the community was engaged prior to and during construction, and during operations. If there was effective dialogue, if problems were efficiently dealt with, and if Gope residents directly benefited from the presence of the mine, issues around mine closure could be effectively dealt with. Specific closure issues included the need to be able to use mine facilities for other purposes (tourism was most commonly noted), safety around the pit, and the development of skills and alternative livelihood strategies for young people.

With all of these issues, and additional points noted below, there will be separate construction period impacts that will often differ from operations. The fluid situation that will exist during construction is of particular concern, requiring open dialogue, the early development of the Community Action Plan, and systems to lodge disputes and resolve conflicts.

There are visual and noise disturbances associated with the mine that will now need enhanced mitigation, with the arrival of people at Gope. Mitigation and management measures are discussed in section 10.2.1.11 and visual impact mitigation measures in section 10.2.1.13. Here is it important to note that any decisions made about how to respond to visual, noise or similar disturbances should be considered in liaison with Gope residents through channels established and agreed between the mine and the residents, i.e. the establishment of a community forum.

An added complication is that returnees have settled in part within the mine footprint, and are accessing resources within the footprint area.

The discussion around graves and the possible need for relocation of graves is being handled through the Archaeological Impact Assessment. Here it is important to note that former Gope residents interviewed in Kaudwane, as well as key informants familiar with the Gope area interviewed in various locations, consistently raised the issue of the graves when discussing the mine. Clearly careful attention needs to be devoted to any relocation of graves.

All social programmes will follow guidance as provided in the Draft CKGR Management Plan.

10.2.1.15.5 Kaudwane

Repeatedly, key informants and focus group discussion participants lamented a perceived lack of control over events in their lives, and the importance of full information, transparency, and open dialogue in any new developments. In this respect, it is especially important to work with the committees and village development structures in Kaudwane, where the majority of former Gope residents are now resident. The community is served by a Village Leadership Council, a Village Development Committee, a Parents Teacher Association, a Village Health Committee, and a Village Multi-Sectoral AIDS Committee. Government officers found in Kaudwane include teachers, officers from DWNP, extension officers, social and community development, nurses at the health facility, and a Remote Area Development Programme officer. There is also one community-based organisation, Kuango Development Trust, located in Kaudwane. A cultural village is planned, to be supported by the RADP. These formal groups and community opinion leaders are particularly important when actions are required to prevent problems, and to respond to problems that arise. At the same time, it would be important to establish strong working relations with the Kweneng West Sub-District authorities, as well as the Kweneng District authorities.

While close working relations with various authorities and committees is important, quantitative respondents in particular highlighted concerns about the extent to which institutions represented the interests of all community members. Former Gope residents noted other channels of consultation that were important to them. Equally importantly, there are many avenues for effective consultation that allow direct dialogue with smaller, more homogeneous groups, ensuring that voices that get 'lost' in larger groups are still heard. Systems that engage with stakeholders in a sustained fashion are therefore especially important. These systems are not haphazard, instead there are numerous tools that can be employed in an orderly, coherent fashion, by experienced development workers. These systems can substantially inform the decisions that need to be made.

However, while these consultative structures and representative institutions could anticipate and respond to these issues more broadly, there was nevertheless the need to cope with anticipated specific impacts through:

- Expanding the number of police officers;
- Ensuring that local institutions are not overwhelmed with new arrivals, and indeed that local services are improved;
- Developing programmes around particular problems, notably alcohol abuse but also gender-based violence;
- Regulating shebeen activity, including enforcing minimum age regulations for alcohol sales, and
- Strengthening local systems for conflict resolution (including traditional courts).

Respondents repeatedly noted the important of prioritising local residents for jobs, during construction and operations, as well as during decommissioning and closure. The GEC's policy on hiring emphasises hiring locally where possible (both for individuals and citizen-owned companies).

10.2.1.15.6 Services for Workers

Implementation of policies associated with wellness, safety and security, and other areas, and following best practices as per mine operations elsewhere in Botswana and South Africa, would offer important benefits for the operation of the GDMP. It is assumed that occupation health and safety rules and regulations would also be developed and implemented. It is also understood that various recreational opportunities will be offered at the mine.

Having said this, the wellness programme should further consider extended actions intended to mitigate various social pathologies. Examples of this include extending wellness programme benefits to key family members (especially associated with HIV testing and AIDS-related services, but also alcohol abuse rehabilitation), dealing with issues around stigma and HIV&AIDS, discrimination and ethnicity, and conflict resolution.

10.2.1.15.7 Gender Issues

Given that gender stereotypes are likely to be well entrenched, open discussion needs to take place about the potential roles for males and females in terms of construction and mine employment. If possible quota systems should be avoided, as these are artificial and can cause resentment.

10.2.1.15.8 Roads

Mitigation activities associated with in-migration, HIV&AIDS, and other social pathologies were noted above. Enhancement activities associated with employment were noted above. For the road, mitigation activities associated with road signage, speed limits, and other interventions based on the advice of the Botswana Road Safety Council would be required, coupled with enforcement of road regulations and road safety education in directly-affected communities. In addition, given Botswana's serious litter problem, and consistent with recommendations in the CKGR Management Plan, institute systems designed to reduce litter along the roads to Gope (e.g., provide paper rubbish disposal bags free of charge to vehicles, make the mine a plastic bag free environment, etc.). Also, consider the livestock and wildlife watering potential of borrow pits used to improve the road, if the borrow pits would retain water after rain.

10.2.1.15.9 Other Mitigatory Issues

There are a few other mitigatory issues that need specific comment. It should be noted that the review session with all team members highlighted design and mitigatory actions that will support worker health and safety. The following are additional to those technical recommendations:

- Fence the Gope Project Site;
- Increased numbers of rodents and snakes due to waste disposal requires specific attention in terms of worker safety;
- Consider a plastic bag free operation;
- Ensure that the cell phone tower will allow access to cell phone services in neighbouring Gope settlement;
- Ensure adequate lighting and security patrols along pathways near residential areas;

- Fencing of the staging camp. With local assistance, regulation of shebeens in the area;
- Police and security guard enforcement against trade in dagga, and
- Female policy officers and security guards as well as males.

10.2.1.16 Regional Socio-Economic Structure

During the construction phase it is possible that people may be inclined to move to the immediately affected area as the opportunity for employment can create expectations. The possibility that squatting could take place both at the mine and source town is a reality. A contingency plan should stipulate the management of such an occurrence. The following aspects should be addressed within such a plan:

- Security at gates and fences to control assess to the CKGR, including increased vigilance at the Department of Wildlife's gate;
- Implementation of a land management policy in conjunction with the Department of Wildlife;
- Security to curb trade of any goods to and from the local community resident outside the mine perimeter;
- An eviction strategy should be compiled with the Department of Wildlife's and the Police Services' input, and
- A clear and well communicated labour recruitment plan for construction phase, with preference being given to CKGR residents where possible.

10.2.2 Operational Phase

A summary of mitigation measures is provided in Table 124 overleaf.

10.2.2.1 Geology

The nature of a mining operation is such that there are no mitigation or management plans that will reduce the impact on the geology. The ore body and its immediately adjacent host rock geology will be impacted totally, and the resource will be mined out, processed and deposited in a completely different form on surface. In essence, the geology will be change permanently.

In order to optimise available resources associated with the GDMP, it has been proposed that tailings material (the by-products from the processing of the Kimberlite) be used as a soil amelioration agent. However, it has to be noted that a decision in this regard can only be taken by GEC once the plant has been in operation for some time and metallurgical testing has proven that the optimal diamond extraction has been achieved. Should this be proven in due course, tailings material will be added to the topsoil material for the increased success of rehabilitation. The clay content and nutrient levels associated with the tailings material will definitely enhance the ability of the soils to both retain water as well as better sustain a vegetative cover.

10.2.2.2 Soils

Although the major construction activities are expected to have been completed during the construction phase of the project, some construction will occur over the LOM. Of particular importance with regard to soil management are:

- The opening of the second section of the open pit;
- The ongoing vegetation clearing and soil stripping associated with the WRD and sand dump, and
- Soil pollution prevention.

The objective of the management and mitigation measures during the operation is to minimise the impacts caused to, and on the stripping and dumping of the underlying sands and rock associated with the open pit mining operation and related infrastructure development, to maintain the soil stockpiles and materials needed for rehabilitation purposes (including the TMF) that are removed from the mining and processing areas.

Table 124: Operational SEMP Summary.

IMPACT	CAUSE / ASPECT	OBJECTIVE	MANAGEMENT & MITIGATION PRACTICE	SCHEDULE OF ACTIONS	RESPONSIBLE PERSON	MONITORING REQUIREMENTS	CLOSURE OBJECTIVE
GEOLOGY							
Destruction of target geology	• Total removal of targeted ore and limited removal of host material.	• Kimberlite and overburden material will be removed, processed and either stockpiled as slimes, tailings or as waste rock	• No management / mitigation measures can be implemented.	Ongoing / continuous throughout operational phase.	Project manager / Principle contractor.	• Visual inspection.	• All mineralogical waste sites will be rehabilitated accordingly. • The open pit will be rehabilitated accordingly. • All shallow foundations are to be removed during rehabilitation. • All deep foundations are to be top-dressed and the area re-vegetated.
SOILS							
Expansion of disturbed areas.	• Soil resource management (compaction, stockpiling, erosion, denutrification)	• Minimisation of disturbed area. • Rehabilitation commencement.	• Strip and stockpile top- and subsoils appropriately. • Commence rehabilitation of affected and completed areas as soon as possible. • Application of soil handling and removal practices (including vegetative cover). • Application of soil emplacement and storage practices. • Fertilisation and amendments. • Erosion control and treatment. • Implementation of good house keeping practices. • Spill clean up.	Ad hoc throughout operational phase when required.	Project manager / Principle contractor.	• Visual inspection. • Measurement of dimensions. • Soil testing.	• Return land to wilderness conservation status or as close as possible to that.
LAND CAPABILITY							
Change of land capability to mining land over an increasing portion of the MLA.	• Disruption of ecosystem due to mining activities and construction of infrastructure.	• Conserve land capability.	• Effective soil handling and removal practices. • Effective soil emplacement and storage practices. • Fertilisation and amendments. • Soil amelioration. • Ongoing rehabilitation. • Topdressing of permanent features.	Ongoing throughout operational phase.	Project manager / Principle contractor.	• Visual inspection. • Measurement of dimensions. • Soil testing.	• Return land to wilderness conservation status or as close as possible to that.
LAND USE							
Change of land use from wilderness to mining, resulting in a loss of natural habitat over an increasing portion of the MLA.	• Mining operation and construction of infrastructure.	• Mitigate the GDMP footprint.	• Limiting the footprint of the mining operation to the MLA. • Prevention of dust and spillage of rock material. • Appropriate maintenance of the road ways.	Ongoing throughout operational phase.	Project manager / principle contractor.	• Visual inspections. • Complaints from surrounding community.	• Return land to wilderness land use or as close as possible to that.
FLORA							
Potential loss / degradation of local pristine vegetation / habitat in surrounds to mining site	• Additional land transformation though unforeseen events, possible expansion	• Preserve as much pristine habitat as possible. • Limit and prevent ecological degradation where possible. • Ensure long term success of rehabilitation.	• Minimise GDMP footprint: - Use existing roads where possible. - Clear minimum vegetation. - Maximise site vegetation retention areas. - Erection of fence. • Preservation of vegetation. • Implementation of conservation practices. • Fire prevention. • Ongoing rehabilitation.	Bi-annual monitoring	Environmental officer.	• Visual inspections to ensure 60% vegetation cover.	• Competent ecosystem. • 60% Vegetation cover.
Alteration of natural ecological processes / ecosystem functioning	• Creation of atypical/ non-natural habitat, presence of humans for prolonged periods, infrastructure & impact sprawl						
Introduction of species not associated with the region	• Aesthetic development, gardens, high traffic volume between site & other areas						
Changes in vegetation dynamics	• Fires, water, vegetation control/ management, wood harvesting, plant collection						

IMPACT	CAUSE / ASPECT	OBJECTIVE	MANAGEMENT & MITIGATION PRACTICE	SCHEDULE OF ACTIONS	RESPONSIBLE PERSON	MONITORING REQUIREMENTS	CLOSURE OBJECTIVE
FAUNA							
Potential loss / degradation of local pristine faunal habitat and/or communities	• Land transformation though mine & associated infrastructure development	• Minimise land transformation.	• Ensure pockets of vegetation remain in order to ensure a measure of ecological connectivity. • Limit impacts to the MLA.	Ongoing throughout operational phase.	Environmental officer.	• % Of land transformed.	• Rehabilitation of entire site.
Road deaths of animals on access roads	• Reckless driving and night-time driving on access roads	• Minimise road deaths of animals.	• Vehicles are to yield to larger mammals. • Keep within the applicable speed limits. • No night time driving except in emergencies.	Continuous throughout LOM.	Vehicle drivers. Environmental officer.	• Recording of animal deaths on roads in log book.	• Elimination of animal road deaths on roads.
Alteration of natural ecosystem functioning/ disruption of migration routes	• Land transformation though mine & associated infrastructure development	• Minimise land transformation. •	• Ensure pockets of vegetation remain in order to ensure a measure of ecological connectivity. • Limit impacts to the Gope Project Site.	Ongoing throughout operational phase.	Environmental officer.	• % Of land transformed.	• Rehabilitation of entire site.
Increase in poaching, snaring and trapping of animals	• Increase in human habitation at the site and lack of environmental awareness	• Prevent poaching, snaring, trapping.	• Maintenance of the boundary fence. • Policing of boundary fence. • GEC stipulated disciplinary action. • Warning signs. • Appointment of Honorary Game Wardens.	Ongoing throughout operational phase.	Environmental officer.	▪ Number of incidents recorded. • Inspections in area surrounding Gope Project Site of veld.	• Elimination of poaching, snaring and trapping.
Impact of chemical compounds from construction on animals	• Release of hazardous/ bio-accumulating chemicals into the environment	• Prevention of animal death / health hazard due to chemical contamination.	• Eliminate leaching of chemicals. • Implementation of containment structures. • Responsible transportation and storage of chemicals.	Ongoing throughout operational phase.	Environmental officer.	• Number of incidents recorded.	• Removal of all hazardous / bio-accumulating chemicals, effluents, leachates.
Attraction of animals to artificial surface water	• Large sources of artificial surface water introduced	• Prevention of ecological alteration.	• Limit open water sources to those required only. • Monitor animal access. • If required, upgrade fences immediately surrounding open water sources to electrified fencing.	Ongoing throughout operational phase.	Environmental officer.	• Size of open water sources.	• Elimination of open water sources.
Loss of natural faunal species to introduced faunal species	• Killing of small mammals by domestic cats and dogs	• Prevention of ecological alteration.	• Prevent introduction of foreign species to the CKGR by prohibiting all pets	Ongoing throughout operational phase.	Environmental officer.	• Inspections.	• Prevention of long term ecological alteration through introduction of foreign species.
SURFACE WATER							
Reduction of surface water yield through reduced catchment to localised pond areas and ecological systems.	• Development of mining infrastructure. • Considered at ESS phase due to possible pan to be conserved. However, no significant conservation value of pan could be established.	• Minimise reduction of surface water availability to the ecosystem.	• No mitigation is to be implemented. The ponding area has been rated as low conservation value. • However, the general principle is to allow clean runoff to flow back to the environment and should be allowed for where practicable.	Ongoing throughout operational phase.	Environmental officer.	• Inspections.	• Restore natural surface water drainage.
Spillage of mine affected water during extreme rainfall events.	• Insufficient storage on site for the 1:50 year event.	• Minimise the impact of groundwater on surface water resources.	• DTM model and implementation of surface water management structures. • Limit discharge of mine affected water to the receiving environment.	Ongoing throughout LOM.	Environmental officer.	• Inspections.	• Restore area to pre-impact ecosystem.

IMPACT	CAUSE / ASPECT	OBJECTIVE	MANAGEMENT & MITIGATION PRACTICE	SCHEDULE OF ACTIONS	RESPONSIBLE PERSON	MONITORING REQUIREMENTS	CLOSURE OBJECTIVE
Contamination of the receiving environment from surface water discharge.	• Brine and sludge from the RO plant. • Sludge and water effluent from sewage works. • Impact from workshop area, including areas of storage of diesel, fuel, lubricants and cleaning materials. • Surface water runoff from roads and mining areas affected by oil spills or other contaminated material. • and RWDs.) • Accidental fuel and other hazardous, toxic and chemical spills. • Ongoing chemical contamination (i.e. fertilizer application during rehabilitation, seepage, etc.) • Leachate from mining infrastructure (i.e. TMF, slimes dam, WRD, sand dump and RWDs. • Water pumped from open pit for dewatering purposes.	• Prevention of surface water contamination.	• Brine will be managed in terms of legal requirements for its hazard classification. • Sewage sludge will be classified and managed accordingly. • Hydrocarbons will be contained within engineered areas at point sources and managed accordingly. • Remediation kits to be made available on site for diesel and other hydrocarbon related spills. • Slimes dam design has been undertaken to mitigate seepage impacts. • Waste rock is predicted to be inert and therefore no further mitigation is proposed.	Ongoing throughout operational phase.	Environmental officer.	• Inspections. • Surface water monitoring of artificial surface water impoundments.	• Rehabilitate any contaminated areas.
Increased TDS in surface water.	• Steep slopes will result in accelerated erosion (i.e. side walls of stockpiles, TMF, slimes dam and WRD).	• Elimination of impacts on surface water movement.	• Minimise wind and water erosion. • Slope stabilisation.	Ongoing throughout operational phase.	Environmental officer.	• Inspections of erodible areas	• Rehabilitation of affected areas.
GROUNDWATER							
Lowering of groundwater level	• Dewatering of the aquifer to ensure dry mining conditions and pit slope stability. • Groundwater abstraction for potable and process water demand.	• Create safe working conditions for open pit operation.	• No groundwater users are located in the vicinity of the GDMP (human / ecological). • Groundwater to be provided to any Gope returnees by GEC, should agreement with government be reached in this regard.	Ongoing throughout operational phase.	Environmental officer.	• Monthly groundwater monitoring.	• Ensure sufficient water availability to Gope returnees post closure.
Groundwater quality deterioration	• Return of mine operation contaminated water to the aquifer due to infiltration (TMF, slimes dam, RWDs and other infrastructure). • Biological contamination of localised aquifer due to domestic and sewage effluent disposal	• Prevent aquifer contamination.	• All contaminants to be contained and managed at the point source.	Ongoing through operational phase.	Environmental officer.	• Monthly groundwater monitoring.	• Ensure the aquifer is not contaminated post closure.
AIR QUALITY							
Reduction in ambient air quality from fugitive dust emissions.	• Construction and grading of haul roads.	• Reduce fugitive dust emissions to acceptable	• Reduce extent of construction operation taking place, rather phase in (thus reduce exposure).	Ongoing throughout operational phase.	Environmental officer.	• Ongoing dust fallout	• Elimination of fugitive dust and other sources of

IMPACT	CAUSE / ASPECT	OBJECTIVE	MANAGEMENT & MITIGATION PRACTICE	SCHEDULE OF ACTIONS	RESPONSIBLE PERSON	MONITORING REQUIREMENTS	CLOSURE OBJECTIVE
Dust emissions resulting in respiratory and cardiovascular ailments. Reduced visibility, soiling of buildings and materials. Reduced growth and production in vegetation and potential affect on sensitive areas.	• Ongoing civil site preparation. • Continued construction of mining operations / infrastructure: • Pre-stripping of sand in second split shell. • Overburden & waste rock dumping. • Material transfer operations; • Wind erosion from exposed storage (stockpiles & mine residue deposits) piles; • Vehicle entrained dust from both paved and unpaved road surfaces; • Process fugitive emissions (crushing and screening operations). • Remediation and rehabilitation	standards.	• Use of windbreaks, chemical + water suppression. • Rock cladding of stockpiles / dumps on prevailing wind facing slopes. • Re-vegetation of areas as soon as possible. • Reduction of drop height as far as is practicable. • Reduction of speed of vehicles to keep within the applicable speed limit.			monitoring. • Annual audits.	air contaminants.
Reduction in ambient air quality (land and air transportation).	• Exhaust fumes containing nitrogen, oxygen, carbon monoxide, water vapour, sulphur dioxide, nitrogen oxide, volatile hydrocarbons and polyaromatic hydrocarbons (PAHs) and their derivatives, acetylaldehyde, benzene and formaldehyde, carbon particles, sulphates, aldehydes, alkanes, and alkenes.		• Maintenance of vehicles. • Keep within the applicable speed limits. • Road maintenance and dust suppression.			• Ongoing dust fallout monitoring. • Annual audits. • Vehicle speed monitoring.	
PM, Carbon monoxide, VOC, nitrogen oxides - reduction in ambient air quality.	• Veld fires.	• Prevent fires.	• No pollution in the area (i.e. glass, cigarette buts). • Restrict fires from being made on site, except in designated areas. • Fire breaks.	Ongoing throughout operational phase.	Environmental officer. Camp manager.	• Ongoing inspections.	• No fires resulting from mining operation activities.
NOISE & VIBRATION							
Increased ambient noise levels	• Increase traffic flow (on-site)	• Comply with noise level criteria in legislative and Best Practice requirements.	• All vehicles will be fitted with appropriate sound suppression devices or silencers. • Keep within the applicable speed limits.	Monthly noise monitoring. Investigation of each noise complaint. Annual audits.	Mine manager.	• Annual audits. • Investigation of all noise related complaints. • Monthly noise monitoring.	• Elimination of mine operation related noise sources.
	• Air traffic flow (aircraft & helicopter)		• Weekly flights to & from the GDMP will be restricted to daylight hours, except for emergencies.				
	• Mining operation (earth moving, mineral processing plant, specifically crushing)		• All machinery used during operation will be maintained in sound mechanical condition. • Placement of waste structures has been designed such as to create a noise barrier.				
	• Continuous blasting throughout operational phase		• Placement of waste structures has been designed such as to create a noise barrier. • PPE will be worn as per GECs stipulations. • Complaints by I&APs will be recorded in a Complaints Register and addressed throughout the LOM. • Blasts will be designed by a suitably qualified engineer.				

IMPACT	CAUSE / ASPECT	OBJECTIVE	MANAGEMENT & MITIGATION PRACTICE	SCHEDULE OF ACTIONS	RESPONSIBLE PERSON	MONITORING REQUIREMENTS	CLOSURE OBJECTIVE
ARCHAEOLOGY & HERITAGE							
Impact of mining activities on the graves situated outside of the Gope Project Site, but inside the MLA.	• Mining	• Preservation of historical / cultural sites.	• Maintenance of fence and management of site.	Ongoing.	Environmental officer. Mine manager.	• Legal compliance. • Compliance with procedure agreed with affected family.	• Safety of graves • Access for family
Impact of mining on the graves situated outside of the MLA.	• Mining	• Preservation of historical / cultural sites.	• No mitigation required.	Not applicable	Not applicable	• Not applicable	
Impact of mining on the settlements situated outside of the Gope Project Area but inside the MLA.	• Mining	• Preservation of historical / cultural sites.	• No mitigation required.	Not applicable	Not applicable	• Not applicable	• Preservation of cultural heritage.
Impact of mining on the settlements situated outside of the MLA.	• Mining	• Preservation of historical / cultural sites.	• No mitigation required.	Not applicable	Not applicable	• Not applicable	
VISUAL ASPECT							
Change in land-use and available view.	• Temporary structures construction.	• Minimise the visual impact and associated available view.	• All buildings are to be maintained regularly.	Ad hoc during construction of structures. As required during operational phase.	Project manager / Principle contractor.	• Visual inspection.	• All buildings that won't be used post closure will be removed from site. • All remaining buildings are to be resurfaced at GEC's cost for future use by the end user of the infrastructure.
	• Entrances, signs and boundary treatment.		• Limit signage (number & size) to fall within the GEC requirements.				• All signage to be removed during closure. • Boundary fence to be removed upon obtaining closure.
	• Material storage (sand dump, slimes dam, TMF, topsoil stockpiles and material stockpiles).	• Minimise the visual impact and associated available view.	• Restriction of the height of mineralogical waste structures. • Ongoing rehabilitation and re-vegetation of mineralogical waste structures.	Throughout operational phase.	Project manager / Principle contractor.	• Visual inspection.	• Re-vegetation to start as soon as possible. • 60% vegetative cover to be achieved within 2 years.
Light pollution.	• Lighting of mining operations.	• Minimise the visual impact of illumination.	• Appropriate light fitting installation. • Installation of shielding. • Limit light intensity.	Once-off during the construction of lighting.	Project manager / Principle contractor.	• Visual inspection.	• All non essential lighting to be removed.
WASTE MANAGEMENT							
Same as during construction phase							
SOCIAL							
Employment at GDMP.	• Mining operation.	• Maximisation of positive benefit.	• Implementation of best practice standards in labour hiring and management practices. Work with Mineworkers Union, offer competitive packages.	Ongoing throughout operational phase.	HR Manager.	• Number of people employed: - Employees from directly affected community. - Local employees. - Expatriates.	• Skills development for long term sustainability.
Employment in surrounding communities.	• Mining operation.	• Maximisation of positive benefit.	• Operations - skills training and internship opportunities to prepare for mining employment, through extensive community liaison.	Ongoing throughout operational phase.	HR Manager.	• Number of people employed: - Employees from directly affected community. - Local employees. - Expatriates.	• Skills development for long term sustainability. • Empowered community.

IMPACT	CAUSE / ASPECT	OBJECTIVE	MANAGEMENT & MITIGATION PRACTICE	SCHEDULE OF ACTIONS	RESPONSIBLE PERSON	MONITORING REQUIREMENTS	CLOSURE OBJECTIVE
HIV& AIDS at GDMP.	• Mining operation and associated infrastructure.	• Minimising infection rates.	• Mine owner interventions on site, as per HIV/AIDS plan of action instituted by GEC, and as per the Wellness Policy. Need to include condom programming, information and attitudinal change, gender relations and power over sexual decision-making, life skills education, testing, ARVs, recreational activities. • Conduct within the context of a broader wellness programme.	Ongoing throughout operational phase.	HR Manager.	• Staff participation in voluntary HIV/Aids programmes. • Sick days above expected median. • Staff productivity.	• Increased awareness around HIV/Aids.
HIV& AIDS in surrounding communities.	• Mining operation and associated infrastructure.	• Minimising infection rates.	• Contracting firms required to engage in enhanced HIV/AIDS response. Consider contracting local partner NGO skilled in the HIV/AIDS prevention and response arena.	Ongoing throughout operational phase.	Community liaison manager.	• Staff participation in voluntary HIV/Aids programmes. • Sick days above expected median. • Staff productivity.	• Increased awareness around HIV/Aids.
Shift work.	• Mining operation.	• Maximum distribution of employment benefits. • Best fit with local livelihood strategies.	• Operations - institute a two week on one week off system. Provide transport to a central location.	Ongoing throughout operational phase.	HR Manager.	• Sustained employment. • Annual audits.	• Positive socio-economic benefit to communities.
Gope settlement.	• Mining operation.	• Maximisation of benefit to the Gope and greater CKGR residents.	• Extensive and sustained consultation. • Agreement to prioritise employment among Gope residents. • Agreement to prioritise employment among other CKGR residents. • Development and implementation of a Community Action Plan and communication plan. • Provision of water subsequent to consultation with the responsible authorities. • Access to health services. • Minimisation of violence. • Minimisation of alcohol abuse. • Informal enterprises. • Prevention of establishment of sex trade. • HIV/Aids spread prevention. • As local residents, Gope residents will be affected by decommissioning and rehabilitation arrangements. Of particular importance are safety aspects in terms of pit closure, and the removal of any hazardous substances. • Consider referring to the area as Gaagoo.	Ongoing throughout operational phase.	Community liaison manager.	• Community surveys. • Annual audits.	• Positive socio-economic benefit to communities.
Kaudwane.	• Establishment of the mine.	• Maximise positive benefit to community. • Mitigate negative impacts on community, including social pathologies.	• Community Action Plan. • Work with community representative institutions. • Establish effective consultation networks. • Respond to negative social impacts through these structures.	Ongoing throughout operational phase.	Community liaison manager.	• Community surveys. • Annual audits.	• Positive socio-economic benefit to communities.
Services at GDMP.	• Mining operation.	• Maximise in house services to staff and Gope residents.	• Provide services as intended. • Extend services to Gope residents.	Ongoing throughout operational phase.	HR Manager.	• Community surveys. • Annual audits.	• Improved health and wellbeing of Gope residents.
Gender aspects.	• Gender stereotyping associated with mining related project.	• Minimise gender in-equality.	• Open dialogue about male and female employment opportunities. Specific requests for females with experience to apply for mine jobs.	Ongoing throughout operational phase.	HR Manager.	• Employee surveys. • Community surveys. • Annual audits.	• Empowered staff and community members.
REGIONAL SOCIO-ECONOMIC STRUCTURE							

IMPACT	CAUSE / ASPECT	OBJECTIVE	MANAGEMENT & MITIGATION PRACTICE	SCHEDULE OF ACTIONS	RESPONSIBLE PERSON	MONITORING REQUIREMENTS	CLOSURE OBJECTIVE
Levels of economic activity / increase in GGP.	• Increase in business activity / sales and demand for consumer services.	• Maximise benefits to the local communities.	• Optimise economic lifespan of the mine. • Encourage procurement of domestic upstream and downstream services to the value chain where possible.	Ongoing throughout operational phase.	HR Manager.	• Employee surveys. • Community surveys. • Annual audits.	• Empowered staff and community members.
Increase in employment opportunities (national level).	• Reduction in national unemployment levels. • Forward and backward linkages (multiplier-effect).	• Maximise employment benefits.	• Encourage employment practices beneficial to local / domestic labour as far as possible. • Encourage business networking / sourcing from local / domestic service providers as far as possible.	Ongoing throughout operational phase.	HR Manager.	• Employee surveys. • Community surveys. • Annual audits.	• Empowered staff and community members.
Increase in employment opportunities (local communities).	• Reduction in local unemployment levels. • Forward and backward linkages (multiplier-effect).		• Encourage employment practices beneficial to local / domestic labour as far as possible. • Encourage business networking / sourcing from local / domestic service providers as far as possible.	Ongoing throughout operational phase.	HR Manager.	• Employee surveys. • Community surveys. • Annual audits.	• Empowered staff and community members.
Improvement of living conditions and poverty alleviation.	• Increase in spending power. • Betterment of people's living conditions.	• Maximise local benefit.	• Maximise on multiplier effect. • Develop and implement Community Trust.	Ongoing throughout operational phase.	HR Manager.	• Employee surveys. • Community surveys. • Annual audits.	• Empowered staff and community members.
Enabling environment relating to infrastructure.	• Development of roads, electricity, housing, social, health and educational facilities.	• Maximise benefit to local community through infrastructure upgrade assistance.	• Infrastructure maintenance initiatives should encourage and facilitate the use of local materials and labour intensive practices, if and where possible. • Infrastructure should be accessible to local economic activities, if and where possible.	Ongoing throughout operational phase.	HR Manager.	• Employee surveys. • Community surveys. • Annual audits.	• Empowered staff and community members.
Improvement in skills levels.	• Provision of training and skills development programmes.	• Community upliftment with relevant skills training.	• Procure training service providers to skill / reskill local labourers.	Ongoing throughout operational phase.	HR Manager.	• Employee surveys. • Community surveys. • Annual audits.	• Empowered staff and community members.
Encouragement of entrepreneurship.	• Growth of the informal sector in the local communities.	• Maximisation of benefit to the local communities during the operational LOM.	• Harness informal economic activities to supply the mine and workers with selected goods and services predetermined and negotiated minimum standards, i.e. fresh fruit, meat, etc. • Rotate contracts to small scale service providers on a roster basis to encourage fair trade practices and business diversification.	Ongoing throughout operational phase.	HR Manager.	• Employee surveys. • Community surveys. • Annual audits.	• Empowered staff and community members.
Increased commitment from government in the area.	• Government involves communities and drives / funds community projects (LED).		• Ongoing engagement between mine management and government to insure economic and social issues promptly identified and addressed.	Ongoing throughout operational phase.	HR Manager.	• Employee surveys. • Community surveys. • Annual audits.	• Empowered staff and community members.
Returning of local communities to the Gope area.	• Local communities return to the affected area (Gope). The site itself will not be accessible but people could settle in the surrounding area.	• Ensure that no squatting takes place around the GDMP. • Preserve Basarwa lifestyle as far as	• In situ upgrade programmes	Ongoing throughout operational phase.	HR Manager.	• Employee surveys. • Community surveys. • Annual audits.	• Empowered staff and community members.

IMPACT	CAUSE / ASPECT	OBJECTIVE	MANAGEMENT & MITIGATION PRACTICE	SCHEDULE OF ACTIONS	RESPONSIBLE PERSON	MONITORING REQUIREMENTS	CLOSURE OBJECTIVE
Unplanned settlements (regional) resulting in strain on social service delivery and infrastructure.	• Squatting.	practicable.	• Squatting management plan. • Involve DWNP.	Ongoing throughout operational phase.	HR Manager.	• Employee surveys. • Community surveys. • Annual audits.	• Empowered staff and community members. • No squatter camps located around the Gope Project Site.
Unplanned settlements (local) resulting in strain on social service delivery and infrastructure.	• Squatting.						
Urbanisation resulting in lower standards of living due to the risk of squatting.	• Increase in unemployment, health risks, crime.		• Social and labour plan.	Ongoing throughout operational phase.	HR Manager.	• Employee surveys. • Community surveys. • Annual audits.	• Empowered staff and community members.
Health (regional): Impact of HIV/Aids on the health care system.	• Transitory work force and sex trade.	• Mitigate HIV/Aids impact on the regional population.	• Social and labour plan.	Ongoing throughout operational phase.	HR Manager.	• Employee surveys. • Community surveys. • Annual audits.	• Empowered staff and community members.
Health (national): Impact of HIV/Aids on the health care system.			• Social and labour plan.	Ongoing throughout operational phase.	HR Manager.	• Employee surveys. • Community surveys. • Annual audits.	• Empowered staff and community members.
Narrow economic base, focussed around one mine.	• Local economy is dependant on a single economic activity. • Affected by market fluctuations and economic trends.	• Diversify economic base and empower people through skills development.	• Social and labour plan. • Local economic development plan through Community Trust projects.	Ongoing throughout operational phase.	HR Manager.	• Employee surveys. • Community surveys. • Annual audits.	• Empowered staff and community members.

The ultimate objective is to re-create a landscape that emulates the existing landscape as closely as possible, and does not adversely impact on the area in general.

It has to be noted that topsoils will be used as soon as possible for ongoing rehabilitation during the LOM.

10.2.2.2.1 General Soil Management Practices

The following management and maintenance is required:

- All re-vegetated areas are to be kept clear of animals and human activity and traffic (apart from maintenance, ongoing rehabilitation, and/or monitoring), until the vegetation is self sustaining;
- The soil stockpiles in place are to be maintained and vegetation cover managed for the mitigation of erosion and dust generation;
- All top and subsoils stripped during the operational phase are to be handled as previously described;
- Newly seeded / planted areas must be protected against compaction and erosion;
- The areas are to receive temporary irrigation if necessary to establish rooting;
- Weeds should be removed regularly;
- Unhealthy or dead plant material is to be left where found, but replaced with healthy plants / re-seeded;
- All seeded and grassed areas are to be fertilised as required based on annual sample analysis, and
- All erosion affected areas are to be repaired.

10.2.2.2.2 Soil Handling and Removal

All soils that are to be stripped as part of the ongoing operation of the mine, is to be handled in accordance with the SEMP as stipulated in section 10.2.1.3.

10.2.2.2.3 Soil Emplacement and Storage

Soil stockpiles are to be managed in accordance with the SEMP as stipulated in section 10.2.1.3.

10.2.2.2.4 Fertilisation and Amendments

Soil stockpiles are to be managed in accordance with the SEMP as stipulated in section 10.2.1.3.

Maintenance dressings are applied for the purpose of maintaining the nutrient levels. These applications will be undertaken only if required, and only after additional sample analysis has been undertaken. Monitoring of the nutrient status will be essential as outlined in the soil monitoring programme.

10.2.2.2.5 Soil Erosion

Areas showing erosion due to wind or water activity should be addressed timeously (not exceeding one month) from when the erosion is discovered. The treatment of the erosion as outlined in section 10.2.1.3.4, is to be applied.

The areas affected by erosion are to be monitored for a period of a year after the implementation of the corrective action in order to ensure the effective rehabilitation of the area.

10.2.2.2.6 Mineralogical Contamination Amelioration

Where spillage of mineralogical material occurs, the ore bearing materials will be removed to the mineral processing plant.

Good housekeeping practices are to be implemented across the Gope Project Site to minimise the spread of ore to areas not associated with the plant and keeping the site neat.

10.2.2.2.7 Hydrocarbon Contamination Amelioration

Hydrocarbon contamination of soils (and other components of the receiving environment) should be avoided through the implementation of good housekeeping practices and treated as outlined in section 10.2.1.3.6.

10.2.2.3 Land Capability

If the guidelines given in the previous section are followed and instituted, the capability of the land (other than the dumps) will be returned to a state that is as close to its original state as possible, but at least a rating of “Grazing Land” as defined in the Chamber of Mines Guidelines (1997).

The areas that have been dedicated to the dumping of materials (sand dump and WRD) will be covered with rock (where required on the prevailing wind facing slopes), top and subsoil, and vegetated with a natural grass seed throughout the LOM as and when an area of these structures is finalised (refer to section 10.7.2 for details regarding ongoing rehabilitation).

Should the use of the tailings material have been proven to be a feasible option, tailings material is to be worked into the soils prior to placement.

10.2.2.4 Land Use

During the operational phase of the GDMP, little can be done to mitigate the change in land use over the directly affected area. However, the mining operations' footprint is to be limited to the Gope Project Site in as far as is possible, but should not extend beyond the MLA in order to mitigate this impact.

10.2.2.5 Flora

During the operational phase of the GDMP, the following mitigation and management measures can be implemented relating to the flora aspect:

10.2.2.5.1 Seed Collection

Collection of seeds for the purpose of propagation in rehabilitation areas is recommended since it will ensure that only species that occur naturally in the area is used for rehabilitation purposes. This is also true for slight genetic variances that might occur between geographically separated individuals of the same species. Collection methods will depend on the target species and growth groups. The storage area should be closed in order to prevent access by rodents. Seed harvesting should be done during the summer period when seeds are fully developed and in the process of drying on the plant. No green / undeveloped seeds / fruit should be collected. Storage periods should not exceed a year.

Grasses:
Collection with seed nets is recommended. Seed nets are similar to butterfly nets with an opening diameter of approximately 0.5 – 0.75 m, constructed from a robust pole (such as a broomstick) and strong material that will be able to withstand contact with rigid woody plants. This net is swept across and forth the top layer of grass sward and seeds are collected in the bag area. Alternative methods might include the harvesting of grasses by means of cutting of grasses on a large scale. Although this is not recommended since it might alter local ecological conditions, a benefit is that additional organic material is collected.

The prime period of seed collection should be determined by an on site specialist, but is expected to be middle summer subsequent to good rains.

Collected seeds should be stored in a cool dry place with ample ventilation in order to prevent rotting.

Germination trials should be run prior to rehabilitation commencing in order to determine an effective method of application. It is recommended that seeds be mixed with topsoil and applied over the rehabilitation area. Light watering is recommended until germination has occurred (in order to augment rain). Moderate fertilising could be applied, depending on the growth success. Care must to prevent erosion in areas where a considerable slope is present.

Forbs and Herbs:

Seeds and fruits can be hand collected from surrounding areas and dried in a cool dry place with sufficient ventilation in order to prevent rotting. These fruits and seeds are easily collected by hand. Care must be taken to prevent rotting of seeds from *Acanthosicyos, Citrullus, Dicerocaryum, Harpagophytum, Oxygonum* and *Senna* since they have a high water content.

Trees and Shrubs:

Seeds and fruits can be hand collected from surrounding areas and dried in a cool dry place with sufficient ventilation in order to prevent rotting. These fruits and seeds are easily collected by hand. Seedpods from particularly the *Acacia* species is easily harvested underneath the tree canopies.

10.2.2.5.2 Plants Recommended for Re-vegetation Purposes

The use of the following plant species are recommended in order to establish a layer of vegetation on rehabilitated areas. These plants should be sourced from surrounding areas. Grasses and forbs should be used to establish a layer of vegetation in a relative short period of time. Irrigation should be provided until such time that the vegetation is able to sustain itself from available rain and soil moisture.

Trees and shrubs should be used in areas where screening is required, such as alongside roads and other infrastructure

Grasses:
Digitaria milanjiana
Eragrostis lehmanniana
Schmidtia pappophoroides
Stipagrostis uniplumis
Urochloa mosambicensis

Forbs:
Acanthosicyos naudinianus
Ammocharis coranica
Citrullus lanatus
Dicerocaryum eriocarpum
Gisekia africana

Harpagophytum procumbens

Indigofera daleoides

Oxygonum delagoense

Senna italica

Talinum crispalatum

Woody Plants:

Acacia erioloba

Acacia hebaclada

Bauhinia petersiana

Boscia albitrunca

Burkea africana

Commiphora glandulosa

Crotalaria species

Ehretia rigida

Grewia flava

Grewia retinervis

Philenoptera nelsii

Rhus tenuinervis

Terminalia sericea

Ziziphus mucronata

These species occur abundantly in the general region and has properties that will aid in the rehabilitation process, such as fast growth, pioneering characteristics, high surface cover, strong root system, propagation success and are easily harvested.

10.2.2.5.3 Species Mixture for Rehabilitation

Only general guidelines can be provided for rehabilitation procedures. Trials are recommended by on-site personnel to determine the optimum seed density, planting methods, watering requirements, maintenance activities, etc. Monitoring of the growth success in rehabilitation areas will be included in the environmental monitoring plan. While forbs and grasses have soil stabilizing abilities, shrubs will provide visual benefits as well as minimizing the effect of wind erosion and dust control.

In order to stabilise the soil, particularly in steep areas, it is recommended that a mixture of grasses and forbs (particularly the creeper species) are established initially. Only when a lasting layer of vegetation is present within the rehabilitation area should shrub species be introduced. It is recommended that, in areas of high slopes, shrub species be planted as individuals that were propagated from seeds and not mature individuals.

The covering of sowed areas with brushwood1 (the covering should not exceed 0.5 m). The brushwood will retain the soil moisture and prevent surface erosion during precipitation events. Mulch (e.g. straw or fine brushwood material) should be added to control erosion during seed germination, and to provide organic matter for plant growth (Figure 69).

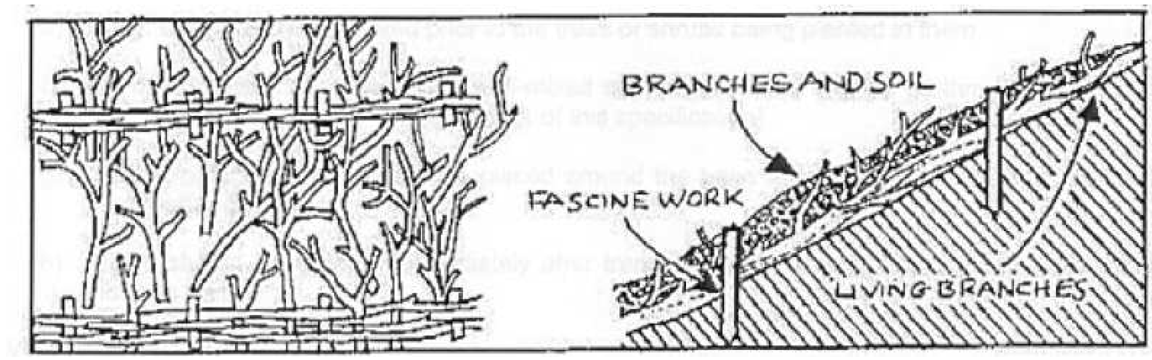

Figure 69: A Typical Example of Brushwood (mulch) Application.

Sowing should take place immediately after the first reliable rains. On steep areas sowing should be in rows and should take place between barrier lines (or fascine work). Barrier lines must follow the natural contour line of the land. The barrier lines will slow the movement of surface water in the event of heavy rains and prevent bank erosion. Areas with very little topsoil should be augmented by creating fascine work filled with topsoil to facilitate plant establishment (see Figure 70).

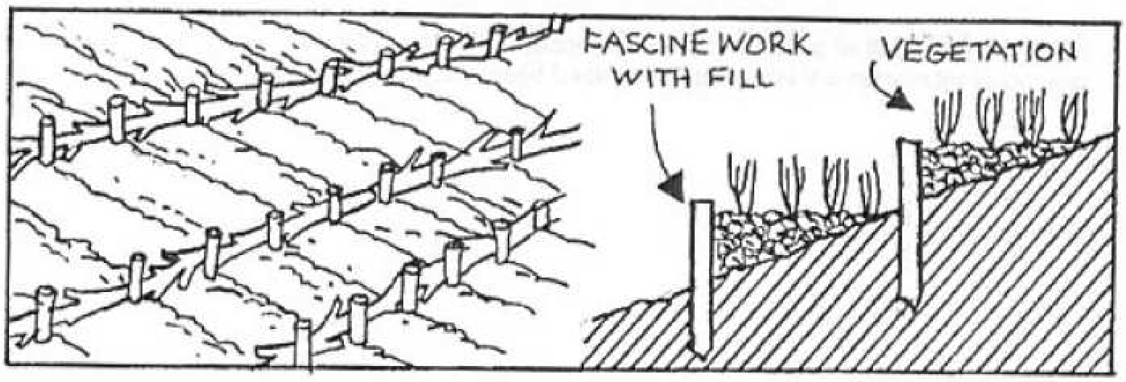

Figure 70: An Example of Fascine Work and Fascine Work with Fill.

During the rehabilitation of the steep it is recommended that woody species be established to facilitate soil binding and bank stabilization (Figure 71).

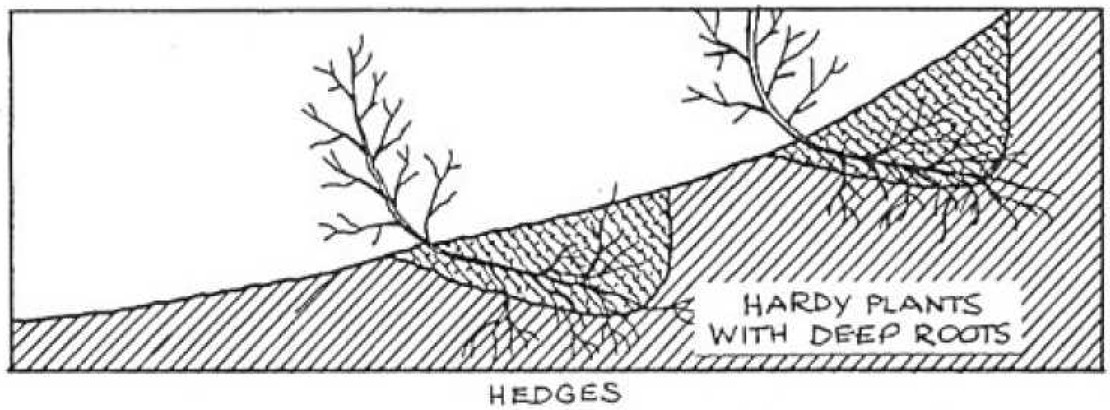

Figure 71: An Example of Slope Stabilization by Means of Woody Species.

General guidelines include:

- All pant specimens should be in good condition and free from pests and diseases;
- The potting materials and specimens to be used should be free from weeds and declared invaders;
- Ensure that the potting soil that the plant has been growing in is retained around its roots when planting takes place;
- All holes should be well-watered prior to planting and should be re-watered immediately after transplanting to ensure that the soil around the plant is wet, and
- Indigenous plant material should be sourced within a radius of 30 km of the study site.

Fertilizing should ideally be applied as slow release granular type fertilizing that will augment the growth of roots and leaf areas. A popular type that will stimulate root and leaf development is 3:1:5 (Nitrogen/N: Potassium/P: Sodium/K). Subsequent to the planting of shrubs a 2:3:2 (Nitrogen/N: Potassium/P: Sodium/K) granular fertilizer can be applied in order to stimulate stem growth. Sufficient watering (twice weekly) is recommended.

10.2.2.5.4 Composting / Vermiculture / Growing of Vegetables and Other Plants

The establishment of gardens for the purpose of vegetable growing should not be allowed. Species such as tomatoes are extremely aggressive invaders and, although the study area is within a water stressed environment, their presence could possibly result in infestation of natural areas. Waste vegetable material from kitchen is to be put through the Vermicomposting system and should not be disposed of elsewhere on site. Should disposal be required for any reason, kitchen waste is to be transported out of the CKGR.

The Vermicomposting process is known not to sterilise viable seeds as a result of high decomposing temperatures, but a low possibility does exist that natural areas might be affected due to the presence of some viable seeds. For this reason, monitoring of re-vegetated areas that received Vermicompost is to be monitored for a period of at least three years after the placement of the last compost and all foreign species that have germinated are to be physically removed from the growth area and destroyed. Removal of these plants, together with all flowers, seeds, fruit and roots are advised. Monitoring of the presence of invasive and exotic species will form part of the environmental monitoring programme. Relevant actions and guidelines will be prescribed in the monitoring reports.

10.2.2.5.5 Irrigation Guidelines

Temporary irrigation of rehabilitation areas is recommended in order to successfully establish the layer of vegetation that will stabilize topsoil. Irrigation of areas that were recently re-vegetated should ideally be done twice weekly, taking available rain into consideration. The method of irrigation should be in the form of drip or sprinkle methods, not flooding since this will increase erosion in steep areas. Frequent monitoring of all areas of rehabilitation should be done in order to identify areas where erosion control or other maintenance should be applied.

Irrigation should be applied in periods when active growth is evident, early spring to middle autumn, augmenting available rain. During periods of extreme temperatures or drought the frequency should be increased to thrice per week. Irrigation should only be applied in early mornings or late afternoons, not after 8h00 or before 16h00.

Once a 60% vegetative cover has been established, irrigation can cease.

10.2.2.6 Fauna

No significant mitigation is possible within the study area itself to mitigate the continued loss and degradation of pristine faunal habitat as dumps and other structures continue to expand. Impacts should be limited (in terms of area) by prohibiting habitat degradation or destruction outside of the MLA – except for activities directly related to the construction and operation of the power line and access road.

In addition, areas disturbed inside the MLA is to be kept to a minimum in order to create pockets of vegetation that will ensure some level of ecological connectivity.

In order to minimize the death of animals on the roads associated (especially along the access road) with the mine, driving at night should be prohibited without exception (except for medical emergencies). Secondly, a speed limit of no more than 40 km/h should be enforced inside the CKGR and to the appropriate speed limit on roads outside the CKGR as agreed with the Department of Roads. Vehicles are to yield to larger mammals on the access roads. Any transgressions of above-mentioned measures must be subjected to the appropriate disciplinary action of GEC.

Road kills should be monitored through the reporting and recording of animal road deaths at both the Gope Project Site and the staging camp. This log is to be maintained by a designated person at these two sites. The log is to describe the describing species and the time of death.

The fence around the Gope Project Site should have been completed by the commencement of the operational phase and should be regularly inspected and maintained. The Policing of areas bordering the Gope Project Site should be continued during the operational phase, in order to mitigate impacts relating to poaching, snaring and trapping of animals. Transgressors will be subject to the appropriate disciplinary action of the GEC as outlined in section 10.2.1.7. There must be strong focus on warnings on the access road and at the Gope Project Site. Honorary Game Wardens should continue their work. The community training programme is to continue during the operational phase.

The presence of personnel in an area where animals occur naturally implies that activities such as the trade of meat and biltong can develop. While this should be discouraged at all costs within the Gope Project Site, there is limited control on the outside areas. Buying meat / biltong from surrounding communities should be prohibited and no meat / biltong should be allowed to enter into the Gope Project Site. Frequent control and policing is recommended.

In order to manage and mitigate any impact of chemical compounds from the operation on animals, GEC has to ensure that no leaching of chemicals occur to soils and groundwater resources, through the implementation of appropriate structures. Likewise, transportation and storage of all chemicals must be undertaken in such a manner that no animal can gain access to these chemicals.

A major concern associated with the GDMP, is the attraction of fauna to open water sources that will result from the mining operation. These areas include the slimes dam and RWDs. Open water sources must be limited as far as is practicable. Should it become evident that animals are regularly accessing these open water sources, the boundary fence surrounding the open water source should be electrified in order to limit such access.

Areas comprising steep slopes of fine, silty settled sediments are to be avoided to protect birds drinking from getting stuck and drowning. If and when areas form where birds get stuck, fabric (i.e. shade netting material) should be placed in such areas. This will not interfere with the operation of the water storage areas and will provide a secure footing for the birds to still access the said water in a safe manner.

In order to prevent the loss of natural faunal species to introduced faunal species, all pets should be disallowed at the Gope Project Site.

The possibility exists that bats might inhabit some of the infrastructure. Other than not building any structures or having structures without roofs, there are no sensible mitigation measures that would effectively keep these species out. Putting up bat houses is not regarded sensible as this would result in further encouragement. Their presence in the area is not expected to have any effect on the ecology on a local or regional scale since they are generalist feeders (flying insects) and are unlikely to have a significant impact on any other species or group of species.

Scavengers, predators and rodents are likely to be attracted to the living quarters, and in particular where food is stored, prepared and disposed of. Proper control is required to prevent this impact. Access to storage areas should be prevented, proper disposal is recommended through storage in closed bins and removal to suitable disposal sites outside the CKGR on a frequent basis.

The implementation of the biodiversity monitoring programme and observations of the Environmental Compliance Officer (ECO) will monitor the actual movement of large mammals (presence of elephants) and this information will be used to guide and prompt actions to control impacts.

Complete control of animals is not perceived as possible, particularly water fowl in areas of surface water. However, this is expected to be minimal on the local ecology.

10.2.2.7 Surface Water

The fact that no specific high conservation areas are dependant on runoff from the area that is proposed to be mined indicates that no mitigation is required. However, in terms of good practice:

- All dumps that will generate runoff that meets the guidelines for discharge to ephemeral catchments will be drained back to the environment. These areas will include the sand dump and the rock dump, both of which are expected to generate relatively clean runoff, and
- Road and other infrastructure will be raised above the natural ground level to reduce the risk of flooding during extreme rainfall events. Any localised areas of ponding will be drained by means of pipe culverts so that runoff can occur back to the natural environment.

It is important to note that the runoff is extremely low in this area, being typically only several millimetres in a year (refer to the baseline section).

The water balance modelling has indicated that the mine will generally have a water shortage and this will be addressed by extracting groundwater for use in the plant from either a well field located within the MLA or by increasing the dewatering infrastructure surrounding the pit.

Detail on the construction activities and waste management has been outlined in the waste management section of the report, but the following key issues are highlighted here relating to potential point source contamination:

- All point sources such as the workshops and plant areas will have bunding around above ground storage tanks. Concrete slabs and bunds will be used where hydrocarbons and oils are worked with on a daily basis to prevent ingress and runoff from these point sources. Fuel tanks will comply with legal requirements to minimise the risk of undetected leakage;
- Brine from the RO plant will be assessed in terms of its classification (hazardous or not), but for purposes of the EMP, it is considered hazardous. The brine will need to be disposed of into a lined facility for evaporation and the residue appropriately disposed of. Depending on the qualities achieved by the plant, a final disposal strategy will be applied that meets the legal requirements for such brines;
- All dumps that will generate runoff that meets the guidelines for discharge to ephemeral catchments will be drained back to the environment. These areas will include the sand dump and the rock dump, both of which are expected to generate relatively clean runoff;
- Road and other infrastructure will be raised above the natural ground level to reduce the risk of flooding during extreme rainfall events. Any localised areas of ponding will be drained by means of pipe culverts so that runoff can occur back to the natural environment, and
- GEC is committed to sampling surface runoff if and when it occurs so as to allow the water qualities around the various point sources to be measured. However, there will be limits to the extent to which this can be achieved due to both the relatively quick infiltration in the sands, as well as the extremely low runoff for average rainfall conditions.

Two options exist for material that is placed outside of a natural landform:

- Allow or facilitate the flattening of all slopes to a naturally sustainable slope. Since on this site it would appear that only very flat slopes will be sustainable in the longer term, effectively all of the sandy material would either need to be placed back into the pit, or encapsulated with rocky material that can sustain a steeper slope, and
- If one considers steep slopes in an arid environment, it is apparent that vegetation alone cannot sustain the steeper slope. An example of steep slopes in an arid environment is shown in the photo below taken at a road cutting in an arid area (although not close to the site). There is extensive rock coverage that serves to slow water down when the vegetation may be absent or poor, such as after relatively dry periods.

The mitigation strategy for the slopes that will be located in sandy material is thus as follows:

- Current planning is to flatten all slopes in sandy material to approximately 18°. In the natural environment slopes are seldom linear and tend to be steeper at the highest point (where water flow velocities and volumes are lower) and flattening out down the slope. Wind erosion also results in a varying slope, but there may be practical limits to achieving a final slope that emulates those formed by natural processes;
- The soil will then be improved in terms of water holding capacity as discussed in previous sections. The addition of tailings material to the replaced soils is recommended in order to raise the clay content of the soils, should it prove economically feasible, and
- The slope will then be partially covered with rocky material aiming for around 20 to 30% coverage of the slope by rocks, typically by placing the rocky material at the top of the slope and dozing material down the slope on wind facing slopes.

Note that a commitment is given to undertake trials on the soft slopes to obtain the best environmental and economic mix of rock, vegetation and slope for the site. This can be achieved since the sand dump will be largely completed relatively early in the life of the mine, which will allow field trials of rehabilitation options to be monitored and managed during the operational phase. Modifications required can thus be implemented at closure to ensure a long term sustainable slope.

The main slopes targeted for the above treatment are the wind facing slopes of the sand dump, the slimes facility (with rehabilitation where practical during the operational phase but primarily at closure), and the soft slopes around the pit itself, that is, sloping down towards the ore body.

10.2.2.8 Groundwater

During the operational phase the water demand for the operation will be at its peak and the dewatering cone will expand to beyond the boundaries of the MLA. The groundwater model must be utilised to determine the optimum yield and pumping arrangement through ongoing refinement. This can only be done once all the boreholes are in place and tested. The primary aim should be to achieve maximum drawdown at the pit and should the well field option be selected, minimise the drawdown at the well field. To minimise the risk to the regional groundwater table the groundwater abstraction should be minimised. This can only be achieved through reuse of the available water and therefore reducing abstraction rates.

There are no groundwater users within the radius of influence of the dewatering cone and the lowering of the groundwater table therefore not considered being a severe impact. Weekly groundwater monitoring must continue and if excessive drawdown at the well field is noticed the management of groundwater will have to be revised. It is important to note that the current groundwater model is a starting point and must continually be upgraded as new information becomes available.

It is evident from leach testing that iron is the only slightly elevated element and it is concluded that the waste material will not add contaminants to the groundwater system. The biggest threat to groundwater remains the concentration of salts through the evaporation of untreated groundwater. The potential risk of inorganic contamination to the groundwater can best be managed by reducing the residence time of untreated groundwater in the water reticulation system. The use of treated water, from which the majority of salts have been removed through use of RO will reduce this potential problem significantly.

The potential risk of organic contamination can best be managed through proper waste handling and management. Recycling of domestic waste and the planned removal of waste from the Gope Project Site will be sufficient to manage this risk. The planned sewage treatment system is a closed circuit and if managed properly will not pose any risk to the groundwater system.

The storage of fuel must be done in accordance with acceptable environmental practises in concrete bunded areas. The groundwater table is some 90 mbgl and any seepage will migrate through 80 – 90 m of sandy material, similar to a sand filter. It is unlikely that any organic organism will survive this process to reach the groundwater table. Organic contamination of the groundwater is therefore considered to be negligible and therefore, no management / mitigation procedures are proposed.

10.2.2.9 Air Quality

This section outlines the methods that may be employed to mitigate the impacts predicted to take place as a result of the proposed plant and mining operations.

Air quality management of on-site activity, although geared at the reduction of off-site impacts, can also be a measure of improving occupational exposure. The following sections details best management practice principles which should be deployed in order to best manage the air quality impact resulting from on-site activity.

The management control measures are outlined as follows:

- Watering of road surfaces;
- Treatment of suitable surfaces with dust suppressant agents;
- Management of vehicle speed;
- Rehabilitation of exposed surfaces where practicable;
- Erecting wind breaks / fences where required;
- Avoid unnecessary storage of material on site, and
- Carry out blasting when wind speeds are at there lowest.

The watering of roads reduces the amount of dust generated as a result of vehicle entrainment. As the amount of water required may vary from month to month due to the changes in potential evaporation rates for that period, the rate of water application would need to be altered for each month of the year. In the event that the acquisition of water for the use as a dust suppressant is not possible, the following alternative methods can be deployed:

- *Chemical suppression:* Although water is still required for the making of the mixture, the frequency of application will reduce, thus the amount of water required will also reduce proportionately. Some of the chemical suppressants readily available for use in South Africa are Dust-A-Side, SDS 2 and SDS 4 supplied by 3M, SoilTac and Durasoil supplied by Soil and Dust Solutions, etc.;
- *Application of gravel:* This will result in the reduction of available silt which can be entrained by vehicles making use of these roads, however continued maintenance by the reapplication of gravel periodically would be required in order to ensure the maximum control efficiency is achieved;
- *Tarring:* This is listed as an option, although it is recognises that this would not be the most practical or cost effective measure to limit entrained dust from these sources, especially due to the transient nature of mining haul roads;
- Reduction of vehicle speed (maximum speed of 40 km/hr inside the CKGR), and
- In order to reduce the number of vehicle trips per day, various conveyor systems have been included in the design of the GDMP plant and infrastructure. This has resulted in the significant reduction of the number of vehicle trips per day.

During excavation the material should be wet to maintain moisture content at > 10 % and the ongoing rehabilitation of such areas should be taking place as soon as possible, after the excavation is completed.

The minimum amount of material required should be stored in stockpiles and piles should not be left to stand for very long periods. The erection of wind breaks / fences is an additional method of controlling wind blown dust at storage piles. The windbreak should ideally be as high as the storage pile and placed with reference to prevailing wind conditions.

Although blasting is not a long lasting impact, it can have a large impact if the wind is blowing when the blasting is carried out. During blasting there is a significant amount of fine material that becomes airborne, and can take a long time to settle out. With a strong wind it is possible for the airborne material to be carried a number of kilometres from the Gope Project Site itself, which has the potential to settle out in communities.

10.2.2.10 Noise

Please refer to the Noise Management Actions and Strategies in section 10.2.1.11.

10.2.2.11 Sites of Archaeological and Cultural Interest

By the time the mine is fully operational, the mitigation measures for the graves and settlements located within the mining development footprint would have been successfully completed. As a result only the graves situated within the MLA but outside of the mining footprint will be discussed here.

For these sites, the following mitigation measures should be followed:

- The fences which had been erected during the construction phase must be maintained throughout this phase. The gates are to be kept locked at all times and access restricted to members of the affected family as well as heritage specialist undertaking site monitoring. A copy of the key should still be kept on the mine premises by a responsible mine employee while the original will still be with the affected family. For the aims of mine health and safety the family must still report to the operations manager before visiting the grave. The visitor's book containing the names and contact details of all individuals visiting the grave must be maintained, and
- The monitoring process with which any impacts on the sites can be identified and acted upon must continue. During the operational phase a monitoring schedule consisting of a monitoring visit once every year can be implemented. However, should any impacts on the sites be identified, these must be acted upon and at the same time the monitoring schedule will be

increased (i.e. to once every six months). Monitoring should be undertaken by a suitably qualified heritage specialist.

10.2.2.12 Visual

During the operational phase of the GDMP, the following mitigation and management measures are to be implemented:

- The change in available view is to be managed as outlined in section 10.2.1.13 of the construction phase SEMP;
- Material storage areas (including the TMF, WRD, sand dump and slimes dam) are to reach a height of no more than 50 m. However, lower limits have been applied to the infrastructure as part of the design phase. Re-vegetation of any finalised slopes is to commence as soon as is practicable and vegetation cover is to achieve 60%;
- All outdoor lighting is to be installed in such a manner so as to shield the cone of light to fall within the MLA as far as is practicable, and
- Shielding is to be used and intensity of lighting minimised to limit sky glow.

10.2.2.13 Waste Management

Appendix 9 includes a comprehensive Waste Management Plan.

10.2.2.13.1 Overview of Waste Management Plan

It is important to note that a number of disposal methods for various waste streams are discussed in this report, but it is not the intention that these methods are to become the only allowed or available methods relevant to the Gope Project Site. These methods are rather to be considered suggestions as the preferred disposal method may change over the LoM depending on various factors. These factors include, inter alia, newly available options, new types of wastes (should processes change), new waste facilities in Botswana, cost of options, handling and transportation logistics. Principles and generally accepted waste management principles have been included in this plan, which must be considered when evaluating and comparing the current disposal method (at the time) and new options.

There are a number of steps to be considered in the management of waste across the life cycle of waste. These phases are illustrated in the figure below, and detailed in the Waste Management Plan (Appendix 9) sections to describe the manner in which is to be managed at the mine.

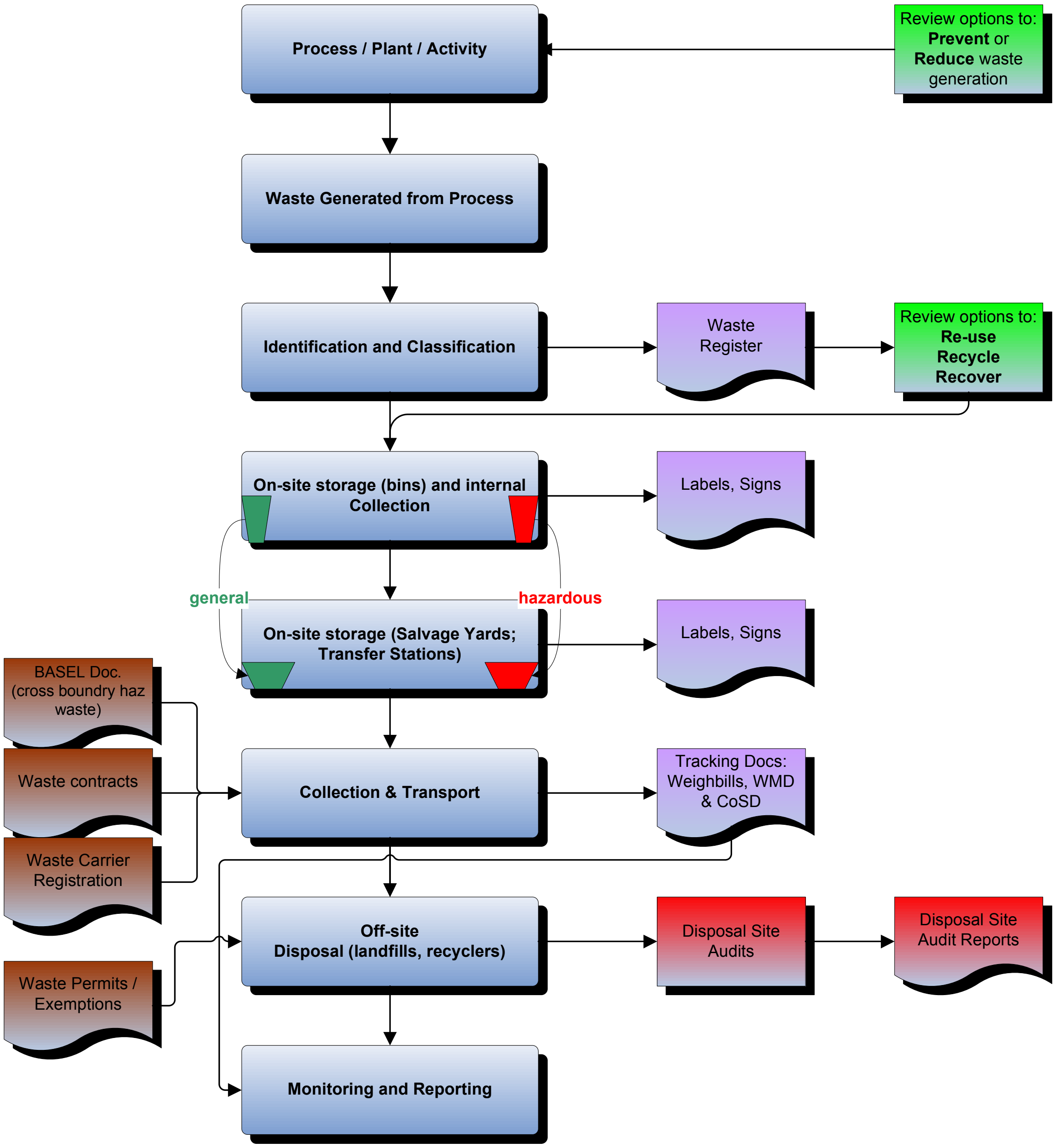

Figure 72: Waste Management Flowchart.

As far as is practicably possible, all waste will be separated so that it can be re-used, recycled or land filled appropriately, with and underlying objective to minimise waste to landfill. Bins for separate waste streams will be located around the Gope Project Site.

A Waste Storage Area is planned for all domestic type waste streams, with facilities to sort, compact, bail and store the wastes for transfer. A Salvage Yard is planned for operational and maintenance wastes, with facilities to sort the waste, and transfer the domestic type waste streams to the Waste Storage Area.

Degradable organic matter (vegetable food waste) will be composted for use on site. Non-recyclable waste will be land filled. As the mine is situated within a Game Reserve, there is a risk of animals burrowing into waste tailings or slimes facilities, and that there is the possibility that the tailings facilities may be re-mined in the future, there will be no land filling, burying or burning of wastes on site.

All hazardous wastes that requires final disposal and cannot be recycled on or off site will be disposed of at an authorised hazardous landfill. There will be no on-site disposal of hazardous waste. Areas within the Waste Storage Area and Salvage Yard will be designed and constructed to ensure that all hazardous wastes are contained to prevent exposure to the environment.

All wastes that are removed off site will be disposed at authorised/permitted disposal facilities in Botswana or South Africa (where suitable and authorised facilities are not available in Botswana).

10.2.2.14 Social Aspects

Implementation of policies associated with wellness, safety and security, and other areas, and following best practices as per mine operations elsewhere in Botswana and Southern Africa, would offer important benefits for the operation of the GDMP. Occupation Health and Safety rules and regulations would also be developed and implemented. Various recreational opportunities will be offered at the mine.

Having said this, the wellness programme should further consider extended actions intended to mitigate various social pathologies. Examples of this include:

- Extending wellness programme benefits to key family members (especially associated with HIV testing and AIDS-related services, but also alcohol abuse rehabilitation), and
- Dealing with issues around stigma and HIV/AIDS, discrimination and ethnicity, and conflict resolution.

10.2.2.14.1 Gender Issues

The arrival of men with money in Kaudwane on a bi-weekly basis raises a number of concerns about the impacts this will have on gender relations in the community. There are considerable fears in this respect, associated with a variety of social pathologies.

Given that gender stereotypes are likely to be well entrenched, open discussion needs to take place about the potential roles for males and females in terms of construction and mine employment. If possible quota systems should be avoided, as these are artificial and can cause resentment. However, if local community members decide on a quota system, it may certainly be adopted.

Additional mitigation agreed to with GEC, involves the increase of the number of collection and drop-off points to include Gaborone, Salajwe and Molepolole, in order to minimise this impact.

10.2.2.15 Regional Socio-Economic Structure

In order to create opportunities where secondary / by-products material (such as rock, sand etc) can be used for optimal utilisation, such additional applications need to be identified. As part of this process the following may serves as pointers:

- Identify secondary / by-products material e.g. rock for road surfacing and crushed stone for brick making and paving stone manufacturing, and
- Sand for silica for glass manufacturing.

Numerous other opportunities can be created on-site for which labour can be procured from the surrounding communities, including:

- Security work;
- Artisans and other manual labour (e.g. masonry work, pluming, etc.), and
- Drivers and labour transport enterprises.

Additionally, it can be considered to establish a vegetable farming community project in Kaudwane (or other surrounding settlement) for provision of fresh vegetables to the GDMP. This project, should it be implemented, is to be developed outside the CKGR, in order to minimise the impact of species invasion within the Game Reserve's footprint.

Although up- and downstream SMME development is not a direct responsibility of GEC, it would be prudent if an awareness of such opportunities is created with a local authorities relevant to the GDMP:

- The rehabilitation and sustainability of the natural environment can be enhanced through the use and creation of a nursery and seed collection programme. The nursery can supply indigenous plants for the rehabilitation of the Gope Project Site. Labour could be recruited to manage the nursery, creating work opportunities.
- Similar to the construction phase, people may be enticed to move to the immediately affected area as the opportunity for employment tends to create expectations. The possibility that squatting could take place is a reality – both at the mine, in Kaudwane and Lephepe. A management plan should stipulate the management of such an occurrence as is outlined in this report.
- Local authorities need to be sensitised regarding the potential impacts of mining project development. The potential impact of the establishment of economic activities could lead to an increased demand for housing. The local authority Spatial Development Framework (SDF) should be geared to direct such developments and ensure urban development takes place in an organised manor in Kaudwane. It can be expected that people will be attracted to the area

in search of employment. The subsequent demand for housing and ancillary social services could be addressed by:

  - Forecasting growth in housing demand at Kaudwane and/or Lephepe, and
  - GEC could assist the local authority in developing a spatial framework to guide and manage future expansions at Kaudwane and/or Lephepe.

- A Spatial Development Framework (SDF) also needs to be developed for the GDMP area. The SDF should address aspects such as:
  - Internal site configuration, and
  - Interaction / interface with the surrounding natural environment.
- The Social and Labour Plan of the mine should give directives to minimise the spread of the diseases and especially HIV/AIDS in the camp site and educate the workers of the disease:
  - The recreational facilities are important to ensure people are actively participating and not just lying around, and
  - A thorough audit needs to be completed of the unutilised / underutilised clinic / hospital facility at Kaudwane. A decision can then be made to upgrade these facilities.
- Towards the latter stages of the operational phase local economic strategies and plans should be devised to address sustainable livelihoods of the remaining affected communities. Inter alia the following is recommended:
  - SWOT analysis of the Gope area (Strengths, Weaknesses, Opportunities and Threats);
  - Sectoral analysis, highlighting opportunities in the local economy, and
  - A detailed audit and register to assist employees in finding alternative employment / starting up their own small businesses ventures

10.2.3 Decommissioning and Closure Phase

At closure, the EMP will have been implemented, and the monitoring and auditing process will have determined the degree of compliance or lack thereof.

Objective: To understand and implement a management plan that will reduce the impacts to an acceptable level, and to obtain a stand alone situation that emulates the existing landscape as closely as possible, and does not adversely impact on the area in general.

Table 125: Decommissioning and Rehabilitation Phase SEMP Summary.

IMPACT	CAUSE / ASPECT	OBJECTIVE	MANAGEMENT & MITIGATION PRACTICE	SCHEDULE OF ACTIONS	RESPONSIBLE PERSON	MONITORING REQUIREMENTS	CLOSURE OBJECTIVE
GEOLOGY							
Impacts on geology ceases.	• Cessation of mining operation.	• Ensure safety for animals and humans.	• Investigate the practicability of blasting of the lower reaches of the open pit to form vertical cliffs. • Allow erosion processes to take place.	Upon withdrawal of equipment and people of pit.	Operations manager.	• Visual inspection.	• Stabilisation of open pit. • Safe final landform.
SOILS							
Improvement of soil status and remediation of soil area.	• Rehabilitation, including soil emplacement, soil fertilisation and amendments, sloping and re-vegetation.	• Replace all stockpiled soils. • Create suitable growth medium for sustainable ecosystem.	• Effective soil emplacement and storage practices. • Fertilisation and amendments. • Soil amelioration. • Rock cladding, dust suppression methods, re-vegetation practices.	Ongoing throughout rehabilitation phase.	Project manager / Principle contractor.	• Visual inspection. • Measurement of dimensions. • Soil testing.	• Return land to wilderness conservation status or as close as possible to that.
LAND CAPABILITY							
Re-vegetation of Gope Project Site and all infrastructure.	• Rehabilitation of site.	• Remediate land to pre-mining land capability.	• Effective soil emplacement and storage practices. • Fertilisation and amendments. • Soil amelioration. • Finalisation of rehabilitation. • Topdressing of permanent features.	Ongoing throughout rehabilitation phase.	Project manager / Principle contractor.	• Visual inspection. • Measurement of dimensions. • Soil testing. • % Vegetation cover. • Ecosystem integrity.	• Return land to wilderness conservation status or as close as possible to that.
LAND USE							
Change of land use from mining to wilderness, resulting in an increase of natural habitat over the MLA.	• Rehabilitation of the site.	• Remediate Gope Project Site and return land to pre-mining land use as far as possible.	• Effective soil emplacement and storage practices. • Fertilisation and amendments. • Soil amelioration. • Finalisation of rehabilitation. • Topdressing of permanent features.	Ongoing throughout rehabilitation phase.	Project manager / principle contractor.	• Visual inspection. • Measurement of dimensions. • Soil testing. • % Vegetation cover. • Ecosystem integrity.	• Return land to wilderness land use or as close as possible to that.
FLORA							
Potential loss / degradation of local pristine vegetation / habitat	• Land transformation though additional infrastructure development (sprawl)	• Preserve as much pristine habitat as possible. • Limit and preserve ecological degradation where possible. • Ensure long term success of rehabilitation.	• Minimise GDMP footprint: - Use existing roads where possible. - Clear minimum vegetation. - Maximise site vegetation retention areas. - Erection of fence. • Preservation of vegetation. • Implementation of conservation practices. • Fire prevention. • Ensure implementation of final rehabilitation practices. • Ensure 60% vegetation cover.	Ongoing throughout rehabilitation phase.	Environmental officer.	• Visual inspections to ensure 60% vegetation cover.	• Competent ecosystem. • 60% Vegetative cover.
Alteration of natural ecological processes / ecosystem functioning	• Continued presence of residual infrastructure, erosion						
Introduction of species not associated with the region	• Rehabilitation of remaining dumps, dams, etc						
Changes in vegetation dynamics	• Remaining infrastructures, dumps & dams, peripheral impacts						
FAUNA							
Potential loss / degradation of local pristine faunal habitat and/or communities	• Land transformation though mine & associated infrastructure development	• Minimise land transformation.	• Ensure that pockets of vegetation increased due to rehabilitation process. • Limit impacts to the MLA.	Ongoing throughout rehabilitation phase.	Environmental officer.	• % Of land transformed.	• Rehabilitation of entire site. • Ensure a competent ecosystem.
Road deaths of animals on access roads	• Reckless driving and night-time driving on access roads	• Minimise road deaths of animals.	• Minimise number of vehicles accessing the site. • Vehicles are to yield to larger mammals. • Keep within the applicable speed limits.	Ongoing throughout rehabilitation phase.	Vehicle drivers. Environmental officer.	• Recording of animal deaths on roads in log book.	• Elimination of animal road deaths on roads.
Alteration of natural ecosystem functioning/ disruption of migration routes	• Land transformation though mine & associated infrastructure development	• Minimise land transformation. •	• Ensure pockets of vegetation increase in order to ensure ecological connectivity. • Limit impacts to the MLA.	Ongoing throughout rehabilitation phase.	Environmental officer.	• % Of land transformed.	• Rehabilitation of entire site.

IMPACT	CAUSE / ASPECT	OBJECTIVE	MANAGEMENT & MITIGATION PRACTICE	SCHEDULE OF ACTIONS	RESPONSIBLE PERSON	MONITORING REQUIREMENTS	CLOSURE OBJECTIVE
Increase in poaching, snaring and trapping of animals	• Increase in human habitation at the site and lack of environmental awareness	• Prevent poaching, snaring, trapping.	▪ Minimising the number of people on site. ▪ Fencing of site is to remain around permanent mining structures. ▪ Policing of boundary fence to continue until closure. ▪ GEC stipulated disciplinary action. • Warning signs. • Appointment of Honorary Game Wardens.	Ongoing throughout rehabilitation phase.	Environmental officer.	▪ Number of incidents recorded. • Inspections in area surrounding Gope Project Site of veld.	• Elimination of poaching, snaring and trapping.
Impact of chemical compounds from construction on animals	• Release of hazardous/ bio-accumulating chemicals into the environment	• Prevention of animal death / health hazard due to chemical contamination.	▪ Eliminate leaching of chemicals and remove all such chemicals from the Gope Project Site.	Ongoing throughout rehabilitation phase.	Environmental officer.	• Number of incidents recorded.	• Removal of all hazardous / bio-accumulating chemicals, effluents, leachates.
Attraction of animals to artificial surface water	• Large sources of artificial surface water introduced	• Prevention of ecological alteration.	▪ Evaporation of the water contained in the slimes dam and RWDs should be allowed.	Ongoing throughout rehabilitation phase.	Environmental officer.	• Size of open water sources.	• Elimination of open water sources.
Loss of natural faunal species to introduced faunal species	• Killing of small mammals by domestic cats and dogs	• Prevention of ecological alteration.	• Prevent introduction of foreign species to the CKGR.	Ongoing throughout rehabilitation phase.	Environmental officer.	• Inspections.	• Prevention of long term ecological alteration through introduction of foreign species.
SURFACE WATER							
Unstable land form resulting in increased erosion.	• As final side slopes as final post closure profile formed.	• Stabilisation of landforms.	• Flatten slopes to 18° and achieve recommended slope profile. • Vegetate all slopes and rock clad where necessary.	Ongoing throughout rehabilitation phase.	Environmental officer.	• Visual inspections.	• Stable landforms that blend with the surrounding area.
Increase in saline conditions in pit lake.	• Continued evapo-concentration of water resulting in increased saline conditions of the pit lake. • Suitability of water for consumption by game questionable.	• Minimising impact on surrounding ecology.	• Keep the bottom of the open pit dry as far as practicable. • Study to be implemented during operational phase on alternative strategies.	Ongoing throughout operational and rehabilitation phases.	Environmental officer.	• Visual inspections. • Water level monitoring.	• Mitigate open water source so as to limit impact on surrounding ecosystem.
Erosion of side slopes of the pit.	• Side slopes too steep, damage by game trying to access water into the pit.	• Stabilisation of landform.	• Leave the open pit area to become susceptible to erosional forces.	Ongoing throughout rehabilitation phase.	Environmental officer.	• Visual inspections.	• Stable landforms that blend with the surrounding area.
GROUNDWATER							
Recovery of groundwater level.	• Rainfall recharge to aquifer. • Cessation of mining activities.	• Re-instatement of groundwater aquifer.	• Natural process of rebound of aquifer. No mitigation / management measures can be implemented.	Ongoing throughout rehabilitation phase.	Environmental officer.	• Water level monitoring.	• Rebound of groundwater aquifer to sustainable levels.
Groundwater quality deterioration.	• Continued infiltration of contaminated water to the aquifer (TMF and slimes dam). • Continued natural infiltration of water into the pit lake exacerbated by high evaporation rates.	• Minimise groundwater contamination.	• Due to the slow movement of groundwater, the contaminants will largely be restricted to the immediate vicinity of the mine.	Ongoing throughout rehabilitation phase.	Environmental officer.	• Monthly groundwater quality monitoring.	• Leave aquifer uncontaminated.
AIR QUALITY							
Reduction in ambient air quality from fugitive dust emissions. Dust emissions resulting in respiratory and cardiovascular ailments. Reduced visibility, soiling of buildings and materials.	• Ongoing civil work from site rehabilitation. • Overburden & waste rock dumping. • Material transfer operations; • Wind erosion from exposed storage (stockpiles & mine residue deposits) piles; • Vehicle entrained dust from both paved and unpaved road surfaces;	• Reduce fugitive dust emissions to acceptable standards.	• Reduce extent of construction operation taking place, rather phase in (thus reduce exposure). • Use of windbreaks, chemical + water suppression. • Rock cladding of stockpiles / dumps on prevailing wind facing slopes. • Re-vegetate all areas that have reached finalisation and ensure a 60% vegetation cover is achieved.	Ongoing throughout rehabilitation phase.	Environmental officer.	• Ongoing dust fallout monitoring. • Annual audits.	• Elimination of fugitive dust and other sources of air contaminants.

IMPACT	CAUSE / ASPECT	OBJECTIVE	MANAGEMENT & MITIGATION PRACTICE	SCHEDULE OF ACTIONS	RESPONSIBLE PERSON	MONITORING REQUIREMENTS	CLOSURE OBJECTIVE
Reduced growth and production in vegetation and potential affect on sensitive areas.	• Remediation and rehabilitation		• Reduction of drop height as far as is practicable. • Reduction of speed of vehicles to keep within the applicable speed limit.				
Reduction in ambient air quality (land and air transportation).	• Exhaust fumes containing nitrogen, oxygen, carbon monoxide, water vapour, sulphur dioxide, nitrogen oxide, volatile hydrocarbons and polyaromatic hydrocarbons (PAHs) and their derivatives, acetylaldehyde, benzene and formaldehyde, carbon particles, sulphates, aldehydes, alkanes, and alkenes.		• Maintenance of vehicles. • Reduction of speed of vehicles to keep within the applicable speed limit. • Road maintenance. • Watering of haul roads.			• Ongoing dust fallout monitoring. • Annual audits. • Vehicle speed monitoring.	
PM, Carbon monoxide, VOC, nitrogen oxides - reduction in ambient air quality.	• Veld fires.	• Prevent fires.	• No pollution in the area (i.e. glass, cigarette buts). • Restrict fires from being made on site to designated areas only. • Maintain fire breaks.	Ongoing throughout rehabilitation phase.	Environmental officer. Camp manager.	• Ongoing inspections.	• No fires resulting from mining operation activities.
NOISE & VIBRATION							
Noise pollution	• Increase traffic flow (on-site). • Decommissioning activities (plant and associated building removal). • Final rehabilitation (i.e. slimes dam capping, remaining final slope and exposed areas rehabilitation).	• Minimise noise and vibrational impacts.	• All vehicles will be fitted with appropriate sound suppression devices or silencers. • Keep within the applicable speed limits. • All machinery used during decommissioning and closure will be maintained in sound mechanical condition.	Noise & vibration monitoring with each blast. Annual audits.	Mine manager.	• Annual audits. • Investigation of all noise complaints. • Monthly noise monitoring.	• Elimination of noise sources from the Gope Project Site.
ARCHAEOLOGY & HERITAGE							
Impact of mine closure and rehabilitation on the one grave situated outside of the mining footprint but inside the mine license area.	• Mine closure and rehabilitation activities.	• Preservation of historical and cultural sites.	• Maintenance of fencing. • Management of site. • Hand all keys to the sites to the family of the deceased and take fences down should the family require this.	Ongoing throughout rehabilitation phase.	Environmental manager. Mine manager.	• Legal compliance. • Compliance with procedure agreed with affected family.	• Safety of graves. • Access for family.
Impact of mine closure and rehabilitation on the five graves situated outside of the mine license area.	• Mine closure and rehabilitation activities.	• Preservation of historical and cultural sites.	• No mitigation required.	Not applicable.	Not applicable.	• Not applicable.	
Impact of mine closure and rehabilitation on the 11 settlements situated outside of the mining footprint but inside the mine license area.	• Mine closure and rehabilitation activities.	• Preservation of historical and cultural sites.	• No mitigation required.	Not applicable.	Not applicable.	• Not applicable.	• Preservation of cultural heritage.
Impact of mine closure and rehabilitation on the four settlements situated outside of the mine license area	• Mine closure and rehabilitation activities.	• Preservation of historical and cultural sites.	• No mitigation required.	Not applicable.	Not applicable.	• Not applicable.	
VISUAL ASPECT							
Change in land-use and available view	• Buildings and other structures (including residential structures, process plant and offices), including any signage erected during the construction and/or operational phases.	• Minimise visual impact and associated available view.	• At closure, all buildings and infrastructure that will not be re-used and handed over must be demolished and footprints rehabilitated to re-establish vegetation cover.	Ongoing monitoring throughout rehabilitation phase.	• Principle Contractor / Mine Manager	• Once-off at decommissioning with bi - annual monitoring of re-vegetation programme until 60% cover is achieved.	• At closure, all buildings and infrastructure that are not re-used and handed over must be demolished and footprints rehabilitated to re-establish vegetation cover.

IMPACT	CAUSE / ASPECT	OBJECTIVE	MANAGEMENT & MITIGATION PRACTICE	SCHEDULE OF ACTIONS	RESPONSIBLE PERSON	MONITORING REQUIREMENTS	CLOSURE OBJECTIVE
	• Material storage (sand dump, slimes dam, topsoil stockpiles and material stockpiles).		• All permanent mine residue stockpiles must be re-vegetated to establish a 60% vegetation cover.	• Once-off at decommissioning with bi - annual monitoring of re-vegetation programme until 60% cover is achieved.	• Principle Contractor / Operations Manager	• Visual Inspection	• All permanent mine residue stockpiles must be re-vegetated to establish a 60% vegetation cover.
WASTE MANAGEMENT							
Consumption of landfill space	• Generation and disposal of general waste (e.g. rubble) to landfill	• Removal and appropriate disposal of waste material.	• Recycling of wastes off site. • Use of rubble waste on site for future purposes.	• Ongoing throughout rehabilitation phase.	• Environmental Manager	• Visual inspect. • Site audit prior to application for closure.	• Removal of all waste material from the Gope Project Site. • Rehabilitation of mineralogical waste structures remaining on site.
Consumption of landfill space	• Generation and disposal of hazardous waste to landfill (e.g. oil-contaminated rubble)		• Cleaning rubble to reduce quantity of hazardous wastes.				
Contamination of soil & groundwater. Consumption of land space	• Burial of wastes on site (e.g. contaminated rubble)		• Off-site disposal at authorised facilities.				
Contamination of soil	• Temporary storage of hazardous wastes on unprotected ground (e.g. when decommissioning hazardous waste stores or chemical stores) • Hazardous waste spills		• Storage of hazardous wastes in containers. • Labelling of containers.				
Contamination of groundwater	• Disposal of hazardous wastes on general landfills		• Contactor control. • Traceability (documentation) and reconciliation of waste disposed.				
Litter - aesthetic impacts Litter - ingestion by animals	• Waste not contained and placed in suitable containers		• Provision of bins. • Management and of people/contractors.				
Odour – unpleasant and may attract pests and wildlife	• Waste not disposed of timeously or kept in closed containers		• Frequent removal of waste.				
SOCIAL							
Employment (mine specific).	• Creation of mine specific employment opportunities.	• Limit the negative impact associated with mine closure.	• Retirement packages, skills retooling as required. • Assisting with CVs and job seeking.	• Ongoing throughout rehabilitation phase.	• HR Manager	• Re-employment figures of GEC staff.	• Ensure that people have the tools and resources to seek new employment.
Employment (directly affected areas).	• Creation of employment opportunities not directly related to the mine itself.	• Limit the negative impact associated with mine closure.	• Focus on short term employment opportunities near communities.	• Ongoing throughout rehabilitation phase.	• HR Manager	• Community surveys.	• Ensure that people have the tools and resources to seek / create new employment.
Mine-community interface.	• Mine closure.	• Ensure the community is left with a safe and productive remaining environment.	• As local residents, Gope residents will be affected by decommissioning and rehabilitation arrangements. Of particular importance are safety aspects in terms of pit closure, and the removal of hazardous substances.	• Ongoing throughout rehabilitation phase. • End of phase audit.	• Environmental Manager.	• Stakeholder engagement and sign off.	• Ensure a safe, sustainable and productive site remains for community utilisation.
Impacts on Kaudwane.	• Secondary socio-economic benefits.	• Ensure the residents of Kaudwane are left in a better socio-economic position than prior to the mine construction.	• Finalisation of Community Action Plan projects. • Work with the community representative institutions. • Respond appropriately to negative social impacts.	• Ongoing throughout rehabilitation phase.	HR Manager.	• Stakeholder engagement and sign off.	• Ensure a self sufficient and sustainable community.
REGIONAL SOCIO-ECONOMIC STRUCTURE							
Decline in employment opportunities	• Reduction in national unemployment levels. • Limitation of forward and backward linkages (multiplier-effect).	• Mitigate effect of mine closure on local, regional and national economy.	• Downstream activities and local projects for future employment.	• Ongoing throughout rehabilitation phase.	HR Manager.	• Stakeholder engagement and sign off.	• Ensure a self sufficient and sustainable community.

10.2.3.1 Geology

During the decommissioning and closure phase of the GDMP, there will be no additional impacts on the geology. All operational activities will have ceased and all by-products and waste materials produced from the mining of the lithologies will have been utilized to their best potential (combining of tailings materials with soils to cover the sand dump, and the covering of the wind facing slopes on the TMF and sand dump with waste rock).

There will be no mitigation that can feasibly be undertaken to minimise or mitigate the impacts of open pit mining on the geology.

10.2.3.2 Soils

Soil related impacts during the decommissioning and closure phases, are positive in nature.

At closure, the management plan will have been implemented, and the monitoring and auditing process will have determined the degree of compliance or lack thereof.

The aim of the of the implementation of a soils management plan during this phase is to enhance positive impacts through remediation the site to a stand alone situation that emulates the pre-mining landscape as closely as possible.

10.2.3.2.1 Infrastructure Removal and Rehabilitation

The impacts on the soils may be mitigated with management procedures, including:

- The effective replacement of the soils once the site is no-longer needed or at closure of the GDMP. The mining plan will require that all facilities will be rehabilitated before closure can be achieved;
- The amelioration of the soils will enhance the capability of the soils and aid in the prevention of erosion and the sustainability of the vegetative cover.

10.2.3.3 Land Capability

The correct order of replacement of the soils and the preparation of an adequate seed bed will facilitate the re-vegetation program and will help to limit the potential for erosion, and will enhance the ability of obtaining a land capability of at least a grazing rating.

10.2.3.4 Land Use

During the decommissioning and closure phase, the land use is to remain mining, as the entire area would be in the process of undergoing rehabilitation. Therefore, the following management practices are to be implemented:

- All grazing animals should be kept off the entire area;
- Reduce the number of vehicles and people allowed onto the site, and
- Limit the amount of infrastructure on site to include only that infrastructure that is to remain post closure.

Provided that the correct management and mitigation measures were followed as outlined in this section, the area will revert back to its natural use as wilderness and is expected to be able to support limited grazing.

Regular inspection of the rehabilitated areas will be needed to make sure that a self sustaining condition is obtained.

10.2.3.5 Flora

Objectives during this phase will include the final rehabilitation of all areas of infrastructure to a status that will resemble a natural environment as far as possible. Towards this goal it is recommended that:

- All infrastructure be dismantled and removed to a suitable dumping site outside the CKGR;
- Rehabilitate surface conditions in areas of previous infrastructure to prepare for re-vegetation as per guidelines presented in the previous section;
- Re-vegetate areas as per guidelines presented in previous sections;
- Ensure monitoring and complete removal/ control of invasive and exotic vegetation;
- Continue with the environmental monitoring programme in order to ensure success of rehabilitation activities subsequent to cessation of all activities on the site; and
- Re-establish the fence so that only areas that cannot be rehabilitated are fenced in, thereby re-incorporating all areas that were successfully rehabilitated with natural outside areas.

10.2.3.6 Fauna

Since few personnel will remain on site during the decommissioning phase, the killing of animals on the roads are regarded as insignificant. However, all precautions should be taken in the event of entering the CKGR for any purpose of revisiting the site. Precautionary measures, as described in the previous section are applicable.

During the decommissioning phase the impact of poaching, snaring and trapping of animals are likely to diminish due to the decline in the number of people at the Gope Project Site and the potential impact therefore reduces. However, it is important that the same mitigations as during the construction and operational phases are applied.

Since all activities will have ceased subsequent to mining, the increase in chemicals in any surface water and soils are regarded an unlikely impact. However, areas might be present where contamination remains a significant threat to the fauna of the area. These areas should be treated in order to restore suitable environmental conditions.

Areas of open water must be limited and managed accordingly. Steep slopes of fine, silty soils should be avoided to protect birds drinking from getting stuck and drowning. The access to the pit is to be limited through the placement of rock material. Blasting of the sides of the open pit was indicated as a possibility of preventing any access to open water. This will not prevent animals from being attracted to the water; it is likely that their presence will be short-term. The ideal would be to prevent any surface water in the open pit. The possibility of filling the pit to a level above the permanent water level should be investigated and be seriously considered at the closure phase. Monitoring of animal movements during the operational phase will guide the recommendations pertaining to the open pit during this stage.

10.2.3.7 Surface Water

The mitigation strategy related to the erosion of stockpiles and dumps during the decommissioning phase will be as discussed before for the sandy slopes, with additional rock brought on to the benches formed by the roads as erosion protection for surface water runoff as and where required. Experience obtained on site during the operational phase will be used to optimise the final rehabilitation strategy.

The issue of the stability of the slopes remaining post closure has been discussed previously. In terms of surface water, the stability of the pit sides, in particular the upper sandy material, is important, with surface water one of the likely erosion mechanisms if the side slopes are not made stable in the long term.

In addition to keeping the bottom of the pit dry, it is proposed to minimise access to the open pit in as far as is possible. To serve this purpose, the design layout have been altered to ensure that mineralogical waste structures encircle the open pit as far as is possible. In areas where such an access barrier is not viable during the operational phase of the mine, dumping of rock material will take place to effect a similar (albeit lower) access barrier. In addition, the fence will remain post closure around the mining area to further limit access.

The general principles of shaping and stabilising the slopes post closure remains as indicated for the operational phase, since the principle is to implement rehabilitation during the operational phase and not to wait for closure. However, pit stability measures implementation will cease during the decommissioning phase. Access to the area will be prevented (in as far as is possible) for safety reasons and the area allowed to be subject to the natural processes of erosion. This will, in due time, aide in the natural filling of the open pit, thereby reducing the source of open water associated with the pit lake.

10.2.3.8 Groundwater

Groundwater abstraction will largely cease when mining is completed. The groundwater level will start to recover at this point, which is a positive impact. The final groundwater level elevation will be at 720 mamsl, which is some 210m below the pre-mining water level elevation. Post mining groundwater usage will only be for domestic purposes to supply the remaining camp. It is recommended that the borehole pumps be removed from the boreholes not required for further water supply and that these boreholes are capped for safety reasons. The dedicated monitoring boreholes are to remain open and the groundwater level recovery must be monitored on a quarterly basis for a period of approximately 3 years post closure.

Bi-annual monitoring of the groundwater quality is recommended until it can be shown that there is no further impact.

10.2.3.9 Air Quality

The impact on air quality will have significantly reduced by the commencement of the decommissioning and rehabilitation phases due to the reduction of activities associated with the GDMP, as well as the fact that many areas would have reached the required vegetation cover as part of the ongoing rehabilitation programme.

The same mitigation measures as outlined in the construction and operational phases are to be implemented where relevant.

10.2.3.10 Noise

Please refer to the Noise Management Actions and Strategies in section 10.2.1.11.

10.2.3.11 Sites of Archaeological and Cultural Interest

The impacts upon the grave sites are expected to diminish due to the limited number of people remaining at the Gope Project Site. The same mitigation / management measures as outlined in the operational phase SEMP, should be implemented.

During this phase consultation should again take place with the affected family. In consultation with them it may be decided to leave the grave fenced and locked and to supply them with all the copies of the gate keys.

10.2.3.12 Visual

During the decommissioning phase of the GDMP, the visual impact will start reducing significantly. However, the continuation of the management and mitigation programme is recommended:

- All buildings and structures that are not to be used post closure, are to be dismantled and the footprints rehabilitated, and
- All permanent mine residue structures are to be rehabilitated to achieve a vegetation cover of 60%.

10.2.3.13 Waste Management

The SEMP described for the operational phase of the mine applies to the closure. The type and quantities of wastes generated will change during this phase, but all requirements and principles outlined in the Waste Management Plan (Appendix 9) will still apply.

Should the waste stores be removed, the mine will need to ensure that the suitable facilities and waste receptacles are provided during this phase to ensure that waste, and in particular hazardous wastes, are contained to prevent the impacts that may arise from waste as described in previous sections of this report.

Inspections will be required to ensure that waste is managed in a responsible manner during this phase.

10.2.3.14 Social Aspects

As with all mining operations, it is inevitable that various social dependencies upon the GDMP would have developed during the LOM. In order to minimise the impact of mine closure on the project affected communities, the following mitigation / management measures are to be implemented:

Employment – Mine Specific:

- Retirement packages are to be effected;
- Skills retooling programmes are to be implemented;
- Assist employees with the compilation of CV's and job seeking.

Employment – Directly Affected Areas:

- Focus on short term employment opportunities associated with mine decommissioning and rehabilitation.

Gope Residents / Mine Community Interface:

- Ensure that the Community Action Plan has been implemented to its fullest impact.
- Ensure community safety with reference to the remaining mine infrastructure.
- Ensure that all hazardous chemicals have been removed.

Post Closure Land Use:

- It is important that stakeholder consultation would have been conducted towards the end of the operational phase, in order to finalise plans for the remaining land use post closure.
- Initial indications (at the time of compilation of this report) are that tourism is a favoured option for use of the remaining infrastructure.

10.2.3.15 Regional Socio-Economic Structure

Current building and infrastructure design should be done with a degree of sensitivity to potential alternative future use. The utilisation and maintenance of the accommodation and other structures at the site should consequently take place with this end in mind.

An alternative future use and plan should be commissioned including size of each individual building and structure (gross leasable floor area) and identification of possible alternate uses (i.e. wild life centre, weather and research centre, tourism centre and others).

The afore said skills register should be updated and distributed to the local authority and various employment agencies.

GEC should source expertise that could assist employees in identifying viable business opportunities; developing business plans and compile funding applications for such ventures. The mine could further more assist the Kaudwane local authority in funding a Local Economic Development Study. Miscellaneous on-site SMME opportunities could be created during the decommissioning phase for instance, rehabilitation of the mine site and tree planting.

10.3. POWER LINE

Due to the permanent nature of the power line structure, it is not envisaged that the power line would be removed and the linear impact remediated in its full extent. However, localised management and mitigation is required and the footprint rehabilitated where possible.

10.3.1 Design and Construction Phase

Table 126: Construction Phase SEMP Summary – Power Line.

IMPACT	CAUSE / ASPECT	OBJECTIVE	MANAGEMENT & MITIGATION PRACTICE	SCHEDULE OF ACTIONS	RESPONSIBLE PERSON	MONITORING REQUIREMENTS	CLOSURE OBJECTIVE
GEOLOGY							
No significant impacts anticipated.	• Not applicable.	• Not applicable.	• Not applicable.	Not applicable.	Not applicable.	• Not applicable.	• Not applicable.
SOILS							
Soils disturbance, loss of nutrients, loss of topsoil cover, loss of in situ structure and physical / chemical properties. Soil removal and / or disturbance (compaction, erosion & contamination).	• Access road and power line construction.	• Preservation of viable soil material.	• Stockpiling of top and subsoils for a short period until construction of the particular pylon is completed. • Limitation of extent of impacts to construction footprint only. • Prevention of hydrocarbon contamination of soils. • Spill clean up.	Ongoing throughout construction phase.	Project manager / Principle contractor.	• Visual inspection.	• Return land to wilderness conservation status or as close as possible to that, where possible.
Replacement of topsoils over affected areas.	• Environmental rehabilitation.	• Restoration of the environment.	• Appropriate rehabilitation of affected areas immediately after construction ceases.	Ongoing throughout construction phase.	Project manager / Principle contractor.	• Visual inspection.	• Return land to wilderness conservation status or as close as possible to that, where possible.
LAND CAPABILITY & LAND USE							
Change of land capability from wilderness to industrial land.	• Construction of power line and access road.	• Preservation of natural environment.	• Effective soil emplacement and storage practices. • Finalisation of rehabilitation. • Fertilisation and amendments. • Maintenance of natural vegetative cover along access route.	Ongoing throughout construction phase.	Project manager / Principle contractor.	• Visual inspection.	• Return land to wilderness conservation status or as close as possible to that where construction is completed.
Restoration of construction affected areas.	• Replacement of topsoils over affected areas coupled with seed sowing.	• Environmental rehabilitation.	• Appropriate rehabilitation of affected areas immediately after construction.	Ongoing throughout construction phase.	Project manager / Principle contractor.	• Visual inspection. • % Vegetation cover. • Ecosystem integrity.	• Return land to wilderness conservation status or as close as possible to that where construction is completed.
FLORA							
Destruction of floral communities.	• Construction of power line and access road. • Construction of construction camps.	• Preserve as much pristine habitat as possible. • Limit and prevent ecological degradation where possible. • Ensure long term success of rehabilitation.	• Walk though to identify and remove Red Data species. • Limit damage / pruning, cutting of trees in servitude / road.	Ongoing throughout construction phase.	Project manager / principle contractor.	• Visual inspections.	• Return as large an area to the natural habitat.
Changes in vegetation dynamics.	• Fires, wood harvesting, plant collection.						
Impacts on sensitive environments.	• Direct / indirect impacts, physical or cumulative.		• Avoid pans and other sensitive environments during the construction of the power line.				
Potential loss / degradation of local pristine vegetation / habitat.	• Land transformation through construction activities.		• Minimise power line footprint: - Use existing roads where possible. - Clear minimum vegetation. - Maximise site vegetation retention areas. - Erection of fence. • Preservation of vegetation. • Implementation of conservation practices. • Fire prevention. • Ongoing rehabilitation.				
Alteration of natural ecological processes / ecosystem functioning.	• Creation of atypical/ non-natural habitat, presence of humans for prolonged periods.						
Introduction of species not associated with the region.	• High traffic volume between site & other areas.						
Changes in vegetation dynamics.	• Fires, water, vegetation transformation.						
FAUNA							

IMPACT	CAUSE / ASPECT	OBJECTIVE	MANAGEMENT & MITIGATION PRACTICE	SCHEDULE OF ACTIONS	RESPONSIBLE PERSON	MONITORING REQUIREMENTS	CLOSURE OBJECTIVE
Loss and degradation of faunal habitat.	• Construction of power line and access road. • Construction of construction camps.	• Minimise footprint of power line impacts.	• Minimise footprint of power line and associated infrastructure.	Ongoing throughout construction phase.	Project manager / principle contractor.	• Visual inspections.	• Return as large an area to the natural habitat.
Electrocution of birds.	• Power line infrastructure.	• Reduce number of bird deaths resulting from the power line.	• Installation of perching brackets.	Once off during construction phase.	Project manager / principle contractor.	• Visual inspections. • Record number of bird deaths recorded.	• Perching brackets are to remain and be maintained regularly.
SURFACE WATER							
Construction through sensitive landscapes.	• Power line construction through pans.	• Avoid all surface water features.	• Avoid all surface water features.	Once off during construction.	Project manger / principle contractor.	• Visual inspections.	• Preservation of surface water features (i.e. pans).
GROUNDWATER							
No significant impacts anticipated.	• Not applicable.	• Not applicable.	• Not applicable.	Not applicable.	Not applicable.	• Not applicable.	• Not applicable.
AIR QUALITY							
No significant impacts anticipated.	• Not applicable.	• Not applicable.	• Not applicable.	Not applicable.	Not applicable.	• Not applicable.	• Not applicable.
NOISE & VIBRATION							
Increased ambient noise levels	• Construction of the power line infrastructure	• Mitigate noise & vibration impacts as far as practicable.	• Construction activities will only take place during day time hours.	Noise complaints are to be investigated.	Project manager.	• Monitor number of complaints received from surrounding communities.	• Eliminate noise disturbances.
	• Use of diesel generators at contractor's camps, workshops and equipment storage areas		• On-site generators should be clad in suitable material or housed in structures that would reduce their noise impacts. • Generators will be fitted with appropriate silencers.				
	• Increase traffic flow		• All vehicles will be fitted with appropriate sound suppression devices or silencers.				
ARCHAEOLOGY & HERITAGE							
Impact of construction of power line on two low significant archaeological sites situated within the line footprint.	• Establishment of power line.	• Preservation of historical and cultural sites.	• No mitigation measures required.	Not applicable.	Not applicable.	• Not applicable.	• Not applicable.
Impact of construction of power line on two archaeological sites situated outside the line footprint.	• Establishment of power line.						
VISUAL ASPECT							
Change in land use and available view resulting form the construction of the power line.	• Construction of the power line.	• No mitigation possible.	• No mitigation possible.	Not applicable.	Not applicable.	• Not applicable.	• Not applicable.
WASTE MANAGEMENT							
Consumption of landfill space.	• Generation and disposal of general waste.	• Optimisation of resources.	• Recycling of wastes off site.	Ongoing throughout construction phase.	Environmental officer.	• Volume of waste land filled.	• Elimination of waste generation.
Contamination of soil and groundwater.	• Generation and disposal of hazardous waste to landfill.	• Optimisation of recycling practices.	• Recycling of wastes off site (e.g. oils).	Ongoing throughout construction phase.	Environmental officer.	• % of oils recycled.	• Elimination of waste generated.

IMPACT	CAUSE / ASPECT	OBJECTIVE	MANAGEMENT & MITIGATION PRACTICE	SCHEDULE OF ACTIONS	RESPONSIBLE PERSON	MONITORING REQUIREMENTS	CLOSURE OBJECTIVE
Health risks – exposures to hazardous waste.	• Burial of wastes on site.	• Mitigation of contamination of ground- and surface water resources.	• On-site disposal of organic food waste only. • Disposal to an authorised site / transport to Gope Project site for appropriate waste handling & disposal.	Ongoing throughout construction phase.	Environmental officer.	• Visual inspections.	• Land filling of organic food waste only.
	• Temporary storage of hazardous waste on unprotected ground. • Hazardous waste spills.	• Prevention of soil contamination.	• Storage of hazardous wastes in containers. • Labelling of containers.	Ongoing throughout construction phase.	Environmental officer.	• Visual inspection. • Incident register.	• Elimination of all soil contamination. • Rehabilitation of affected soils.
	• Disposal of hazardous wastes on general landfills.	• Mitigation of contamination of groundwater resources.	• Disposal to an authorised site / transport to Gope Project site for appropriate waste handling & disposal. • Contactor control. • Traceability (documentation) and reconciliation of waste disposed.	Ongoing throughout construction phase.	Environmental officer.	• Incident register.	• Preservation of groundwater aquifer. • Rehabilitation of groundwater aquifer if required.
	• Waste not contained and placed in suitable containers.	• Litter prevention.	• Provision of bins. • Management and of people.	Ongoing throughout construction phase.	Environmental officer.	• Litter management programme. • Visual inspections.	• Removal of litter associated with the power line construction activities.
	• Waste not disposed of timeously or kept in closed containers.	• Elimination / management of unpleasant odours / attraction of pests and wildlife.	• Frequent removal of waste.	Ongoing throughout construction phase.	Environmental officer.	• Regularity of waste removal. • Auditing.	• Removal of all waste associated with the power line construction activities.
SOCIAL							
Employment in surrounding communities.	• Construction of power line.	• Maximisation of positive benefit.	• Optimise the utilisation of unskilled and semi-skilled labour from directly affected communities.	Ongoing throughout operational phase.	HR Manager.	• Number of people employed: - Employees from directly affected community. - Local employees. - Expatriates.	• Skills development for long term sustainability. • Empowered community.
HIV& AIDS in surrounding communities.	• Construction of power line.	• Minimising infection rates.	• Contracting firms required to engage in enhanced HIV/AIDS response. Consider contracting local partner NGO skilled in the HIV/AIDS prevention and response arena.	Ongoing throughout operational phase.	Community liaison manager.	• Staff participation in voluntary HIV/Aids programmes. • Sick days above expected median. • Staff productivity.	• Increased awareness around HIV/Aids.
Power line.	• Construction of power line.	• Maximise social benefits to affected communities.	• Provision of road signage, speed limits, passing areas. • Provide temporary employment during construction. • Road safety interventions. • Litter prevention and management.	Ongoing throughout construction phase.	Community liaison manager.	• Community surveys. • Annual audits.	• Positive socio-economic benefit to communities.

10.3.1.1 Geology

The construction of the power line will not have any impact on the geological strata underlying the route, due to the depth of the Kalahari sands. Therefore no mitigation and/or management measures are proposed.

10.3.1.2 Soils

In mitigation of the impacts, the stockpiling of the material excavated from the pylon foundations will need to be stockpiled alongside each excavation. This will be for a very short time and will therefore not require protection. Once construction of the specific pylon is completed, the disturbed areas are to be rehabilitated through replacement of the removed soils onto affected areas, followed by seeding with the recommended seed mix.

The construction camps will be kept to existing disturbed sites wherever possible, and all vehicles will be equipped with “drip trays” and serviced regularly so as to reduce the potential for hydraulic fluids and oils leaking onto the soils. All sumps will be equipped with these facilities.

10.3.1.3 Land Capability

The area to be disturbed during the construction phase, is to be limited in as far as possible, as this would the impact on alteration of the land capability. For this reason, it is proposed that no new camps be established during the construction phase, but rather, that the existing governmental camps along the route be used in as far as is possible.

10.3.1.4 Land Use

Mitigation of the impacts of the power line will be difficult as the existing access route is a public thoroughfare and will continue to be used by the general public during and after the mine has closed down. The power line will inevitably be used by alternative projects after the mining venture is completed.

10.3.1.5 Flora

Prior to construction commencing, a final walkthrough of power line servitude should be undertaken, with specific focus on ensuring that no Red Data species occur at the sites that will be directly impacted (i.e. where pylons will be places and at tentioner stations). This is to be undertaken by a suitably qualified specialist.

Limit damage/ pruning/ cutting of trees in power line servitudes to a minimum.

10.3.1.6 Fauna

The mitigation of the loss and degradation of pristine faunal habitat is unlikely to be practicable along the power line route. Impacts are to be geographically limited by prohibiting habitat degradation or destruction other than the directly affected areas (i.e. pylons and tentioning stations).

The following measures are proposed to lessen the likelihood of electrocution of raptors in the power line:

- Electrocution of large eagles will be of low probability, as they generally perch on the highest point of a structure, in this case at the top of the pole, well clear of any conductors. They are also solitary species and only one bird will perch per pole (mate is likely to perch on next pole), and
- Electrocution of vultures is high probability since they are gregarious, and will try to perch more than one bird on a pole, this will lead to birds trying to perch on the stand off insulators in addition to the top of the pole. This will place them at risk of a phase-phase electrocution (clearance is 1.8m and vultures can bridge this with wings spread) and/or a phase-earth electrocution (clearance is 1.4m which is even more likely to be bridged). A partial mitigation measure for this is to install the Eskom ‘Bird Perch’ or ‘Perching Bracket’ (picture attached) to the top of the pole. It will require a vertical extension of the pole to raise the perch above the earth wire. This will provide more perching space for birds well above live hardware, hopefully meaning that birds perch there, rather than trying to perch on insulators below. This should be fitted to all poles along the line in natural habitat and away from disturbance. It is probable that some electrocutions would still take place – so it is essential that the line is monitored regularly once operational to detect if problem still exists.

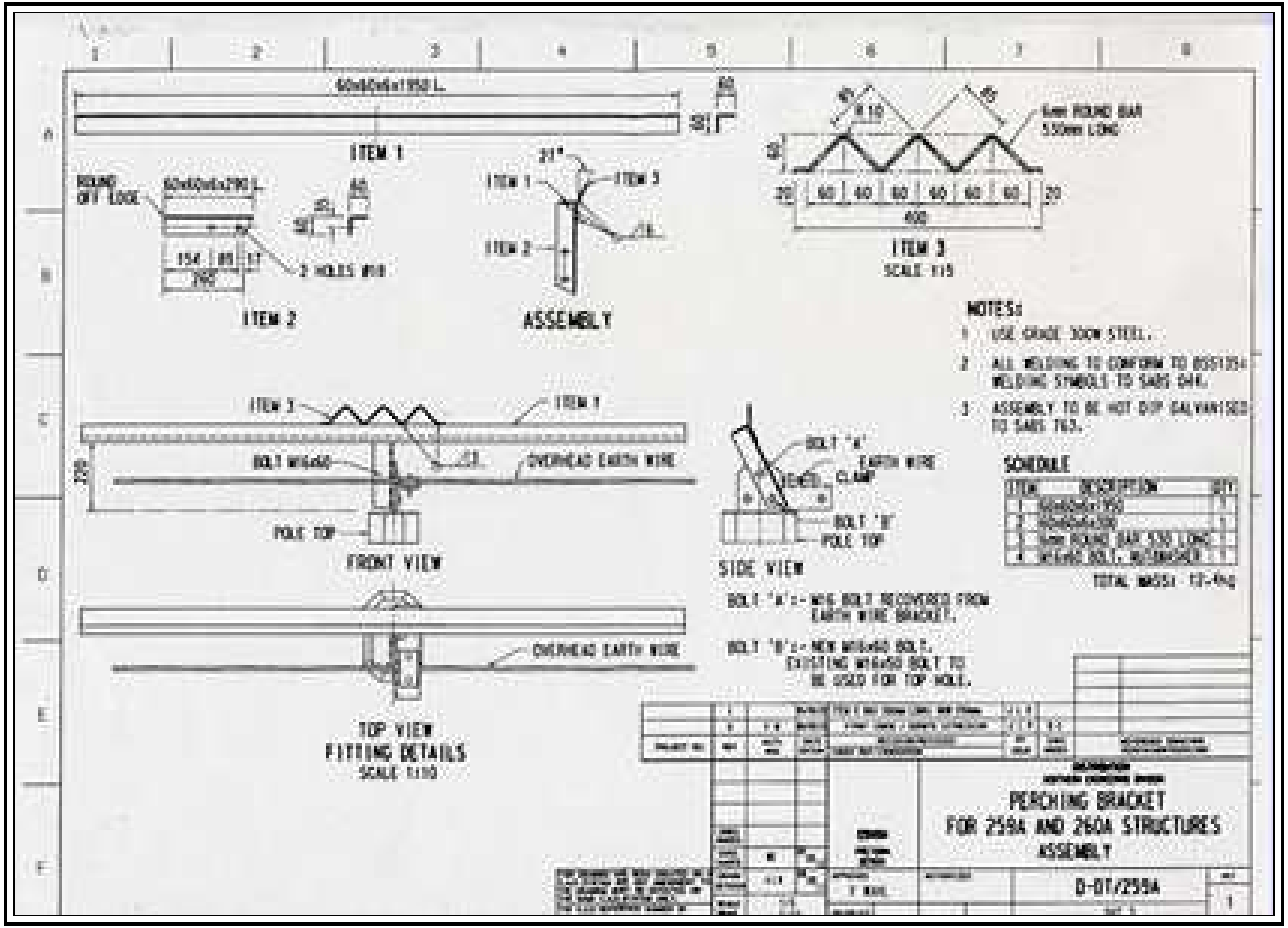

Figure 73: Schematic Drawing of the Perching Bracket.

10.3.1.7 Surface Water

During construction activities, vegetation will be removed for the power line and access road servitude, as well as at construction camps. The removal of vegetation could result in additional erosion through water and wind action and may result in elevated suspended solids content of water draining from the affected areas.

Diesel, oils and sewage are all components of the construction of the power line that may result in the contamination of surface water runoff.

Mitigation of the impacts will include the following:

- Removal of vegetation will be limited to the areas of direct impact along the power line route and access road as far as is practical;
- Vehicle access will be restricted to immediate area of construction;
- Pans and any other water courses located within the vicinity of the power line route will be avoided and the power line routed around such structures;
- Existing road infrastructure will be used as far as possible to limit the required construction of access roads;
- Diesel and oil stored at the construction camps will be stored in drums or tanks and within a bunded and lined area, so as to minimise the risk of spillage to the environment;
- Regular inspections will be undertaken of the diesel and oil storage areas, and if any spillage of hydrocarbons takes place it will be treated in situ or soils affected by the spill will be removed, and
- The portable toilets will be regularly inspected, specifically during emptying and final removal of the units.

10.3.1.8 Groundwater

No groundwater impacts are anticipated to occur during the construction or operation of the power line. Therefore, no groundwater mitigation or management measures are proposed.

10.3.1.9 Air Quality

Particulate emissions during construction phase are anticipated to be a major source of pollution, there area a number of ways that these emissions can be reduced or eliminated to reduce the loss of material. The simplest and most cost effective method when using unpaved roads is to reduce the speed at which the construction vehicles travel. By keeping the speed below 40 km/h inside the CKGR and within the speed limits agreed to with the Department of Roads on roads outside the CKGR, there is a significant reduction in the dust entrainment from bigger vehicles.

By also limiting the number of unnecessary vehicles travelling on unpaved roads will also reduce the dust problem.

The minimum amount of vegetation should be removed to accommodate construction, including the maintenance and construction roads.

10.3.1.10 Noise

The preferred method for controlling noise from stationary sources is to implement noise control measures at the source. Methods for prevention and control of sources of noise emissions are dependant on the source and proximity of receptors.

The following noise reduction mitigatory options are required to keep noise levels within the legislative limits:

- Construction activities to be conducted during daylight hours only;
- Ensure the required silences are fitted on all engines and compressors;
- Ensure that all vehicles keep within the applicable speed limits;
- Regular maintenance of heavy equipment, vehicles and earth moving machinery;
- On site generators should be clad in suitable material or housed in structures that would reduce their noise impacts, and
- Any noise complaints received will be subject to a complaints management system that provides for the assessment and management of the complaint.

10.3.1.11 Sites of Archaeological and Cultural Interest

Only two archaeological sites were found within the footprint of the power line. These are however regarded as insignificant and therefore no mitigation or management measures are proposed.

10.3.1.12 Visual

No mitigation or management measures are recommended.

10.3.1.13 Waste Management

There will be no permanent waste storage facilities for the construction of the power lines and therefore the contractors erecting the power lines will need to ensure that all waste generated is contained and removed from the staff camps and power line erection sites as the lines are erected. Waste can be transported to the Gope Project Site for waste handling, should this be practicable.

The following requirements apply:

- Where possible waste to be separated for recycling, including scrap metals and spent oils;
- Separate bins to be provided for general wastes and hazardous wastes;
- Hazardous wastes bins must adequately contain wastes to prevent seepage;
- Maintenance of vehicles / machinery where the potential of hydrocarbon spillages is present must be done in such a manner to prevent such spillages. This includes the use of drip trays to collect oils and greases;
- Contaminated soils arising from spillages to be collected and disposed of as hazardous waste;
- Medical wastes to be separate and stored in purpose designed medical waste bins and transported to a registered incinerator or to the GDMP for handling;
- Vegetation cleared must be minimised and restricted to working areas and are to be left to degrade naturally;
- Littering, dumping, burying and burning of any waste not allowed;
- Empty waste containers that previously contained hazardous wastes may not be given/sold to staff or the public;
- Waste must be disposed at registered disposal sites or transported to the Gope Project Site for the appropriate handling and disposal;
- Records of waste disposed to be maintained, and
- Inspections along the power line and areas used for the power line construction camps will need to be inspected one the construction phase is complete to verify that waste has been cleared. Inspection records to be kept on file.

10.3.1.14 Social Aspects

As part of the Social Impact Assessment conducted along the power line route, it was determined that no negative social impacts were expected to result from the construction of the power line. However, it is advised that consultation with the directly affected households are undertaken to ensure the safety of these residents. In addition, an extend road safety campaign should be undertaken to cover the power line road.

10.3.1.15 Regional Socio-Economic Structure

The power line is a dedicated project to the current design and is tailored for the capacity needs of the GDMP. Subsequent spin-off benefits during the operational phase are limited. The power line for all intense purposes will not negatively interfere with the flow of economic goods and services. No economic mitigation or enhancement measures are proposed.

10.3.2 Operational Phase

Table 127: Operational Phase SEMP Summary – Power Line.

IMPACT	CAUSE / ASPECT	OBJECTIVE	MANAGEMENT & MITIGATION PRACTICE	SCHEDULE OF ACTIONS	RESPONSIBLE PERSON	MONITORING REQUIREMENTS	CLOSURE OBJECTIVE
GEOLOGY							
No significant impacts anticipated.	• Not applicable.	• Not applicable.	• Not applicable.	Not applicable.	Not applicable.	• Not applicable.	• Not applicable.
SOILS							
Soil Disturbance and possible degradation due to compaction along access route.	• Use of access road for maintenance purposes.	• Not applicable.	• No mitigation proposed as the maintenance road is currently a public road and will be continued to be used as such.	Not applicable.	Not applicable.	• Not applicable.	• Not applicable.
LAND CAPABILITY & LAND USE							
Change of land capability from wilderness to industrial land.	• Operation of power line and access road.	• Not applicable.	• Maintenance of natural vegetative cover along access route.	Quarterly inspections.	ECO.	• Quarterly visual inspections.	• Not applicable.
FLORA							
No significant impacts anticipated.	• Not applicable.	• Not applicable.	• SEMP Guidelines, limited clearing of vegetation during ongoing maintenance	Ongoing throughout operational phase.	ECO.	• Quarterly visual inspections.	• Not applicable.
FAUNA							
Electrocution of birds.	• Power line infrastructure.	• Reduce number of bird deaths resulting from the power line.	• Installation of perching brackets.	Ongoing monitoring and maintenance of the perching brackets during the operational phase.	Project manager / principle contractor.	• Visual inspections. • Number of bird deaths recorded.	• Perching brackets are to remain and be maintained regularly.
SURFACE WATER							
Surface water contamination through hydrocarbon spillage.	• Maintenance of power line.	• Prevent all hydrocarbon spillages. • Prevent surface water contamination.	• Implementation of hydrocarbon material management practices.	Ongoing throughout operational phase.	Project manager / principle contractor.	• Visual inspections. • Incident register.	• Rehabilitation of all hydrocarbon spills.
GROUNDWATER							
No significant impacts anticipated.	• Not applicable.	• Not applicable.	• Not applicable.	Not applicable.	Not applicable.	• Not applicable.	• Not applicable.
AIR QUALITY							
No significant impacts anticipated.	• Not applicable.	• Not applicable.	• Not applicable.	Not applicable.	Not applicable.	• Not applicable.	• Not applicable.
NOISE & VIBRATION							
Increased ambient noise levels.	• Power line noise generation (humming).	• Mitigate noise & vibration impacts as far as practicable.	• Construction activities will only take place during day time hours.	Noise complaints are to be investigated.	Project manager.	• Monitor number of complaints received from surrounding communities.	• Eliminate noise disturbances.
	• Increase traffic flow (BPC maintenance vehicles).		• All vehicles will be fitted with appropriate sound suppression devices or silencers.				
ARCHAEOLOGY & HERITAGE							
Impact of the operation of the power line on two archaeological sites situated outside the line footprint.	• Operation of power line	• Preservation of cultural and historical sites.	• No mitigation measures required	Not applicable.	Not applicable.	• Not applicable.	• Not applicable.
VISUAL ASPECT							

IMPACT	CAUSE / ASPECT	OBJECTIVE	MANAGEMENT & MITIGATION PRACTICE	SCHEDULE OF ACTIONS	RESPONSIBLE PERSON	MONITORING REQUIREMENTS	CLOSURE OBJECTIVE
Change in land use and available view resulting form the construction of the power line.	• Construction of the power line.	• No mitigation possible.	• No mitigation possible.	Not applicable.	Not applicable.	• Not applicable.	• Not applicable.
WASTE MANAGEMENT							
No significant impacts anticipated.	• Not applicable.	• Not applicable.	• Recycling of maintenance waste. • Appropriate waste handling practices. • Disposal to an authorised site or transported to the Gope Project Site for appropriate handling and disposal.	Not applicable.	ECO.	• Not applicable.	• Not applicable.
REGIONAL SOCIO-ECONOMIC STRUCTURE							
Employment opportunities	• Reduction in unemployment • Forward and backward linkages	• Maximise benefits to surrounding community.	• Optimise the utilisation of unskilled and semi-skilled labour from directly affected communities.	Annual.	ECO.	• Community interviews.	• Not applicable.
Infrastructure	• Development of roads, electricity, houses, social, health and educational facilities		• Infrastructure should be accessible to local economic activities, if and where possible.				

10.3.2.1 Geology

There are no mitigation or management measures needed, as the geology will not be impacted during the operational phase.

10.3.2.2 Soils

There are no mitigation measures that can minimise the impacts on the soil as the existing access route is a public thoroughfare.

10.3.2.3 Land Capability

There are no mitigation measures that can minimise the impacts on the land capability during this phase of the project.

10.3.2.4 Land Use

There are no mitigation measures that can minimise the impacts on the land use during this phase of the project.

10.3.2.5 Flora

There are no mitigation measures that can minimise the impacts on the floral communities during this phase of the project.

10.3.2.6 Fauna

The only management or mitigation measure that can be implemented during this phase of the power line's life is the maintenance of the perching brackets. These are to be inspected by BPC quarterly in order to ensure the effective mitigation of the electrocution impact.

10.3.2.7 Surface Water

Once the construction phase is completed, the presence of the power line is not expected to have a further impact on surface water quality and/or quantity. Point source surface water impacts could result from vehicle accidental spillage during usage of the access road, however this impact is classified as minimal and the implementation of an emergency response procedure should be undertaken. No other management or mitigation measures are required.

10.3.2.8 Groundwater

No groundwater impacts are anticipated to occur during the construction or operation of the power line. Therefore, no groundwater mitigation or management measures are proposed.

10.3.2.9 Air Quality

Very little dust pollution is expected during this phase as only occasional maintenance will be undertaken on the power line. As the power line route currently experiences occasional vehicular movement, no mitigation or management measures are recommended.

10.3.2.10 Noise

The preferred method for controlling noise from stationary sources is to implement noise control measures at the source. Methods for prevention and control of sources of noise emissions are dependant on the source and proximity of receptors.

The following noise reduction mitigatory options are required to keep noise levels within the legislative limits:

- Enforce a 40 km/hr speed limit for all vehicles inside the CKGR and within the speed limit agreed upon with the Department of Roads along the roads outside the CKGR;
- Regular maintenance of heavy equipment, and maintenance vehicles, and
- Any noise complaints received will be subject to a complaints management system that provides for the assessment and management of the complaint.

Measurement method to ensure implementation of actions:

- Annual Audits;
- Increased noise levels will result from faults on the line itself. Such faults will be monitored by BPC and corrected promptly in order to ensure operational efficiency. Therefore, no noise monitoring is recommended along the power line route, and
- However, should regular noise complaints be received, the ECO shall investigate all noise complaints and assessed to determine if the noise is unreasonable. All complaints will be recorded and kept on file, and a decision will be taken to implement noise monitoring, should this be required.

10.3.2.11 Sites of Archaeological and Cultural Interest

There is no mitigation or management measure recommended for the operational phase of the power line.

10.3.2.12 Visual

No mitigation or management measures are recommended.

10.3.2.13 Waste Management

A minor quantity of waste will be generated during the operational phase where maintenance of the power lines is required. There will be no waste storage facilities along the power lines, and therefore all maintenance waste that is generated must be removed and disposed at registered disposal sites or to the Gope Project Site for appropriate waste handling and disposal.

The following additional requirements apply:

- General and hazardous wastes to be separated;
- Vegetation cleared may be left to degrade naturally;
- Vegetation cleared must be minimised and restricted to working areas;
- Littering, dumping, burying and burning of any waste not allowed;
- Empty waste containers that previously contained hazardous wastes may not be given/sold to staff or the public;
- Waste must be disposed at registered disposal sites, and
- Records of waste disposed to be maintained.

10.3.2.14 Social

No operational social enhancement or mitigation measures are proposed pertaining to the operation of the power line.

10.3.2.15 Regional Socio-Economic Structure

No operational socio-economic enhancement or mitigation measures are proposed pertaining to the operation of the power line.

10.3.3 Decommissioning and Closure Phase

It is not anticipated that the power line infrastructure will be removed. Therefore, no management and mitigation plan has been compiled for this phase of the project life cycle.

The use of the power supply infrastructure is to be investigated closer to the time of this phase commencing. Excess capacity may exist to accommodate numerous additional low key activities in the decommissioning phase. Discussions with farmers, CKGR management and other interested parties can identify possible future use for the electricity supply. Electricity connections to identified users could create additional economic value chain (down stream) opportunities.

10.4. ACCESS ROAD

10.4.1 General Management Practices

The following general management practices are recommended for both the construction and operational phases of the access road component of the GDMP project:

- Appointment of an ECO:
  As stipulated in the enacted EIA legislation, it is necessary that the project be monitored through out its construction and operation periods. In view of this, an ECO should be appointed prior to project implementation to monitor the implementation of the mitigation measures proposed and react to any other unanticipated impacts.
- Appointment of a resident engineer
  For the rapt attention of the environmental issues raised in this report, it is important that the road and drainage engineers who will be in charge of the overall project should include in their responsibilities in terms of the EMP the following issues:
  - Familiarize themselves with the environmental code of ethics and the mitigation measures outlined in this EMP;
  - Oversee the project activities on site and manage the environmental activities prescribed herein;
  - Ensure that all mitigation measures proposed in this section of the report are adequately carried out;
  - Ensure that other sub-contractors adhere to the specific code of conduct provided for their activities at the site and else where, and
  - While using resources that the people of beneficiary villages depend on such as water, the engineer shall ensure that his demand on this resource does not place the residents in jeopardy thereby causing conflicts.
- Rehabilitation / Decommissioning of Borrow Pits
  The recommended pits for borrowing should be rehabilitated progressively during road construction. The rehabilitation activity and process should take into consideration the aesthetics of the area and safety of people and animals. This is particularly important given the fact that beneficiary villages are mostly livestock farmers. This should therefore be brought to the attention of the contractors at the time of tendering. The Tender Documents must make this requirement mandatory. We therefore recommend to the client that final payment should be made only when the borrow pits have been rehabilitated.
- Health Education
  The environmental health factors and related diseases are of concern to the project and needs to be managed. These include those related to the physical environment such as air and noise pollution and social ones such as sexual transmitted diseases such as HIV/AIDS. Air pollution through fugitive dust could cause irritation of respiratory tracts or respiratory

diseases. The influx of workers in to the project area could potentially lead to the increase of STDs.

- Waste Removal

  It is envisaged that a large volume of waste will be generated during the construction phase of the project especially with regards to road scarifying process. Wastes from this activity should be disposed off at recognized dumps in the project environs. Spoils from the road especially excess gravel and other earth material could be used as filling material for the borrow pits. Like wise waste from construction camps should be collected and dumped at recognized dumping sites.

  Waste that would be generated from machineries (oil and fuel) should be contained and as much as possible prevented from entering the pans that exist along the road and drainage alignments.

- Road Safety

  One important issue needing critical management during the operation of the infrastructure is road safety. It is unavoidable that there would be both motorised and non-motorised users of the road of which majority of the pedestrians would be residents of Lephepe or other populated areas. It is important that extensive educational campaigns be carried out for the public on the safety issues relating to road traffic. There is also the need to enforce the road traffic regulations to deter drivers and pedestrians from recklessness, and careless use of the road. Cattle owners should also be educated on the need to monitor the movements of their cattle at all times especially at locations closer to the road reserve. Drivers should also be educated and alerted that the proposed road is within a wildlife and livestock area so they should drive cautiously and plan their trips along the road properly.

10.4.2 Design and Construction Phase

The detailed SEMP is presented in Table 128.

10.4.2.1 Climate

No mitigations pertaining to the climatic aspect of the environment is proposed.

10.4.2.2 Geology

Further investigation into viable sources of aggregate is to be undertaken.

Table 128: Summary of the Access Road SEMP.

Phase/Activities/Process	*Environmental Issues or aspect*	*Environmental Actions/Mitigation measures*	*Estimated Cost*	*Implementing Agency*
Pre-Construction *(application for permits)*	*Land Allocation* *Borrow pits* *Quarry sites*	*Ensure that the following clearances have been obtained;* *✓Archaeological Clearance Letter* *✓Clearance from the Department of Environmental Affairs* *✓Land Rights for borrowing or quarrying materials* *✓Clearance letter from Mines Department for earth materials to be borrowed.* *✓Restoration plans of borrow pits prepared.*	*Part of Total Project cost*	*Appointed Contractor*
Pre-Construction *(Environmental supervision)*	*The project EMP*	*✓ Oversee implementation of the mitigation measures and monitoring*	*Part of EMP monitoring cost*	*Appointed Environmentalist*
Pre-Construction *(Mobilization)*	*Air Pollution* *Water pollution* *Land Pollution* *Noise nuisance*	*✓ Ensure that all construction equipment and vehicles are in good condition.* *✓Silencers are attached to heavy machines to reduce noise pollution.*	*Part of Total Project cost*	*Appointed Contractor*
Pre-Construction *(Recruitment of labour force)*	*Employment* *Skilled and unskilled labour* *Gender balance*	*✓Adhere to the Labour laws of the country* *✓ Ensure a fair criterion for selection of labourers* *✓ Ensure both men and women are equitably employed.* *✓ Satisfactory working package is provided to motivate workers to be productive and give out their best.*	*Part of Total Project cost*	*Appointed Contractor*
Pre-Construction *(Planning for the collection, sorting, storage and disposal of waste materials)*	*Waste Management*	*✓ Use approved waste disposal sites for rubbish and rubbles identified.* *✓ Identify type of waste which could be re-used or recycled* *✓Acquire sufficient numbers of waste bins (skip hire), portable toilet facilities, Wave Sanitation. etc)* *✓ Site and locate a bonded area where fuel, materials, etc could be kept and controlled to prevent pollution and fire risk.*	*Part of Total Project cost*	*Appointed Contractor*

Phase/Activities/Process	Environmental Issues or aspect	Environmental Actions/Mitigation measures	Estimated Cost	Implementing Agency
Pre-Construction *(Develop strategies of Minimising hazards to workers' safety and health)*	*Health and Safety Issues*	✓ *Preparation for health education of workers to be employed including posters, acquisition of condoms etc.* ✓ *At least 2 First Aid Kits equipped with basic drugs and painkillers.* ✓ *Protective gear like overall, hand gloves, boots, earplugs, nose masks etc in sufficient numbers should be purchased.* ✓ *Proposed camping sites is planned to be of hygienic standards.*	*Part of Total Project cost*	*Appointed Contractor*
Pre-Construction *(Water withdrawal)*	*Water Use*	✓ *Monitoring water consumption*	*Part of Total Project cost*	*Appointed Contractor*
Pre-Construction *(Movement of machinery and preliminary earth works)*	*Traffic and safety*	✓ *Adequate road signs prepared or purchased to be placed at strategic points to warn on-coming vehicles from both approaches of the road.*	*Part of Total Project cost*	*Appointed Contractor*
Pre-Construction *Camping facilities*	*Game Poaching*	✓*Purchase portable camping facilities for road crews*	*Part of Total Project cost*	*Appointed Contractor*
Pre-Construction Phase *Road alignment*	*Ecological disturbance*	✓*Road to be aligned close to the existing fire break (east of Dibete veterinary fence)* ✓*The veterinary fence along the boundary with CKGR be closed* ✓*A manned gate be introduced at the current entrance in to the CKGR* ✓*The introduced gate should be specifically for authorised people going to the mine* ✓*Tourists to be advised to use designated points for visiting the Game Reserves*	*Part of Total Project cost* *Costs from Government budget (veterinary office)* *Costs from Government budget (DWNP)* *-*	*Appointed Design Engineer* *Department of animal health* *Division of Parks* *-*
Construction/ *Operation Phase*	*Noise Pollution* *Air Pollution*	✓ *Silencers are attached to heavy machines to reduce noise pollution or noise-suppressing*	*Part of Total Project cost*	*Appointed*

Phase/Activities/Process	*Environmental Issues or aspect*	*Environmental Actions/Mitigation measures*	*Estimated Cost*	*Implementing Agency*
(vegetation clearance, soil excavation, transportation of construction materials)	*Water pollution* *Land Pollution*	*mechanism is attached to machineries.* *✓Minimizing emissions and odours from construction activities.* *✓Soil erosion is reduced and controlled.*		*Contractor*
Construction Phase *(Opening up of access routes to Borrow pits)*	*Borrow pits* *Quarry sites*	*To ensure that:* *✓Access tracks to borrow pits/quarry sites have been identified or created in a safe manner.*	*Part of Total Project cost*	*Appointed Contractor*
Construction/ Operation Phase *(Movement of machinery and earth works)*	*Traffic and safety*	*✓Adequate road signs are placed at strategic points to warn on-coming vehicles from both approaches of the road.*	*Part of Total Project cost*	*Appointed Contractor*
Construction Phase *(Orientation of the workforce)*	*Training of Labourers*	*✓ Training on the job of local artisans by the contractor* *✓ A workers committee is formed to put forward workers grievances.* *✓Educate workers to save money or invest for long term gains* *✓Arrange that workers are paid on time.*	*Part of Total Project cost*	*Appointed Contractor*
Construction Phase *(Collection, sorting, storage and disposal of waste materials)*	*Waste Management*	*All recyclable materials (cans, boxes) must be separated for recycling.* *✓Acquire sufficient numbers of waste bins (skip hire), portable toilet facilities,* *✓Good practice to ensure that the site compresses of a bonded area where fuel, materials, etc could be kept and controlled to prevent pollution and fire risk.*	*Part of Total Project cost*	*Appointed Contractor*
Construction Phase *Siting of road crew camps*	*Game Poaching*	*✓ Road crews to be accommodated in portable camps and none should be sited inside CKGR* *✓Only authorised people allowed at the camps* *✓An Honorary Game Warden is to be appointed at each construction camp and fulfil such duties for the duration of the construction phase.*	*Part of Total Project cost*	*Appointed Contractor*

Phase/Activities/Process	*Environmental Issues or aspect*	*Environmental Actions/Mitigation measures*	*Estimated Cost*	*Implementing Agency*
Decommissioning Phase (Closure of borrow pits)	*Borrow pits*	✓*Ensure that progressive rehabilitation of borrow pits is done*	*Part of Total Project cost*	*Appointed Contractor*

Source: EHES, 2008

10.4.2.3 Soils

Topsoils are to be stripped and stockpiled for use in the rehabilitation of the borrow pits.

Drainage ditches should be provided as appropriate to direct runoff away from the road so as to protect the road. The impact of potential erosions is regarded as low post the implementation of the said mitigation measure.

10.4.2.4 Land Capability & Land Use

No mitigation measures regarding land capability and land use are proposed. However, the construction activities should disturb only the minimum area that is required.

10.4.2.5 Flora

The clearing of vegetation is to be limited to the areas of direct impact only and the footprint of the road is to be kept as small as possible.

The significance of the construction of the road post the implementation of the above stated mitigation is regarded to be low.

10.4.2.6 Fauna

Due to the increased number of vehicles that will be travelling on the access road, coupled with the increased speed at which these vehicles will be able to travel, is expected to result in an increase of animal deaths on the access road.

Driving at night should be prohibited without exception (except for medical emergencies). Secondly, a speed limit of 40 km/h should be enforced inside the CKGR and to the applicable speed limit on roads outside the CKGR. Any transgressions of above-mentioned measures must be subjected to the appropriate GEC disciplinary action.

10.4.2.7 Surface Water

Drainage ditches should be provided as appropriate to direct runoff away from the road so as to protect the road.

10.4.2.8 Groundwater

The ECO should ensure that oil baths are used if repairs are to be undertaken at site. The residual impact is regarded to be of low negative significance.

10.4.2.9 Air Quality

The watering of roads reduces the amount of dust generated as a result of vehicle entrainment.

As the amount of water required may vary from month to month due to the changes in potential evaporation rates for that period, the rate of water application would need to be altered for each month of the year. In the event that the acquisition of water for the use as a dust suppressant is not possible, the following alternative methods can be deployed:

- Chemical suppression: Although water is still required for the making of the mixture, the frequency of application will reduce, thus the amount of water required will also reduce proportionately. Some of the chemical suppressants readily available for use in South Africa are Dust-A-Side, SDS 2 and SDS 4 supplied by 3M, SoilTac and Durasoil supplied by Soil and Dust Solutions;
- Application of gravel: This will result in the reduction of available silt which can be entrained by vehicles making use of these roads, however continued maintenance by the reapplication of gravel periodically would be required in order to ensure the maximum control efficiency is achieved, and
- Reduction of vehicle speed to 40 km/h inside the CKGR and to the applicable speed limit on roads outside the CKGR.

10.4.2.10 Noise

The contractor should as much as possible minimize noise generation by using silencers in machinery. The DWNP are to be consulted and informed of the operational periods of construction. The residual impact is expected to be of medium significance.

10.4.2.11 Sites of Archaeological and Cultural Interest

Although no archaeological artefacts were found during the impact assessment stage, it is likely that these may be found when the earth is exposed. An archaeologist should be part of the environmental monitoring team.

10.4.2.12 Visual

No mitigation measure pertaining to the visual aspects of the environment is proposed.

10.4.2.13 Waste Management

Waste bins and toilet facilities are to be provided at the site and should be strategically located. These are to be emptied regularly.

10.4.2.14 Social Aspects

Impacts associated with in-migration, HIV/AIDS, and other social pathologies were noted above. The road will have serious negative impacts on affected communities in these respects, unless efficiently mitigated. There are, nevertheless, a number of positive impacts associated with the development of the road, including improvements in access (including access to the settlement at Gope), as well as increased traffic and therefore better opportunities to find transport.

Mitigation activities associated with in-migration, HIV/AIDS, and other social pathologies were noted. Enhancement activities associated with employment were noted above. For the road, mitigation activities associated with road signage, speed limits, and other interventions based on the advice of the Botswana Road Safety Council would be required, coupled with enforcement of road regulations and road safety education in directly-affected communities. In addition, given Botswana's serious litter problem, and consistent with recommendations in the CKGR Management Plan, institute systems designed to reduce litter along the roads to Gope (e.g., provide paper rubbish disposal bags free of charge to vehicles, make the mine a plastic bag free environment, etc.). Borrow pits have also been proven to be desired landscape features in communities, as these provide dams resulting from surface water runoff for the community to utilize as livestock watering points.

10.4.2.15 Regional Socio-Economic Structure

Employment opportunities will be associated with the construction of the access road. In order to enhance the positive impact that this will have on the local communities, recruitment should be done fairly (as outlined in the GEC recruitment policy) and in a transparent manner.

Labour as much as possible should be sought first from the villages in the proximity of the access road.

Where practically possible goods and services needed during construction should be obtained from villages along the access road particularly to boost the local economy.

In order to prevent an increase in accidents as a result of the construction activities, signs indicating the constructional activities should be placed about 100m away from both approaches to inform motorists.

Where possible the area under construction should be blocked to keep intruders away.

10.4.2.16 Traffic

A speed limit of 40 km/h is to be enforced along roads inside the CKGR and the relevant speed limit on roads outside the CKGR. Sign boards advising travellers of the speed limit should be placed at regular intervals.

Night time driving is to be prohibited, except in cases of medical emergency.

10.4.3 Operational Phase

No other mitigation measures are proposed for the operational phase of the access road.

However, traffic and social mitigation measures outlined in the construction phase should be implemented for the duration of the operational phase of the road.

It is not expected that the road will be rehabilitated and therefore, no assessment for a decommissioning and/or rehabilitation phase was undertaken or an SEMP compiled for such an eventuality.

10.5. ENVIRONMENTAL AWARENESS PROGRAMME

A detailed Environmental Awareness Programme (EAP) is required to be developed for the GDMP.

The objectives of the EAP are outlined below:

- Ensure that all employees, contractors, subcontractors and visitors (hereafter referred to as GDMP employees) have the specific skills, knowledge and competency levels to enable the achievement of the objectives of the GDMP's Environmental Policy;
- Ensure that GDMP employees acquire an understanding of the sensitive environmental conditions associated with the Gope Project Site;
- Ensure that GDMP employees understand the relevant legislative and CKGR permit conditions pertaining to environmental protection;
- Ensure that GDMP employees with direct responsibility for activities relevant to the project's social and environmental performance understand the potential impacts and mitigation / management measures relating to their activities;
- Ensure continuous improvement of the effectiveness of environmental management and mitigation measures at the Gope Project Site, and
- Ensure that GDMP employees are cognisant of the GEC prescribed disciplinary actions that may be imposed in cases of transgression from the site rules and regulations.

All people arriving at the Gope Project Site will undergo environmental awareness training as part of the mine's induction programme. In depth training will be given to those managers / supervisors who may, as a result of their activities on site, have a direct impact on the environment. Refresher courses are to be attended on a regular basis, coupled with mine wide ongoing environmental awareness campaigns.

The Australian Environmental Protection Agency outlines the following principles of effective environmental awareness:

Table 129: Effective Environmental Awareness Programmes.

PRINCIPLE	SUCCESS FACTOR	BEST PRACTICE	PERFORMANCE MEASURE
Communication	Method	• Personal communication for important messages. • Communication is consistent with organisational values and business strategy. • Multi-media communication.	• Degree of management / supervisor involvement in ongoing training
	Use of Local Language Mix	• Use of local languages and terminologies.	• User understanding. • Formal communication effectiveness evaluation.

	Style	• Limited use of jargon / acronyms. • Sensitivity to local customs / taboos.	• User understanding. • Effort made to tailor information to local customs.
	Frequency	• Frequent communication. • Regular organisational initiatives.	• Frequency and mix of communications and initiatives.
Urge	Employee Receptiveness	• Employees are receptive to / initiate environmental initiatives.	• Number of environmental initiatives and ideas. • Number of employee volunteers. • Independent surveys / audits.
	Manager Receptiveness	• Recognition off potential to impact on the environment. • Attempts to use the EMS. • Salary reviews include environmental KPIs.	• Presence of an EMS. • Number of environmental performance complaints. • Independent surveys / audits.
	Resources	• Large percentage of resources is spent on EMS & EAP.	• Environmental training and awareness budget as a % of total budget.
	Support	• Comprehensive EAP and training.	• Environmental training and awareness budget as a % of total budget.
Leadership	Commitment	• Corporate and mine specific environmental policy.	• Presence of environmental policies.
	Accountability	• Accountability at senior management level. • Specific accountability to managers / employees in all areas.	• Presence of a system to validate accountability.
	Personal Demonstration.	• Senior management are actively involved in supporting and maintaining environmental initiatives.	• Employee's perception of manager's personal commitment to environmental aspects.
Team Work	Shared Environmental Vision and Values	• Explicit shared values / goals / vision in environmental policy.	• Environmental policy statement including values statement.
	Self Managing Teams	• Multi-disciplinary teams include team members with environmental skills.	• Number of teams including environmentalists.

Understanding	Knowledge	• Employees are able to understand local and global environmental impacts. • Multi-media approach to EAP. • Annual induction / refresher programme.	• Benchmarking of level of understanding. • Employee exposure to environmental awareness raising tools.
	Skills	• Employees understand the rationale behind environmental impacts. • Development of procedures to reduce impacts.	• Application of knowledge to solve environmental issues. • Development of procedures.
Recognition	Acknowledgement	• Organisational acknowledgement for environmentally responsible initiatives.	• Presence of system to acknowledge environmentally responsible initiatives.
	Reward	• Use of reward(s) as a tool to encourage cultural change.	• Mix and type of cultural change rewards.
Empowerment	Recognition of Responsibility	• Environmental team in support role and they are consulted where impacts are likely.	• Documented consideration of environmental impacts in key management decisions.
	Authorisation	• Delegation of responsibility to employees. • Guidance notes on how to undertake environmental initiatives.	• Evidence of employee initiatives.
	Resource	• Funds allocated with consideration of operational cost / benefit and organisational image.	• Number of initiatives supported.

10.6. Social and Environmental Monitoring Plan

Monitoring is directed to measure environmental performance in terms of key environmental issues identified and assessed as part of the SEIA. In order to ensure that a monitoring programme is effective it must consist of the aspects detailed in Figure 74.

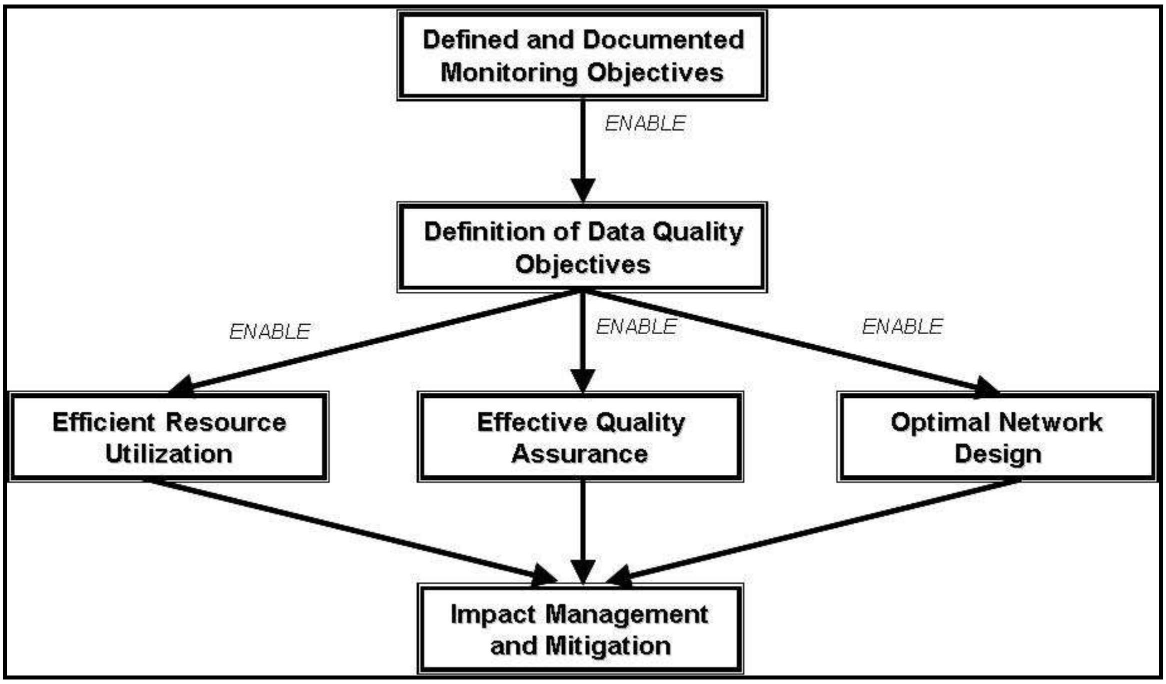

Figure 74: Monitoring Programme Requirements.

10.6.1.1 Environmental Effects Monitoring

When the objectives of the monitoring program require that actual effects be determined, environmental effects monitoring is required. Environmental effects monitoring has been defined as the repetitive measurement of environmental parameters to test specific hypotheses of the effects of human activity on the environment (LGL Ltd. et al 1984). Conover (1985) added to this definition the notion that environmental monitoring measures changes for the purpose of establishing cause-effect relationships. The following is a definition of environmental monitoring (EIA for Developing Countries):

> *"Environmental effects monitoring is the repetitive and systematic measurement of the characteristics of environmental components to test specific hypotheses of the effects of human activity on the environment. Environmental monitoring is undertaken primarily to determine the environmental effects of human activities, and secondarily to increase understanding of cause effect relationships between human activity and environmental change."*

The implications of this definition are that:

- Environmental monitoring programs should involve repetitive sampling over a number of years;
- Environmental monitoring programs should be scientifically rigorous and be based on testable hypotheses;
- Sampling programs designed to test the hypotheses should be such that the results may be used to detect temporal trends and/or spatial differences, and
- Environmental monitoring programs should attempt to establish empirical links between human activities and their effects on the environment.

Environmental effects monitoring programs provide the necessary information to verify the accuracy of SEIA predictions and to determine the effectiveness of measures to mitigate adverse effects of projects on the environment. Feedback from environmental monitoring programmes may be used to determine whether more or less stringent mitigation measures are needed, and improve the predictive capability of EIAs.

The evaluation of monitoring results is necessary to ensure that environmental objectives are achieved and, if necessary, that project modifications or remedial measures are undertaken to address unforeseen impacts. Environmental monitoring thus aims at providing feedback about the actual environmental impacts of a project.

10.6.1.2 Compliance Monitoring

Compliance monitoring is a commonly practiced form of environmental monitoring. The purpose of compliance monitoring is to ensure that the quality or quantity of an environmental component is not altered by a human activity beyond a specified standard of regulation level. An example of compliance monitoring is a sampling programme conducted by either industry or government to ensure that concentrations of a contaminant do not exceed a specified level either in the effluent or in the receiving waters. Implicit in compliance monitoring is the assumption that if the characteristic being monitored is within acceptable limits, then the effects will be within acceptable limits. Compliance monitoring is not concerned with determining actual effects.

10.6.1.3 Key Objectives of the GDMP Monitoring Programme

The key objectives of the monitoring programme are therefore to:

- Measure against baseline for the required environmental parameters;
- Measure the accuracy of predicted impacts;
- Evaluate the effectiveness of identified aspect specific environmental mitigation measures and review / adjust the management and mitigation measures where and if required;
- Recognise changes and trends in the environmental conditions and enable the analysis of their causes in order to maintain and improve the mitigation, and

- Measure compliance to the EMP and legal standards and enable the improvement of practices and procedures for environmental protection and social enhancements.

In order to ensure that a monitoring programme complies to quality assurance standards it is essential that all programmes comply with the following standards:

- Measurements should be accurate, precise and credible;
- Data should be representative of the actual site conditions;
- The results should be comparable and auditable;
- The measurements should be consistent over time;
- The rate of data capture should be appropriate to the parameter being monitored;
- Resources should be sufficient to the monitoring requirements (appropriately skilled and sufficient capacity), and
- Ensure that the monitoring programme is continually improved.

Table 130: Summary of Monitoring Plan

IMPACT	LOCATION	PARA-METER TO BE MONITORED	OBJECTIVE	KEY PERFOR-MANCE INDICATOR	RESPONSI-BILITY	FRE-QUENCY OF MONITO-RING	RE-SOURCES	REPORTING STRUCTURE	THRES-HOLD OR EXISTING STAN-DARDS	MITIGATION	RECOM-MENDED ACTION IF THRES-HOLDS IS EXCEEDED
Groundwater quantity.	- Each borehole drilled around open pit perimeter. - Exact locations to be determined subsequent to detailed geophysical surveys.	Groundwater level.	- Improve understanding of aquifer. - Measure actual impacts upon groundwater. - Determine effectiveness of mitigation measures. - Determine level of risk. - Determine groundwater path way and impact site.	Records of groundwater levels.	Environmental officer.	Monthly.	Groundwater monitoring programme, estimated at P30 000 / month.	Signed off by Environmental officer. Governmental audits: - Bi-annual – DWA, DWMPC. - Annual – DEA.	None.	None proposed.	None proposed.

IMPACT	LOCATION	PARA-METER TO BE MONITORED	OBJECTIVE	KEY PERFOR-MANCE INDICATOR	RESPONSI-BILITY	FRE-QUENCY OF MONITO-RING	RE-SOURCES	REPORTING STRUCTURE	THRES-HOLD OR EXISTING STAN-DARDS	MITIGATION	RECOM-MENDED ACTION IF THRES-HOLDS IS EXCEEDED
Groundwater quality	- Potential leachate from WRD. - Potential contamination from the open pit. - Potential leachate from TMF. - Potential leachate from slimes dam. - Potential biological contamination from sewage works. - Potential contamination from EMV workshop. - Ambient / background value borehole.	BOS / WB: - pH. - TDS. - Sodium. - Potassium. - Calcium. - Iron. - Chloride. - Sulphate. - Nitrate. - Fluoride.	- Identify potential sources of pollution. - Measure actual impacts on groundwater. - Determine effectiveness of mitigation measures. - Determine level of risk. - Determine groundwater pathways and impact sites.	Records of groundwater quality.	Environmental officer.	Monthly.	Groundwater monitoring programme, estimated at P30 000 / month.	Signed off by Environmental officer. Governmental audits: - Bi-annual – DWA, DWMPC. - Annual – DEA.	- Existing conditions – refer to Table 33. - Additionally: BOS and World Bank Standards. Refer to Table 128.	- Implement recommended waste management systems. - Manage inorganic substances on surface to prevent groundwater impacts. - All potential contaminants to be contained and managed at point source.	- Remediate groundwater aquifer using appropriate methods.

IMPACT	LOCATION	PARA-METER TO BE MONITORED	OBJECTIVE	KEY PERFOR-MANCE INDICATOR	RESPONSI-BILITY	FRE-QUENCY OF MONITO-RING	RE-SOURCES	REPORTING STRUCTURE	THRES-HOLD OR EXISTING STAN-DARDS	MITIGATION	RECOM-MENDED ACTION IF THRES-HOLDS IS EXCEEDED
Groundwater quality	- Potential contamination from the open pit. - Potential contamination from EMV workshop. - Ambient / background value borehole.	BOS / WB: - Total hydrocarbons	- Identify potential sources of pollution. - Measure actual impacts on groundwater. - Determine effectiveness of mitigation measures. - Determine level of risk. - Determine groundwater pathways and impact sites.	Records of groundwater quality.	Environmental officer.	Quarterly.	Groundwater monitoring programme, estimated at P30 000 / month.	Signed off by Environmental officer. Governmental audits: - Bi-annual – DWA, DWMPC. - Annual – DEA.	- World Bank Standards. Refer to Table 128.	- Implement recommended waste management systems. - Manage inorganic substances on surface to prevent groundwater impacts. - All potential contaminants to be contained and managed at point source.	- Remediate groundwater aquifer using appropriate methods.

IMPACT	LOCATION	PARA-METER TO BE MONITORED	OBJECTIVE	KEY PERFOR-MANCE INDICATOR	RESPONSI-BILITY	FRE-QUENCY OF MONITO-RING	RE-SOURCES	REPORTING STRUCTURE	THRES-HOLD OR EXISTING STAN-DARDS	MITIGATION	RECOM-MENDED ACTION IF THRES-HOLDS IS EXCEEDED
Surface water quantity.	- Man made surface water structures.	- Water level. - Available freeboard.	- Assess and quantify potential sources of pollution. - Assess level of potential impacts upon receiving environment. - Measure levels of acceptable change. - Determine the level of risk. - Monitor impact upon sensitive receptors.	Records of dam levels.	Environmental officer.	Monthly.	Surface water monitoring programme, estimated at P30 000 / month.	Signed off by Environmental officer. Governmental audits: - Bi-annual – DWA, DWMPC. - Annual – DEA.	Exceedance of 1:50 year flood event level.	- Increase water consumption. - Discharge to receiving environment only in emergency conditions where uncontrolled discharge becomes a threat.	- Increase water consumption. - Discharge to receiving environment only in emergency conditions, where uncontrolled discharge becomes a threat.

IMPACT	LOCATION	PARA-METER TO BE MONITORED	OBJECTIVE	KEY PERFOR-MANCE INDICATOR	RESPONSI-BILITY	FRE-QUENCY OF MONITO-RING	RE-SOURCES	REPORTING STRUCTURE	THRES-HOLD OR EXISTING STAN-DARDS	MITIGATION	RECOM-MENDED ACTION IF THRES-HOLDS IS EXCEEDED
Surface water quality.	Man made surface water structures, i.e. RWD.	BOS / WB: - pH. - TDS. - Sodium. - Potassium. - Calcium. - Iron. - Chloride. - Sulphate. - Nitrate. - Fluoride.	- Assess and quantify potential sources of pollution. - Assess level of potential impacts upon receiving environment. - Measure levels of acceptable change. - Determine the level of risk. - Monitor impact upon sensitive receptors.	Records of groundwater quality.	Environmental officer.	Monthly.	Surface water monitoring programme, estimated at P30 000 / month.	Signed off by Environmental officer. Governmental audits: - Bi-annual – DWA, DWMPC. - Annual – DEA.	- Existing TDS levels.	- Limit areas to be stripped of vegetation. - Minimise wind and water erosion. - Slope stabilisation. - Implementation of surface water management structures.	- Increase soil erosion prevention measures until TDS falls within acceptable levels.

IMPACT	LOCATION	PARA-METER TO BE MONITORED	OBJECTIVE	KEY PERFOR-MANCE INDICATOR	RESPONSI-BILITY	FRE-QUENCY OF MONITO-RING	RE-SOURCES	REPORTING STRUCTURE	THRES-HOLD OR EXISTING STAN-DARDS	MITIGATION	RECOM-MENDED ACTION IF THRES-HOLDS IS EXCEEDED
Noise	- In areas prone to noise generation within the MLA. - At identified sensitive receptor sites.	Noise level.	Reduction and control of noise levels generated.	Noise records.	Environmental officer.	Monthly. Annual audits.	Noise monitoring programme, estimated at P100,000 / annum.	- Signed off by Environmental officer. - Annual governmental audits.	55 dB(A) and the night time is 45 dB(A).	- Maintain machinery & vehicles in good condition. - Placement of mineralogical waste structures to limit noise propagation. - PPE supplied to workers. - Fitment of silencers where appropriate.	Determine source(s) of noise. Increase noise reduction measures where required.

IMPACT	LOCATION	PARA-METER TO BE MONITORED	OBJECTIVE	KEY PERFOR-MANCE INDICATOR	RESPONSI-BILITY	FRE-QUENCY OF MONITO-RING	RE-SOURCES	REPORTING STRUCTURE	THRES-HOLD OR EXISTING STAN-DARDS	MITIGATION	RECOM-MENDED ACTION IF THRES-HOLDS IS EXCEEDED
Air quality.	Along site boundary within 2 km of fence.	- Dust fallout.	- Adherence to regional best practice standard.	Records of air quality.	Environmental officer.	Continuous.	Air quality monitoring programme, estimated at P50 000 / month.	- Signed off by Environmental officer. - Annual governmental audits.	1,200 mg/m^2/day.	- Use wind breaks. - Chemical and water dust suppression. - Rock cladding. - Re-vegetation. - Reduction in drop heights. - Keeping within applicable speed limits.	Requires investigation and remediation if two sequential months exceed this level or more than three months / annum exceed this level.

IMPACT	LOCATION	PARA-METER TO BE MONITORED	OBJECTIVE	KEY PERFOR-MANCE INDICATOR	RESPONSI-BILITY	FRE-QUENCY OF MONITO-RING	RE-SOURCES	REPORTING STRUCTURE	THRES-HOLD OR EXISTING STAN-DARDS	MITIGATION	RECOM-MENDED ACTION IF THRES-HOLDS IS EXCEEDED
Air quality.	Along site boundary within 2 km of fence.	- PM10.	- Adherence to legislated standards.	Records of air quality.	Environmental officer.	Continuous.	Air quality monitoring programme, estimated at P50 000 / month.	- Signed off by Environmental officer. - Annual governmental audits.	200 µ/m^3.	- Use wind breaks. - Chemical and water dust suppression. - Rock cladding. - Re-vegetation. - Reduction in drop heights. - Keeping within applicable speed limits.	Requires investigation and remediation if two sequential months exceed this level or more than three months / annum exceed this level.

IMPACT	LOCATION	PARA-METER TO BE MONITORED	OBJECTIVE	KEY PERFOR-MANCE INDICATOR	RESPONSI-BILITY	FRE-QUENCY OF MONITO-RING	RE-SOURCES	REPORTING STRUCTURE	THRES-HOLD OR EXISTING STAN-DARDS	MITIGATION	RECOM-MENDED ACTION IF THRES-HOLDS IS EXCEEDED
Soils.	-Rehabilitated areas. - Soil stockpiles.	- pH. - Calcium. - Magnesium - Potassium. - Phosphorus - Sodium. - Zinc. - Clay %. - S value. - Ca ratio. - Mg ratio. - K ratio. - Na ratio.	- Determine soil viability.	Soil nutrient monitoring records.	Environmental officer.	Annual.	Soil monitoring programme, estimated at P150,000 / annum.	- Signed off by Environmental officer. - Annual governmental audits.	Refer to Table 136.	- Strip and stockpile soils appropriately. - Commence rehabilitation of completed areas as soon as possible. - Apply soil handling and removal practices as outlined in SEMP. - Apply soil emplacement and storage practices as outlined in SEMP. - Fertilisation and amendments.	- Apply required nutrients upon rehabilitation.

IMPACT	LOCATION	PARA-METER TO BE MONITORED	OBJECTIVE	KEY PERFOR-MANCE INDICATOR	RESPONSI-BILITY	FRE-QUENCY OF MONITO-RING	RE-SOURCES	REPORTING STRUCTURE	THRES-HOLD OR EXISTING STAN-DARDS	MITIGATION	RECOM-MENDED ACTION IF THRES-HOLDS IS EXCEEDED
										- Erosion control and treatment. - Soil amelioration. - Spill clean up.	
Fauna and Flora.	Sites to be indentified upon finalisation of detailed mine layout plan.	- Leaf structure. - Leaf arrangement. - Flower. - Fruit / pod. - Bark. - Size in relation to environment. - Floral species. - Community integrity.	Ensure implementation of conservation principles as outlined in SEMP.	Records of fauna and flora monitoring.	Environmental officer.	Annual.	Fauna and flora monitoring programme, estimated at P100,000 / annum.	- Signed off by Environmental officer. - Annual governmental audits.	None exist.	- Minimise GDMP footprint. - Preserve vegetation. - Ongoing rehabilitation. - Ensure pockets of natural habitats on site.	

IMPACT	LOCATION	PARA-METER TO BE MONITORED	OBJECTIVE	KEY PERFOR-MANCE INDICATOR	RESPONSI-BILITY	FRE-QUENCY OF MONITO-RING	RE-SOURCES	REPORTING STRUCTURE	THRES-HOLD OR EXISTING STAN-DARDS	MITIGATION	RECOM-MENDED ACTION IF THRES-HOLDS IS EXCEEDED
Social Impacts: Employment.	Employees and their communities.	- Involvement in consultative activities. - Complaints about discrimination - Skills training provided.	Ensure adequate provision of services to employees.	HR Reports.	HR Manager, Community Liaison Officer.	Ongoing.	Social monitoring programme, estimated at P200,000 / annum.	HR Manager to sign off.	Measure against industry standard.	As outlined in SEMP.	As outlined in SEMP.
Social Impacts: HIV/Aids.	- Employees and their communities. - Directly affected communities.	- Adherence to agreed upon programme implementation.	Ensure adequate provision of services to employees.	HR Reports.	HR Manager, Community Liaison Officer.	Ongoing.	Social monitoring programme, estimated at P200,000 / annum.	HR Manager to sign off.	Measure against industry standard.	As outlined in SEMP.	As outlined in SEMP.
Social Impacts: Gope residents / other directly impacted communities.	- At Gope.	- Adherence to Community Action Plan.	Ensure the minimisation of negative impacts and the enhancement of positive impacts upon Gope residents.	Community liaison reports.	Community Liaison Officer.	Annual.	Community Action Plan monitoring programme, estimated at P100,000 / annum.	Operations manager to sign off.	Measure against industry standard.	As outlined in SEMP.	As outlined in SEMP.

IMPACT	LOCATION	PARA-METER TO BE MONITORED	OBJECTIVE	KEY PERFOR-MANCE INDICATOR	RESPONSI-BILITY	FRE-QUENCY OF MONITO-RING	RE-SOURCES	REPORTING STRUCTURE	THRES-HOLD OR EXISTING STAN-DARDS	MITIGATION	RECOM-MENDED ACTION IF THRES-HOLDS IS EXCEEDED
Social Impacts: Work shifts & services to workers.	- Employees.	- Adherence to agreed upon programme implementation.	Ensure adequate provision of services to employees.	HR Reports.	HR Manager, Community Liaison Officer.	Ongoing.	Social monitoring programme, estimated at P200,000 / annum.	HR Manager to sign off.	Measure against industry standard.	As outlined in SEMP.	As outlined in SEMP.

10.6.2 Groundwater Monitoring Programme

Monitoring requirements were developed, based on the groundwater impacts identified during the SEIA phase and includes the following:

- Improve the understanding of the aquifer to enable the sustainable use thereof;
- Identify potential sources of pollution;
- Measure actual impacts on groundwater;
- Determine the effectiveness of the implemented mitigation measures;
- Determine the level of risk, and
- Groundwater pathways and impact sites.

10.6.2.1 Groundwater Sampling Locations

The location and construction / design of groundwater monitoring boreholes are crucial to the success of the monitoring programme. Effective monitoring boreholes are situated close to the source of potential pollution, is drilled to the depth at which the draw down of the aquifer can be quantified and contamination is expected to occur, and is constructed (cased) to intercept contamination early.

This report only provides an indication of the potential location of the monitoring boreholes. However, once the borehole locations have been determined subsequent to detailed geophysical assessments, it is advised that the groundwater sampling locations be revised by a suitably qualified specialist.

The following monitoring points are advised, but are subject to on site confirmation based on detailed geophysical assessments:

Groundwater Quantity:

- Water levels will be measured on an ongoing basis in each borehole drilled around the perimeter of the open pit. These data is to be used for groundwater drawdown monitoring, and
- Water levels will be monitored on a monthly basis in all monitoring boreholes.

Groundwater Quality:

The following initial monitoring locations have been identified:

- BH1 & 2: Monitoring of potential leachate migration generated from the WRD;
- BH3 & 4: Monitoring of contamination occurring within the open pit;
- BH5: Monitoring of potential leachate migration generated from the TMF;
- BH6: Monitoring of potential leachate migration generated from the slimes dam;
- BH7: Monitoring of potential biological contamination from sewage works;

- BH8: Monitoring of contamination occurring as a result of activities associated with the EMV workshop, and
- BH9: Ambient condition / background value monitoring point located upslope of the Gope Project Site. This borehole will be located within the well field.

Depending on the outcome of the detailed geophysics assessments, some of the above stipulated borehole locations may be combined.

10.6.2.2 Key Groundwater Quality Indicators

Analysis of groundwater samples will be undertaken at a laboratory accredited by the South African National Accreditation System (SANAS) & ISO/IEC 17025.

Naturally occurring groundwater associated with the Gope Project Site exceed both the World Bank Standards and BOS Standards for the following parameters:

- TDS;
- Sodium;
- Chloride, and
- Sulphate.

Therefore, the groundwater quality will be assessed against the recorded naturally occurring groundwater quality, as outlined in Table 34. For comparative analysis, the following standards will also be noted as part of the ongoing groundwater quality monitoring programme.

Table 131: Additional / Applicable Water Quality Standards.

PARAMETER	WORLD BANK STANDARDS***	BOS 93:2004 STANDARDS****
pH	6-9	6-9
TDS (mg/l)	NSA	2,000
Sodium (mg/l)	NSA	400
Potassium (mg/l)	NSA	100
Calcium (mg/l)	NSA	500
Iron (mg/l)	3.5	0.05
Chloride (mg/l)	NSA	600
Sulphate (mg/l)	NSA	400
Nitrate as N (mg/l)	NSA	22
Fluoride (mg/l)	20	1.5
Oil and Grease (Total Hydrocarbons)	10	NSA

PARAMETER	WORLD BANK STANDARDS***	BOS 93:2004 STANDARDS****
*** World Bank Standards for wastewater discharged to surface water (PPAH, 1998), no detailed groundwater guidelines are available. **** Botswana Bureau of Standards (BOS 93:2004), Water Quality – Waste Water – Physical, microbiological and chemical requirements – Specification NSA No Standard Available		

The recommended chemical analysis techniques of samples collected from the Gope Project Site, are detailed in Table 132 .

Table 132: Recommended Chemical Analysis Techniques.

ELEMENT TO BE TESTED	METHOD	INSTRUMENT USED
pH	ISO 10523	pH meter
Electrical Conductivity	ISO 7888	Conductivity meter
TDS	SABS 213	Oven
Total Hardness	EDTA titration	Burette
Sodium	Flame photometric	Flame photometer
Potassium	Flame photometric	Flame photometer
Calcium	EDTA titration	Burette
Magnesium	EDTA titration	Burette
Iron	Phenanthroline	Spectrophotometer
Manganese	Persulphate	Spectrophotometer
Chloride	Argentometric	Burette
Sulphate	Trubitimetric	Sectrophotometer
Bicarbonate	Titration	Burette
Nitrate	ISO 7890-3	Sectrophotometer
Fluoride	Ion selective	Ion Concentration meter
Total Alkalinity	Tritration	Burette

10.6.2.3 Groundwater Sampling Frequency

The groundwater sampling frequency is detailed in Table 133. In order to assess the impact of the project on groundwater effectively, it is important to monitor and record rainfall, groundwater levels and groundwater quality. It is recommended that a full quantitative sampling run is done every quarter during the first three years of monitoring. This will include analysis of major cations and anions. This detailed information will be used to characterise the groundwater quality as well as potential impacts from pollutions sources identified.

This monitoring strategy can be revised after three years, or as trends are established and through discussions and agreement with the Botswana DEA, Department of Water Affairs (DWA), and the Department of Waste Management and Pollution Control.

It is essential that the monthly groundwater quality analysis indicated in Table 133 must be updated and / or amended from the results of the full analysis undertaken on a quarterly basis, as and when required.

Groundwater sampling frequency is proposed below:

Table 133: Groundwater Sampling Frequency.

PARAMETER	DESCRIPTION	SAMPLING FREQUENCY	ELEMENTS FOR ANALYSIS	GOVERNMENTAL AUDITS
Rainfall	On site rainfall station	Daily	NA	NA
Groundwater Levels	All monitoring boreholes	Monthly	NA	DWA, bi-annually DWMPC, bi-annually DEA, annually
Groundwater Quality	All monitoring boreholes	Monthly	All major cations and anions	DWA, bi-annually DWMPC, bi-annually DEA, annually
Groundwater Quality	EMV Sewage bh	Quarterly	Total Hydrocarbons Microbiological	DWA, bi-annually DWMPC, bi-annually DEA, annually

10.6.2.4 Groundwater Monitoring Database

All monitoring information gathered will be entered into an electronic database which will be used to compile time series data and trends as well as spatial data and trends. This information will be used to determine overall groundwater quality trends. The data will be compared against the BOS 93:2004 Water Quality Guidelines.

The monitoring information will be analysed by assembling monitoring data from photographic records, data tables and time-series graphs. Relational changes such as relative proportions of chemical constituents in the groundwater will be presented as triangular plots called Piper Diagrams.

10.6.2.5 Groundwater Monitoring Reporting

Quarterly and annual monitoring reports will be generated with the annual monitoring reports being distributed to the Department of Waste Management and Pollution Control, the DEA, and the DWA. Monitoring reports will contain the following information:

- Monitoring borehole location map;
- Monitoring borehole geology and construction log;
- All coordinates of the groundwater sampling sites will be included in the annual monitoring reports to be submitted to the relevant government departments;
- Results of the all monitoring date in tabular format. All monitoring data will be appended to groundwater monitoring reports and certificates of analysis will be included for quality assurance. Monitoring results will be compared to Botswana Bureau of Standards (BOS 93:2004) guideline limits and World Bank limits for wastewater (refer to Table 131);
- Time-series graphs for key indicator elements;
- Trilinear or other analytical groundwater plots;
- A discussion regarding observed trends and potential groundwater contamination, and
- Recommendations regarding possible amendments or additions to the groundwater monitoring programme, based on trends and other information observed.

An annual groundwater monitoring programme audit will be undertaken to ensure that the monitoring programme is efficient and effective.

10.6.2.6 Performance Assessment and Evaluation

Performance assessments are based on monitoring programme data and provide the basis of information to the public, regulators and feedback for review of the project's SEMP. Internal review plays an important role in this regard.

The monitoring programme is to reflect the objectives of the SEMP, describing the information necessary to produce a systematic, comprehensive and informative report on groundwater compliance performance. Such a report will permit clear conclusions about the state of aquifers in the project area and identify the need, if any, for additional studies or appropriate remedial action.

The most important aspect of the review process is the feedback on monitoring programmes into environmental management systems. The review will highlight strengths, weaknesses and gaps. Where modifications are deemed necessary, the monitoring programme will be revised in pursuit of continued improvement.

Suggested time periods have been given in Table 133 for governmental audits, however, these should be confirmed with both the DEA and other identified departments prior to the implementation of the monitoring programme.

10.6.3 Surface Water

No naturally occurring surface water features have been identified at the Gope Project Site. Therefore, the surface water monitoring programme will only extend to the man made surface water structures, i.e. the RWDs. The surface water monitoring programme has been designed such that potential pollution that may result from emergency conditions relevant to the RWDs is monitored.

It has to be noted that water associated with the GDMP will be contained in a closed loop system and that the RWDs will be lined with a suitable material.

10.6.3.1 Surface Water Monitoring Objectives

The surface water monitoring plan is designed to effectively measure the pollution potential contained within the man made surface water structures associated with the GDMP and the potential impact of emergency conditions upon the receiving environment. The monitoring programme was designed to monitor the following:

- Assessment and quantification of potential sources of pollution;
- Assessment of the level of potential impacts on the receiving environment;
- Levels of acceptable change;
- The level of risk, and
- Sensitive receptors (i.e. Gope returnees and fauna).

Based on this, the key objectives of the surface water monitoring strategy are to:

- Prevent contamination through residue, chemical and hydrocarbon spills at the Gope Project Site, power line and access roads;
- Develop improved practices and procedures for the protection of the receiving environment surrounding the Gope Project Site;
- Detect short and long term trends within the man made surface water structures;
- Recognise changes in mine related surface water structures and enable analysis of their causes;
- Measure impacts and risks upon the receiving environment;
- Check the accuracy of predicted impacts, and
- Develop improved monitoring systems, management strategies and mitigation measures.

10.6.3.2 Surface Water Sampling Locations

Due to the non-existence of surface water courses associated with the Gope Project Site, only man made surface water structures (i.e. RWDs) will be sampled and monitored. No other monitoring points exist at or around the Gope Project Site.

10.6.3.3 Key Water Quality Indicators

Based on the potential sources of surface water contamination, the key water quality indicators that are of importance are indicated in Table 134.

Table 134: Key Indicators for Surface Water Contamination Monitoring.

PARAMETER	DESCRIPTION	ELEMENTS FOR ANALYSIS
Rainfall	On site measurement	Levels only
Surface water quality	All monitoring points	All major cations and anions, Total Hydrocarbons
Surface water quantity	All monitoring points	Water level. Available freeboard.

However, since the surface water being sampled originates from the mining and mineral processing operations, no assessment against any national or international standards will be relevant.

10.6.3.4 Surface Water Sampling Method and Analysis

Analysis of surface water samples will be undertaken at a laboratory accredited by the South African National Accreditation System (SANAS). The chemical analysis techniques that are recommended are detailed in Table 132.

10.6.3.5 Surface Water Sampling Frequency

The surface water sampling frequency is detailed Table 135 below with the elements for analysis.

Table 135: Surface Water Sampling Frequency.

PARAMETER	DESCRIPTION	SAMPLING FREQUENCY	ELEMENTS FOR ANALYSIS	GOVERNMENTAL AUDITS
Rainfall	On site rainfall station	Daily	N/A	N/A
Dam Levels	Water level. Available freeboard.	Monthly	N/A	DWA, bi-annually DWMPC, bi-annually DEA, annually

PARAMETER	DESCRIPTION	SAMPLING FREQUENCY	ELEMENTS FOR ANALYSIS	GOVERNMENTAL AUDITS
Surface water quality	All dams.	Monthly	All major cations and anions, Total Hydrocarbons	DWA, bi-annually DWMPC, bi-annually DEA, annually

In order to assess the impact of the project on the surface water regime, it is important that rainfall, temperature and evaporation rates be recorded. This will be achieved through the installation of a weather station at the Gope Project Site and these data will be incorporated into the surface water monitoring analysis.

10.6.3.6 Surface Water Monitoring Database

All monitoring information gathered will be entered into an electronic database which will be used to compile time series data and trends as well as spatial data and trends. This information will be used to determine surface water quality trends that may develop over time at the operations and that may lead to contamination of the receiving environment.
In order to ensure that relational changes in water chemistry are documented and placed in perspective, findings will be presented in Piper Diagrams.

10.6.3.7 Surface Water Monitoring Reporting

Sampling of surface water will be conducted on a monthly basis. Quarterly and annual monitoring reports will be generated with the annual monitoring reports being distributed to the DWMPC, the DEA and the DWA. Monitoring reports will contain the following information:

- Surface water monitoring point location map;
- Surface water monitoring point conditions;
- Co-ordinates of the surface water monitoring points;
- Results of the all monitoring data in tabular format. All monitoring data will be appended to surface water monitoring reports and certificates of analysis will be included for quality assurance;
- Time-series graphs for key indicator elements;
- Trilinear or other analytical surface water plots;
- A discussion regarding observed trends and potential for contamination to the receiving environment; and
- Recommendations regarding possible amendments or additions to the surface water monitoring programme, based on trends and other information observed.

Annual surface water monitoring programme audits will be undertaken to ensure that the monitoring programme is efficient and effective.

10.6.3.8 *Performance Assessment and Evaluation*

Performance assessments are based on monitoring programme data and provide the basis of information to the public, regulators and feedback for review of the project's SEMP. Internal review plays an important role in this regard.

The monitoring programme has been designed in such a way as to reflect best practice standards and set a high standard for the SEMP. The monitoring programme's objectives will be reflected in the management principles of the SEMP and visa versa. This will enable the monitoring programme to provide input into the SEMP to ensure an ongoing cycle of continuous improvement of management and mitigation practices.

10.6.4 Noise

Noise monitoring shall be conducted based upon the following:

- Monthly noise monitoring is required in order to measure daily levels of exposure, and implement mitigation measure when required. These values will assist in assessing the impact of noise on the surrounding environment and the nearby sensitive receptors;
- The Operations Manager or his / her designate shall investigate all noise complaints, or an official appointed by him/her, and assessed to determine if the noise is unreasonable. All complaints will be recorded and kept on file;
- For persistent noise complaints, this includes monitoring of noise to determine whether daytime levels exceed ambient +3 dBA, and
- Annual Audits.

Table 136: Typical Rating Levels for Ambient Noise in Districts.

TYPE OF DISTRICT	EQUIVALENT CONTINUOUS RATING LEVEL, $L_{REQ.T}$ FOR NOISE					
	OUTDOORS			INDOORS, WITH OPEN WINDOWS		
	DAY-NIGHT	DAY-TIME	NIGHT-TIME	DAY-NIGHT	DAY-TIME	NIGHT-TIME
Residential Districts						
Rural districts	45	45	35	35	35	25
Suburban districts with little road traffic	50	50	40	40	40	30
Urban districts	55	55	45	45	45	35
Non-Residential Districts						
Urban districts with some workshops, with business premises and with main roads	60	60	50	50	50	40
Central business districts	65	65	55	55	55	45
Industrial districts	70	70	60	60	60	50
IFC EHS GUIDELINES	**DAY-TIME**			**NIGHT-TIME**		

TYPE OF DISTRICT	EQUIVALENT CONTINUOUS RATING LEVEL, $L_{REQ.T}$ FOR NOISE					
	OUTDOORS			INDOORS, WITH OPEN WINDOWS		
	DAY-NIGHT	DAY-TIME	NIGHT-TIME	DAY-NIGHT	DAY-TIME	NIGHT-TIME
Residential; Institutional; Educational	55			45		
Industrial; Commercial	70			70		

10.6.5 Air Quality

10.6.5.1 Dust Monitoring Methodology

The dust monitoring methodology has been designed with legislative requirements as well as site specific conditions in mind.

10.6.5.1.1 Dust Fallout:

Fallout dust is monitored using the American ASTM D-1739-82 standard testing method as specified in the South African National Standard – Ambient Air Quality – Limits for Common Pollutants (SANS 1929:2004). The method is stipulated as follows:

- A 5 litre cylindrical container with a wind directional opening is placed on a stand, at lease 1.5 m from the ground surface;
- The container is filled to two thirds with de-ionised water and biocide to prevent the growth of algae in the stagnant water. The water level is continuously monitored and new water added to ensure that the water level does not drop too much;
- Large solid and liquid particles (> 10 µm in diameter) are collected via gravitational settling in the container for a period of one calendar month, viz. 30 ± 3 days;
- The container is returned to a laboratory and the water is poured through a sieve and filtered;
- The residue is dried before the insoluble dust is weighed to determine the dust fallout rates. The derived dust fallout rate is calculated using the following formula:

$$\text{FALLOUT RATE (MG/M}^2\text{/DAY)} = \frac{\text{MASS 2} - \text{MASS 1}}{\text{Constant x no. of days}}$$

Where:

- Mass 2 – Mass 1 equals the collected mass of the sample;
- Constant is the constant derived from the cross-sectional area of the bucket;
- Days are the number of days of exposure of the bucket.

- Once the measurements are concluded, the container is to be returned to its original location immediately for the continuation of the monitoring programme, and
- The container is to be refilled with water and biocide to the two thirds level.

10.6.5.1.2 PM10:

PM10 will be sampled using a gravimetric sampler. The sampler will have a target accuracy of <10 mg/m^3 and precision of <5 mg/m^3 for daily average concentrations below 100 mg/m^3. The following method will be used:

- Filters are preconditioned for 48 hours in open dust protected sieve trays in an air conditioned room with a temperature of 20 ± 1ºC and a relative humidity of 50 ± 3%;
- The filter is weighed and transported in a sealed container to the site;
- Air is drawn across a filter for a specified period of time (viz. 24 hours) in the gravimetric sampler;
- The filter is collected the mass measured;
- The sampler's inlet will be tested annually to ensure that the accurate size fraction is captured.

10.6.5.2 Location of Dust Collection Buckets

Dust collection buckets are to be placed along the boundary of the site. The main areas identified as potential dust generators, include the open pit, TMF, WRD and slimes dam and along access routes.

Buckets are to be placed no more than 2 km from the MLA and access road. The exact placement of these dust buckets is to be determined during the construction phase.

10.6.5.3 Standards for Comparison

For the monitoring of PM10, the data will be measured against three standards:

- Botswana Air Quality Objectives;
- World Bank Guidelines, and
- South African National Standards.

The permissible limits are depicted in Table 137.

Table 137: Standards for Comparison in Terms of PM10.

STANDARD	LIMIT
Botswana air quality objectives	200 µ/m^3
World Bank guidelines	125 µ/m^3
SANS	75 µ/m^3

For the monitoring of dust fallout, the data collected will be measured against the South African Department of Environmental Affairs and Tourism (DEAT) and SANS 1929. These limits are depicted in the Table 138.

Table 138: DEAT Guidelines for Dust Fallout / Deposition.

CLASSIFICATION	DUSTFALL – MONTHLY AVERAGE ($MG/M^2/DAY$)
Slight	< 250
Moderate	250 – 500
Heavy	500 – 1200
Very heavy	> 1200

In addition, a four-band scale evaluation (Table 139) is used as well as target, action and alert thresholds.

Table 139: Four-Band Scale Evaluation of Dust Fallout.

BAND NUMBER	BAND DESCRIPTION LEVEL	DUSTFALL RATE (D) (MG.M2.DAY) (30 DAY AVERAGE)	COMMENT
1	Residential	D < 600	Permissible for residential & light commercial areas
2	Industrial	600 < D < 1 200	Permissible for heavy commercial & industrial areas
3	Action required	1 200 < D < 2 400	Requires investigation and remediation if 2 sequential months fall in this band, or more than three occur in a year.
4	Alert	2 400 < D	Immediate action & remediation required following the first incident of rate exceedance.

10.6.5.4 Reporting of Air Quality Monitoring Data

The following aspects pertaining to the sampling month will be detailed in the report:

- Meteorological Conditions:
  - Surface wind field analysis;
  - Ambient temperature, and
  - Precipitation.
- Dust fall out results and a comparative analysis to the above stipulated standards;
- PM10 results and a comparative analysis to the above stipulated standards;
- Temporal comparisons for both dust fall out and PM10, and
- Recommendations pertaining to dust management and potential remediation measures;

Monthly monitoring data will be compiled into quarterly and an annual report.

10.6.6 Soils

During the ongoing rehabilitation phase, preliminary soil sampling should be carried out to determine the fertilizer requirements. Additional soil sampling should also be carried out annually until the levels of nutrients, specifically phosphorus and potassium, are at the required level (approximately 20 and 120 mg / kg respectively). Once the desired nutritional status has been achieved, it is recommended that the interval between sampling be increased. An annual environmental audit should be undertaken. If growth problems develop, *ad hoc*, sampling should be carried out to determine the problem.

Sampling should always be carried out at the same time of the year and at least six weeks after the last application of fertilizer.

All of the soil samples should be analysed for the following parameters:

- pH (H_2O);
- Electrical conductivity;
- Calcium mg/kg;
- Magnesium mg/kg;
- Potassium mg/kg;
- Sodium mg/kg;
- CEC;
- Phosphorus (Bray I);
- Zinc mg/kg;
- Clay%, and
- Organic matter content (C%).

The following optimal ranges are to be complied with:

Table 140: Soil Nutrition Optimal Ranges.

ELEMENT	UNIT	OPTIMUM RANGE
pH (KCl)	pH unit	5.2 - 6.5
Calcium as Ca	mg/kg	>200
Magnesium as Mg	mg/kg	>60
Potassium as K	mg/kg	>40
Sodium as Na	mg/kg	To be determined at time of rehabilitation
"S" Value	me %	To be determined at time of rehabilitation
Ca Ratio	me %	55 - 75
Mg Ratio	me %	18 - 30
K Ratio	me %	6 - 10
Na Ratio	me %	<2.0

ELEMENT	UNIT	OPTIMUM RANGE
Phosphorus as P	mg/kg	20 - 80
Zinc as Zn	mg/kg	2 - 10
Clay %	%	To be determined at time of rehabilitation

10.6.7 Fauna and Flora

10.6.7.1 Sampling

Flora sampling and monitoring will be undertaken as follows:

- Flora will be sampled for a radius of no less than 3 m around each identified sampling location;
- Floral samples obtained for identification will be placed in plastic Ziploc bags, clearly marked and GPS co-ordinates thereof obtained;
- Each sample obtained should include, where possible, samples of the following:
  - Leaf structure;
  - Leaf arrangement;
  - Flower;
  - Pod / fruit, and
  - Bark.
- Photographic records of all samples obtained for analysis purposes must be taken to ensure a secondary documentation and analysis method. Photographs will show the following per sample obtained:
  - Leaf structure;
  - Leaf arrangement;
  - Flower;
  - Pod / fruit;
  - Bark, and
  - Size of vegetation in relation to environment (e.g. showing height of tree or grass).
- Floral species will be demarcated on a plan of the study area to ensure accurate community mapping;
- Photographic records of each sampling site will be obtained in order to document the increase / decrease in floral density at each site. Photographs will be taken from the same point on each sampling run;
- GPS co-ordinates will be taken at all points where samples and / or photographs are obtained in order to maintain an accurate record of findings, and
- Identification of Red Data species will be undertaken for all floral categories.

10.6.7.2 Monitoring

- The study area will be traversed on foot ensuring that the area around each identified sampling location is fully covered;
- Floral species will be identified and demarcated on a plan of the study area to ensure accurate community mapping;
- Photographic records of sampling sites will be obtained in order to document the increase / decrease in floral density at each site. Photographs will be taken from the same point on each sampling run;
- Photographs will be taken of the surrounding project area and / or any additional features that may be deemed relevant to the monitoring programme;
- GPS co-ordinates will be taken at all points where photographs are obtained in order to maintain an accurate record of findings, and
- Identification of Red Data species will be undertaken for all floral categories.

10.6.8 Social Monitoring Programme

- Employment:

  Preferably, monitoring should include the normal residence of employees, involvement in consultative activities, complaints about discrimination, and skills training provided (by type and relevance for mine construction and operation);
- HIV/Aids:

  A minimalist approach is generally what can be expected from contractors, unless held to a higher standard. This would therefore require enhanced monitoring from the mine owners, and the possible sub-contracting of an agency to oversee the HIV&AIDS response. Monitoring of directly-affected construction crews would entail a review of progress made around agreed activities, included in the monthly reports and quarterly reviews common for construction.
- Work Shifts:

  Monitoring should include the normal residence of employees, involvement in consultative activities, complaints about discrimination, and skills training provided (by type and relevance for mine construction and operation). For the mine-site itself, this should include the separate listing of Gope residents, and also a separate listing for other residents of the CKGR and external settlements.
- Gope Residents:

  Monitoring and evaluation indicators and procedures would be included in the Community Action Plan. Community-based systems of monitoring and evaluation would be best suited for such a Plan. Annual reporting systems for the mine would include progress assessments with regard to the Community Action Plan.

- Kaudwane Residents:

  Overall, as with Gope, a Kaudwane Community Action Plan, as associated with the development of the mine, would be an important tool to monitoring, and evaluation, local impacts.
- Services to Workers:

  Monitoring and evaluation indicators and procedures would need to be developed for each aspect of service provision.
- Gender Issues:

  Employment of males and females by industrial classification, position, and other variables of interest (e.g., wage rates).
- Roads Impact:

  Review tender document associated with road signage and community safety programmes. Regular community consultations (preferably bi-annually) should be undertaken by GEC in order to ensure that communication remains in good stead with communities.
- Power Line Impact:

  Regular community consultations (preferably bi-annually) should be undertaken by GEC in order to ensure that communication remains in good stead with communities.

10.7. Closure and Rehabilitation Plan

Due to the fact that the GDMP is located within the CKGR, a comprehensive rehabilitation plan that will ensure sustainability, is of critical importance to the success of this project. In order to ensure that a sustainable landform is achieved as soon as possible, the plan has been divided into two sections:

- Ongoing Rehabilitation: This rehabilitation will occur concurrently with the mining activities of the project and will commence during the construction phase, and
- End of LoM Rehabilitation: All rehabilitation subsequent to the operation ceasing, are detailed in this section. This phase of rehabilitation will be undertaken to achieve the ‘walk away’ scenario and for GEC to obtain final closure of the mine and receive certification for such from the DoM.

This rehabilitation plan is the culmination of a series of workshops undertaken by the specialist scientists in conjunction with the design engineers involved in the GDMP in order to ensure the implementation of the “Design for Closure” principle is achieved (EIPPCB, 2005). It also reflects the Best Practice Standards available at the time of the compilation of this report. In addition, the BATNEEC (Best Available Technique Not Entailing Excessive Cost) principle was applied in the development of this plan.

The Director of Mines is to be notified of the intention to cease mining operations, not less than three months or such period as the Director of Mines may allow before such cessation or termination.

Requirements and activities relating to cessation will be undertaken according to the Mines, Quarries, Works and Machinery Act and Regulations (Act No. 20 of 1973 (as amended)) and the Mine and Minerals Act (Act No. 17 of 1999). This includes requirements upon furnishing the cessation notification to the Director, as well as fencing requirements.

10.7.1 Objectives & Principles for Remediation and Closure

The following objectives for rehabilitation and closure were used as the basis of the rehabilitation plan:

- Achieve physical stability across the site and for all residual landforms;
- Ensure chemical stability of the site;
- Minimise and/or eliminate any residual environmental impacts;
- Ensure human safety, and
- Ensure that the agreed upon future land use will be practicable.

Outlined in the Best Practice Environmental Management in Mining: Rehabilitation and Re-vegetation (Australian Environmental Protection Agency, 1995), the following principles are to be implemented during the rehabilitation plan, see Table 141 below:

Table 141: Best Practice Principles of Rehabilitation & Remediation

BEST PRACTICE PRINCIPLE	APPLICATION AT GDMP
Prepare rehabilitation plan prior to the commencement of mining.	• A detailed rehabilitation plan was developed through collaboration of the engineering and specialist scientist teams.
Agree on the long term post mining land use objective.	• Still to be finalised during ongoing consultation with stakeholders.
Progressively rehabilitate site where possible, in order to render the rate of rehabilitation consistent to that of mining.	• The remediation plan is divided into ongoing rehabilitation and end of LoM rehabilitation.
Prevent the introduction of noxious weeds and pests.	• Preventative measures are described in the SEMP as well as rehabilitation plan.
Minimise the area cleared for mining and associated facilities to the minimum required.	• As described throughout the SEMP.
Reshape the land disturbed by mining so that it is stable, adequately drained and suitable for the desired long term use.	• A closure objective is to ensure that all landforms are stable and sustainable prior to achieving closure.
Minimise the long term visual impacts by creating landforms that are compatible with the surrounding landscape.	• No landforms resulting from the operation can be compatible with the surrounding area due to the flat topography. However, all structures (TMF, Slimes dam, WRD and Sand dump) will be re-vegetated to blend in with the natural surroundings.
Reinstate natural drainage patterns where possible.	• Surface water management structures will be designed and implemented where required. During the rehabilitation phases (ongoing and end of LOM), all rehabilitated areas are to be free draining and required to be integrated with the natural drainage remaining on the site.
Minimise the potential for wind and water erosion.	• Exposed soils and mineralogical material will be dressed to minimise wind and water erosion. Refer to the SEMP and ongoing rehabilitation plan.
Remove or control residual hazardous materials. Identify any potential toxic overburden or exposed strata and manage them so as to prevent environmental damage.	• Very little hazardous materials will occur at the Gope Project Site. • Leach testing has shown an insignificant risk attaching to the potential leaching of mineralogical wastes. (Refer to section 10.7.3.)
Characterise the topsoil and retain it for use in rehabilitation. It is preferable to reuse the topsoil immediately rather than storing it in stockpiles. Only discard it if it is physically or chemically undesirable, or if it contains high levels of weed seeds or plant pathogens.	• Topsoils will only be stockpiled where the material cannot be used immediately. • Where soils are to be stockpiled, it will be done in a manner that will ensure the best preservation of such soils (refer to section 10.2.1.3).
Consider spreading the cleared vegetation on disturbed areas.	• Vegetation will be stripped with the topsoils so as to ensure the optimal nutrient content of the soils (refer to section 10.2.1.3 and 10.2.1.6).

BEST PRACTICE PRINCIPLE	APPLICATION AT GDMP
Deep rip compacted surfaces to encourage infiltration, allow plant root growth and key the topsoil to the subsoils.	• All compacted surfaces will be ripped and keyed prior to re-vegetation commencing.
Ensure that the surface one or two meters of soil is capable of supporting plant growth.	• Soil nutrient testing is to be undertaken as outlined in section 10.6.7.2.
If topsoil is unsuitable or absent, identify and test alternative substances, e.g. overburden that may be a suitable substitute after addition of soil improving substances.	• Geological strata that will eventually form the tailings material have been subjected to nutrient testing and have been proven to be a suitable growth medium. As part of the topsoil conservation programme, tailings material will be mixed with the topsoils prior to being placed for rehabilitation in order to improve the soil condition (refer to 11.3.1.3).
Re-vegetate the area with plant species consistent with the post mining land use.	• Community members will be employed by the mine in as far as is practicable to collect seed from plants native to the Gope Project Site in a sustainable manner. A nursery will be established on site where plants (especially shrubs and trees) will be grown for use in rehabilitation (refer to section 10.2.1.6).
Meet all statutory requirements.	• The GDMP takes cognisance of the legal framework (refer to Section 3) and will adjust both the SEMP and rehabilitation plan as and when statutory requirements are altered.
Make the area safe.	• Dangerous areas remaining post mining (i.e. slimes dam, open pit) will be adequately fenced and signposted. In addition, the open pit will be blasted in such a way that vertical cliffs are formed to prevent animals from accessing water remaining in the pit lake.
Remove all facilities and equipment from site.	• All equipment will be dismantled at the end of the operation and either sold for reuse, or recycled. • However, depending on the final land use post closure, some accommodation and other facilities may remain on site, subject to agreement being reached with the relevant stakeholders and Government Departments. • The access road to the Gope Project Site will remain in place in order to serve the growing tourist trade in the area.
Monitor and manage rehabilitated areas until the vegetation is self-sustaining and meets the requirements of the post closure land users.	• A detailed post closure monitoring programme will need to be developed and implemented closer to the cessation of the operation. GEC will not be allowed to obtain closure of the site prior to the area being self sustainable.

It is therefore important that the principle of Adaptive Management be borne in mind. Should better technologies or solutions become available during the LOM, this remediation plan is to be altered and approved by the DEA prior to implementation. Although not a legislative requirement under the current Botswana legislation, it is recommended that an annual audit of the rehabilitation plan be undertaken in order to ensure that change be effected as soon as is practicable. This will benefit both the long term sustainability of the site as well as save rehabilitation costs in the long term.

10.7.2 Ongoing Rehabilitation

Ongoing rehabilitation can be defined as the remediation of the site during the operational LOM and can commence as early as the construction phase. It implies that once activity in a particular area of the site ceases, rehabilitation of that area can commence.

This type of rehabilitation can only be effective where the closure objectives are borne in mind and are seen as the ultimate goal of the rehabilitation. It is beneficial to both the environment and GEC, as sustainability is achieved earlier in the rehabilitation process and limits environmental impacts, thereby limiting expenditure required.

The ongoing rehabilitation plan has been developed in such a manner that it reflects the step by step actions required to be followed and excludes measures requiring implementation at the end of LOM.

The following general rehabilitation practices are to be implemented across the site and are applicable to all structures discussed in detail in the section following:

- The soil potential is to be increased through the addition of tailings material if this is proven to be feasible based on metallurgical testing. This will increase the clay content of the predominantly sandy soils to a level that will improve capillary water holding capacity of the soils to ensure effective and sustainable re-vegetation of the rehabilitated areas;
- In addition, soils are to be treated with slow release commercial phosphate fertilisers and compost material prior the placement of these soils onto the rehabilitated areas. Compost will be made on site using the Vermicomposting system. This will reduce the potential of foreign plant material and weeds establishing at the site that may cause irreparable damage to the ecosystem;
- During the ongoing and final rehabilitation of the site, it is to be ensured that no further land is sterilised as a result of the rehabilitation practices;
- All access to the areas undergoing rehabilitation is to be restricted during the rehabilitation phase;
- All seed material is to be collected from the surrounding veld and no commercial seed mixes are to be obtained from commercial / other sources. This is recommended, in order to ensure that no foreign species (i.e. weeds) enter the ecosystem. The process of seed collection and nursery establishment and operation is detailed in section 10.2.1.6 of this report;
- Re-vegetation will take place in areas that were subjected to surface disturbances, areas where soils were removed or areas where soils and rocks are temporarily or permanently stored and covered with topsoil. The purpose of this is firstly to ameliorate the visual impact of the impacts associated with the disturbance and secondly to prevent resulting impacts from affecting surrounding areas, such as erosion and dust control. In order to achieve these

goals it is imperative that the layer of vegetation that is established is similar in appearance and species composition than the surrounding areas, hence the collection of seeds from the immediate surrounds and the used of species that are associated with the region.

Success of the re-vegetation of impacted areas will ultimately be the establishment of a layer of vegetation that is:

- Similar in appearance than the surrounds;
- Similar in dominant species composition than surrounding vegetation;
- Similar in structure than the surrounds;
- Effectively cover impacted areas in order to contain existing impacts and stabilize soil conditions, and
- Is self-sustained in terms of water requirements and propagation.

The cover of vegetation in re-vegetated areas should ideally simulate natural conditions. Results of the surveys generally indicated a crown cover of approximately 85% (60% grasses and forbs and 30% shrubs). This is recommended as the ideal, but is not envisaged to be achievable in the short term in the Gope Project Site area. Therefore, a cover of approximately 60% is regarded adequate, and

- Fire breaks are to be established across the site as and where required.

10.7.2.1 Open Pit

- Prior to the sand stripping commencing, the top- and subsoils of the area to be disturbed are to be stripped as per the method outlined in section 10.2.1.3;
- The area that requires clearing is to be kept to a minimum. The area around the pit where the dewatering infrastructure will be placed, can remain vegetated and in its natural state, apart from access routes to the boreholes and the borehole infrastructure itself;
- Storm water drainage is to be established around the perimeter of the pit in order to ensure that storm water does not access the pit itself;
- During the operational phase, mineralogical waste structures will be placed around the open pit area in order to limit access to the pit itself. The area will remain fenced to further limit access to the pit itself, and
- The sand slopes in the upper section of the open pit have been designed to be stable and no additional stabilising measures will be implemented.

Other remediation measures are outlined in section 10.7.3.1 below that is required to be implemented upon cessation of the operation.

10.7.2.2 Sand Dump

- All vegetation and topsoils are to be stripped from the area identified for the first dumping sequence. These topsoils are to be stockpiled following the prescribed manner (refer to section 10.2.1.3 and 10.2.1.7);
- Subsoils are to be stripped from the same area subsequent to topsoil stripping and stockpiled in the prescribed manner (refer to section 10.2.1.3);
- Sand material will be dumped in a designated area for permanent disposal through use of a conveyor system. This will result in the sand coming to rest in a natural angle of repose, estimated at approximately 35º. It is expected that some areas on the sand dump will be ready for rehabilitation approximately 1 year after the pre-strip commence;
- Once dumping of one area has been finalised, the area is to be shaped to an angle of no more than 1:6. This will ensure topsoil and vegetation stability post remediation. Refer to Figure 75 and Figure 76 for a diagrammatic representation of the ideal slope profile to be obtained;

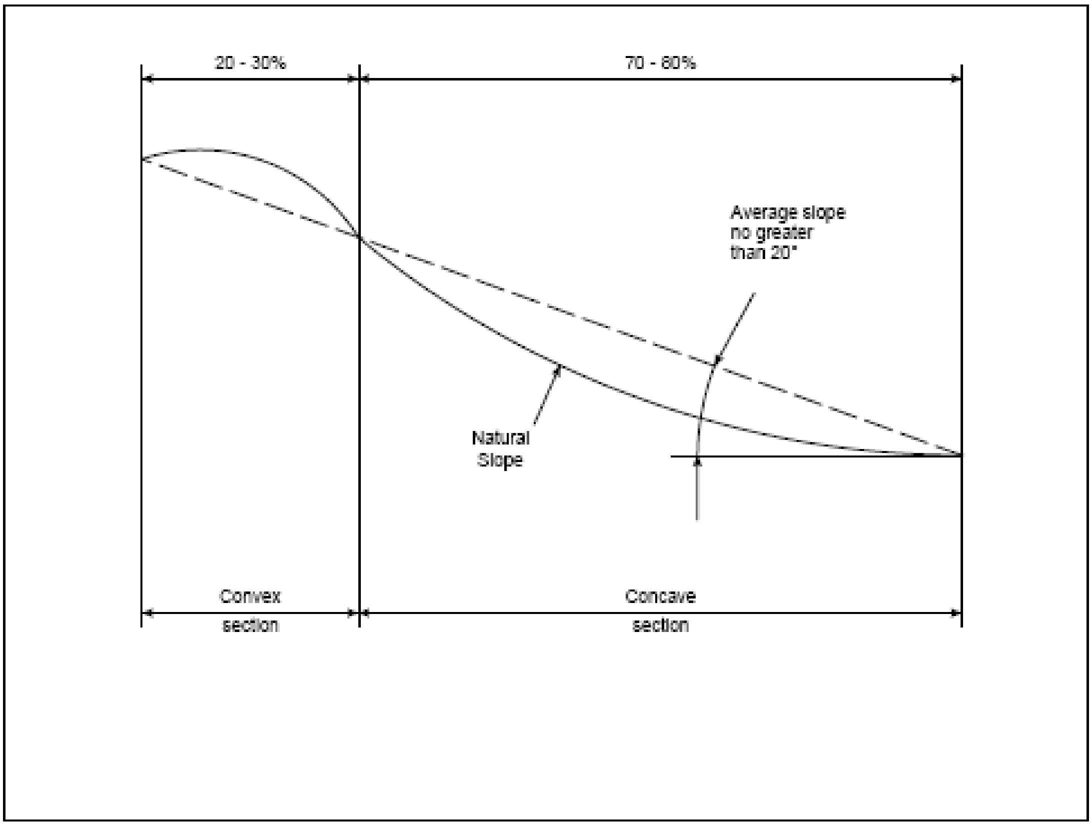

Figure 75: Ideal Final Slope after Shaping has Occurred. (DME – Western Australia, 1996)

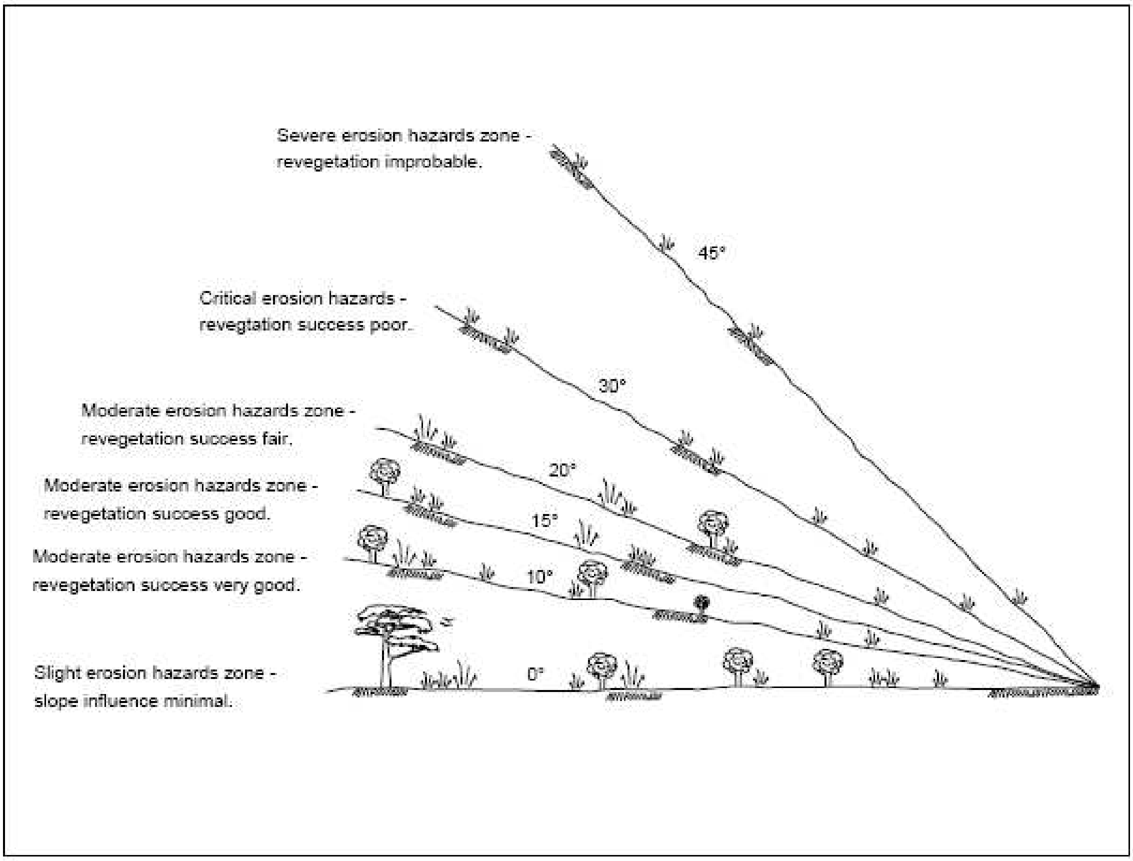

Figure 76: Effect of Slope on Success of Rehabilitation. (DME – Western Australia, 1996)

- Slopes longer than 50 m in running length area to be broken up by the shaping of a second sequence as indicated in Figure 75 in order to ensure that surface water runoff speeds are controlled;
- Subsoils are to be placed onto the sand material;
- A mixture of topsoil, tailings material (if proven feasible), fertiliser and compost is to be replaced onto the sloped areas (refer to section 10.2.1.3);
- However, all areas that comprise wind facing slopes are to be stabilised using rock cladding or synthetic soil stabilisers. This will remain on a permanent basis. Therefore placement of subsoils in suitable voids should be undertaken, followed by the placement of the topsoil, tailings, fertiliser and compost mixture. Small shrubs from the on-site nursery should be planted in this growth material;
- Once an area has been topsoiled, temporary water and wind erosion structures are to be installed. This can either take the form of rock cladding, using basalt from the open pit, or through the use of SoilTac in the form of a crust like application;
- It is recommended that SoilTac be mixed with the correct seed mixture for simultaneous application. This will enable the germination of grasses and other plant material to occur while soils are stabilised through alternative methods. SoilTac being a bio-degradable product, will dissolve over time as plant growth and cover increases;

- Small shrubs from the on site nursery is to be planted onto the slopes using manual labour. This should include a variety of suitable shrubs and be planted at a suitable distance form each other;
- The seeded and planted area is to be watered on a regular basis to assist in the re-vegetation process. This can be done through the implementation of a removable temporary irrigation system that can be re-used for future rehabilitation areas. Temporary irrigation is to remain in place until it has been verified that a vegetation cover of 60% has been achieved in that particular area, before the irrigation system can be dismantled for used elsewhere;
- As stated before, no slope is to exceed an uninterrupted length of 50 m. Storm water management systems are to be implemented to ensure sediment control and water management. These systems are to be constructed in such a way as to increase the capture and infiltration of rainfall and to create protective sub-sites. With torrential rainfall, gully erosion is very common in unconsolidated material and it is therefore advisable to establish a drainage pattern which can control and divert this flow. One method for storm water control is the implementation of looping mounds (also called berms) about 1.5 metres deep and between 8 and 10 metres apart. This configuration permits heavy equipment to cut these structures quickly and efficiently. The interlocking and staggered off-set of each structure and mound reduces the energy of the run-off and so avoids channelling and gully formation in unconsolidated strata (refer to Figure 77 below). However, other storm water management measures can also be implemented, and

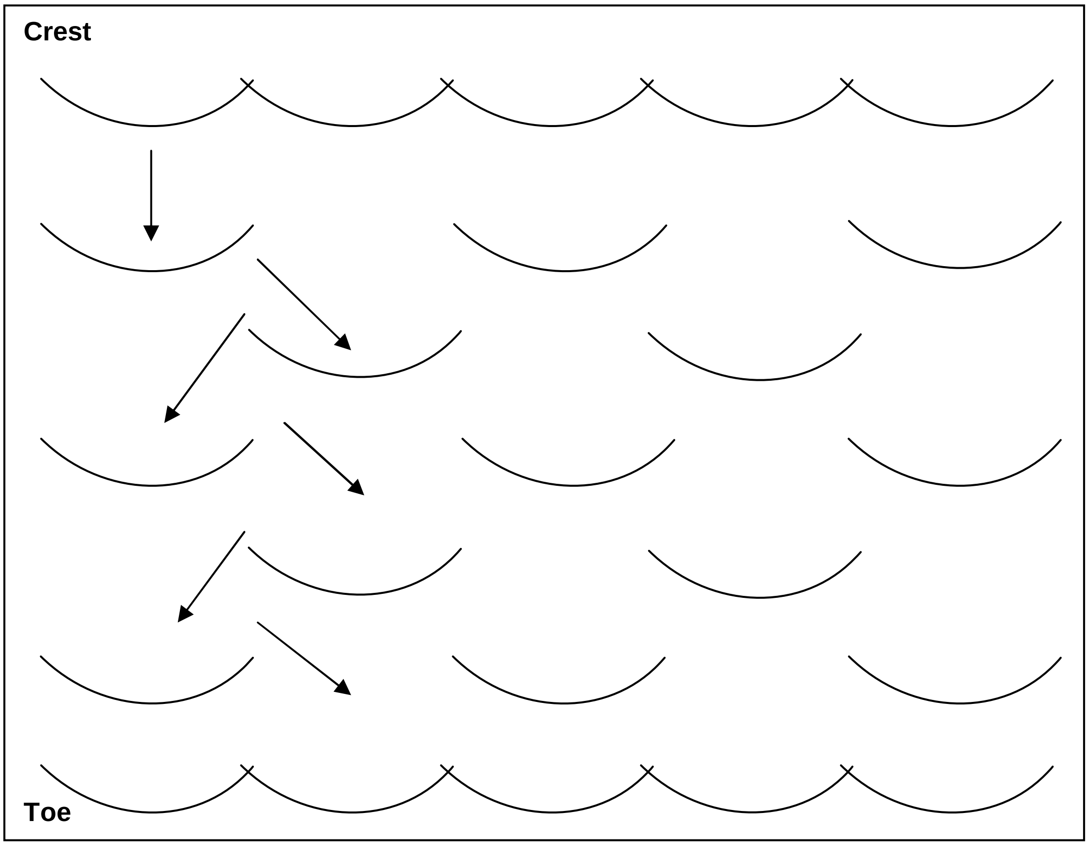

Figure 77: Construction of Looping Mounds.

- Re-vegetated areas are to be inspected on a monthly basis for the following:
  - Remove any unwanted plants and weeds;
  - Inspect for and repair soil / wind erosion features;
  - Inspect for areas where seeds and shrubs did not take. These areas can be re-planted and re-seeded using manual labour.
  - Inspections can only cease once a 60% plant vegetative cover have been established.

10.7.2.3 Waste Rock Dump

The WRD will be constructed over a long time period, as and when basalt material is hauled from the open pit. The WRD will be formed through the dumping of waste rock in successive placements over this period.

No harmful leachates are expected to occur as a result of the long term storage of waste rock, as is outlined in section 10.7.2.3. Therefore, no rehabilitation is proposed in terms of assuring chemical stability of the site. However, the following rehabilitation practices are to be implemented during the ongoing construction of the WRD.

- All vegetation and topsoils are to be stripped from the area identified for the first dumping sequence. These topsoils are to be stockpiled following the prescribed manner (refer to section 10.2.1.3 and 10.2.1.7);
- Subsoils are to be stripped from the same area subsequent to topsoil stripping and stockpiled in the prescribed manner (refer to section 10.2.1.3);
- Waste rock material will be hauled to the soil stripped area designated for dumping at that point in time and tipped from the haul trucks. This will result in the waste rock coming to rest at its natural angle of repose and is estimated to create a slope of approximately 1:1.5. The WRD slopes will be shaped to represent the profile depicted in Figure 75 as soon as a dumping area has been finalised. However, areas from which waste rock will be used throughout the LOM should not be shaped prior to its finalisation;
- Due to the size of material expected to be dumped onto the WRD, very little dust generation is expected. In addition, the voids between adjacent rocks, are expected to be significant in size. Therefore no top-soiling and / or re-vegetation are recommended during this phase, and
- Storm water management systems are to be implemented to ensure sediment control and water management.

10.7.2.4 Slimes Dam

The starter walls of the slimes dam will be constructed with sand material from the open pit. The side slopes of the slimes dam will be constructed at a 35º angle (~ 1:1.5). Prior to construction the following actions are to be taken for the entire footprint of the area on which the slimes dam is to be constructed:

- All vegetation and topsoils are to be stripped from the area identified for the first dumping sequence. These topsoils are to be stockpiled following the prescribed manner (refer to section 10.2.1.3 and 10.2.1.7), and
- Subsoils are to be stripped from the same area subsequent to topsoil stripping and stockpiled in the prescribed manner (refer to section 10.2.1.3).

Due to the operation of the slimes dam, initial rehabilitation will focus on the starter wall section of the slimes dam only. However, as and when deposition of slimes allows for rehabilitation to progress, the following rehabilitation is to continue where practicable:

- Toe drains are to be constructed at the foot of the slimes dam in order to collect any seepage water that may emanate from the facility. This water is to be led to either of the RWDs for reuse in the plant. This will ensure the minimisation of seepage recharging the aquifer and assist in maintaining the stability of the slimes dam;
- During the operational life of the slimes dam facility, no shaping of the side slopes will be practicable if the stability of the impoundment facility is to be assured. However, the 1:1.5 angle is too steep for mechanised rehabilitation to occur (refer to Figure 76). Due to the fine nature of the material being stored, it is important that rehabilitation commences as soon as possible, in order to limit the effects of water erosion and dust generation;
- Therefore, the slimes dam is to be constructed in a series of outer terraces. (The construction of looping mounds is deemed unsuitable for this application, as a 'random' disturbance of the outer slopes of the slimes dam may lead to instability of the slimes facility.) These terraces will ensure that no long slopes are created where water can accelerate and cause erosion gullies (refer to Figure 78 below). Each terrace is to be back sloped in order to prevent accelerated surface water runoff;

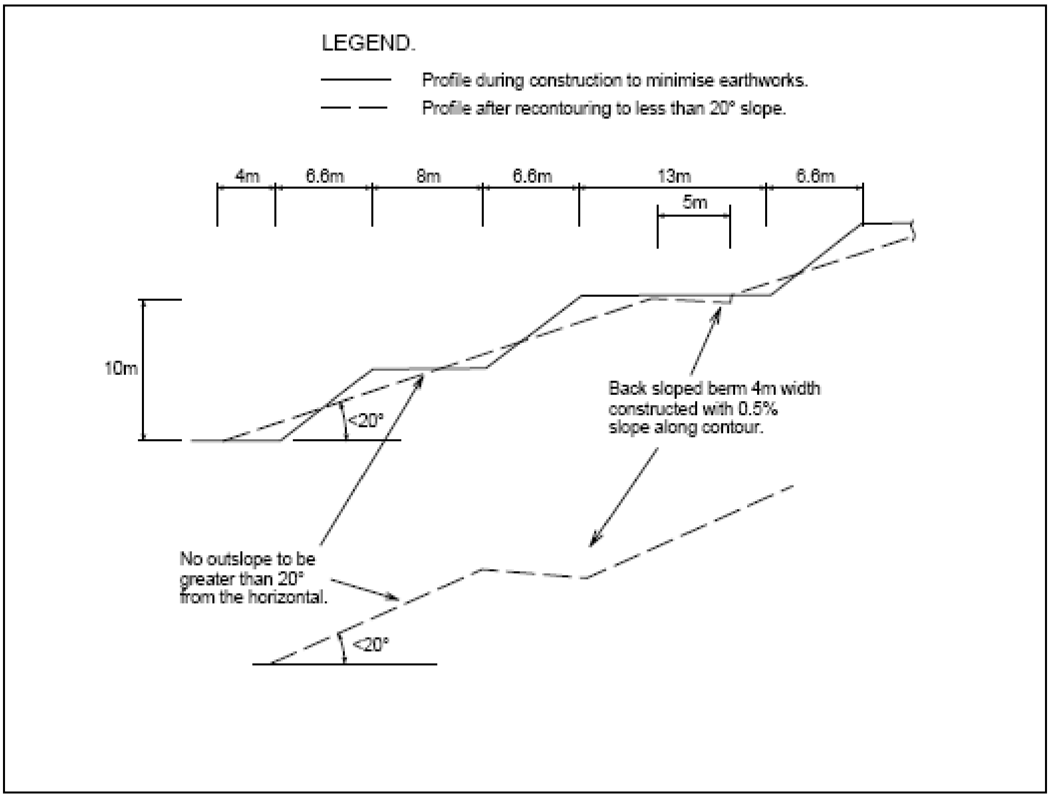

Figure 78: Slope Profile for Slimes Dam. (DME – Western Australia, 1996)

- Upon completion of each of these terraces, suitable surface water drainage is to be installed in order to prevent the collection of permanent water onto the back slope. This will contribute to the stability of the slimes dam walls;
- Slope stability is generally problematic on slimes dams where the water content in slurry is too high. As a result of high permeability and high water volume, generally the phreatic aquifer becomes too high and approaches the side walls of the slimes dam. Slope failure occurs where the slimes dam wall material becomes saturated with water. Although this is likely to be the case at the GDMP, Best Practice dictates that a suitable system of Piezometric Monitors be installed on the side slopes of the slimes dam to monitor the phreatic aquifer;
- The completed slopes are then to be planted with Vetiver grass for the operational life of the facility and is considered a temporary (albeit long term) solution;
- All areas that comprise wind facing slopes, are to be stabilised using rock cladding or a synthetic soil binder. This will remain on a permanent basis;
- The slopes are to be inspected on a monthly basis for the following:
  - Remove any unwanted plants and weeds;
  - Inspect for and repair soil / wind erosion features. Should engineering intervention be required to limit areas of consistent erosion (wind / water), these should be implemented timeously;

- Inspect for areas where Vetiver grass did not take. These areas can be re-planted as needed using manual labour, and
- Inspections are to continue for the LOM.

10.7.2.5 Tailings Management Facility

The construction of the TMF will continue over the LOM in progressive deposition areas. Therefore, the stripping of soils and vegetation will occur on an ongoing basis and should follow the guideline below:

- All vegetation and topsoils are to be stripped from the area identified for the first dumping sequence. These topsoils are to be stockpiled following the prescribed manner (refer to section 10.2.1.3 and 10.2.1.7);
- Subsoils are to be stripped from the same area subsequent to topsoil stripping and stockpiled in the prescribed manner (refer to section 10.2.1.3);
- The spreading of tailings material will result in slopes of 35º (1:1.5 slope angle). This is considered to be too steep for the long term sustainable rehabilitation and re-vegetation of the slope (refer to Figure 76). It should be noted that the tailings material may be used for rehabilitation purposes should this be proven feasible. Until this has been determined, no rehabilitation of the TMF is recommended, and
- Suitable surface water management structures are to be developed through the DTM model and implemented for the TMF.

10.7.2.6 Processing and Recovery Plant Area

Including: Metallurgical Process, Recovery Process, Diamond Cleaning Process, Water Treatment Plant for Process Water, RO Plant for Potable Water & Sewage Treatment Plant

As part of the SEMP, it is stipulated that the minimum footprint area is to be disturbed during the construction phase of the GDMP. All of the areas listed for inclusion in this section will be actively operating throughout the LOM. Therefore, no ongoing remediation measures are proposed for these facilities. However, the mitigation and management measures outlined in section 10.2 are to be implemented.

10.7.2.7 Other Buildings

Including: Mine Medical Facility, Offices and Accommodation Units.

As part of the SEMP, it is stipulated that the minimum footprint area is to be disturbed during the construction phase of the GDMP. All of the areas listed for inclusion in this section will be actively operating throughout the LOM. Therefore, no ongoing remediation measures are proposed for these facilities. However, the mitigation and management measures outlined in section 10.2 are to be implemented.

10.7.2.8 General Infrastructure

As part of the SEMP, it is stipulated that the minimum footprint area is to be disturbed during the construction phase of the GDMP. All of the areas listed for inclusion in this section will be actively operating throughout the LOM. Therefore, no ongoing remediation measures are proposed for these facilities. However, the mitigation and management measures outlined in section 10.2 are to be implemented.

Power Line:

The power line is not expected to be removed from its location, as it will revert to the responsibility of BPC post closure of the GDMP. However, rehabilitation of the areas affected through the construction activities are to be undertaken as soon as the area in question has been finalised. This will require that the following steps are taken:

Construction Camps:

- Remove all infrastructure and waste from the site. All hazardous and domestic waste is to be containerised and disposed of at a suitably registered site. All sewage is to be removed form the site by an appropriate contractor;
- All fences are to be taken down and removed from site;
- Once all structures have been removed from the site, the area is to be contoured to be free draining and is to blend with the surrounding topography;
- Soils removed are to be placed onto the affected areas, and
- The area is to be seeded with the appropriate seed mix and the planting of shrubs and small trees is to be undertaken.

Power Line Infrastructure:

- All litter and other waste material is to be collected from the footprint and disposed of at an appropriately licensed disposal site;
- The affected footprint areas are to be contoured to be free draining and is to blend with the surrounding topography;
- The area is to be lined with subsoils, followed with the laying down of a mixture of topsoil, tailings material, fertiliser and compost as a growth medium. These materials are to be keyed appropriately, and
- The area is to be seeded with the appropriate seed mix and the planting of shrubs and small trees is to be undertaken.

10.7.2.9 Chemical, Fuel and Storage Areas

As part of the SEMP, it is stipulated that the minimum footprint area is to be disturbed during the construction phase of the GDMP. All of the areas listed for inclusion in this section will be actively operating throughout the LOM. Therefore, no ongoing remediation measures are proposed for these facilities. However, the mitigation and management measures outlined in section 10.2 are to be implemented.

10.7.2.10 Hazardous Waste Areas

As part of the SEMP, it is stipulated that the minimum footprint area is to be disturbed during the construction phase of the GDMP. All of the areas listed for inclusion in this section will be actively operating throughout the LOM. Therefore, no ongoing remediation measures are proposed for these facilities. However, the mitigation and management measures outlined in section 10.2 are to be implemented.

10.7.3 End of Life of Mine Rehabilitation

10.7.3.1 Open Pit

- At the end of LOM, the remaining unprotected sections around the pit perimeter will be closed with rock material in order to form a continuous barrier around the pit. The area will remain fenced to further limit access to the pit itself, and
- Although the sand slopes at the top of the pit have been designed for stability, no additional stabilising measures will be implemented. This will result in due time, in the erosion of pit walls and will result in the natural filling of the pit, thereby limiting the extent of the open water source created by the pit lake.

Due to the cost associated with the backfilling of the open pit (estimated at approximately P730 million, taking into consideration inflation of 10% over 17 years of operation), the post closure landform will allow for the pit to remain open. It also has to be noted that it is considered standard industry practice for open pits of this nature to remain open post closure.

Should it however, become practicable for the pit to be backfilled due to the development of new technologies / other, it is the consensus of the specialists involved in this project, that the pit be backfilled. Should this opportunity present itself during the course of the LOM, this remediation plan is to be amended accordingly.

It is expected that over time, the pit will fill with groundwater that seeps into the final void. Rebound of the aquifer will take place over geological time only, due to the low infiltration rates associated with the area. However, as water ingress takes place, evaporation will continue, resulting in a highly saline pit lake at the bottom of the final void. This water will not be fit for consumption and therefore, the final void should be designed such that access for both animals and humans are restricted in as far as is practicable.

Therefore, the following rehabilitation measures are to be implemented:

- All equipment and machinery is to be removed from the open pit upon cessation of the operation;
- As part of the retreat of operation, a controlled blast / series of blasts is to be undertaken to ensure that an in-pit cliff face is formed;
- This will also aid in the increase of surface dimensions, thereby increasing the evaporation rate of water in the pit lake;
- No stabilisation of the sand material is recommended, in order for the pit to be subject to natural erosion processes, thereby aiding in the filling of the pit and thus reducing the open water source formed by the expected pit lake;
- No re-vegetation is recommended as the final void is to be kept free of animals in as far is possible;
- Water management structures are to be maintained around the open pit to prevent water ingress into the pit lake, and
- Upon closure, the rock structures around the pit will be completed in order to limit access to the pit itself. The existing fence will remain in place around the pit and will be with the Mines, Quarries, Works and Machinery Act and Regulations (Act No. 20 of 1973 (as amended)).

10.7.3.2 Sand Dump

The sand dump will be finalised once the entire sand stripping operation has been completed. It is expected that this will occur during year 2014. As soon as the last sand from the open pit has been dumped the following programme is to be instituted:

- The same procedure as for Ongoing Rehabilitation as outlined in section 10.7.2.2, is to be followed during the End of LOM rehabilitation of the sand dump;
- The conveyor and associated infrastructure, as well as any other equipment used on the sand dump are to be removed from the area;
- Throughout the construction of the sand dump, the slopes of each finalised dumping area would have been subjected to the reshaping of slope angle of no more than 18°. Upon finalisation of the construction of the sand dump, the final dumping area is to be sloped to 18° as well. (Refer to Figure 75 for a diagrammatic representation of the final slope profile to be obtained.) During this phase, a competent person will be required to verify the slope angle of the entire dump in order to ensure the long term stability of the structure;
- The entire structure is to be shaped such that it is free draining in terms of surface water drainage and should be engineered (if required) to seamlessly integrate with the natural surface drainage patterns;

- Subsoils are to be placed onto the sand material;
- A mixture of topsoil, tailings material, fertiliser and compost is to be replaced onto the final sloped areas (refer to section 10.2.1.3). In addition, the entire dump is to be inspected for any areas where re-topsoiling is to be undertaken through use of manual labour;
- Once the final slope and any other areas requiring re-topsoiling has been covered with the above mentioned mixture, temporary water and wind erosion structures are to be installed. This can either take the form of rock cladding, using basalt from the open pit / WRD, or through the use of SoilTac in the form of a crust like application;
- It is recommended that SoilTac be mixed with the correct seed mixture for simultaneous application. This will enable the germination of grasses and other plant material to occur while soils are stabilised through alternative methods. SoilTac being a bio-degradable product, will dissolve over time as plant growth and cover increases;
- Small shrubs from the on site nursery is to be planted onto the final slope and any additional areas requiring re-vegetation, using manual labour. This should include a variety of suitable shrubs and be planted at a suitable distance form each other;
- The seeded and planted area is to be watered on a regular basis to assist in the re-vegetation process. This can be done through the implementation of a removable temporary irrigation system. Temporary irrigation should remain in place at any particular site on the sand dump, until it has been verified that a vegetation cover of 60% have been achieved;
- All areas that comprise wind facing slopes, are to be stabilised using rock cladding if required. This will remain on a permanent basis. However, during the final rehabilitation of the sand dump, these rocky areas are to be planted manually with small shrubs form the on site nursery in order to create a natural looking environment;
- Storm water management systems are to be implemented to ensure sediment control and water management (i.e. the looping mounds previously described).
- Ongoing monitoring of the sand dump will be required on a monthly basis, and shall include the following:
    - Removal of any unwanted plants and weeds;
    - Inspect for and repair soil / wind erosion features;
    - Inspect for areas where seeds and shrubs did not take. These areas can be re-planted and re-seeded using manual labour, and
    - Inspections can only cease once a 60% plant vegetative cover have been established.

10.7.3.3 Waste Rock Dump

At the end of LOM the WRD will have been completed.

No harmful leachates are expected to occur as a result of the long term storage of waste rock, as is outlined in section 10.7.2.3. Therefore, no rehabilitation is proposed in terms of assuring chemical stability of the site. However, the following rehabilitation practices are to be implemented during the final rehabilitation of the WRD:

- The final slopes of the WRD should be shaped as detailed in Figure 75;
- The entire structure is to be shaped such that it is free draining in terms of surface water drainage and should be engineered (if required) to seamlessly integrate with the natural surface drainage patterns;
- As described in 10.7.2.3, the WRD will not be topsoiled and re-vegetated in the same manner as other mineralogical waste structures. However, with the expected compaction and stabilisation of the dump that would have occurred over the LOM, there are sure to be localised points / areas that will be capable of sustaining plant life. Therefore, these areas are to be identified by a suitably qualified person (i.e. ecologist). The aim of this rehabilitation plan is to create a landscape similar to that found between Lephepe and Serowe (refer to Figure 79). This will ensure that a foreign object (i.e. the WRD) is transformed to a landscape characteristic that is not completely foreign to citizens of the country;

Figure 79: Landscape Found Between Serowe and Lephepe.

- Bulldozers can be used to push material (subsoils and/or sand) onto areas where these pockets occur area;
- There after, the next layer, comprising a mixture of topsoil, tailings material (if proven feasible), fertiliser and compost as a growth medium are to be spread;
- These pockets are to be vegetated with shrubs / trees grown for this purpose in the on-site nursery. (However, it should be noted that the vegetation growth in the CKGR cannot be expected to be as dense as shown in Figure 79.), and

- Storm water management systems are to be implemented to ensure sediment control and water management.

10.7.3.4 Slimes Dam & Return Water Dams

- At the end of LOM, the all water from the slimes dam and RWDs should be allowed to evaporate prior to the commencement of final rehabilitation. According to the engineering team, this evaporation process should take approximately 6 – 9 months post the cessation of operation of the slimes dam;
- All surface and large shallow piping associated with water reticulation (i.e. the penstock system) are to be drained and removed from the slimes dam;
- Deeper pipes and drains are to be plugged and sealed at depth in order to stop future flow of water through the system;
- The toe drains are to be backfilled;
- All sediments collected over the LOM in the RWDs and associated sediment traps, are to be removed to a suitable depth and placed onto the slimes dam for permanent disposal;
- Once water has been drained from the reticulation system and all water associated with the slimes dam have evaporated, the terraced side slopes are to be shaped to a final 18° outer slope (refer to Figure 75). The remaining Vetiver grass can be worked into the slopes and is not required to be removed prior to the shaping taking place. This material will add to the nutrient status of the final landform;
- At this point in time the Piezometers can be removed;
- No capping of the slimes dam is required, as the compaction of material is expected to limit infiltration sufficiently. In addition, based on the TCLP tests conducted during the SEIA phase of the project, no toxic leachates are expected to form;
- The top of the structure is also to be treated with sub and topsoils and re-vegetated;
- Ideally, the rock cladded slopes / areas are to be shaped to the same profile as described above. However, the practicability of this is to be investigated as the operation nears the closure phase. One of the following options should then be followed:
    - Reshaping Option: All rock cladding is to be removed and temporarily stored at the toe of the slimes dam. The slope should be reshaped as previously described and rock cladding replaced onto the reshaped slope. Subsoil should be placed into the suitable voids between rocks, followed by the application of the topsoil, tailings, fertiliser and compost mixture. Temporary irrigation is to be installed. Re-vegetation of the slope is to occur using the seed mix as prescribed. In addition, small shrubs and trees are to be planted into suitable voids, or
    - Retaining Existing Cladding Option: A suitable rock buttress is to be constructed at the base of the rock cladded slopes to assist with the long term stabilisation of the landform. Subsoil is to be placed into the suitable voids between rocks, followed by the application

of the topsoil, tailings, fertiliser and compost mixture. Temporary irrigation is to be installed.
    - Re-vegetation of the slope is to occur using the seed mix as prescribed. In addition, small shrubs and trees are to be planted into suitable voids.
- The objective of the rehabilitation is to ensure that the slimes dam become an integrated part of the natural landscape remaining post closure. For this purpose, the structure is to be shaped such that it is free draining in terms of surface water drainage in as far as is practicable and should integrate with the natural surface drainage patterns;
- The slopes are to be inspected on a monthly basis for the following:
    - Remove any unwanted plants and weeds;
    - Inspect for and repair soil / wind erosion features. Should engineering intervention be required to limit areas of consistent erosion (wind / water), these should be implemented timeously;
    - Inspect for areas where vegetation did not take. These areas can be re-planted as needed using manual labour, and
    - Inspections are to continue for the duration of the closure and post closure monitoring phases.

10.7.3.5 Tailings Management Facility

It is important to note that rehabilitation of the TMF is not to be finalised until enough material has been removed for the mixture with topsoils required for re-vegetation purposes.

At final closure, the following remediation measures are to be implemented:

- The objective of the rehabilitation is to ensure that the TMF become an integrated part of the natural landscape remaining post closure;
- It is recommended that all the tailings material from the TMF be used as part of the topdressing of rehabilitated areas and should be removed in its entirety;
- The toe drains are to be filled and reshaped;
- The area underlying the TMF is to receive sub and topsoil treatment and should be re-vegetated as per the recommended method.

10.7.3.6 Processing and Recovery Plant Area

Including: Metallurgical Process, Recovery Process, Diamond Cleaning Process, Water Treatment Plant for Process Water, RO Plant for Potable Water & Sewage Treatment Plant

It is of critical importance that the final land use be determined through consultation with stakeholders at least two years prior to the cessation of the operation. This will enable adequate time for the detailed planning for the preservation of structures to remain on site post closure.

- Upon cessation of the operation, all buildings that are to remain post closure, are to be clearly marked;
- All buildings and equipment are to be decontaminated and cleaned where necessary;
- All cleaning effluent (wash water and other) is to be contained in suitable containers and disposed of appropriately at a registered disposal site;
- Chemicals of all types to be recycled, returned to vendor, sold, or disposed of in an approved site.
- All structures are to be dismantled and where appropriate, material should be recycled, including all steel, glass, prefabricated buildings and others as is appropriate;
- All pipelines and containers (surface and subsurface) are to be drained of substances and these are to be containerised for appropriate disposal;
- All containers / pipes removed from site are to be recycled / disposed of at a suitably registered facility;
- Concrete and impermeable substrates are to be broken up and dispose of at a licensed disposal site;
- All compacted soil / sand areas are to be ripped;
- Once all equipment and materials have been removed from the site, the plant area is to be contoured to be free draining and is to blend with the surrounding topography;
- The area is to be lined with subsoils, followed with the laying down of a mixture of topsoil, tailings material, fertiliser and compost as a growth medium. These materials are to be keyed appropriately;
- The area is to be seeded with the appropriate seed mix and the planting of shrubs and small trees is to be undertaken;
- The area is to be inspected on a monthly basis for the following:
  - Remove any unwanted plants and weeds;
  - Inspect for and repair soil / wind erosion features. Should engineering intervention be required to limit areas of consistent erosion (wind / water), these should be implemented timeously;
  - Inspect for areas where vegetation did not take. These areas can be re-planted as needed, and
  - Inspections are to continue for the duration of the closure and post closure monitoring phases.

10.7.3.7 Other Buildings

Including: Mine Medical Facility, Offices and Accommodation Units.

As stated in section 10.7.3.6, the use of these buildings is to be included in the discussions with stakeholders regarding the post closure land use of the site and the buildings that are to remain.

- Upon cessation of the operation, all buildings and other infrastructure (piping for water, sewage system, other) that are to remain post closure, are to be clearly marked;
- All medical waste is to be containerised and disposed of at an approved disposal site;
- All buildings and equipment are to be decontaminated and cleaned where necessary;
- All cleaning effluent (wash water and other) is to be contained in suitable containers and disposed of appropriately at a registered disposal site;
- All structures are to be dismantled and where appropriate, material should be recycled, including all steel, glass, prefabricated buildings and others as is appropriate;
- All pipelines and containers (surface and subsurface) are to be drained of substances and these are to be containerised for appropriate disposal;
- All containers / pipes removed from site are to be recycled / disposed of at a suitably registered facility;
- Concrete and impermeable substrates are to be broken up and dispose of at a licensed disposal site;
- All compacted soil / sand areas are to be ripped;
- Once all structures have been removed from the site, the area is to be contoured to be free draining and is to blend with the surrounding topography;
- The area is to be lined with subsoils, followed with the laying down of a mixture of topsoil, tailings material, fertiliser and compost as a growth medium. These materials are to be keyed appropriately;
- The area is to be seeded with the appropriate seed mix and the planting of shrubs and small trees is to be undertaken;
- The area is to be inspected on a monthly basis for the following:
    - Remove any unwanted plants and weeds;
    - Inspect for and repair soil / wind erosion features. Should engineering intervention be required to limit areas of consistent erosion (wind / water), these should be implemented timeously;
    - Inspect for areas where vegetation did not take. These areas can be re-planted as needed, and
    - Inspections are to continue for the duration of the closure and post closure monitoring phases.

10.7.3.8 General Infrastructure

Based upon the final land use consultation to be undertaken during the final stages of the operational phase, the stakeholders will need to decide if the air strip is to remain or be rehabilitated.

Should a decision be taken that the air strip is to remain, GEC is to complete one last maintenance cycle of the facility prior to hand over to the relevant stakeholder.

Should the option selected be to rehabilitate the air strip, the following steps are to be taken:

- Remove culverts and make excavation stable;
- Remove all elevated wires and poles;
- Ground all buried wires;
- Rip compact surfaces;
- Once all structures have been removed from the site, the area is to be contoured to be free draining and is to blend with the surrounding topography;
- The area is to be lined with subsoils, followed with the laying down of a mixture of topsoil, tailings material, fertiliser and compost as a growth medium. These materials are to be keyed appropriately, and
- The area is to be seeded with the appropriate seed mix and the planting of shrubs and small trees is to be undertaken.

10.7.3.9 Chemical, Fuel and Storage Areas

- Chemicals of all types are to be recycled, returned to vendor, sold, or disposed of in an approved site;
- During this phase, the clean and dirty water diversion structures as well as chemical containment structures are to be maintained. Only once all chemicals have been removed from the site, is infrastructure to be dismantled and removed from the site. Should some of the building rubble be contaminated with chemicals / hydrocarbons, those materials are to be treated as hazardous waste and handled and disposed of at a registered H:H site;
- All other concrete and impermeable substrate is to be broken up and disposed of at an appropriately licensed disposal site;
- All compacted areas are to be ripped;
- Any soils affected by hydrocarbon contamination is to be treated as outlined in section 9.2.1.2 of this report;
- Once all structures have been removed from the site, the area is to be contoured to be free draining and is to blend with the surrounding topography;
- The area is to be lined with subsoils, followed with the laying down of a mixture of topsoil, tailings material, fertiliser and compost as a growth medium. These materials are to be keyed appropriately;
- The area is to be seeded with the appropriate seed mix and the planting of shrubs and small trees is to be undertaken;
- The area is to be inspected on a monthly basis for the following:
  - Remove any unwanted plants and weeds;
  - Inspect for and repair soil / wind erosion features. Should engineering intervention be required to limit areas of consistent erosion (wind / water), these should be implemented timeously;

- Inspect for areas where vegetation did not take. These areas can be re-planted as needed, and
- Inspections are to continue for the duration of the closure and post closure monitoring phases.

10.7.3.10 Hazardous Waste Areas

- All hazardous materials are to be appropriately containerised and removed from the site. The materials can either be recycled, returned to vendor, sold, or disposed of in an approved site;
- During this phase, the clean and dirty water diversion structures as well as hazardous waste containment structures are to be maintained. Only once all hazardous materials have been removed from the site, is infrastructure to be dismantled and removed from the site. Should some of the building rubble be contaminated with hazardous waste material, those materials are to be treated as hazardous waste and handled and disposed of at a registered H:H site;
- All other concrete and impermeable substrate is to be broken up and disposed of at an appropriately licensed disposal site;
- All compacted areas are to be ripped;
- Once all structures have been removed from the site, the area is to be contoured to be free draining and is to blend with the surrounding topography;
- The area is to be lined with subsoils, followed with the laying down of a mixture of topsoil, tailings material, fertiliser and compost as a growth medium. These materials are to be keyed appropriately;
- The area is to be seeded with the appropriate seed mix and the planting of shrubs and small trees is to be undertaken;
- The area is to be inspected on a monthly basis for the following:
  - Remove any unwanted plants and weeds;
  - Inspect for and repair soil / wind erosion features. Should engineering intervention be required to limit areas of consistent erosion (wind / water), these should be implemented timeously;
  - Inspect for areas where vegetation did not take. These areas can be re-planted as needed, and
  - Inspections are to continue for the duration of the closure and post closure monitoring phases.

10.7.3.11 Well Field

Should a well field become a requirement of the GDMP in due course and should it be constructed, consultation with the relevant Government Departments will be entered into in order to determine their requirements relating to the infrastructure to remain operational on site.

All other borehole infrastructure is to be removed from the site and the boreholes capped to prevent access. All related infrastructure is to be removed. This will result in adequate water provision from the selected boreholes, while making other, disused boreholes safe.

The area surrounding these boreholes is to be dressed with topsoil and the appropriate seed mix applied. These areas are to be temporarily irrigated, until the desired 60% vegetation cover has been achieved.

10.7.4 Post Closure Monitoring

After closure, the SEMP and rehabilitation plans would have been implemented, and the monitoring and legal compliance auditing process will have determined the degree of compliance or lack thereof. However, post closure monitoring should include the following measures and should be undertaken for a period of 3 – 5 years or as otherwise stated in the closure certificate documentation:

10.7.4.1 Geology

There will be no mitigation that can feasibly be undertaken to minimise or mitigate the impacts of open pit mining on the geology post closure. Visual monitoring of the high wall will be prudent if the area is to be utilized by any form of habitation.

10.7.4.2 Soils, Land Capability and Land Use

Annual surface surveys (audits) will be undertaken over the disturbed area to establish the degree of compliance and the success of the re-establishment of vegetation on rehabilitated areas.

10.7.4.3 Flora

Monitoring of post closure conditions, as part of the environmental monitoring programme will provide guidelines for further recommendations in terms of additional requirements. In general, post closure rehabilitation success will be indicated by:

- The presence of vegetation that is similar in species composition and structure than the surrounding regional vegetation;
- Layers of vegetation that is self-sustainable in terms of water requirements and propagation, and
- The absence of species not associated with the area, including weeds.

These aspects will need to be monitored on an ongoing basis.

10.7.4.4 Fauna

Sampling of the rehabilitated area is to be undertaken to calculate the effectiveness of rehabilitation in terms of return to original ecological state.

10.7.4.5 Surface Water

During the post closure phase, continued quarterly surveys of the pit lake are to be undertaken. The following components are to be monitored:

- Integrity of the berm and fence;
- Water levels in the pit lake;
- Water quality, with specific focus on the salinity of the water;
- Presence of dead animals in the pit lake, and
- Stability of the pit slopes.

Should any further management measures be required, these are to be implemented.

10.7.4.6 Groundwater

The monitoring of groundwater level recovery and the groundwater quality must continue post closure based upon data collected from the monitoring boreholes until the groundwater table has reached its final level of 720 mamsl. Groundwater quality must be monitored bi-annually until it can be shown that the mine is not adding contaminants to the water, in other words that current ambient groundwater quality should not deteriorate.

The dedicated groundwater monitoring boreholes are to be used for this purpose.

10.7.4.7 Air Quality

On completion of the project it is recommended that a monitoring program is put in place to ensure the mitigation measures which have been recommended and implemented, match the design criteria. This should be in the form of dust fallout monitoring to ensure the storage piles are not producing dust which could potentially cause a health risk. This monitoring is to continue until 60% vegetative cover has been achieved.

10.7.5 Financial Quantum Determination for Rehabilitation

The financial quantum for rehabilitation is presented in Table 142.

This will be revised on an ongoing basis in order to keep the financial quantum current and will vary over time as the operations progress and conditions at the Gope Project Site changes.

No final decision has been taken by GEC on how the trust will be managed or what type of financial vehicle will be used. This level of detail wil only be determined once the Mining License has been granted. However, it may take one of the following forms:

- Bank guarantee;
- Parent company guarantee, or
- Insurance product vehicle.

At the time of the compilation of this report, there was no legislation in Botswana guiding such trusts. However, the promulgation of such legislation is imminent. Therefore, once the relevant legislation has been promulgated, GEC will be required to ensure compliance with this legislation in terms of the management of the trust. -

Table 142: Financial Quantum Determination for Rehabilitation

	Aspect	Description	Unit	Quantity	Master Rate (Pula)	Multiplication Factor	ELoM Rehab Total (Pula)
1	Plant Infrastructure						
1a	*Steel Infrastructure*						
	Heavy Steel Constructed Buildings		m^2	1 560.00	352.00	1.00	549 120.00
	Light Steel Constructed Buildings	e.g. Stores and site offices	m^2	1 000.00	200.00	1.00	200 000.00
1b	*Concrete Infrastructure / Structures*						
	Reinforced Concrete Structures		m^2	4 000.00	900.00	1.00	3 600 000.00
	Reinforced Concrete Slabs		m^2	2 000.00	450.00	1.00	900 000.00
	Concrete Slabs and Paved Surfaces		m^2	2 500.00	50.00	1.00	125 000.00
1c	*Conveyors*		m	1 300.00	400.00	1.00	520 000.00
1d	*DMS Modules*		Item	3	500 000.00	1.00	1 500 000.00
1e	*Containers*		Item	14	25 000.00	1.00	350 000.00
1f	*Equipment*		Item	All equipment	5 000 000.00	1.00	5 000 000.00
2	Sheeted Buildings						
	Nutec Sheeted Buildings with Chromodeck Roofing	Includes the permanent camps, recreation centre, kitchen-dining area, clinic, offices.	m^2	6 350.00	150.00	1.00	952 500.00
3	Roads						
	Access Road outside CKGR	Kauwande-Gope road will not be rehabilitated	m^2		0.30	1.00	0.00
	Mine Roads	Including internal roads and airport road	m^2	28 000.00	5.00	1.00	140 000.00
4	Open pit	Area will be made safe					1 000 000.00
5	Overburden and Spoils	Sand berm	ha	173.00	80 000.00	1.00	13 840 000.00
		Waste rock dump	ha	241.00	65 000.00	1.00	15 665 000.00
6	Processing Waste Deposits						
	Tailings Dam	Tailings material will be reused for rehabilitation	ha				5 000 000.00
	Slimes Dam	Basic, salt-producing waste	ha	288.00	100 000.00	1.00	28 800 000.00
	Return Water Dams		ha	20.00	25 500.00	1.00	510 000.00
7	General Surface Rehabilitation	Including revegetation of denuded areas	ha	960.00	20 000.00	1.00	19 200 000.00
8	Water Management		ha	1 990.00	24 000.00	0.60	28 656 000.00
9	Maintenance		ha	1 990.00	900.00	1.00	1 791 000.00
10	Piping	Pipes from dewatering, slimes pumping, water supply from well field	m	6 000.00	150.00	1.00	900 000.00
11	Fencing						
	Removal of Fencing	In areas required	m	2 000.00	20.00	1.00	40 000.00
	Sub Total						**129 238 620.00**
	Contingency (25% of Sub Total)						**32 309 655.00**
	Total						**161 548 275.00**

Notes

All figures above are given in present day value. No escalation / discounting has been provided for.

2 Worst case scenario with all buildings being demolished and is subject to stakeholder consultation prior to end of operational phase.

3 During the rehabilitation phase, the access road will undergo one full proper maintenance, before responsibility is handed over to the Roads Agency.

4 The open pit will not be remediated by means of backfilling. The area will be made safe and access restrictions implemented.

6 Tailings material will be used at end of life of mine as amelioration material to be added to soils.

8 Multiplication factor - 0.60 - Risk class B, Medium environmental sensitivity

SECTION 11. CONCLUSIONS AND RECOMMENDATIONS

In the assessment conducted by Marsh and its specialist teams, no fatal flaws have been found to pertain to the Gope Diamond Mining Project and associated infrastructure for any of the bio-physical or socio-economic environmental aspects investigated.

All impacts associated with the project can be suitably mitigated or managed and positive impacts can be adequately enhanced.

It is therefore Marsh' recommendation that approval of the Gope Diamond Mining Project (including the power line and road infrastructure) be granted to Gope Exploration Company.

SECTION 12. REFERENCES AND SUPPORTING DOCUMENTATION

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SECTION 13. APPENDICES

Appendix 1:	Soils, Land Use and Land Capability Specialist Investigation
Appendix 2:	Biodiversity, Fauna and Flora Specialist Investigation
Appendix 3:	Surface Water Specialist Investigation
Appendix 4:	Groundwater Specialist Investigation
Appendix 5:	Air Quality Specialist Investigation
Appendix 6:	Noise & Vibration Specialist Investigation
Appendix 7:	Archaeology and Heritage Specialist Investigation (AIA)
Appendix 8:	Visual Impact Assessment Specialist Investigation
Appendix 9:	Waste Specialist Investigation
Appendix 10:	Social Impact Assessment Specialist Investigation
Appendix 11:	Regional Socio-Economic Specialist Investigation
Appendix 12:	Legal Framework
Appendix 13:	Public Participation Data
Appendix 14:	SRK – Block Caving vs. Open Pit Mining Method Investigation
Appendix 15:	Road EIA
Appendix 16:	GDL HSSE Policies